For Office Use Only:

File Number	ZNPL2023392	Public Notice Sign	_____
Related File Number	28TPL2023390	Application Fee	_____
Pre-consultation Meeting	_____	Conservation Authority Fee	_____
Application Submitted	_____	Well & Septic Info Provided	_____
Complete Application	_____	Planner	_____

Check the type of planning application(s) you are submitting.

- ☐ Official Plan Amendment
- ☒ Zoning By-Law Amendment (Removal of Holding)
- ☐ Temporary Use By-law
- ☒ Draft Plan of Subdivision/Vacant Land Condominium
- ☐ Condominium Exemption
- ☐ Site Plan Application
- ☐ Extension of a Temporary Use By-law
- ☐ Part Lot Control
- ☐ Cash-in-Lieu of Parking
- ☐ Renewable Energy Project or Radio Communication Tower

Please summarize the desired result of this application (for example, a special zoning provision on the subject lands to include additional use(s), changing the zone or official plan designation of the subject lands, creating a certain number of lots, or similar)

Draft Plan Approval for a 45 lot residential subdivision.

Removal of an existing holding provision. Phase 2 ESA is attached.

Property Assessment Roll Number: 49102448600

A. Applicant Information

Name of Owner	Akhtar Syed
Address	130 Guelph Ave
Town and Postal Code	Cambridge ON, N3C 1A4
Phone Number	519-983-7000
Cell Number	519-614-9485
Email	nasar.syed@gmail.com
Name of Applicant	Dillon Consulting Limited c/o Mike Pletch
Address	130 Dufferin Ave, Suite 1201
Town and Postal Code	London, N6A 5R2
Phone Number	519-438-1288 ext 1262
Cell Number	226-582-9802
Email	mpletch@dillon.ca
Name of Agent	Chris DeClark and Peter Braun
Address	15 Goshen Road
Town and Postal Code	Tillsonburg ON, N4G 4G7
Phone Number	519-983-7000
Cell Number	519-614-9485
Email	chris.declark@century21.ca, p.braun@braunz.ca

Unless otherwise directed, Norfolk County will forward all correspondence and notices regarding this application to both owner and agent noted above.

☐ Owner ☐ Agent ☐ Applicant

Names and addresses of any holder of any mortgagees, charges or other encumbrances on the subject lands:

N/A

B. Location, Legal Description and Property Information

1. Legal Description (include Geographic Township, Concession Number, Lot Number, Block Number and Urban Area or Hamlet):
   Part of Lot 24, Concession 12, Geographic Township of Windham (Town of Delhi) in Norfolk County. Parts 1 and 2 Deposited Plan 37R-3287

   Municipal Civic Address: Waverly Street

   Present Official Plan Designation(s): Urban Residential

   Present Zoning: R-2 (Urban Residential Type 2)

2. Is there a special provision or site specific zone on the subject lands?

   ◒ Yes ☐ No If yes, please specify corresponding number:
   Special Provision 14.439. Holding provision for a Record of Site Condition, which is attached.

3. Present use of the subject lands:
   Vacant

4. Please describe **all existing** buildings or structures on the subject lands and whether they will be retained, demolished or removed. If retaining the buildings or structures, please describe the type of buildings or structures, and illustrate the setback, in metric units, from the front, rear and side lot lines, ground floor area, gross floor area, lot coverage, number of storeys, width, length, and height on your attached sketch which must be included with your application:
   N/A

5. If an addition to an existing building is being proposed, please explain what it will be used for (for example: bedroom, kitchen, or bathroom). If new fixtures are proposed, please describe.
   N/A

6. Please describe **all proposed** buildings or structures/additions on the subject lands. Describe the type of buildings or structures/additions, and illustrate the setback, in metric units, from front, rear and side lot lines, ground floor area, gross floor area, lot coverage, number of storeys, width, length, and height on your attached sketch which must be included with your application:
   Proposed single family detached homes with setbacks matching the current zoning.
   Details to follow at building permit applications.

7. Are any existing buildings on the subject lands designated under the *Ontario Heritage Act* as being architecturally and/or historically significant? Yes ☐ No ■

   If yes, identify and provide details of the building:

   N/A

8. If known, the length of time the existing uses have continued on the subject lands:

   N/A

9. Existing use of abutting properties:
   Residential, agricultural, industrial.

10. Are there any easements or restrictive covenants affecting the subject lands?

    ■ Yes ☐ No If yes, describe the easement or restrictive covenant and its effect:
    An access easement at the SW corner of the subject site, allowing access to 599 Gage Street.
    Easement will be removed when Brock Avenue is extended and provides frontage to the existing property

C. Purpose of Development Application

Note: Please complete all that apply.

1. Please explain what you propose to do on the subject lands/premises which makes this development application necessary:
   A 45 lot subdivision is proposed. A draft plan of subdivision application is required.

2. Please explain why it is not possible to comply with the provision(s) of the Zoning By-law/and or Official Plan:
   N/A. Application complies with the Zoning Bylaw and Official Plan.

3. Does the requested amendment alter all or any part of the boundary of an area of settlement in the municipality or implement a new area of settlement in the municipality? ☐ Yes ■ No If yes, describe its effect:

4. Does the requested amendment remove the subject land from an area of employment? ☐ Yes ■ No If yes, describe its effect:

5. Does the requested amendment alter, replace, or delete a policy of the Official Plan?
☐ Yes ■ No If yes, identify the policy, and also include a proposed text of the policy amendment (if additional space is required, please attach a separate sheet):
N/A

6. Description of land intended to be severed in metric units:
Frontage: N/A
Depth: N/A
Width: N/A
Lot Area: N/A
Present Use: N/A
Proposed Use: N/A
Proposed final lot size (if boundary adjustment): N/A
If a boundary adjustment, identify the assessment roll number and property owner of the lands to which the parcel will be added: N/A

Description of land intended to be retained in metric units:
Frontage: N/A
Depth: N/A
Width: N/A
Lot Area: N/A
Present Use: N/A
Proposed Use: N/A
Buildings on retained land: N/A

7. Description of proposed right-of-way/easement:
Frontage: N/A
Depth: N/A
Width: 20m Right-of-Way for Future Street A, and 5m Storm Easement. Refer to Draft Plan.
Area: N/A
Proposed use: Future Right-of-way and Storm easement

8. Name of person(s), if known, to whom lands or interest in lands to be transferred, leased or charged (if known):
N/A

9. **Site Information**	**Zoning**	**Proposed**
Please indicate unit of measurement, for example: m, m^2 or %		
Lot frontage	Interior Lot 12.0m min. Corner Lot 15.0m min.	Varies, meets min zoning. See Draft Plan.
Lot depth	N/A	Varies by Lot
Lot width	N/A	Varies by lot
Lot area	Interior Lot: 360m^2 min. Corner Lot: 450m2 min.	Varies, meets minimum zoning. See Draft Plan.
Lot coverage	N/A	N/A
Front yard	6.0m min.	6.0m min.
Rear yard	7.5m min.	7.5m min.
Left Interior side yard	1.2m min.	1.2m min.
Right Interior side yard	1.2m min.	1.2m min.
Exterior side yard (corner lot)	6.0m min.	6.0m min.
Landscaped open space	N/A	N/A
Entrance access width	N/A	N/A
Exit access width	N/A	N/A
Size of fencing or screening	N/A	N/A
Type of fencing	N/A	N/A

10. Building Size

Number of storeys	N/A	N/A
Building height	11m max.	11m max.
Total ground floor area	N/A	N/A
Total gross floor area	N/A	N/A
Total useable floor area	N/A	N/A

11. Off Street Parking and Loading Facilities

Number of off street parking spaces	N/A	N/A
Number of visitor parking spaces	N/A	N/A
Number of accessible parking spaces	N/A	N/A
Number of off street loading facilities	N/A	N/A

12. Residential (if applicable)

Number of buildings existing: N/A

Number of buildings proposed: N/A

Is this a conversion or addition to an existing building? ☐ Yes ■ No

If yes, describe: N/A

Type	Number of Units	Floor Area per Unit in m2
Single Detached	45	Varies
Semi-Detached	0	N/A
Duplex	0	N/A
Triplex	0	N/A
Four-plex	0	N/A
Street Townhouse	0	N/A
Stacked Townhouse	0	N/A
Apartment - Bachelor	0	N/A
Apartment - One bedroom	0	N/A
Apartment - Two bedroom	0	N/A
Apartment - Three bedroom	0	N/A

Other facilities provided (for example: play facilities, underground parking, games room, or swimming pool):

13. Commercial/Industrial Uses (if applicable)

Number of buildings existing: N/A

Number of buildings proposed: N/A

Is this a conversion or addition to an existing building? ☐ Yes ■ No

If yes, describe:

N/A

Indicate the gross floor area by the type of use (for example: office, retail, or storage):

N/A

Seating Capacity (for assembly halls or similar): N/A

Total number of fixed seats: N/A

Describe the type of business(es) proposed: N/A

Total number of staff proposed initially: N/A

Total number of staff proposed in five years: N/A

Maximum number of staff on the largest shift: N/A

Is open storage required: ☐ Yes ■ No

Is a residential use proposed as part of, or accessory to commercial/industrial use?

☐ Yes ■ No If yes please describe:

N/A

14. Institutional (if applicable)

Describe the type of use proposed: N/A

Seating capacity (if applicable): N/A

Number of beds (if applicable): N/A

Total number of staff proposed initially: N/A

Total number of staff proposed in five years: N/A

Maximum number of staff on the largest shift: N/A

Indicate the gross floor area by the type of use (for example: office, retail, or storage):

N/A

15. Describe Recreational or Other Use(s) (if applicable)

N/A

D. Previous Use of the Property

1. Has there been an industrial or commercial use on the subject lands or adjacent lands? ■ Yes ☐ No ☐ Unknown

   If yes, specify the uses (for example: gas station or petroleum storage):

   Former Solac building to the west. A former TV antenna manufacturer. The building is currently vacant.

2. Is there reason to believe the subject lands may have been contaminated by former uses on the site or adjacent sites? ☐ Yes ■ No ☐ Unknown
3. Provide the information you used to determine the answers to the above questions:

   An Environmental Site Assessment (ESA) revealed no risks.

4. If you answered yes to any of the above questions in Section D, a previous use inventory showing all known former uses of the subject lands, or if appropriate, the adjacent lands, is needed. Is the previous use inventory attached? ☐ Yes ■ No

E. Provincial Policy

1. Is the requested amendment consistent with the provincial policy statements issued under subsection 3(1) of the *Planning Act, R.S.O. 1990, c. P. 13*? ■ Yes ☐ No

   If no, please explain:

   N/A

2. It is owner's responsibility to be aware of and comply with all relevant federal or provincial legislation, municipal by-laws or other agency approvals, including the Endangered Species Act, 2007. Have the subject lands been screened to ensure that development or site alteration will not have any impact on the habitat for endangered or threatened species further to the provincial policy statement subsection 2.1.7? ■ Yes ☐ No

   If no, please explain:

   Field survey completed on October 27, 2023, by Dillon Consulting Limited biologists.

   For due diligence, a second field survey is planned for the spring 2024.

3. Have the subject lands been screened to ensure that development or site alteration will not have any impact on source water protection? ☐ Yes ■ No

   If no, please explain:

   Stormwater management (SWM) facility meeting MOECC design criteria is proposed.

   A SWM report is attached to this application.

   Note: If in an area of source water Wellhead Protection Area (WHPA) A, B or C please attach relevant information and approved mitigation measures from the Risk Manager Official.

4. Are any of the following uses or features on the subject lands or within 500 metres of the subject lands, unless otherwise specified? Please check boxes, if applicable.

   Livestock facility or stockyard (submit MDS Calculation with application)

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Wooded area

   ■ On the subject lands or ☐ within 500 meters – distance _____

   Municipal Landfill

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Sewage treatment plant or waste stabilization plant

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Provincially significant wetland (class 1, 2 or 3) or other environmental feature

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Floodplain

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Rehabilitated mine site

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Non-operating mine site within one kilometre

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Active mine site within one kilometre

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Industrial or commercial use (specify the use(s))

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Active railway line

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Seasonal wetness of lands

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Erosion

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Abandoned gas wells

   ☐ On the subject lands or ☐ within 500 meters – distance _____

F. Servicing and Access

1. Indicate what services are available or proposed:

Water Supply

- ■ Municipal piped water
- ☐ Communal wells
- ☐ Individual wells
- ☐ Other (describe below)

Sewage Treatment

- ■ Municipal sewers
- ☐ Communal system
- ☐ Septic tank and tile bed in good working order
- ☐ Other (describe below)

Storm Drainage

- ■ Storm sewers
- ☐ Open ditches
- ☐ Other (describe below)

2. Existing or proposed access to subject lands:

- ■ Municipal road
- ☐ Provincial highway
- ☐ Unopened road
- ☐ Other (describe below)

Name of road/street: Waverly Street and Brock Avenue

G. Other Information

1. Does the application involve a local business? ☐ Yes ■ No

   If yes, how many people are employed on the subject lands?

   N/A

2. Is there any other information that you think may be useful in the review of this application? If so, explain below or attach on a separate page.

   N/A

H. Supporting Material to be submitted by Applicant

In order for your application to be considered complete, **folded** hard copies (number of paper copies as directed by the planner) and an **electronic version (PDF) of the properly named site plan drawings, additional plans, studies and reports** will be required, including but not limited to the following details:

1. Concept/Layout Plan
2. All measurements in metric
3. Key map
4. Scale, legend and north arrow
5. Legal description and municipal address
6. Development name
7. Drawing title, number, original date and revision dates
8. Owner's name, address and telephone number
9. Engineer's name, address and telephone number
10. Professional engineer's stamp
11. Existing and proposed easements and right of ways
12. Zoning compliance table – required versus proposed
13. Parking space totals – required and proposed
14. All entrances to parking areas marked with directional arrows
15. Loading spaces, facilities and routes (for commercial developments)
16. All dimensions of the subject lands
17. Dimensions and setbacks of all buildings and structures
18. Location and setbacks of septic system and well from all existing and proposed lot lines, and all existing and proposed structures
19. Gross, ground and useable floor area
20. Lot coverage
21. Floor area ratio
22. Building entrances, building type, height, grades and extent of overhangs
23. Names, dimensions and location of adjacent streets including daylighting triangles
24. Driveways, curbs, drop curbs, pavement markings, widths, radii and traffic directional signs
25. All exterior stairways and ramps with dimensions and setbacks
26. Retaining walls including materials proposed
27. Fire access and routes
28. Location, dimensions and number of parking spaces (including visitor and accessible) and drive aisles
29. Location of mechanical room, and other building services (e.g. A/C, HRV)
30. Refuse disposal and storage areas including any related screening (if indoors, need notation on site plan)
31. Winter snow storage location

32. Landscape areas with dimensions
33. Natural features, watercourses and trees
34. Fire hydrants and utilities location
35. Fencing, screening and buffering – size, type and location
36. All hard surface materials
37. Light standards and wall mounted lights (plus a note on the site plan that all outdoor lighting is to be dark sky compliant)
38. Business signs (make sure they are not in sight lines)
39. Sidewalks and walkways with dimensions
40. Pedestrian access routes into site and around site
41. Bicycle parking
42. Architectural elevations of all building sides
43. All other requirements as per the pre-consultation meeting

In addition, the following additional plans, studies and reports, including but not limited to, **may** also be required as part of the complete application submission:

☐ Zoning Deficiency Form

☐ On-Site Sewage Disposal System Evaluation Form (to verify location and condition)

☐ Architectural Plan

☐ Buildings Elevation Plan

☐ Cut and Fill Plan

☐ Erosion and Sediment Control Plan

☐ Grading and Drainage Control Plan (around perimeter and within site) (existing and proposed)

☐ Landscape Plan

☐ Photometric (Lighting) Plan

☐ Plan and Profile Drawings

☐ Site Servicing Plan

☐ Storm water Management Plan

☐ Street Sign and Traffic Plan

☐ Street Tree Planting Plan

☐ Tree Preservation Plan

☐ Archaeological Assessment

☐ Environmental Impact Study

- ☒ Functional Servicing Report
- ☒ Geotechnical Study / Hydrogeological Review
- ☐ Minimum Distance Separation Schedule
- ☐ Noise or Vibration Study
- ☐ Record of Site Condition
- ☒ Storm water Management Report
- ☒ Traffic Impact Study – please contact the Planner to verify the scope required

Site Plan applications will require the following supporting materials:

1. Two (2) complete sets of the site plan drawings folded to 8½ x 11 and an electronic version in PDF format
2. Letter requesting that the Holding be removed (if applicable)
3. A cost estimate prepared by the applicant's engineer
4. An estimate for Parkland dedication by a certified land appraiser
5. Property Identification Number (PIN) printout

Standard condominium exemptions will require the following supporting materials:

- ☐ Plan of standard condominium (2 paper copies and 1 electronic copy)
- ☐ Draft condominium declaration
- ☐ Property Identification Number (PIN) printout

Your development approval might also be dependent on other relevant federal or provincial legislation, municipal by-laws or other agency approvals.

All final plans must include the owner's signature as well as the engineer's signature and seal.

I. Development Agreements

A development agreement may be required prior to site plan approval, subdivision and condominium applications. Should this be necessary for your development, you will be contacted by the agreement administrator with further details of the requirements including but not limited to insurance coverage, professional liability for your engineer, additional fees and securities.

J. Transfers, Easements and Postponement of Interest

The owner acknowledges and agrees that if required, it is their solicitor's responsibility on behalf of the owner, to disclose the registration of all transfer(s) of land and/or easement in favour of the County and/or utilities. Also, the owner further acknowledges and agrees that it is their solicitor's responsibility on behalf of the owner for the registration of postponements of any charges in favour of the County.

K. Permission to Enter Subject Lands

Permission is hereby granted to Norfolk County officers, employees or agents, to enter the premises subject to this application for the purposes of making inspections associated with this application, during normal and reasonable working hours.

L. Freedom of Information

For the purposes of the *Municipal Freedom of Information and Protection of Privacy Act*, I authorize and consent to the use by or the disclosure to any person or public body any information that is collected under the authority of the *Planning Act, R.S.O. 1990, c. P. 13* for the purposes of processing this application.

Owner/Applicant Signature — Date: NOV. 3/23

M. Owner's Authorization

If the applicant/agent is not the registered owner of the lands that is the subject of this application, the owner(s) must complete the authorization set out below.

I/We Akhtar Syed am/are the registered owner(s) of the lands that is the subject of this application.

I/We authorize Dillon Consulting (Mike Pletch) to make this application on my/our behalf and to provide any of my/our personal information necessary for the processing of this application. Moreover, this shall be your good and sufficient authorization for so doing.

Owner — Date: NOV. 3/23

Owner — Date

N. Declaration

I, Mike Pletch of Dillon Consulting Limited

solemnly declare that:

all of the above statements and the statements contained in all of the exhibits transmitted herewith are true and I make this solemn declaration conscientiously believing it to be true and knowing that it is of the same force and effect as if made under oath and by virtue of *The Canada Evidence Act*.

Declared before me at:
City of London

Owner/Applicant Signature

In Province of Ontario

This 6 day of November

A.D., 20 23

MELANIE ANNE MUIR,
a Commissioner, etc., Province of Ontario,
for Dillon Consulting Limited.
Expires May 3, 2025.

A Commissioner, etc.

Planning Department Development Application Form

Complete Application

A complete development application consists of the following:

1. A completed, signed, and notarized application form
2. Supporting information adequate to illustrate your proposal as indicated in **Section H** of this application form
3. Written authorization from the registered owner of the subject lands where the applicant is not the owner as per Section N
4. Cash, debit, credit or cheque payable to Norfolk County in the amount set out in the user fees By-Law that will be accepted and deposited once the application has been deemed complete.

Pre-Submission Consultation:

Norfolk County requires a Pre-Consultation Meeting for all applications; however, minor applications may be exempted depending on the nature of the proposal. The purpose of a Pre-Consultation Meeting is to provide the applicant with an opportunity to present the proposed application, discuss potential issues, and for the Norfolk County and Agency staff to identify the application requirements. Application requirements, as detailed in the Pre-Consultation Meeting Comments, are valid for one year after the meeting date.

Development Application Process

Once an application has been deemed complete by a Planner, Norfolk County staff will circulate the application to adjacent landowners, public agencies, and internal departments for comment. The time involved in application processing varies depending on its complexity, acceptability to the other agencies, and statutory Planning Act decision time-frames.

Payment is required once your application is deemed complete. Pre-payments will not be accepted.

Norfolk County collects personal information submitted through this form under the Municipal Freedom of Information and Protection Act's authority. Norfolk County will use this information for the purposes indicated or implied by this form. You can direct questions about collecting personal information to Norfolk GIS Services at NorfolkGIS@norfolkcounty.ca.

Additional studies required for the complete application shall be at the applicant's sole expense. Sometimes, peer reviews may be necessary to review particular studies at the applicant's expense. In these caseds, Norfolk County staff will select the company to complete the peer review.

Norfolk County will refund the original fee if applicants withdraw their applications before circulation. If Norfolk County must recirculate your drawings, there will be an additional fee. If Norfolk County must do more than three reviews of engineering drawings due to revisions by the owner or failure to revise engineering drawings as requested, Norfolk County will charge an additional fee. Full refunds are only available before Norfolk County has circulated the application.

Notification Sign Requirements

For public notification, Norfolk County will provide you with a sign to indicate the intent and purpose of your development application. It is your responsibility to:

1. Post one sign per frontage in a conspicuous location on the subject lands.
2. Ensure one sign is posted at the front of the subject lands at least three feet above ground level and not on a tree.
3. Notify the Planner when the sign is in place.
4. Maintain the sign until the development application is finalized and, after that, remove it.

Contact Us

For additional information or assistance completing this application, please contact a Planner at 519-426-5870 or 519-875-4485 extension 1842 or planning@norfolkcounty.ca. Please submit the completed application and fees to the attention of the Planning Department at 185 Robinson Street, Suite 200, Simcoe, ON N3Y 5L6.

For Office Use Only:

File Number	28TPL2023390	Public Notice Sign	
Related File Number	ZNPL2019318	Application Fee	$22,264
Pre-consultation Meeting		Conservation Authority Fee	
Application Submitted		Well & Septic Info Provided	
Complete Application	December 15 2023	Planner	Mohammad Alam

Check the type of planning application(s) you are submitting.

- ☐ Official Plan Amendment
- ☒ Zoning By-Law Amendment (Removal of Holding)
- ☐ Temporary Use By-law
- ☒ Draft Plan of Subdivision/Vacant Land Condominium
- ☐ Condominium Exemption
- ☐ Site Plan Application
- ☐ Extension of a Temporary Use By-law
- ☐ Part Lot Control
- ☐ Cash-in-Lieu of Parking
- ☐ Renewable Energy Project or Radio Communication Tower

Please summarize the desired result of this application (for example, a special zoning provision on the subject lands to include additional use(s), changing the zone or official plan designation of the subject lands, creating a certain number of lots, or similar)

Draft Plan Approval for a 45 lot residential subdivision.

Removal of an existing holding provision. Phase 2 ESA is attached.

Property Assessment Roll Number: 49102448600

A. Applicant Information

Name of Owner	Akhtar Syed
Address	130 Guelph Ave
Town and Postal Code	Cambridge ON, N3C 1A4
Phone Number	519-983-7000
Cell Number	519-614-9485
Email	nasar.syed@gmail.com
Name of Applicant	Dillon Consulting Limited c/o Mike Pletch
Address	130 Dufferin Ave, Suite 1201
Town and Postal Code	London, N6A 5R2
Phone Number	519-438-1288 ext 1262
Cell Number	226-582-9802
Email	mpletch@dillon.ca
Name of Agent	Chris DeClark and Peter Braun
Address	15 Goshen Road
Town and Postal Code	Tillsonburg ON, N4G 4G7
Phone Number	519-983-7000
Cell Number	519-614-9485
Email	chris.declark@century21.ca, p.braun@braunz.ca

Unless otherwise directed, Norfolk County will forward all correspondence and notices regarding this application to both owner and agent noted above.

☐ Owner ☐ Agent ☐ Applicant

Names and addresses of any holder of any mortgagees, charges or other encumbrances on the subject lands:

N/A

B. Location, Legal Description and Property Information

1. Legal Description (include Geographic Township, Concession Number, Lot Number, Block Number and Urban Area or Hamlet):
   Part of Lot 24, Concession 12, Geographic Township of Windham (Town of Delhi) in Norfolk County. Parts 1 and 2 Deposited Plan 37R-3287

   Municipal Civic Address: Waverly Street

   Present Official Plan Designation(s): Urban Residential

   Present Zoning: R-2 (Urban Residential Type 2)

2. Is there a special provision or site specific zone on the subject lands?

   ◒ Yes ☐ No If yes, please specify corresponding number:
   Special Provision 14.439. Holding provision for a Record of Site Condition, which is attached.

3. Present use of the subject lands:
   Vacant

4. Please describe **all existing** buildings or structures on the subject lands and whether they will be retained, demolished or removed. If retaining the buildings or structures, please describe the type of buildings or structures, and illustrate the setback, in metric units, from the front, rear and side lot lines, ground floor area, gross floor area, lot coverage, number of storeys, width, length, and height on your attached sketch which must be included with your application:
   N/A

5. If an addition to an existing building is being proposed, please explain what it will be used for (for example: bedroom, kitchen, or bathroom). If new fixtures are proposed, please describe.
   N/A

6. Please describe **all proposed** buildings or structures/additions on the subject lands. Describe the type of buildings or structures/additions, and illustrate the setback, in metric units, from front, rear and side lot lines, ground floor area, gross floor area, lot coverage, number of storeys, width, length, and height on your attached sketch which must be included with your application:
   Proposed single family detached homes with setbacks matching the current zoning.
   Details to follow at building permit applications.

7. Are any existing buildings on the subject lands designated under the *Ontario Heritage Act* as being architecturally and/or historically significant? Yes ☐ No ■

   If yes, identify and provide details of the building:

   N/A

8. If known, the length of time the existing uses have continued on the subject lands:

   N/A

9. Existing use of abutting properties:
   Residential, agricultural, industrial.

10. Are there any easements or restrictive covenants affecting the subject lands?

    ■ Yes ☐ No If yes, describe the easement or restrictive covenant and its effect:
    An access easement at the SW corner of the subject site, allowing access to 599 Gage Street.
    Easement will be removed when Brock Avenue is extended and provides frontage to the existing property

C. Purpose of Development Application

Note: Please complete all that apply.

1. Please explain what you propose to do on the subject lands/premises which makes this development application necessary:
   A 45 lot subdivision is proposed. A draft plan of subdivision application is required.

2. Please explain why it is not possible to comply with the provision(s) of the Zoning By-law/and or Official Plan:
   N/A. Application complies with the Zoning Bylaw and Official Plan.

3. Does the requested amendment alter all or any part of the boundary of an area of settlement in the municipality or implement a new area of settlement in the municipality? ☐ Yes ■ No If yes, describe its effect:

4. Does the requested amendment remove the subject land from an area of employment? ☐ Yes ■ No If yes, describe its effect:

5. Does the requested amendment alter, replace, or delete a policy of the Official Plan?
☐ Yes ■ No If yes, identify the policy, and also include a proposed text of the policy amendment (if additional space is required, please attach a separate sheet):
N/A

6. Description of land intended to be severed in metric units:
Frontage: N/A
Depth: N/A
Width: N/A
Lot Area: N/A
Present Use: N/A
Proposed Use: N/A
Proposed final lot size (if boundary adjustment): N/A
If a boundary adjustment, identify the assessment roll number and property owner of the lands to which the parcel will be added: N/A

Description of land intended to be retained in metric units:
Frontage: N/A
Depth: N/A
Width: N/A
Lot Area: N/A
Present Use: N/A
Proposed Use: N/A
Buildings on retained land: N/A

7. Description of proposed right-of-way/easement:
Frontage: N/A
Depth: N/A
Width: 20m Right-of-Way for Future Street A, and 5m Storm Easement. Refer to Draft Plan.
Area: N/A
Proposed use: Future Right-of-way and Storm easement

8. Name of person(s), if known, to whom lands or interest in lands to be transferred, leased or charged (if known):
N/A

9. **Site Information**	**Zoning**	**Proposed**
Please indicate unit of measurement, for example: m, m^2 or %		
Lot frontage	Interior Lot 12.0m min. Corner Lot 15.0m min.	Varies, meets min zoning. See Draft Plan.
Lot depth	N/A	Varies by Lot
Lot width	N/A	Varies by lot
Lot area	Interior Lot: 360m^2 min. Corner Lot: 450m2 min.	Varies, meets minimum zoning. See Draft Plan.
Lot coverage	N/A	N/A
Front yard	6.0m min.	6.0m min.
Rear yard	7.5m min.	7.5m min.
Left Interior side yard	1.2m min.	1.2m min.
Right Interior side yard	1.2m min.	1.2m min.
Exterior side yard (corner lot)	6.0m min.	6.0m min.
Landscaped open space	N/A	N/A
Entrance access width	N/A	N/A
Exit access width	N/A	N/A
Size of fencing or screening	N/A	N/A
Type of fencing	N/A	N/A

10. Building Size

Number of storeys	N/A	N/A
Building height	11m max.	11m max.
Total ground floor area	N/A	N/A
Total gross floor area	N/A	N/A
Total useable floor area	N/A	N/A

11. Off Street Parking and Loading Facilities

Number of off street parking spaces	N/A	N/A
Number of visitor parking spaces	N/A	N/A
Number of accessible parking spaces	N/A	N/A
Number of off street loading facilities	N/A	N/A

12. Residential (if applicable)

Number of buildings existing: N/A

Number of buildings proposed: N/A

Is this a conversion or addition to an existing building? ☐ Yes ■ No

If yes, describe: N/A

Type	Number of Units	Floor Area per Unit in m2
Single Detached	45	Varies
Semi-Detached	0	N/A
Duplex	0	N/A
Triplex	0	N/A
Four-plex	0	N/A
Street Townhouse	0	N/A
Stacked Townhouse	0	N/A
Apartment - Bachelor	0	N/A
Apartment - One bedroom	0	N/A
Apartment - Two bedroom	0	N/A
Apartment - Three bedroom	0	N/A

Other facilities provided (for example: play facilities, underground parking, games room, or swimming pool):

13. Commercial/Industrial Uses (if applicable)

Number of buildings existing: N/A

Number of buildings proposed: N/A

Is this a conversion or addition to an existing building? ☐ Yes ■ No

If yes, describe:

N/A

Indicate the gross floor area by the type of use (for example: office, retail, or storage):

N/A

Seating Capacity (for assembly halls or similar): N/A

Total number of fixed seats: N/A

Describe the type of business(es) proposed: N/A

Total number of staff proposed initially: N/A

Total number of staff proposed in five years: N/A

Maximum number of staff on the largest shift: N/A

Is open storage required: ☐ Yes ■ No

Is a residential use proposed as part of, or accessory to commercial/industrial use?

☐ Yes ■ No If yes please describe:

N/A

14. Institutional (if applicable)

Describe the type of use proposed: N/A

Seating capacity (if applicable): N/A

Number of beds (if applicable): N/A

Total number of staff proposed initially: N/A

Total number of staff proposed in five years: N/A

Maximum number of staff on the largest shift: N/A

Indicate the gross floor area by the type of use (for example: office, retail, or storage):

N/A

15. Describe Recreational or Other Use(s) (if applicable)

N/A

D. Previous Use of the Property

1. Has there been an industrial or commercial use on the subject lands or adjacent lands? ■ Yes ☐ No ☐ Unknown

   If yes, specify the uses (for example: gas station or petroleum storage):

   Former Solac building to the west. A former TV antenna manufacturer. The building is currently vacant.

2. Is there reason to believe the subject lands may have been contaminated by former uses on the site or adjacent sites? ☐ Yes ■ No ☐ Unknown
3. Provide the information you used to determine the answers to the above questions:

   An Environmental Site Assessment (ESA) revealed no risks.

4. If you answered yes to any of the above questions in Section D, a previous use inventory showing all known former uses of the subject lands, or if appropriate, the adjacent lands, is needed. Is the previous use inventory attached? ☐ Yes ■ No

E. Provincial Policy

1. Is the requested amendment consistent with the provincial policy statements issued under subsection 3(1) of the *Planning Act, R.S.O. 1990, c. P. 13*? ■ Yes ☐ No

   If no, please explain:

   N/A

2. It is owner's responsibility to be aware of and comply with all relevant federal or provincial legislation, municipal by-laws or other agency approvals, including the Endangered Species Act, 2007. Have the subject lands been screened to ensure that development or site alteration will not have any impact on the habitat for endangered or threatened species further to the provincial policy statement subsection 2.1.7? ■ Yes ☐ No

   If no, please explain:

   Field survey completed on October 27, 2023, by Dillon Consulting Limited biologists.

   For due diligence, a second field survey is planned for the spring 2024.

3. Have the subject lands been screened to ensure that development or site alteration will not have any impact on source water protection? ☐ Yes ■ No

   If no, please explain:

   Stormwater management (SWM) facility meeting MOECC design criteria is proposed.

   A SWM report is attached to this application.

   Note: If in an area of source water Wellhead Protection Area (WHPA) A, B or C please attach relevant information and approved mitigation measures from the Risk Manager Official.

4. Are any of the following uses or features on the subject lands or within 500 metres of the subject lands, unless otherwise specified? Please check boxes, if applicable.

   Livestock facility or stockyard (submit MDS Calculation with application)

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Wooded area

   ■ On the subject lands or ☐ within 500 meters – distance _____

   Municipal Landfill

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Sewage treatment plant or waste stabilization plant

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Provincially significant wetland (class 1, 2 or 3) or other environmental feature

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Floodplain

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Rehabilitated mine site

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Non-operating mine site within one kilometre

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Active mine site within one kilometre

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Industrial or commercial use (specify the use(s))

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Active railway line

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Seasonal wetness of lands

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Erosion

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Abandoned gas wells

   ☐ On the subject lands or ☐ within 500 meters – distance _____

F. Servicing and Access

1. Indicate what services are available or proposed:

Water Supply

- ■ Municipal piped water
- ☐ Communal wells
- ☐ Individual wells
- ☐ Other (describe below)

Sewage Treatment

- ■ Municipal sewers
- ☐ Communal system
- ☐ Septic tank and tile bed in good working order
- ☐ Other (describe below)

Storm Drainage

- ■ Storm sewers
- ☐ Open ditches
- ☐ Other (describe below)

2. Existing or proposed access to subject lands:

- ■ Municipal road
- ☐ Provincial highway
- ☐ Unopened road
- ☐ Other (describe below)

Name of road/street: Waverly Street and Brock Avenue

G. Other Information

1. Does the application involve a local business? ☐ Yes ■ No

   If yes, how many people are employed on the subject lands?

   N/A

2. Is there any other information that you think may be useful in the review of this application? If so, explain below or attach on a separate page.

   N/A

H. Supporting Material to be submitted by Applicant

In order for your application to be considered complete, **folded** hard copies (number of paper copies as directed by the planner) and an **electronic version (PDF) of the properly named site plan drawings, additional plans, studies and reports** will be required, including but not limited to the following details:

1. Concept/Layout Plan
2. All measurements in metric
3. Key map
4. Scale, legend and north arrow
5. Legal description and municipal address
6. Development name
7. Drawing title, number, original date and revision dates
8. Owner's name, address and telephone number
9. Engineer's name, address and telephone number
10. Professional engineer's stamp
11. Existing and proposed easements and right of ways
12. Zoning compliance table – required versus proposed
13. Parking space totals – required and proposed
14. All entrances to parking areas marked with directional arrows
15. Loading spaces, facilities and routes (for commercial developments)
16. All dimensions of the subject lands
17. Dimensions and setbacks of all buildings and structures
18. Location and setbacks of septic system and well from all existing and proposed lot lines, and all existing and proposed structures
19. Gross, ground and useable floor area
20. Lot coverage
21. Floor area ratio
22. Building entrances, building type, height, grades and extent of overhangs
23. Names, dimensions and location of adjacent streets including daylighting triangles
24. Driveways, curbs, drop curbs, pavement markings, widths, radii and traffic directional signs
25. All exterior stairways and ramps with dimensions and setbacks
26. Retaining walls including materials proposed
27. Fire access and routes
28. Location, dimensions and number of parking spaces (including visitor and accessible) and drive aisles
29. Location of mechanical room, and other building services (e.g. A/C, HRV)
30. Refuse disposal and storage areas including any related screening (if indoors, need notation on site plan)
31. Winter snow storage location

32. Landscape areas with dimensions
33. Natural features, watercourses and trees
34. Fire hydrants and utilities location
35. Fencing, screening and buffering – size, type and location
36. All hard surface materials
37. Light standards and wall mounted lights (plus a note on the site plan that all outdoor lighting is to be dark sky compliant)
38. Business signs (make sure they are not in sight lines)
39. Sidewalks and walkways with dimensions
40. Pedestrian access routes into site and around site
41. Bicycle parking
42. Architectural elevations of all building sides
43. All other requirements as per the pre-consultation meeting

In addition, the following additional plans, studies and reports, including but not limited to, **may** also be required as part of the complete application submission:

☐ Zoning Deficiency Form

☐ On-Site Sewage Disposal System Evaluation Form (to verify location and condition)

☐ Architectural Plan

☐ Buildings Elevation Plan

☐ Cut and Fill Plan

☐ Erosion and Sediment Control Plan

☐ Grading and Drainage Control Plan (around perimeter and within site) (existing and proposed)

☐ Landscape Plan

☐ Photometric (Lighting) Plan

☐ Plan and Profile Drawings

☐ Site Servicing Plan

☐ Storm water Management Plan

☐ Street Sign and Traffic Plan

☐ Street Tree Planting Plan

☐ Tree Preservation Plan

☐ Archaeological Assessment

☐ Environmental Impact Study

- ☒ Functional Servicing Report
- ☒ Geotechnical Study / Hydrogeological Review
- ☐ Minimum Distance Separation Schedule
- ☐ Noise or Vibration Study
- ☐ Record of Site Condition
- ☒ Storm water Management Report
- ☒ Traffic Impact Study – please contact the Planner to verify the scope required

Site Plan applications will require the following supporting materials:

1. Two (2) complete sets of the site plan drawings folded to 8½ x 11 and an electronic version in PDF format
2. Letter requesting that the Holding be removed (if applicable)
3. A cost estimate prepared by the applicant's engineer
4. An estimate for Parkland dedication by a certified land appraiser
5. Property Identification Number (PIN) printout

Standard condominium exemptions will require the following supporting materials:

- ☐ Plan of standard condominium (2 paper copies and 1 electronic copy)
- ☐ Draft condominium declaration
- ☐ Property Identification Number (PIN) printout

Your development approval might also be dependent on other relevant federal or provincial legislation, municipal by-laws or other agency approvals.

All final plans must include the owner's signature as well as the engineer's signature and seal.

I. Development Agreements

A development agreement may be required prior to site plan approval, subdivision and condominium applications. Should this be necessary for your development, you will be contacted by the agreement administrator with further details of the requirements including but not limited to insurance coverage, professional liability for your engineer, additional fees and securities.

J. Transfers, Easements and Postponement of Interest

The owner acknowledges and agrees that if required, it is their solicitor's responsibility on behalf of the owner, to disclose the registration of all transfer(s) of land and/or easement in favour of the County and/or utilities. Also, the owner further acknowledges and agrees that it is their solicitor's responsibility on behalf of the owner for the registration of postponements of any charges in favour of the County.

K. Permission to Enter Subject Lands

Permission is hereby granted to Norfolk County officers, employees or agents, to enter the premises subject to this application for the purposes of making inspections associated with this application, during normal and reasonable working hours.

L. Freedom of Information

For the purposes of the *Municipal Freedom of Information and Protection of Privacy Act*, I authorize and consent to the use by or the disclosure to any person or public body any information that is collected under the authority of the *Planning Act, R.S.O. 1990, c. P. 13* for the purposes of processing this application.

Owner/Applicant Signature — Date: NOV. 3/23

M. Owner's Authorization

If the applicant/agent is not the registered owner of the lands that is the subject of this application, the owner(s) must complete the authorization set out below.

I/We Akhtar Syed am/are the registered owner(s) of the lands that is the subject of this application.

I/We authorize Dillon Consulting (Mike Pletch) to make this application on my/our behalf and to provide any of my/our personal information necessary for the processing of this application. Moreover, this shall be your good and sufficient authorization for so doing.

Owner — Date: NOV. 3/23

Owner — Date

N. Declaration

I, Mike Pletch of Dillon Consulting Limited

solemnly declare that:

all of the above statements and the statements contained in all of the exhibits transmitted herewith are true and I make this solemn declaration conscientiously believing it to be true and knowing that it is of the same force and effect as if made under oath and by virtue of *The Canada Evidence Act*.

Declared before me at:
City of London

Owner/Applicant Signature

In Province of Ontario

This 6 day of November

A.D., 20 23

MELANIE ANNE MUIR,
a Commissioner, etc., Province of Ontario,
for Dillon Consulting Limited.
Expires May 3, 2025.

A Commissioner, etc.

Pre-Submission Consultation Meeting Notes

Date: February 1, 2023; *Updated on September 15, 2023*

Description of Proposal: A Draft Plan of Subdivision to allow for the creation of 47 lots and for Single Family Dwellings.

Property Location: Waverly Street, Delhi

Roll Number: 49102448600

Please read all the information contained in this document, as it pertains to the requirements for future development planning applications. As a result of the information shared at the pre-consultation meeting dated February 1, 2023, the following applications and qualified professional documents / reports are required as part of a complete application. Failure to include all listed items with the application will deem the application incomplete. The County reserves the right to change, reduce or add requirements for a complete application, particularly if the submission does not match the proposal as reviewed during the pre-submission consultation meeting.

Please note that various fees are associated with each application and there are also costs for qualified professionals retained to complete various documents / reports. All requirements identified are minimum and determined as of the date of the pre-consultation meeting with the information available at that time. As the proposal proceeds and more information is made available, additional applications, studies, reports, etc. may be required.

The information contained in this document is applicable for a maximum of one (1) year from the date of meeting. If an application is not received within that time frame or any component of the proposal changes, a new pre-submission consultation meeting is required.

All applications are required to include information outlined in the Pre-submission consultation meeting notes; failure to include all items with the application submission without prior approval will necessitate a notice of incomplete application response by the County.

Before you submit your application, please contact the assigned Planner to confirm submission requirements and the applicable fee.

As part of a complete application, a signed version of these meeting notes is required.

Proponent / Agent Name	Signature	Date

Attendance List

Proponent	Peter Braun, Chris DeClark, Mike Pletch, Christine Demers, Joana El Gamal
Community Development – Planning and Agreement	Tricia Givens, Director, Planning (Chair) Mohammad Alam, Senior Planner Lindsay King, Planning Coordinator Annette Helmig, Agreement and Development Coordinator
Community Development – Building and Zoning	Jonathon Weir, Building Inspector
Environment & Infrastructure Services – Development Engineering	Stephen Gradish, Development Technologist
Community Services – Fire	Katie Ballantyne, Community Safety Officer
Corporate Support Services – Realty Services	Kelly Darbishire, Specialist, Realty Services Karen Lambrecht, Corporate Support Generalist

Table of Contents

Pre-Submission Consultation Meeting Notes 1

Attendance List 2
Table of Contents 2
List of Application Requirements* and General Comments 4
- Planning Department 4
- Planning Comments 5
- Development Engineering 6
- Agreements 7
- Corporate Support Services – Realty Services 8
- Fire Department 8

Appendix A: Planning Reference Materials 9
- Provincial Policy Statement, 2020 9
- Norfolk County Official Plan https://www.norfolkcounty.ca/government/planning/official-plan/ 9
- Norfolk County Zoning By-Law 1-Z-2014 https://www.norfolkcounty.ca/government/planning/new-zoning-by-law/ 9

List of Application Requirements* and General Comments

Planning Department

Planning application(s) required to proceed	**Required**
Official Plan Amendment Application Choose an item.	
Zoning By-law Amendment Application Choose an item.	X (for any zoning deficiency)
Site Plan Application Choose an item.	
Draft Plan of Subdivision Application	X
Draft Plan of Condominium Application	
Part Lot Control Application	
Consent / Severance Application	
Minor Variance Application	
Removal of Holding Application	
Temporary Use By-Law Application	
Other - Click here to enter text.	

Planning requirements for a complete application The items below are to be submitted as part of the identified Planning Application(s). ** electronic/PDF copies of all plans, studies and reports are required**	**Required at OPA/ Zoning Stage** (For any zoning deficiency)	**Required at Draft Plan Stage**
Proposed Site Plan / Drawing	X	X
Planning Impact Analysis Report / Justification Report	X	
Environmental Impact Study Choose an item.		
Neighbourhood Plan (TOR (Terms of Reference) must be approved by the County)		
Agricultural Impact Assessment Report		
Archaeological Assessment		
Heritage Impact Assessment		
Market Impact Analysis		
Dust, Noise and/or Vibration Study		
MOE D-Series Guidelines Analysis	X	X
Tree Plantation Plan		X
Elevation Plan		
Photometrics (Lighting) Plan		
Odour mitigation plan (in relation to Cannabis Production and Processing Facilities)		
Shadow Analysis Report		

Record of Site Condition	X	X
Contaminated Site Study		
Minimum Distance Separation Schedule		
Parking Assessment		
Hydrogeological Study		
Restricted Land Use Screening Form		
Topographical Survey Drawing		X
Additional Planning requirements		**Required**
Development Agreement		X
Parkland Dedication/Cash-in-lieu of Parkland		X

*The list of Planning Department requirements is based on the information submitted and as presented for this specific pre-consultation meeting. Norfolk County reserves the right to adjust requirements including identifying additional requirements or reducing requirements. Any changes to a proposal may necessitate changes to Planning Department submission requirements. Furthermore, reports and studies are subject to peer review.

Community Development fees, applications, and helpful resources can be found can be found by visiting https://www.norfolkcounty.ca/government/planning/

Planning Comments

Note: All comments are general and nature and subject to change pending modifications to the proposal and full analysis at the application submission stage.

The subject land is designated as Urban Residential in the Official Plan. No Official Plan will be required for the proposed development.

The subject lands are located adjacent to Protected Industrial Designated lands.

Official Plan Section 7.12 - Protected Industrial Designation requires that the proposed sensitive land use meet the required separation distance from protected industrial zone. A D-series guidelines analysis will be required to identify any required separation distance from a proposed sensitive land use.

The site is also subject to a Record of Site Condition which will be a condition of any future planning application approval.

The Site is zoned as Urban Residential Type 2 (R2) with a Holding. R2 zone only permits single detached dwellings that are under R1-B zoning provisions.

Adjacent Rail-line: It is Staff's understanding the previous CN rail is no more active. To prevent potential conflicts in the future should the adjacent rail line come back into

operation, Staff requests to reference the FCM RAC Guidelines for New Development in Proximity to Existing Rail Operations (“the Guidelines”) when reviewing the subdivision applications.

Future Trail: Staff would recommend pedestrian and open space connection to any future trail network to enhance active transportation within the community. .

Note: Endangered and threatened species and their habitat are protected under the provinces Endangered Species Act, 2007 (ESA), O. Reg. 242/08 & O. Reg. 830/21. The Act prohibits development or site alteration within areas of significant habitat for endangered or threatened species without demonstrating that no negative impacts will occur. The Ministry of Environment, Conservation and Parks provides the service of responding to species at risk information requests and project screenings. The proponent is responsible for discussing the proposed activity and having their project screened with MECP (Ministry of Environment, Conservation and Parks).

Please be advised that it is the owner’s responsibility to be aware of and comply with all relevant federal or provincial legislation, municipal by-laws, or other agency approvals.

Assigned Planner:
Mohammad Alam
Principal Planner
Extension 1828
Mohammad.Alam@norfolkcounty.ca

Development Engineering – Waverly St. Delhi

Development Engineering requirements to proceed The below requirements are to be submitted as part of the Formal Development Planning application.	**Required at OPA/ Zoning Stage/DPA**	**Required at detailed engineering stage**	**Potentially Required (See Notes Section)**
General Requirements			
Concept Plan	X	X	
Draft plan	X	X[22]	
Area Rough Grading Plan		X[23]	
Master Grading Plan		X[24]	
Lot Grading Plan		X[25]	
Siltation and Erosion Control Plan		X[25]	
General Plan of Services	X[14]	X[25]	
Plan and Profile Drawings		X[26]	
Composite Utility Plan		X[27]	
Geotechnical Report		X[28]	
Functional Servicing Report	X[14]	X	
Consolidated Linear Infrastructure approval for Sanitary and/or Storm sewer Extension or Alteration		X[29]	X[42]
Form 1 Approval for Watermain extension or Alteration.		X[29]	X[42]
Water Servicing Requirements– Section 10.0 Norfolk County Design Criteria and ISMP Section 4.0			
Extension of Watermain		X[29, 30]	
Water main Looping		X[31]	
Water Modelling (County Consultant)	X[14]	X	
Water Allocation	X[11]	X	
Sanitary Servicing Requirements – Section 9.0 Norfolk County Design Criteria and ISMP Section 4.0			
Sanitary Drainage Plan		X[32]	
Sanitary Design Sheet		X[33]	

Extension of Sanitary Mainline		X[29, 34]	
Sanitary Modelling (County Consultant)	X[14]	X	
Storm Water Servicing Requirements – Section 7.0 and Section 8 Norfolk County Design Criteria and ISMP Section 4.0			
Storm Water Management Design Report (including calculations)	X[15]	X[35]	
Storm Water Drainage Area Plan		X[36]	
Storm Sewer Design Sheet		X[37]	
Establish/Confirm Legal and Adequate Outlet	X[16]	X[38]	
Anticipated Flow/Analysis to Receiving Collection System	X[16]	X	
Extension of Storm Water Mainline		X[39]	
Transportation Requirements – Section 6.0 Norfolk County Design Criteria, ISMP Section 5.0, Section 6.0 and Appendix J			
Traffic Impact Study	X[17]	X	
Street Signage/Traffic Control Plan		X	
Improvements to Existing Roads & Sidewalk (urbanization, pavement structure, widening sidewalk replacement, upgrades, extension and accessibility)	X[8, 9]	X[40, 41]	

General Notes:

1. Securities in the amount of 100% will be required in the form of a Security Schedule 'H' Template. 100% security will be required at time of registration. A copy of this template is available upon request.
2. All reports and drawings are to be signed and stamped by a Professional Engineer (P. Eng) and adhere to Norfolk County's Design Criteria and Integrated Sustainable Master Plan (ISMP). A copy of these criteria is available upon request.
3. Recommendations from all reports (FSR, SWM, TIS, Modelling, etc.) must be incorporated into the design and be constructed at the developer's expense.
4. All applicable permits and inspections to be issued by Public Works
5. As per Norfolk County By-Law 2013-65, only one domestic water service pipe and one water meter shall be installed per lot.
6. As per Norfolk County By-Law 2016-32, only one entrance is permitted per residential lot.
7. Sidewalks are to be installed as per the latest version of the Norfolk County Sidewalk Policy.

8. Norfolk County will require Brock Street to be extended as a secondary access to the development. The existing Brock St Road Allowance will not be permitted to become a permanent dead-end.
9. For Road Maintenance reasons it is not desirable to have the Bulb portion on the bends at Lots 7-11 and 18-22. The configuration shown for the pre consultation meeting does not meet current Norfolk County standards. It shows an extra wide ROW with a bulge on one side. These can be very difficult to maintain and yet are not large enough to meet the County criteria for a Cul-de-sac. It is recommended that outside property lines are in parallel with the Centerline of the street or meet the criteria of a full Cul-de-sac. Additionally, as per Section 6.3.04 - *Subdivision street pattern designs should try to avoid the use of cul-de-sacs*.
10. It must be noted that all construction access will be mandated to Waverly St in any future agreement. Furthermore, a condition assessment will be required to ensure construction traffic has not negatively impacted on the existing road.
11. Norfolk County is recommending that developers consider a phasing approach to most Subdivisions, Condominiums and Site Plans. As the County is updating the allocation policy for water and wastewater it has become apparent that the County may be required to impose phasing onto the developers to allow their applications to move forward to approval.

Required at Draft Plan of Subdivision / Zoning By-Law Amendment Application Stage:

All reports and studies are to be signed and sealed by a Professional Engineer and are to adhere to Norfolk County Design Criteria.

12. A Draft Plan is required.
13. The following reports/studies will be required at time of Zoning By-law Amendment and Draft Plan of Subdivision Submission:

    a. Concept Plan;
    b. Functional Servicing Report (as per Norfolk County Design Criteria);
    c. Water / Sanitary Modelling.
    d. Storm Water Management Report.
    e. Traffic Impact Study (as per ISMP Appendix J – TIS Guidelines);
14. Sanitary and Water modelling will be required. This is to be completed by Norfolk County's third-party consultant. The cost to complete the modelling and any recommendations from reports are to be implemented into the design at the applicant's expense. The following information will be required to receive a quote and complete the modelling.
    a. General Plan of Services
    b. Functional Servicing Report;
        i. Total Wastewater Design Flows shown in Sanitary Design Sheets;
        ii. Total Domestic Water and Fire Flows as per Norfolk County Design Criteria Section 10.1.1

The Functional Servicing Report must include water /sanitary servicing and fire flow calculations. Fire Flow calculations are to be completed in accordance with "Water Supply for Public Fire Protection 2020" by Fire Underwriters Survey.

Once the quote has been received, approval from the applicant will be required before proceeding.

15. Stormwater Management Report is to be completed as per Norfolk County Design Criteria Section 7.0 and Section 4.0 of the ISMP.
16. Confirmation of Legal and Adequate outlet – as clarified at the pre consultation meeting it was the intent of the Designer to use the existing Storm sewer along Waverly for the SWM pond outlet. Prior to Draft Plan approval, confirmation that all downstream sewers are sized accordingly to take this extra flow will be required. Attached to these pre con notes is a copy of the recent design of the Storm system currently being replaced along James Street in Delhi. That Storm sewer design identifies the areas of this proposed development that are tributary to the existing sewer. According to Norfolk County records the downstream sewers are restricted to a 2yr storm.
    Therefore, at this time it is the opinion of Norfolk County that your outlet will be designed equal to the area shown at a 2yr storm event.
17. A full Traffic Impact Study (TIS) will be required. The TIS is to be completed to Norfolk County's ISMP – Appendix J: TIS Guidelines. A copy of these guidelines has been attached for your reference.

Required at Engineering Review Stage:

18. As per Norfolk County Design Criteria, Section 4.1.01(A) – Submission of Engineering Drawings for Draft Plan of Subdivision is to be adhered to.
19. All reports, studies and Engineering drawings are to be signed and sealed by a Professional Engineer and are to adhere to Norfolk County Design Criteria. A copy of this criteria is available upon request.
20. Recommendations from all reports and studies must be incorporated into the Engineering design at the applicant's expense.
21. A Concept Plan will be required.
22. A Draft Plan will be required.
23. An Area Rough grading plan is required when cuts or fills are proposed to exceed 0.5m.
24. A Master Grading Plan will be required. This plan shows the proposed grading for the overall development including any external areas that are tributary to the site.
25. Lot Grading Plan, Siltation and Erosion Control Plan, and General Plan of Services drawing can be shown on one engineering plan as long as it's legible for review.
26. Plan and Profile drawings will be required as per Section 4.4.03.
27. Composite Utility Plan -This plan will identify the proposed Hydro servicing design as well as all criteria in Section 4.4.07 of Norfolk County Design Criteria.
28. A Geotechnical Report will be required as per Section 3.01 (e). In addition, the report must also identify existing and proposed conditions if infiltration galleries are proposed for the Stormwater Management design.
29. Prior to Development Engineering approval and/or any site alteration, the developer must provide a copy of the appropriate Norfolk County Consolidated Linear Infrastructure Environmental Compliance Approval (CLI-ECA) relating to the municipal Sanitary and Storm sewer extensions or alterations. For all Watermain Extensions and Alterations a Form 1 must also be approved.

30. If any of the local Watermains are not extended to the limit of this property, then it will be the responsibility of the developer to extend all watermains at the developer's expense.
31. Watermains must be looped as per Section 10.3.0 - "New subdivisions shall be designed in such a manner that there are two separate watermain feeds into the subdivision and shall be interconnected to existing watermains adjacent to the site in order to promote overall water quality within the water distribution system."
32. Sanitary Drainage Plans are required and must follow Section 4.4.06 of Design Criteria
33. Sanitary Design Sheets can be shown on the drawings but should also be submitted in an Excel format for review of appropriate calculations.
34. Extension of Sanitary sewer – According to Norfolk County records the existing Sanitary is located at Waverly St and Gage St. Extension of the sanitary sewer to the limits of the new subdivision will at the developer's expense.
35. A Stormwater Management Report (SWM) is to be completed as per Norfolk County Design Criteria Section 7.0 and comply with Section 4.0 of the ISMP. During detailed Engineering review of the SWM Pond the County will require a very detailed look at the landscaping plan and overall design to ensure the facility is not only functional and easy to maintain but that it also aesthetically acceptable for the surrounding development.
36. Storm Drainage Areas are required and must follow Section 4.4.06 of Design Criteria
37. Storm Design Sheets can be shown on the drawings but should also be submitted in an Excel format for review of appropriate calculations.
38. The overall SWM shall include confirmation of Legal and Adequate outlet. As mentioned above in comment 16., additional information is included related to storm design of downstream sewers.
39. Extension of Storm sewer – According to Norfolk County records the existing Storm sewers along Waverly Street stop short of Gage St. Extension of the Storm sewer to the limits of the new subdivision will at the developer's expense.
40. Given the requirements to extend both Sanitary and Storm sewers along Waverly Street, Norfolk County will require that the developer to urbanize Waverly Street from Gage Street to the limit of Subdivision including new Curb and Gutter, Sidewalk, Streetlights Etc.
41. Norfolk County will require installation of new sidewalks along Waverly Street to connect to James St in accordance with the most current version of the "Sidewalk Installation Policy."

Potentially Required Notes:

42. Confirmation of a Record of Site condition may be required prior to Approval of the CLI-ECA to ensure all Sewers and Watermains are installed in contaminant free soils.

Stephen Gradish
Development Technologist
Extension 1702
Stephen.Gradish@norfolkcounty.ca

Agreements

A recommended condition of your planning application approval will be to enter into a development agreement with the County that will be registered on title to the subject lands, at the Owner's expense. The additional requirements for a development agreement could include, but are not limited to the following:

- Engineering drawing review
- Engineer's schedule of costs for the works
- Clearance letter and supporting documentation to support condition clearance
- User fees and performance securities
- Current property identification number (PIN printout) (can be obtained by visiting https://help.onland.ca/en/home/)
- Owner's commercial general liability insurance to be obtained and kept in force during the terms of the agreement
- Postponement of interest. If there are mortgages / charges on your property identifier, your legal representative will be required to obtain a postponement from your bank or financial institution to the terms outlined in your development agreement
- Transfers and / or transfer easements along with registered reference plan

Annette Helmig
Agreement and Development Coordinator
Extension 8053
Annette.Helmig@norfolkcounty.ca

Building Inspector:

The proposed construction is considered a Residential Group C type occupancy as defined by the Ontario Building Code (OBC). You will need to retain the services of a qualified individual with BCIN qualifications in House, HVAC House, an Architect or a Professional Engineer to complete the design documentation for this application.
If construction is to include more than 1 dwelling unit, this needs to be included as part of the design at time of application.

MORE THAN 2 DWELLINGS-PLUMBING

The Ontario Building Code (OBC) 7.6.3.4 requires a review of water service connection size at the time of application for projects connected to a water system with more than one dwelling unit. To help with this the Building Department has created an excel spread sheet. This is to be included with at time building permit application.

FIRE FIGHTING REQUIREMENTS PART 9 BLDGS

The OBC Article 9.10.20.3. will require fire department access to buildings by means of a street, private roadway or yard taking into account connection with public thoroughfares, weight of firefighting equipment, width of roadway, radius of curves, overhead clearance, location of fire hydrants, location of fire department connections and vehicular parking.

Items for Building Permit

"New Residential" & " Applicable Law Checklist" Step by Step Guides have been attached to the minutes herein, they contain information on drawing requirements, designers, forms, contact information for Building Department etc.
If you have any questions on the building permit process or plans required, please check out our website www.norfolkcounty.ca/business/building or call 519-426-5870 ext. 6016

Jonathan Weir
Building Inspector III
Extension 1832
Jonathan.weir@norfolkcounty.ca

Corporate Support Services – Realty Services

1. If a Site Plan Agreement is required, then the County will require postponements of any charges/mortgages (if any) on title to the County's Site Plan Agreement. We recommend that you connect with your Lender(s) (if any) and/or your solicitors as early in the process as possible to avoid any delays.
2. The Owner/Developer should investigate through their solicitors the easement this property is subject to as stated in the legal description to ensure it doesn't affect the project.
3. The Owner/Developer should also investigate through their solicitors the Tax Arrears Certificate previously registered against title to the property as this needs to be deleted from title.

Specialist, Realty Services
Realty.services@norfolkcounty.ca

Fire Department

Norfolk County Fire has the following comments for this proposal:

- Ensure roadways are adequate width to accommodate fire department apparatus and any proposed on-street parking,
- Ensure hydrants are provided as per OBC 3.2.5.

Katie Ballantyne
Community Safety Officer
Extension 2423
Katie.Ballantyne@norfolkcounty.ca

Appendix A: Planning Reference Materials

Following is a summary of some land use planning reference materials. It is the requirement of the applicant to ensure compliance with applicable legislation, policies and regulations.

Provincial Policy Statement, 2020

https://www.ontario.ca/page/provincial-policy-statement-2020

Norfolk County Official Plan
https://www.norfolkcounty.ca/government/planning/official-plan/

Section 9.6.1 outlines requirements in relation to requests to amend the Official Plan.

Section 9.6.2 outlines requirements in relation to requests to amend the Zoning By-law.

It is the responsibility of the proponent to review and ensure relevant Official Plan policies are addressed in any future development application.

Norfolk County Zoning By-Law 1-Z-2014
https://www.norfolkcounty.ca/government/planning/new-zoning-by-law/

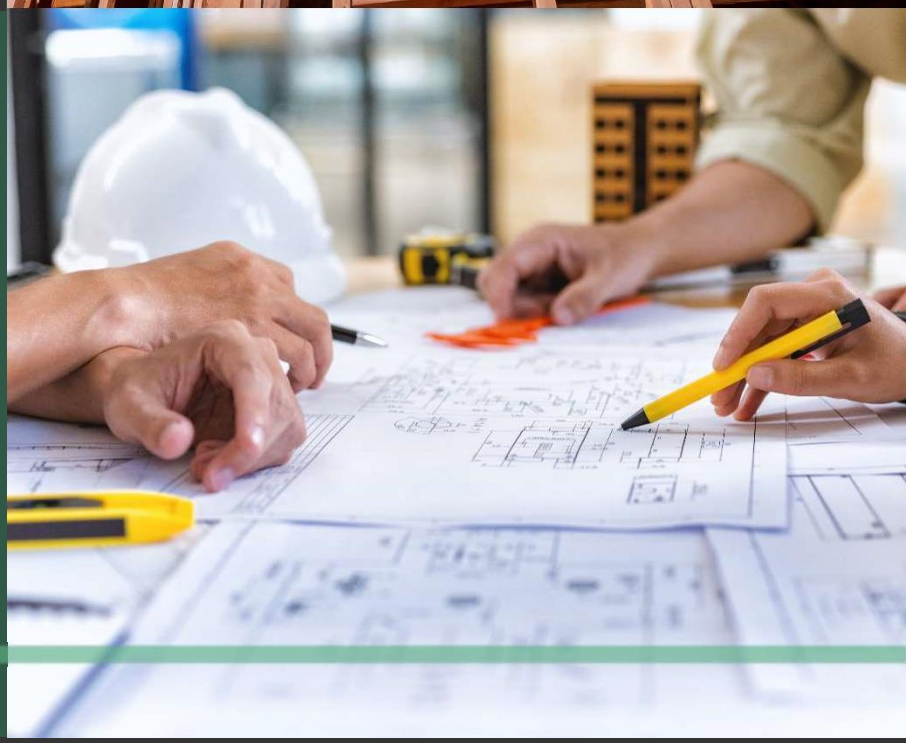
The provisions of the Norfolk County Zoning By-Law shall apply to all lands within the boundaries of Norfolk County. No land, building or structure shall be used, erected, or altered in whole or in part except in conformity with the provisions of this By-Law. No land, building or structure shall be used or occupied except for uses that are specifically identified in the By-Law as permitted uses by the relevant zoning category.

It is the responsibility of the proponent to review and ensure relevant Zoning By-law provisions are addressed in any future development application

NEW RESIDENTIAL HOUSE, SEMI-DETACHED TOWNHOUSES

Building Permit Package

A step by step guide for making a building permit application



Norfolk County Building Department
Community Development Division
185 Robinson Street, Suite 200 Simcoe, Ontario, N3Y 5L6
norfolkcounty.ca

New Residential Permit Package
Houses, Semi-detached, Townhomes

Building permits help protect you, your home, and the interests of your community by making sure the project is structurally sound and follows the Ontario Building Code, municipal zoning and other applicable laws.

There are multiple steps to the building permit process. The purpose of this permit package is to highlight these steps and provide guidance to the building permit process.

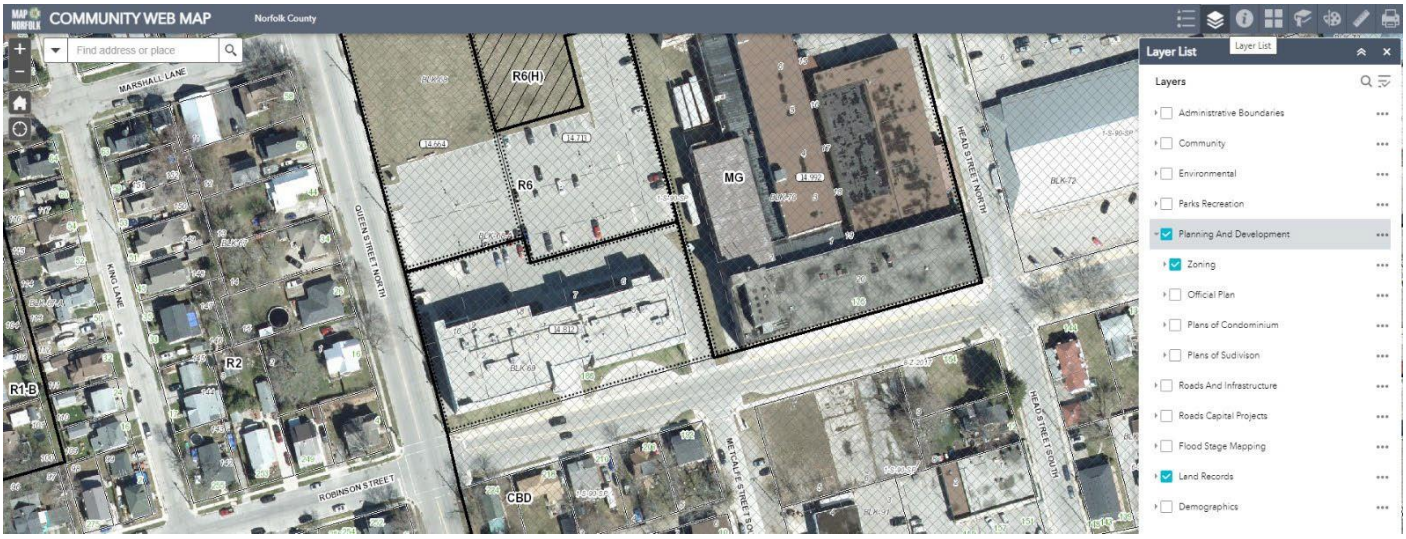
STEP 1: Applicable Law.

Approvals from other agencies are required in many instances before a building permit can be processed and issued. These approvals are **NOT** administered by the Building Department. The fastest way to obtain a building permit is to ensure that all other required approvals are completed prior to permit application.

An Applicable Law Checklist is required as part of a complete application. Agency contacts are attached with this form. Our community mapping has many of these layers mapped to help you determine if additional approvals are required for your application.

Zoning Requirements.

Finding the zoning associated with your property is easy with our GIS Community Web Map, position over your property and turn on the zoning layer by clicking layer list, planning, zoning.



Norfolk County Zoning Bylaw is available online.

To confirm your project conforms to the Zoning By-law you will need to provide a plot plan indicating:

- Property lines and lot dimensions,
- Location of building and all other structures on the lot,
- Location of all steps and landings,
- Distance from dwelling to property lines,
- Parking spots with dimensions,
- Location of septic system.

If your proposed building / structure does not comply with the zoning requirements, a planning application will be required. Zoning and Planning approval is required as part of a complete permit application.

Planning Department: planning@norfolkcounty.ca or 519-426-5870 ext. 1842.
Zoning: zoning@norfolkcounty.ca or 519-426-5870 ext. 1000.

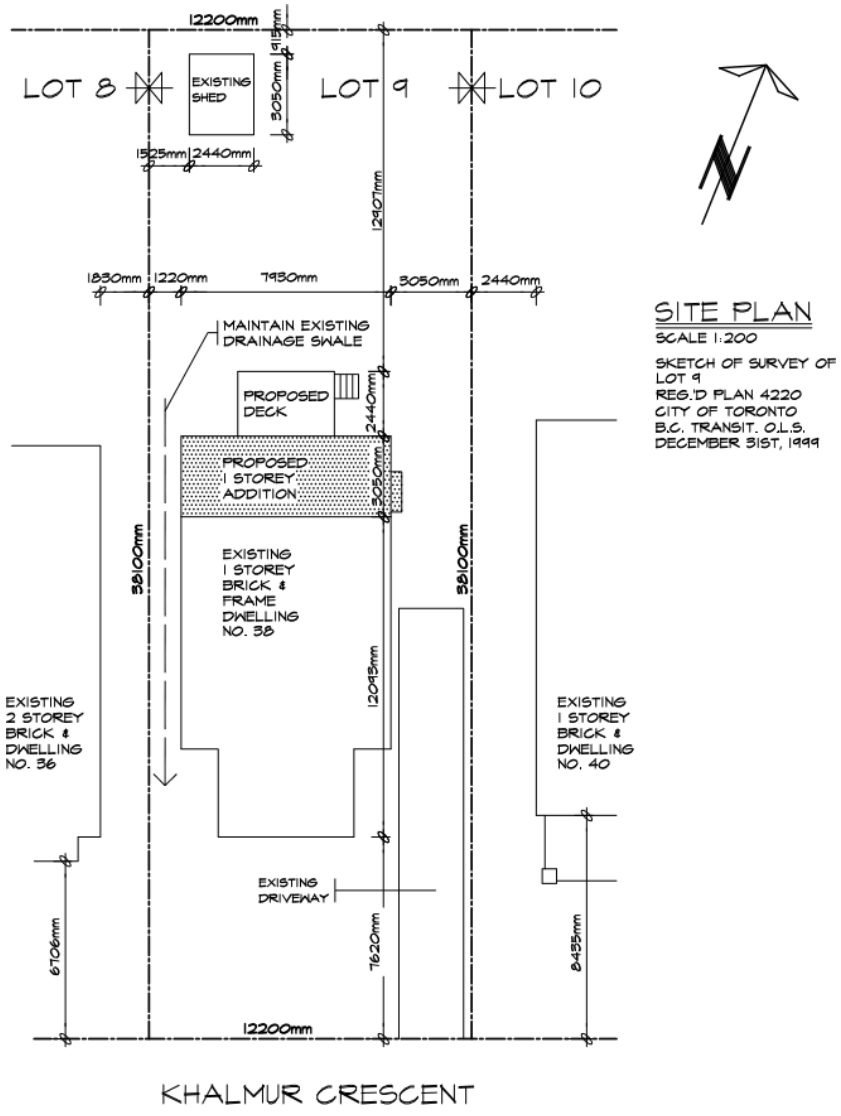
Lot Grading.

Proposed grading plans and lot grading form shall be submitted with all building permit applications, under Norfolk County Grading and Drainage By-law.

Proposed grading plan needs to identify:

- all surface features;
- existing and proposed structures;
- changes in grade and slopes in percent between such changes; and
- include sufficient information regarding adjacent properties to confirm conformance with this By-Law with respect to drainage onto those properties.

An exemption may be considered for a lot in a rural area (complete form, fee applies)



STEP 2: Preparing your application.

A building permit application consists of many documents. The forms attached are to be completed, signed, and dated.

Who can design a house?

As the property owner, you can complete the design yourself for a house, or have a qualified individual with a BCIN number in House, an Architect or a Professional Engineer complete the drawings.

Buildings containing multiple dwelling units may require qualified individuals to complete the design documents. Check with a Building Inspector prior to making application.

Drawings and Documents

Drawings are to be legible and to scale. Use a ruler or computer aided drafting (CAD) software to complete your drawings. Provide enough information and detail to ensure compliance with the Ontario Building Code.

The Ontario Building Code is available online under the 'regulations under this act' tab.

Building Department staff are not permitted by law to provide design advice. It is the responsibility of the property owner or authorized agent to complete a design that meets the requirements of the Ontario Building Code (OBC) and the Building Code Act (BCA).

If you are unable to complete the application and provide the required documents, should retain a qualified designer to assist you in completing the application.

Building Permits – Application Checklist.

Completed Forms.

- □ Building Permit Application Form.
- □ Schedule 1: Designer Information.
- □ Applicant Authorization Form, if application is not completed by the property owner.
- □ Applicable Law Checklist and supporting documents.
- □ Lot grading form or approved exemption.
- □ Water, storm sewer, sanitary sewer connection permit (where required).
- □ Evaluation of existing on-site septic system (where required).

Required Documents.

- □ Plot Plan:
  - Property lines and lot dimensions,
  - Location of building and all other structures on the lot,
  - Location of all steps and landings,
  - Distance from dwelling to property lines,
  - Parking spots with dimensions,
  - Location of septic system.
- □ Lot Grading Plan.

- □ Drawings of the Building:
  - Footing, foundations, anchorage details (where applicable),
  - Floor plans,
  - Room names, sizes and ceiling heights,
  - Door & window location and sizes,
  - Location of plumbing fixtures including laundry facilities,
  - Fire separations, fire wall design (if applicable),
  - Smoke alarms and/or fire alarm systems.
- □ Elevations.
- □ Cross sections of exterior wall from footing to roof.
- □ Roof truss layout or roof framing plan.
- □ Energy Efficiency Design Summary (EEDS), performance or prescriptive option.
- □ Engineered floor system layout (where required).
- □ Engineered beam details (i.e. LVL's, steel beams) (where required)
- □ Residential mechanical ventilation design summary.
- □ Ventilation duct design:
  - Heat Recovery Ventilator (HRV) duct sizing and layout,
  - Exhaust fan duct sizing and layout.
- □ Septic application (where required) This is a separate application, see septic.

Fees

- □ Building Permit fee.
- □ Plumbing fee.
- □ Occupancy fee.
- □ Lot grading exemption fee (if applicable).
- □ Water/Sewer/Storm connection permit fee(if applicable).
- □ Water meter fee (if applicable).
- □ Civic address fee (if applicable).
- □ Development charges.

Septic Permits - Application Checklist.

Completed Forms.

- □ Building Permit Application Form.
- □ Schedule 1: Designer Information.
- □ Schedule 2: Sewage System Installer Information.

Required Documents.

- □ Septic System Permit Application Information Package / Worksheets .
- □ Percolation time ('T' time) report from a licensed testing agency.

Fees.

- □ Septic Permit fee.

STEP 3: Applying.

Online Portal: Visit Norfolk Permits Portal and make your application online.

Building Department

Apply for a Building Permit
Status and Fees

In Person: Visit our service counter located at 185 Robinson Street, Suite 200 Simcoe Ontario.

Our Permit Coordinators will review your application and provide in writing any item which may be missing from the application and a cost break down for the permit fees and payment options.

Step 4: Plans Review.

A Building Inspector will contact you in writing if there are building code concerns or missing information from your application.

A building permit is issued once all documentation has been received, fees are paid in full, and your plans are check for compliance with zoning by-law and the building code.

Step 5: Inspections.

Once you have obtained a building permit, a building inspector needs to attend your site at several milestones in the construction process. For more information, please check the inspection section of Norfolk County's Building Department website. Once all inspections are complete and passed your permit is closed.

Need Help? If you have any question on the building permit process or plans required, please contact permits@norfolkcounty.ca or 519-426-5870 ext. 6016.

Updated October 2022

Appendix J

TIS Guidelines

TABLE OF CONTENTS

A1.1 When to complete a TIS 2
A1.2 Data Requirements 2
A1.3 Existing Conditions 2
A1.4 Study Area 3
A1.5 Development Land Use Type & Site Plan 3
A1.6 Study Horizons 3
A1.7 Traffic Analysis 3
A1.8 Existing Conditions Traffic Analysis 4
A1.9 Future Conditions 4
A1.9.1 Transportation Network Improvements 4
A1.9.2 Future Background 4
A1.9.3 Growth Rates 4
A1.9.4 Other Background Developments 4
A1.9.5 Trip Generation 4
A1.9.6 Trip Distribution 5
A1.9.7 Total Future Analysis and Recommendations 5
A1.10 Heavy Vehicle Trips 5
A1.11 Roadway Improvements 6

A1.1 WHEN TO COMPLETE A TIS

A transportation impact study (TIS) should be completed for every development proposal within Norfolk County that may have an impact on the County road network. Generally speaking, developments that are expected to produce 75 vehicle trips to and from a development would constitute as having an impact. However, the County may request a TIS for developments that produce less than 75 trips in situations where other issues, including but not limited: to safety concerns, significant traffic peaking, and other operational concerns are identified, at the discretion of County staff.

If a development is deemed not to result in a significant impact to the County road network, then a Transportation Impact Study Brief will be required. This brief will provide the information required in Sections x to x of the Transportation Impact Study Guidelines.

A1.2 DATA REQUIREMENTS

The following list of information identifies the data that must usually be collected in order to complete a Transportation Impact Study. Additional information may be required depending on the needs of each individual study.

Table A1
Data Requirements for Transportation Impact Studies

Data	Source
Turning Movement Counts	Manual Collection Information from other studies
Signal Timing Plans	County Staff
Historical MDTs	County Staff MTO iCorridor Website
Road Configuration	Site Visit Google Streetview or equivalent (updated within the last year)
Background Developments within Study Area	County Staff
Collision Information within Study Area	County Staff

A1.3 EXISTING CONDITIONS

- Describes the road jurisdictions, road classifications, existing land use type, speed limits, lane configurations, street names, existing Active Transportation facilities, signalized and/or unsignalized intersections and their locations.
- Where possible, this information should be provided on detailed maps and diagrams.

- Existing Heavy Vehicle Volumes, to be used in the analysis. In areas with significant Heavy Vehicle volumes, please see section A.10 Heavy Vehicle Trips.

A1.4 STUDY AREA

- Contains a description and a map of the study area including but not limited to the site location, land use, type of the surroundings and subject development lands.
- The study area should extend far enough to contain all highways, interchanges and intersections that will be affected by the traffic generated by the proposed development.

A1.5 DEVELOPMENT LAND USE TYPE & SITE PLAN

- Contains a description of the type of land uses proposed and a detailed site plan showing structures, parking, access and site circulation.
- Identifies existing road edges, entrances, pavement markings and traffic control for roads adjacent to the proposed development, shown to scale.
- Details on development size, including property area, number of residential units, gross floor area, number of employees, etc.
- Details on development phasing (if applicable) and approximate timing for partial and full occupancy.

A1.6 STUDY HORIZONS

- Includes the opening date of the development, 5 and 10 years from the opening date.
- Where applicable, each major phase in a multi-phased development should be assessed separately for the 5 and 10 year horizons beyond full build-out of the site.
- Alternative study horizon years require confirmation by ministry staff prior to the commencement of the TIS.

A1.7 TRAFFIC ANALYSIS

- Traffic analysis should be completed using software which calculates traffic capacity under the latest Highway Capacity Manual methodology.
- Impacts on the road network should be evaluated for both weekday A.M. and P.M. peak hours and for the site peak generation hour, if it falls outside highway peak hour times.
- At signalized intersections, movements with v/c ratio greater than 0.85 are deemed to be "critical" in terms of operations. Movements that experience a *vie* ratio of 0.85 or greater should be evaluated for possible operational improvements.

A1.8 EXISTING CONDITIONS TRAFFIC ANALYSIS

- The existing conditions analysis will utilize the information obtained in previous steps, in order to determine the baseline traffic conditions that will be used to identify and compare the impacts in the future analyses.

A1.9 FUTURE CONDITIONS

A1.9.1 Transportation Network Improvements

- Any planned transportation network improvements in the study area will be confirmed with County staff prior to undertaking the future analysis. This will include roads widenings or changes, modifications to intersection configurations.

A1.9.2 Future Background

- The future background traffic conditions are a composite of the existing conditions, and the change in traffic volumes as a result of new development in the immediate area, or more generally throughout the County.
- In order to estimate the various components of the background traffic growth, the following items should be reviewed with the County.

A1.9.3 Growth Rates

- Generalized growth rates on collector and arterial roadways in the County are intended to represent the change in traffic volumes as a result of volumes beyond the study area. This is because it is likely the majority of this traffic is "pass-through" traffic destined to other locations.
- Growth rates should be estimated based on availability of the following sources: historical MDT information, macro model link volumes, or local experience.

A1.9.4 Other Background Developments

- Traffic anticipated to be generated from approved developments within the study area must be accounted for. County Planning staff should be consulted in order to determine the location and magnitude of these developments, and to obtain traffic impact studies for these developments (if available)

A1.9.5 Trip Generation

- The volume of traffic generated by a proposed development should be estimated using the procedures described in ITE's Trip Generation Handbook.
- Special consideration should be given to the guiding principles included in Chapter 3 of the ITE's Trip Generation Handbook for the selection between rates and equations.
- If local data is available, or an alternative methodology for trip generation is proposed, its use should be discussed with Ministry's staff prior to commencement of the TIS.

- For trip generators considered by the Ministry as unique, an alternative methodology for trip generation should be discussed and approved with the Ministry staff prior to commencement of the TIS.
- Trip Generation assumptions and results should be presented in a tabular form.
- For mixed-use developments, NCHRP Project 8-51 should be referenced in addition to Chapter 7 of ITE's Trip Generation Handbook

A1.9.6 Trip Distribution

- Describes methods and assumptions for distribution and route assignment of traffic.
- Assumptions for trip distribution should be supported by one or more of the following:
  - Origin-destination Surveys
  - Comprehensive Travel Surveys
  - Planning models
  - Market studies
  - Assumptions for route assignment should be supported by:
  - Existing travel patterns
  - Expected future travel patterns
- Assumptions for Origin/Destination and Percent Distribution should be presented in tabular form, while traffic assignment should be presented as a diagram.
- For retail developments, pass-by trips should also be assigned as discussed in Chapter 5 of the ITE Trip Generation Handbook.

A1.9.7 Total Future Analysis and Recommendations

- All volumes should be shown in exhibits.
- The Total Future analysis should identify critical movements at intersections and determine what improvements should be made to mitigate these critical movements.
- Proposed improvements should be selected and designed in accordance with the Section A.A Roadway Improvements below.
- In addition, the Total Future Analysis and Recommendations should include measures to maintain and/or improve existing Active Transportation conditions including interconnection of existing facilities.
- Any possible effects on existing or proposed Active Transportation facilities generated by the proposed development should be discussed and mitigated where possible.

A1.10 HEAVY VEHICLE TRIPS

- For developments in which truck trip generation and their effects in the study area are relevant, the following information shall be included as part of the TIS:
  - Existing conditions related to truck traffic (percentage, safety).

- Relationship between land use and truck traffic (cargo, service hours, routing).
- Physical requirements (dedicated access, dedicated lanes).

A1.11 ROADWAY IMPROVEMENTS

For Transportation Impact Studies, or traffic operations studies in general, the following roadway improvements should be selected and designed in accordance with the Norfolk County Design Criteria. For additional design information, the references indicated below in **Table A2** should also be used.

Improvement	Reference(s)	Other Considerations
Widening	1. TAC Geometric Design Guidelines for Canadian Roads	Widening should be justified through detailed operations study.
Turn Lanes	1. TAC Geometric Design Guidelines for Canadian Roads 2. MTO Geometric Design Guidelines for Ontario Highways	Need for turn lane to be determined through MTO Geometric Design Guidelines for Ontario Highways Left Turn Lane warrant.
Traffic Signals	1. OTM Book 12	Traffic signals should only be installed as warranted by OTM Book 12. However, County staff has the latitude to install at locations where the warrant is not met at their discretion, if there are no significant impacts to adjacent intersections.
Roundabouts	1. FHWA An Informational Guide to Roundabounts 2. Waterloo Region Context Sensitive Regional Transportation Corridor Design Guidelines (Section 4.4.7.6)	Roundabouts should be considered using the criteria available in the FHWA guidelines, in parallel with consideration for all-way stops and signals. Detailed design criteria available in Waterloo guidelines.
School Zones	1. TAC School and Playground Areas and Zones: Guidelines for Application and Implementation	Guidelines for limits of school and playground zones, as well as how they should be appropriately implemented, are included.
All-Way Stop	1. OTM Book 5	Consideration for All-way stops should also include reviewing potential for roundabouts and signals.

REQUIRED INFORMATION

Development Name and Phase_____

Property Legal Description_____

Proposed Street Names_____

Roll Number_____

PIN Number_____

Type and Number of Units

Single Detached_____

Semi-Detached_____

Duplex _____

Triplex _____

Four-plex_____

Street Townhouse_____

Stacked Townhouse_____

Apartment_____

Transfer Easements Block Number and Purpose_____

Transfer Block Number and Purpose_____

Geotechnical Report prepared for Lands	◯ YES	◯ NO	◯ UNKNOWN
Lands are Within the Source Water Protection Area	◯ YES	◯ NO	Lands UNKNOWN
Contain any Contaminated or Impacted Soil	◯ YES	◯ NO	Lands UNKNOWN
Contain any Natural Watercourse	◯ YES	◯ NO	Lands UNKNOWN
Contain any Wetlands	◯ YES	◯ NO	Lands UNKNOWN
Contain any Archaeological Sites	◯ YES	◯ NO	Lands UNKNOWN
Contain an Existing Well and or Septic Field	◯ YES	◯ NO	◯ UNKNOWN
Species at Risk Branch MECP Screening	◯ YES	◯ NO	Lands UNKNOWN
Contain any Endangered Species	◯ YES	◯ NO	◯ UNKNOWN

OWNER INFORMATION

NAME AND CONTACT_____

ADDRESS WITH POSTAL CODE_____

PHONE NUMBER_____

EMAIL _____

AGENT INFORMATION

NAME AND CONTACT_____

ADDRESS WITH POSTAL CODE_____

PHONE NUMBER_____

EMAIL _____

ENGINEER INFORMATION

NAME AND CONTACT_____

ADDRESS WITH POSTAL CODE_____

PHONE NUMBER_____

EMAIL _____

LAWYER INFORMATION

NAME AND CONTACT_____

ADDRESS WITH POSTAL CODE_____

PHONE NUMBER_____

EMAIL _____

SURVEYOR INFORMATION

NAME AND CONTACT_____

ADDRESS WITH POSTAL CODE_____

PHONE NUMBER_____

EMAIL _____

INSURANCE PROVIDER INFORMATION

NAME AND CONTACT_____

ADDRESS WITH POSTAL CODE_____

PHONE NUMBER_____

EMAIL_____

FINANCIAL INSTITUTION INFORMATION (IF APPLICABLE)

NAME AND CONTACT_____

ADDRESS WITH POSTAL CODE_____

PHONE NUMBER_____

EMAIL_____

MORTGAGEE INFORMATION (IF APPLICABLE)

NAME AND CONTACT_____

ADDRESS WITH POSTAL CODE_____

PHONE NUMBER_____

EMAIL _____

SPECIES AT RISK SCREENING

The Ontario Endangered Species Act inquiries and Species at Risk screening are now handled by the Ministry of the Environment, Conservation and Parks, specifically the "Species at Risk Branch" and the new e-mail address for handling these inquiries is now SAROntario@ontario.ca.

TRANSFERS, EASEMENTS AND POSTPONEMENT OF INTEREST

The owner acknowledges and agrees that, it is their solicitor's responsibility on behalf of the owner for the registration of all transfer(s) of land to the County, free and clear of any charges or encumbrances, and/or transfer(s) of easement in favour of the County and/or utilities at no cost to the County. In addition, the owner further acknowledges and agrees that it is their solicitor's responsibility on behalf of the owner for the registration of postponements of any charges to the County's agreements.

INSURANCE CERTIFICATES

Prior to the execution of the development agreement, the owner shall at their expense obtain and keep in force, during the term of this development agreement, commercial general liability insurance coverage satisfactory to the County. The owner further acknowledges and agrees that he/she has authorized the County to discuss with their insurance provider the specific insurance requirements of the County for agreement purposes. In addition, the County will require any professionals hired to carry professional liability insurance to provide coverage for acts, errors and omissions arising from their professional services performed.

OWNER'S AUTHORIZATION

I/We am/are the registered owner(s) of the lands that is the subject of this development agreement.

I/We authorize our agent to provide information on my/our behalf and to provide any of my/our personal information necessary for the processing of this agreement. Moreover, this shall be your good and sufficient authorization for so doing.

I/We authorize the Agreement Administrator to provide and receive information on my/our behalf in connection to the insurance coverage, letter of credit and agreement registration of my/our development.

I/We acknowledge that if there are any new charges or mortgage holders on the property they will be added to the development agreement and will be required to postpone their interest on the property to the County's development conformity interest.

Owner Signature Date

To start your agreement, please return the required supporting information and fees along with the first three pages of this document completed and signed. Provide your payments by the mail or courier to the address below or drop off at ServiceNorfolk customer service desk on the first floor 185 Robinson Street, Simcoe ON N3Y 5L6 Monday to Friday from 9 am to 4 pm. Please make your cheque payable to the Corporation of Norfolk County. If paying by credit card please contact ServiceNorfolk at 519 426-5870 Ext. 4636.

CONTACT FOR FURTHER INFORMATION AND QUESTIONS

Annette Helmig, Agreement and Development Coordinator
Norfolk County, Community Development Division, Planning Department, Agreement Services
185 Robinson Street Suite 200, Simcoe ON N3Y 5L6
226.777.1445
annette.helmig@norfolkcounty.ca

KICK OFF MEETING TO DISCUSS YOUR DEVELOPMENT IS ENCOURAGED

Appropriate internal and external agencies will be invited to discuss relevant draft plan of subdivision conditions

- [ ] Complete set of preliminary engineering drawings for review prior to meeting

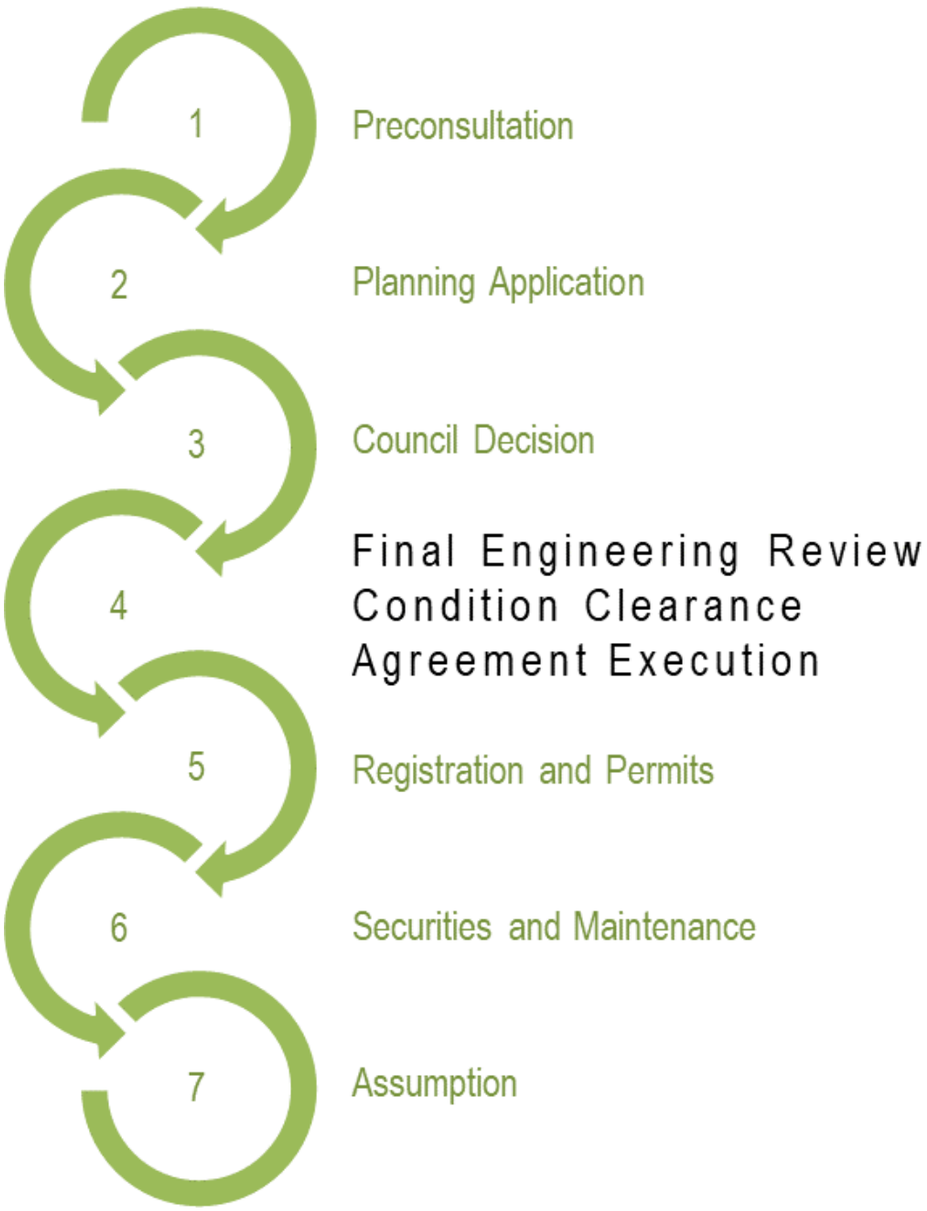
DOCUMENTATION AND FEES REQUIRED FOR PRESERVICING AGREEMENT

- [ ] Complete set of engineering drawings for detailed design review and acceptance including cost estimate, supporting reports, studies and Ministry approvals
- [ ] Phasing plan
- [ ] Street tree planting plan
- [ ] Owner's agreement authorization
- [ ] Postponement of interest from mortgagee / chargee to preservicing (if applicable)
- [ ] Current parcel register (property identifier or PIN printout)
- [ ] Owner's commercial general liability certificate of insurance
- [ ] Construction estimates (100% for external works and 100% to secure site or 10% of total site)
- [ ] Letter of credit or certified cheque for preservicing performance securities
- [ ] User fee (if time is of the essence a certified cheque is required)
  $2,219 for preparation of the preservicing agreement

DOCUMENTATION AND FEES REQUIRED FOR SUBDIVISION AGREEMENT

- [ ] Items identified for preservicing agreement
- [ ] Owner and owner's solicitor's approval to proceed with draft agreement
- [ ] Final reference plan for any transfer easements and lands to be transferred
- [ ] Final preapproved 37M Plan for signature and deposit
- [ ] Letter from owner requesting holding (H) symbol be removed from the subject lands
- [ ] Clearance letter matrix and supporting documentation demonstrating clearance
- [ ] Postponement of interest from mortgagee / chargee to agreement (if applicable)
- [ ] Professional liability insurance for surveyor and / or engineer
- [ ] Hydro One approval to proceed
- [ ] Construction estimates (100% for uncompleted works and 10% for completed works)
- [ ] Letter of credit or certified cheque for subdivision performance securities
- [ ] Current property taxes paid
- [ ] User fee (if time is of the essence a certified cheque is required)
  $4,668 for preparation of the subdivision agreement
  $447 for financial administration of this agreement
  $924 to remove the holding from the zoning on the property (if applicable)
  $542 per tree cash-in-lieu of trees (if applicable)
  5% land appraisal cash-in-lieu of parkland as per consolidated by-law 2016-126 (if applicable)

Development Approval Stages



APPLICABLE LAW CHECKLIST

The Building Code Act prohibits the issuance of a building permit if the proposed construction or demolition will contravene an applicable law as defined by the Building Code. The questions below will help you to determine if an applicable law applies to your project. No timeframe for building permit review can be established until all required applicable law approvals are completed and the approval documents are submitted to the Building Division.

If the answer is **YES** to any question, the relevant approval documents must be submitted with this permit application. Where any required approval has **NOT** been obtained, the agencies listed on the back of this form must be contacted to obtain approval, and the declaration on the bottom of this form must state accordingly.

Property Address: _____ **Permit Number** (office use)_____

Zoning By-Laws – *Norfolk County Planning Department*	YES	NO
Is/was relief required to permit a minor zoning variance in your proposal?		
Is/was rezoning required to permit the proposed building or land use?		
Is a land division or subdivision required and not yet fully completed?		
Are municipal services required but not yet completed or available?		

Planning Approval - *Norfolk County Planning Department*	YES	NO
Is this property regulated by Site Plan Control under Section 41 of the Planning Act?		

Heritage - N*orfolk County Heritage and Culture Department*	YES	NO
Are you demolishing a building that is listed on the County's heritage inventory?		
Is the building designated or in the process of being designated?		
Is the property located in a heritage district or study area?		

Construction and Fill Permits – *Long Point Regional or Grand River Conservation Authority*	YES	NO
Is the property located within a regulated area (i.e. abutting a ravine, watercourse, wetland, or shoreline)?		

Building and Land Use Permits - *Ontario Ministry of Transportation*	YES	NO
Is the property within 45m of a highway or 180 m from any highway intersection?		
Is the property within 395m of a controlled highway intersection? (applies to Sign Permits)		
Is this a major traffic generating project located within 800m of a highway?		

Clean Water Act – *Public Works*	YES	NO
Is the property located within a Source Water Protection regulated area?		
If yes: does a Water Source Protection Plan restrict the land use you are proposing? (s.59 screening form may be required)		

Community Development Division- Building Department
185 Robinson Street, Suite 200, Simcoe, ON N3Y 5L6 • 519-426-5870 Ext. 6016

Agriculture and Farms - *Ontario Ministry of Agriculture and Food*	YES	NO
Is this a farm building that will house animals or manure?		
Is this a milk processing plant?		

Crown Lands Work Permit – *Ministry of Natural Resources*	YES	NO
Are you proposing to construct or place a structure or combination of structures that are in physical contact with more than 15 square meters of shore lands?		
Are you proposing to build on Crown Land?		

Electrical Conductor Clearances - *Electrical Safety Authority*	YES	NO
Are any overhead power lines located above or within 5.5 metres of the proposed building?		

Environmental Approvals - *Ministry of Environment, Conservation, Parks*	YES	NO
Is a Record of Site Condition required to be filed because of a change to more sensitive land use? Is the property a former waste disposal site?		
Is this project a major industrial, commercial, or government project?		
Is this a renewable energy project?		
Does this property have a Certificate of Property Use under the Environmental Protection Act?		

Child Care Centres - *Ministry of Education*	YES	NO
Is a daycare proposed in any part of the building?		

Seniors Centres - Ministry of Children, Community and Social Services	YES	NO
Is this a seniors project where Ontario Government funding is being sought?		

Long Term Care Centres – *Ministry of Health & Long Term Care*	YES	NO
Construction, alteration or conversion of building used for a nursing home?		

Education Act - *Ministry of Education*	YES	NO
Is the project being carried out on the property of an educational facility?		
If so, is any or all building on the property being fully or partially demolished?		

DELCARATION – I have considered the list of applicable laws in the Ontario Building Code as described above, and do hereby declare that:

	None of these applicable law approvals apply to this project
	Applicable laws check 'yes' apply to this project, and approval documents are submitted with this application.
	Applicable laws checked 'yes' apply to this project; however, all approval documents have not yet been obtained

The information provided on this form is true to the best of my knowledge. I have authority to act on behalf of the owner, corporation, or partnership with respect to this application (if applicable).

Name: _____ Signature: _____ Date: _____

Approvals from other agencies are required in many instances before a building permit can be processed and issued. These approvals are **NOT** administered by the Building Department. The fastest way to obtain a building permit is to ensure that all other required approvals are completed prior to permit application. The Building Department is required by law to prioritize applications that are fully complete in terms of applicable law approvals and document submissions. Building permit documents must be consistent with applicable law approvals. If you answer yes to any of the following question please reach out to these agencies for approvals.

Zoning and Planning – Community Services Division – Norfolk County

Zoning 519-426-5870 ext. 6064 or zoning@norfolkcounty.ca
Planning 519-426-5870 ext. 1842 or planning@norfolkcounty.ca

Planning Act, s.34, 34(5), 45, and Part VI
Zoning By-laws restrict such things as land use, lot size, building size, and setbacks. If your project does not comply with any part of the Zoning By-law, a minor variance or rezoning must be obtained before any building permit can be issued. Zoning By-laws also restrict the issuance of permits until any associated land division, subdivision, or municipal servicing is complete.
Planning Act, s.41
Site Plan Approval applies to commercial, industrial, institutional, multi-residential and intensive livestock site plans. The site plan agreement must be registered before site plans will be approved.

Conservation Authority Permits

Grand River Conservation Authority (GRCA)1-866-900-4722 or grca@grandriver.ca
Long Point Regional Conservation Authority (LPRCA) 1-888-231-5408 or conservation@lprca.on.ca

Conservation Authorities Act s. 28 (1)(c), regulation 166/06
Development within certain conservation regulated areas requires a construction and fill permit from the conservation authority before any building permit can be issued. GRCA or LPRCA will confirm if your property falls within their jurisdiction.

Highway Corridor Building & Land Use Permits

Ministry of Transportation (MTO) 1-800-268-4686 or
www.mto.gov.on.ca/english/highway-bridges/highway-corridor-management/index.shtml

Public Transportation and Highway Improvement Act, s.34, 38
Ministry authorization is required for construction of all buildings within certain distances of a highway or intersection. The requirement for Ministry authorization extents to 800m from a highway where development will generate major traffic, such as a shopping centre.

Environmental Approvals

Ministry of the Environment, Conservation and Parks (MECP)1-800-461-6290 or www.ontario.ca

Environmental Protection Act s. 46, 47.3, 168 and the Environmental Assessment Act s 5.
Ministry of Environment approvals are required where a property of industrial or commercial use is changed to more sensitive residential or parkland use, for major government, industrial and commercial projects where defined by regulation, properties formerly used for landfill or waste disposal, or renewable energy projects.

Electrical Conductor Clearances

Electrical Safety Authority 1-877-372-7233 or www.esasafe.com

Subsection 3.1.19. of the Ontario Building Code prohibits buildings being located beneath or within a certain minimum distances of overhead electrical conductor wires, other than the power feed to the building.

Source Water Protection – Environmental and Infrastructure Services – Norfolk County

Environmental Services – Stephanie Davis- Manager, Water & Wastewater Compliance- 519-426-5870 ext. 8037 or Stephanie.Davis@norfolkcounty.ca
Cambium Inc. Racheal Doyle – sourcewaterprotection@cambium-inc.com

Clean Water Act s. 59
Special land use restrictions may apply if a water source protection plan is in effect in the area where the building is located. Uses affected by these restrictions require the approval of the designated Risk Management Official

Agriculture and Farms

Ministry of Agriculture Food and Rural Affairs 1-877-424-1300 or www.omafra.gov.on.ca

Nutrient Management Act 2002 s.11 reg 267/03, Milk Act s.14
Buildings or structures that house animals or store manure may trigger a requirement for a nutrient management strategy approved by the Ministry. The Ministry must determine that a milk processing plant is necessary and authorize it before a building permit can be issued.

Child Care Centres

Ministry of Education (905) 895-9192 or www.ontario.ca

Child Care and Early Years Act, s. 14 reg 137/15
Ministry plan approval is required if a new building is proposed to be used as a day nursery, an existing building is proposed to be used, altered or renovated for a day nursery, or if an existing day nursery is altered or renovated.

Seniors Centres

Ministry of Children, Community and Social Services 1-888-789-4199 or www.mcss.gov.on.ca

Elderly Persons Centres Act s. 6 of reg 314
Reports must be submitted to the Minister and approval obtained for all seniors centres to which government funding applies.

Long Term Care Homes

Ministry of Health & Long Term Care 1-800-387-5559 or www.health.gov.on.ca

Nursing Home Act s. 4, 5 reg 832
Homes for the Aged & Rest Homes Act s. 14
The Long Term Heath Care Act is designed to help ensure that residents of long-term care homes receive safe, consistent, high-quality, resident-centred care.

Education

Ministry of Education (905) 895-9192 or www.ontario.ca

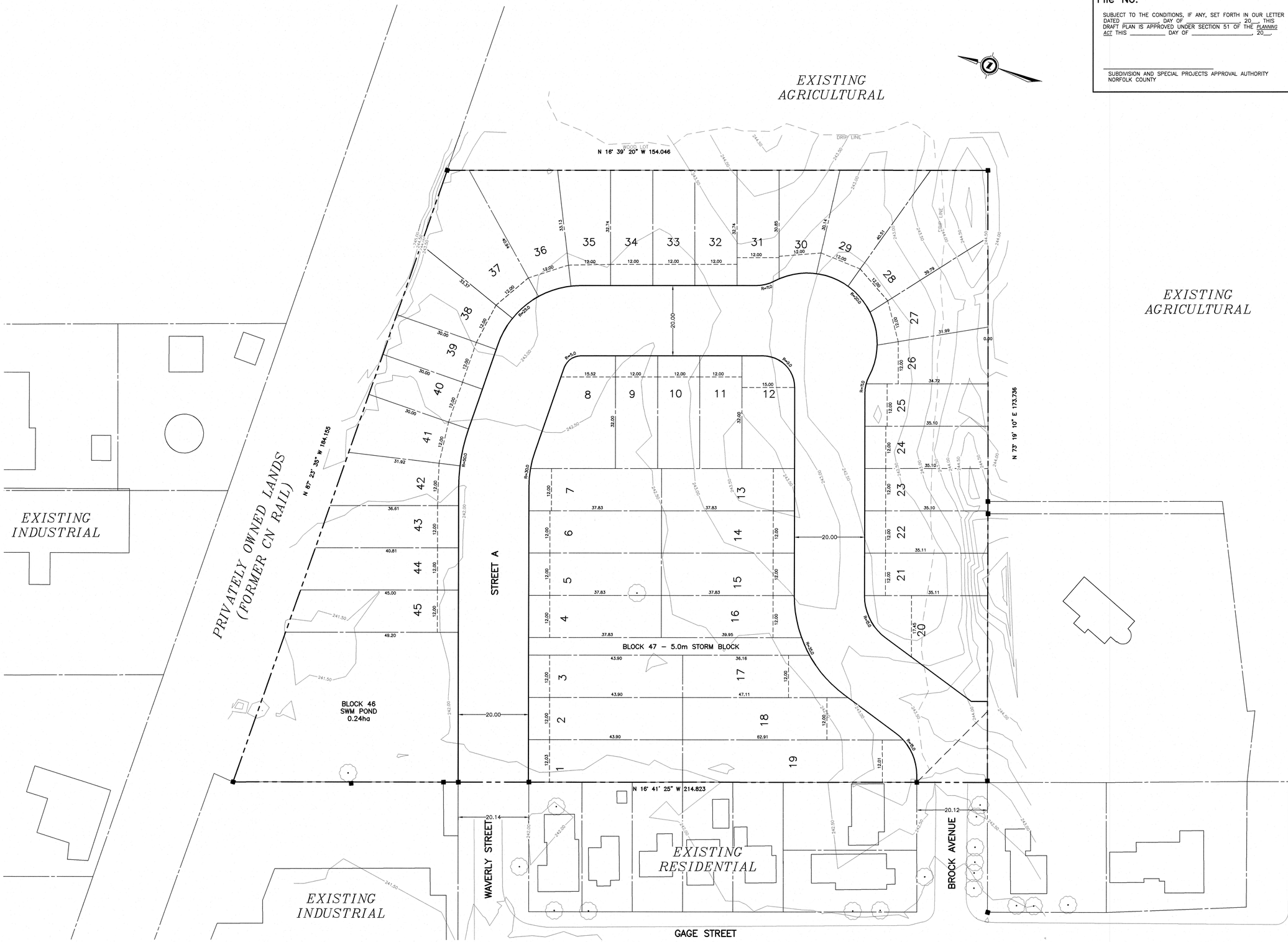
Education Act s. 194
The board shall obtain approval from the Minister for the demolition of any buildings located on a school site regulated by the Education Act. App

Crown Lands Works Permits

Ministry of Natural Resources www.ontario.ca/page/crown-land-work-permits

Ontario Regulation 239/13 s. 2, s. 5
Ministry approval is required to construct a building on crown lands or to construct or place a structure along shorelines.

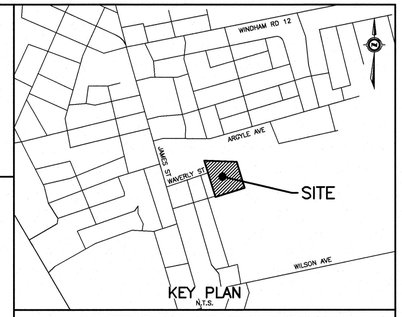
DocuSign Envelope ID: 30C6538F-DBF8-41F4-BABB-EFCF1A2CD979



File No.

SUBJECT TO THE CONDITIONS, IF ANY, SET FORTH IN OUR LETTER DATED _____, DAY OF _____, 20__, THIS DRAFT PLAN IS APPROVED UNDER SECTION 51 OF THE *PLANNING ACT* THIS _____ DAY OF _____, 20__.

_____
SUBDIVISION AND SPECIAL PROJECTS APPROVAL AUTHORITY
NORFOLK COUNTY



DRAFT PLAN OF SUBDIVISION

PART OF
LOT 24
CONCESSION 12
GEOGRAPHIC TOWNSHIP OF WINDHAM
(TOWN OF DELHI)
IN
NORFOLK COUNTY
PARTS 1 AND 2 DEPOSITED PLAN 37R–3287

OWNER'S CERTIFICATE:

I HEREBY SUBMIT THIS DRAFT PLAN OF SUBDIVISION.

DocuSigned by: Dec 5, 2023

AKHTAR SYED
LANDMARK HOMES INC.

DATE

I HAVE THE AUTHORITY TO BIND THE CORPORATION

SURVEYOR'S CERTIFICATE:

I CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED AS SHOWN ON THIS PLAN AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

Jamie Bockx — DEC 5, 2023

JAMIE G. BOCKX
ONTARIO LAND SURVEYOR

DATE

LAND USE SCHEDULE

SINGLE FAMILY RESIDENTIAL – 45 LOTS	2.19 ha
BLOCK 46 – SWM POND	0.24 ha
BLOCK 47 – 5.0m STORM BLOCK	0.04 ha
ROADS – STREET 'A'	0.73 ha
TOTAL AREA	3.20 ha

REQUIREMENTS OF SECTION 51(17) OF THE PLANNING ACT

(a) AS SHOWN ON PLAN	(g) AS SHOWN ON PLAN
(b) AS SHOWN ON PLAN	(h) MUNICIPAL WATER
(c) AS SHOWN ON KEY PLAN	(i) SAND, GRAVEL, SANDY SILT
(d) SINGLE, MULTI–FAMILY RESIDENTIAL	(j) AS SHOWN ON PLAN
(e) AS SHOWN ON PLAN	(k) MUNICIPAL SERVICES
(f) AS SHOWN ON PLAN	(l) AS SHOWN ON PLAN

PROJECT

WAVERLY STREET,
DELHI

LANDMARK HOMES INC.

DILLON CONSULTING

No.	REVISION	DATE	BY

DRAWN CD | CHECKED MTP | SCALE – 1 : 500 (5 0 10m) | DATE 2023-12-08

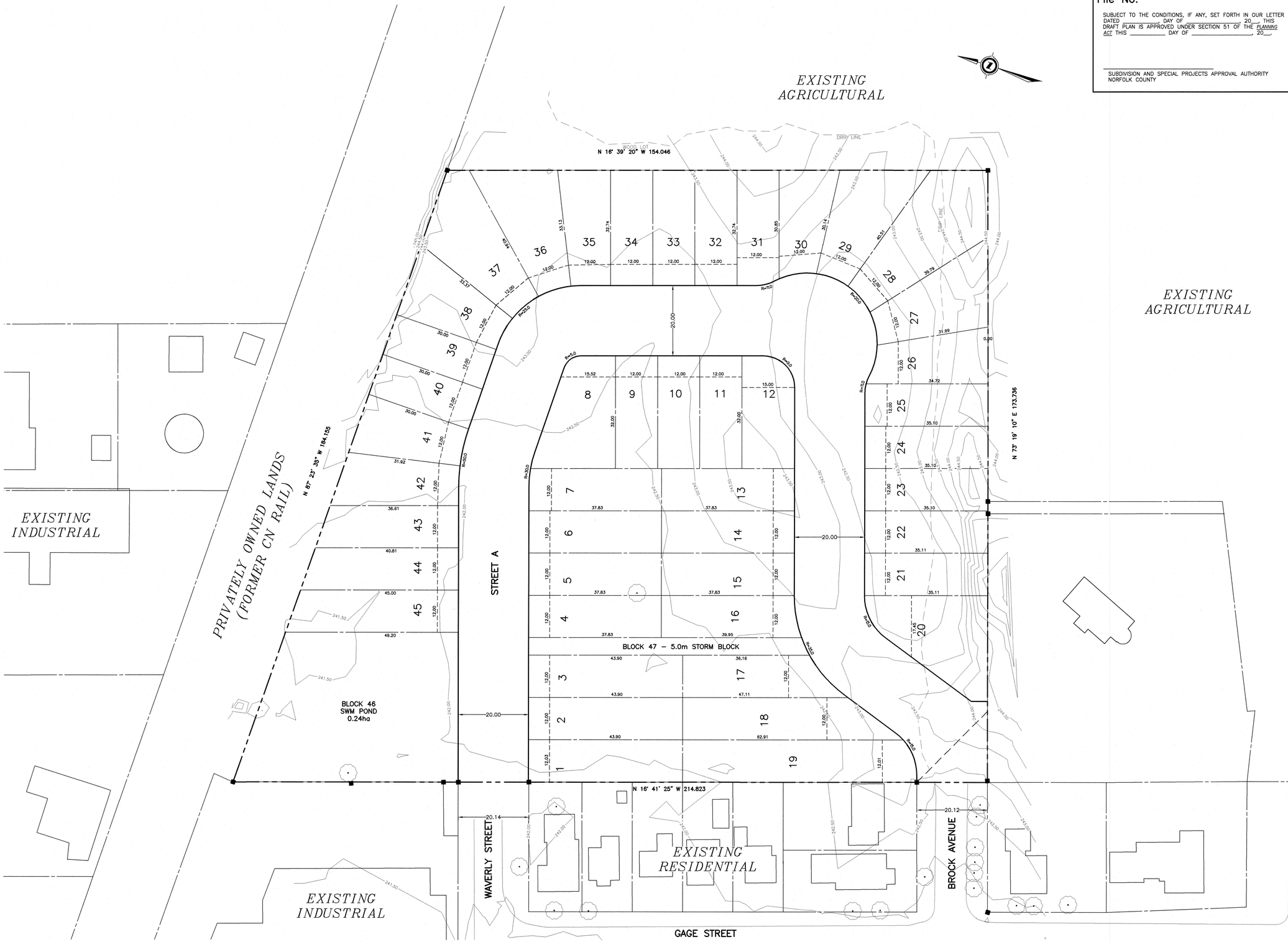
NOTE: DISTANCES SHOWN ON THIS PLAN ARE IN METERS AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

PROJECT No. 22–5115

November 29, 2023

C:\pw working directory\projects 2022\dillon_10cs\dms62516\225115-00-DP-DWG.dwg

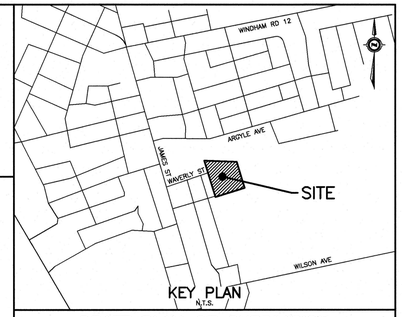
DocuSign Envelope ID: 30C6538F-DBF8-41F4-BABB-EFCF1A2CD979



File No.

SUBJECT TO THE CONDITIONS, IF ANY, SET FORTH IN OUR LETTER DATED _____, DAY OF _____, 20__, THIS DRAFT PLAN IS APPROVED UNDER SECTION 51 OF THE *PLANNING ACT* THIS _____ DAY OF _____, 20__.

_____
SUBDIVISION AND SPECIAL PROJECTS APPROVAL AUTHORITY
NORFOLK COUNTY



DRAFT PLAN OF SUBDIVISION

PART OF
LOT 24
CONCESSION 12
GEOGRAPHIC TOWNSHIP OF WINDHAM
(TOWN OF DELHI)
IN
NORFOLK COUNTY
PARTS 1 AND 2 DEPOSITED PLAN 37R–3287

OWNER'S CERTIFICATE:

I HEREBY SUBMIT THIS DRAFT PLAN OF SUBDIVISION.

DocuSigned by: Dec 5, 2023

AKHTAR SYED
LANDMARK HOMES INC.

DATE

I HAVE THE AUTHORITY TO BIND THE CORPORATION

SURVEYOR'S CERTIFICATE:

I CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED AS SHOWN ON THIS PLAN AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

Jamie Bockx — DEC 5, 2023

JAMIE G. BOCKX
ONTARIO LAND SURVEYOR

DATE

LAND USE SCHEDULE

SINGLE FAMILY RESIDENTIAL – 45 LOTS	2.19 ha
BLOCK 46 – SWM POND	0.24 ha
BLOCK 47 – 5.0m STORM BLOCK	0.04 ha
ROADS – STREET 'A'	0.73 ha
TOTAL AREA	3.20 ha

REQUIREMENTS OF SECTION 51(17) OF THE PLANNING ACT

(a) AS SHOWN ON PLAN	(g) AS SHOWN ON PLAN
(b) AS SHOWN ON PLAN	(h) MUNICIPAL WATER
(c) AS SHOWN ON KEY PLAN	(i) SAND, GRAVEL, SANDY SILT
(d) SINGLE, MULTI–FAMILY RESIDENTIAL	(j) AS SHOWN ON PLAN
(e) AS SHOWN ON PLAN	(k) MUNICIPAL SERVICES
(f) AS SHOWN ON PLAN	(l) AS SHOWN ON PLAN

PROJECT

WAVERLY STREET,
DELHI

LANDMARK HOMES INC.

DILLON CONSULTING

No.	REVISION	DATE	BY

DRAWN CD | CHECKED MTP | SCALE – 1 : 500 (5 0 10m) | DATE 2023-12-08

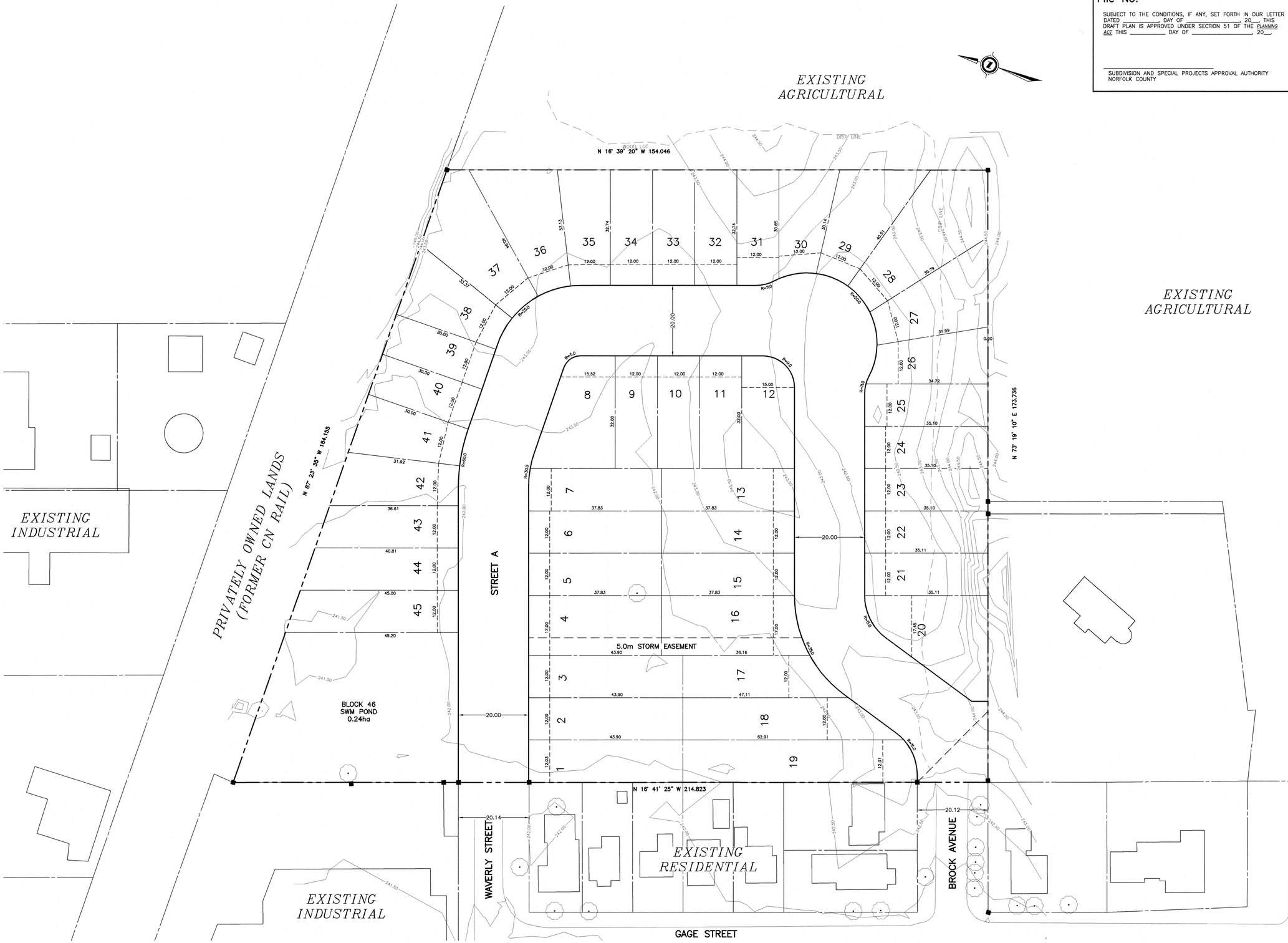
NOTE: DISTANCES SHOWN ON THIS PLAN ARE IN METERS AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

PROJECT No. 22–5115

November 29, 2023

C:\pw working directory\projects 2022\dillon_10cs\dms62516\225115-00-DP-DWG.dwg

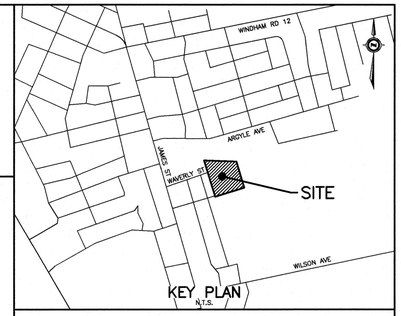
DocuSign Envelope ID: DBA9D923-E9B6-41C2-8D02-5FF0D7714FE9



File No.

SUBJECT TO THE CONDITIONS, IF ANY, SET FORTH IN OUR LETTER DATED _____ DAY OF _____ 20__, THIS DRAFT PLAN IS APPROVED UNDER SECTION 51 OF THE *PLANNING ACT* THIS _____ DAY OF _____, 20__.

_____
SUBDIVISION AND SPECIAL PROJECTS APPROVAL AUTHORITY
NORFOLK COUNTY



DRAFT PLAN OF SUBDIVISION

PART OF
LOT 24
CONCESSION 12
GEOGRAPHIC TOWNSHIP OF WINDHAM
(TOWN OF DELHI)
IN
NORFOLK COUNTY
PARTS 1 AND 2 DEPOSITED PLAN 37R-3287

OWNER'S CERTIFICATE:

I HEREBY SUBMIT THIS DRAFT PLAN OF SUBDIVISION.

DocuSigned by:
5559E47A4C0A41...
AKHTAR SYED
LANDMARK HOMES INC.

Nov 3, 2023
DATE

I HAVE THE AUTHORITY TO BIND THE CORPORATION

SURVEYOR'S CERTIFICATE:

I CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED AS SHOWN ON THIS PLAN AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

JAMIE G. DOCKX
ONTARIO LAND SURVEYOR

Nov 3, 2023
DATE

LAND USE SCHEDULE

SINGLE FAMILY RESIDENTIAL – 45 LOTS	2.23 ha
BLOCK 46 – SWM POND	0.24 ha
ROADS – STREET 'A'	0.73 ha
TOTAL AREA	3.20 ha

REQUIREMENTS OF SECTION 51(17) OF THE PLANNING ACT

(a) AS SHOWN ON PLAN	(g) AS SHOWN ON PLAN
(b) AS SHOWN ON PLAN	(h) MUNICIPAL WATER
(c) AS SHOWN ON KEY PLAN	(i) SAND, GRAVEL, SANDY SILT
(d) SINGLE, MULTI-FAMILY RESIDENTIAL	(j) AS SHOWN ON PLAN
(e) AS SHOWN ON PLAN	(k) MUNICIPAL SERVICES
(f) AS SHOWN ON PLAN	(l) AS SHOWN ON PLAN

PROJECT

WAVERLY STREET, DELHI

LANDMARK HOMES INC.

DILLON CONSULTING

No.	REVISION	DATE	BY

DRAWN CD | CHECKED MTP | SCALE – 1 : 500 | DATE 2023-10-23

NOTE: DISTANCES SHOWN ON THIS PLAN ARE IN METERS AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

5 0 10m

PROJECT No. 22-5115

November 2, 2023 C:\pw working directory\projects 2022\dillon_10cd\dms62516\225115-00-DP-DWG.dwg

TOPOGRAPHIC SURVEY
FOR: LANDMARK HOMES

SCALE - 1: 500

0 10 20 30 METRES

METRIC DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

KIM HUSTED SURVEYING LTD.

CAUTION

- THIS IS NOT A PLAN OF SURVEY OR SURVEYOR'S REPORT AND SHALL NOT BE USED FOR TRANSACTION OR FINANCING PURPOSES
- DO NOT CONVEY FROM THIS PLAN

NOTES

(1) - A SURVEY OF THE SUBJECT PROPERTY HAS NOT BEEN MADE AVAILABLE

(2) - SITE BENCHMARK TOP OF HYDRANT WEST OF SUBJECT PROPERTY, IN FRONT OF LOT 10, REGISTERED PLAN 261 WITH AN ELEVATION OF 242.76 metres

(3) - IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE ELEVATION OF THE UPPER LIMIT OF THE GROUND WATER TABLE, SOIL BEARING CAPACITY AND THE ELEVATION OF THE UNDER SIDE OF FOOTING PRIOR TO EXCAVATION.

(4) - IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE SITE BENCH MARK PRIOR TO EXCAVATION

(5) - THE VARIOUS UTILITY LOCATIONS SHOWN ON THIS PLAN ARE BASED ON PHYSICAL LOCATES OF ABOVE GROUND SERVICES. PRIOR TO ANY ON SITE CONSTRUCTION ACTIVITY A VERIFICATION LOCATE OF UNDERGROUND SERVICES IS BOTH RECOMMENDED AND ADVISED.

SURVEYOR'S CERTIFICATE

I CERTIFY THAT

(1) - THIS SKETCH WAS PREPARED FROM FIELD WORK COMPLETED ON THE 23rd DAY OF APRIL, 2023

MAY 15, 2023
DATE

JAMIE G. DOCKX
ONTARIO LAND SURVEYOR

LEGEND

■	DENOTES	SURVEY MONUMENT FOUND
□	DENOTES	SURVEY MONUMENT SET
SIB	DENOTES	STANDARD IRON BAR
IB	DENOTES	IRON BAR
RIB	DENOTES	ROUND IRON BAR
CM	DENOTES	CONCRETE MONUMENT
(WIT.)	DENOTES	WITNESS
(700)	DENOTES	JEWITT AND DIXON LTD.
(413)	DENOTES	ROGER MELVILLE LEE
P.I.N.	DENOTES	PROPERTY IDENTIFIER NUMBER
BF	DENOTES	BOARD FENCE
WRF	DENOTES	WOOD RAIL FENCE
MF	DENOTES	METAL FENCE
CF	DENOTES	CHAIN LINK FENCE
OH	DENOTES	OVER HEAD UTILITIES
	DENOTES	GUY WIRE
●	DENOTES	UTILITY POLE
	DENOTES	DELETERIOUS TREE
	DENOTES	DECIDUOUS TREE

PROPERTY DESCRIPTION
PART OF LOT 24
CONCESSION 12
GEOGRAPHIC TOWNSHIP OF WINDHAM
(TOWN OF DELHI)
IN
NORFOLK COUNTY
PARTS 1 AND 2 DEPOSITED PLAN 37R-3287

KIM HUSTED SURVEYING LTD.
ONTARIO LAND SURVEYOR
30 HARVEY STREET, TILLSONBURG ONTARIO, N4G 3J8
PHONE:519-842-3638 FAX: 519-842-3639

PROJECT: 23-18462TOPO	LAND MARK HOMES DELHI	REF: FILE	DWG. GES CKD. JGD

E:\OSOFT141\Wayne\Greg's Dwg's\23-18462TOPO.dwg

I REQUIRE THIS PLAN TO BE DEPOSITED UNDER THE LAND TITLES ACT

DATE MAY 15, 2023

JAMIE G. DOCKX O.L.S.

PLAN 37R-

RECEIVED AND DEPOSITED

DATE _____

_____

REPRESENTATIVE FOR THE LAND REGISTRAR FOR THE LAND TITLES DIVISION OF NORFOLK (No. 37)

PART SCHEDULE

PART	LOT	CONCESSION	P.I.N.	AREA
1	PART OF 24	12	PART OF 50168–0246	3.18 HECTARES
2	PART OF 24	12	PART OF 50168–0246	0.02 HECTARES

PARTS 1 AND 2 COMPRISE ALL OF P.I.N.50168–0246
PART 2 IS SUBJECT TO RIGHT–OF–WAY AS SET OUT IN INSTRUMENT NR336488

PLAN OF SURVEY OF
PART OF LOT 24
CONCESSION 12
GEOGRAPHIC TOWNSHIP OF WINDHAM
(TOWN OF DELHI)
IN
NORFOLK COUNTY

SCALE – 1: 500 0 10 20 30 METRES

METRIC DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

KIM HUSTED SURVEYING LTD.

SURVEYOR'S CERTIFICATE

I CERTIFY THAT

(1) – THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE LAND TITLES ACT AND THE REGULATIONS MADE UNDER THEM

(2) – THIS SURVEY WAS COMPLETED ON THE 22nd DAY OF MARCH, 2023

MAY 15, 2023
DATE

JAMIE G. DOCKX
ONTARIO LAND SURVEYOR

THIS PLAN OF SURVEY RELATES TO AOLS PLAN SUBMISSION FORM NUMBER _____.

FORMER CANADIAN NATIONAL RAILWAY
P.I.N. 50169 – 0368
NORTHEAST CORNER LOT 2, REGISTERED PLAN 261
SIB (413)
SIB (700)
OVER HEAD UTILITIES 0.70 EAST
FENCE 0.34 SOUTH (P6 & M)
N 87° 23' 35" W
252.117 (M) (252.326 P2)
436.272 (M) (436.443 P1 + P2)
184.155 (M) (184.117 P1 & P6)
LOT 1 REGISTERED PLAN 261
JAMES – STREET THE KING'S HIGHWAY No.3
FENCE 0.12 SOUTH 0.26 WEST
P.I.N. 50168 – 0247
LOT 2
CHAIN LINK FENCE 33.61 (33.60 P6 & M)
214.823 (P1, P2 & M)
OH
N 16° 41' 25" W (M)
UTILITY POLE 0.56 EAST
IB(700) 0.04 WEST
METAL FENCE 2.59 EAST
BF
BOARD FENCE 0.23 WEST
PART 1 37R–11522
P.I.N. 50168 – 0250
26.265 (P4 & M)
CO 4.215 (P4 & M)
(N 16° 40' 15" W P4)
GUY WIRE 0.21 EAST
GUY WIRE 4.36 EAST
GUY WIRE 3.19 EAST
UTILITY POLE 0.34 EAST
LOT 8 REGISTERED PLAN 9
LOT
PART 2, 37R–11522
P.I.N. 50168–0251
(P1, P2, P4, P6 & M) 20.117
MF
WAVERLY STREET (20.117 WIDE REGISTERED PLAN 261)
P.I.N. 50168 – 0200
LOT 11 REGISTERED PLAN 12
P.I.N. 50168 – 0105
LOT 12 – 0106
P.I.N. 50168
WOOD RAIL FENCE 0.47 EAST
WRF
METAL FENCE 1.54 EAST
BOARD FENCE 1.58 EAST
SHED 0.34 WEST
UTILITY POLE 0.62 EAST
GUY WIRE 2.61 EAST
BOARD FENCE 1.34 EAST
LOT 13 – 0107
P.I.N. 50168
BF
BOARD FENCE 1.29 EAST
SHED ON LINE
CHAIN LINK FENCE 0.07 WEST
LOT 14 PLAN – 0108
P.I.N. 50168
110.508 (P6 & M)
CF
CHAIN LINK FENCE 0.05 EAST
GUY WIRE 2.52 EAST
UTILITY POLE 0.43 EAST
LOT 15 – 0109
P.I.N. 50168
CHAIN LINK FENCE 0.31 WEST
(110.642 P1 & P2)
CHAIN LINK FENCE 0.13 WEST
DWELLING 1.27 WEST
CENTRE LINE OF HEDGE 0.22 WEST
CENTRE LINE OF HEDGE ON LINE
LOT 17 – 0111
P.I.N. 50168
LOT 261
LOT 16
PART 2 SUBJECT TO RIGHT–OF–WAY AS SET OUT IN INSTRUMENT NR336488 P.I.N.50168–0246
N 61° 41' 10" W 28.450 (P1 & M)
PART 2 37R – 3287
UTILITY POLE 0.14 EAST
(P1, P2, P3, P6 & S) 20.117
GRAVEL 7.07
6.88
DRIVE
IB
SIB (413) 0.05 EAST
<20.117 (P1 & S)
OVER HEAD HYDRO
UTILITY POLE 1.02 SOUTH 0.46 EAST
56.083
76.200 (P3 & M)
N 73° 19' 10" E
LOT 48
LOT 47
LOT 46
LOT 45
LOT 44
BROCK STREET (20.117 WIDE REGISTERED PLAN 261)
P.I.N. 50168 – 0202
GAGE STREET (15.240 WIDE REGISTERED PLAN 261)
LOT 52
LOT 51
LOT 50
LOT 49
LOT 54
LOT 55
LOT 56
LOT 57
LOT 58
LOT 59
LOT 60
LOT 61
LOT 62
LOT 63
LOT 64
LOT 65
LOT 66
LOT 67
LOT 68
LOT 69
LOT 70
LOT 71
LOT 72
LOT 73
LOT

Memo

To: Norfolk County
Planning Department

From: Lucas Arnold, P.Eng., Associate, Dillon Consulting Limited (Dillon)
Hamish Corbett-Hains, P.Eng., Associate, Dillon

Date: December 7, 2023

Subject: Waverly Street, Delhi
MECP D-Series Land Use Compatibility Review

Our File: 22-5115

Dillon Consulting Limited (Dillon) was retained by Landmark Homes Inc. (Landmark) to complete a D-Series Compatibility review in support of a Draft Plan submission for a proposed residential development.

The subject lands are located to the east of James Street, at the eastern end of Waverly Street in Delhi, Ontario. Per the Norfolk County Zoning By-Law, the subject lands are surrounded by General Industrial (MG) to the north, northeast, and northwest, with Urban Residential Type 1 (R1) to the southwest and west, and Agricultural (A) to the east, southeast, and south.

The subject lands are zoned for Urban Residential Type 2 (R2). Per the Norfolk County Zoning By-law, the following permitted uses are currently permitted:

- Dwelling, single detached;
- Dwelling, semi-detached;
- Dwelling, duplex;
- Bed and breakfast, subject to subsection 3.4;
- Day care nursery;
- Home occupation; and
- Accessory residential dwelling unit, subject to subsection 3.2.2.

The Ministry of the Environment, Conservation and Parks' (MECP) land-use compatibility guidelines (D-series) are intended to prevent or minimize the encroachment of sensitive land uses upon industrial/commercial land uses and vice versa, as these two types of land uses are normally incompatible, due to possible adverse effects on the sensitive land use. As per the guideline, potential impacts from industrial establishments within the potential influence area or recommended minimum separation distance, as outlined in D-6 (see **Table 1**), should be assessed.

Table 1: Guideline D-6 Potential Influence Area and Recommended Minimum Separation Distance

Industrial Classification	Area of Influence	Recommended Minimum Separation Distance
Class I	70 m	20 m
Class II	300 m	70 m
Class III	1000 m	300 m

Characteristics of a Class I, II, and III industry, per MECP D-6-1, is presented in **Table 2**.

Table 2 Industrial Classification

Class	Outputs	Scale	Process	Operations/Intensity	Possible Examples
I	• Noise: Sound not audible off property • Dust and/or Odour: Infrequent and not intense • Vibration: No ground borne vibration on plant property	• No outside storage • Small scale plant or scale is irrelevant in relation to all other criteria for this Class	• Self-contained plant or building which produces/stores a packaged product. Low probability of fugitive emissions	• Daytime operations only • Infrequent movement of products and/or heavy trucks	• Electronics manufacturing and repair • Furniture repair and refinishing • Beverages bottling • Auto parts supply
II	• Noise: Sound occasionally audible off property • Dust and/or Odour: Frequent and occasionally intense • Vibration: Possible ground-borne vibration, but cannot be perceived off property	• Outside storage permitted • Medium level of production allowed	• Open process • Periodic outputs of minor annoyance • Low probability of fugitive emissions	• Shift operations permitted • Frequent movement of products and/or heavy trucks with the majority of movements during daytime hours	• Magazine printing • Paint spray booths • Metal command • Electrical production manufacturing • Manufacturing of dairy products

Class	Outputs	Scale	Process	Operations/Intensity	Possible Examples
III	• Noise: sound frequently audible off property • Dust and/or Odour: Persistent and/or intense • Vibration: Ground-borne vibration can frequently be perceived off property	• Outside storage of raw and finished products • Large production levels	• Open process • Frequent outputs of major annoyances • High probability of fugitive emissions	• Continuous movement of products and employees • Daily shift operations permitted	• Manufacturing of paint and varnish • Organic chemicals manufacturing • Solvent recovery plants • Metal manufacturing

Based on a review of zoning by-laws and aerial imagery, there are multiple Class I and Class II industrial operations located within the Recommended Minimum Separation Distance of the proposed development. There are no Class III industries within 1 km of the subject lands. The list and classifications of industries within the Potential Influence Area of the proposed development are shown in **Table 3. Figure 1** shows the proposed development in relation to the uses listed in **Table 3** including the D-6 buffer distances.

Table 3: Class I & II Industries

Facility Name and Address	Description of Industry and Operations	D-6 Guideline Industrial Classification	Distance to Proposed Development (m)
The Beer Store 64 Argyle Ave	• Commercial store • Operations include the sale of beer products and recollection of used beer products	I	20
Pure Spirits Express 162 Argyle Ave	• Alcohol distillery • Operations include storage of raw and finished product, distillation processes.	II	60
Various Uses 523 James Street	• Large industrial building • Multiple tenants, including metal fabrication • Based on satellite review, room exists for additional uses	II	0

Figure 1: Proposed Development and Identified Industries

The agricultural operations with proximity to the proposed development are typically not considered as an industrial facility. Agricultural operations are exempt from the requirement of the *Environmental Protection Act* to obtain approval to operate. Additionally, the *Farming and Food Protection Act* provides agricultural uses protection from liability with respect to nuisance operations in accordance with good farming practice. Nuisance impacts may be expected from time to time as a result of agricultural operations, but such impacts are not typically considered to represent a compatibility concern. Notwithstanding the above, planning authorities are advised to consider proximity to agricultural uses when dedicating lands for sensitive uses.

Typically, when a land use change is proposed, at the zoning by-law amendment phase a detailed compatibility assessment evaluating potential impacts from industrial operations within the Potential Area of Influence would be recommended for the proposed sensitive use. The purpose is to prevent or minimize the encroachment of sensitive land uses upon industrial/commercial land uses and vice versa.

However, as the subject lands are currently zoned for sensitive uses (R2), and the proposed development will be aligned and in compliance with the existing zoning by-law, new noise sensitive land permissions are not being introduced.

As the subject lands currently allow sensitive uses, the surrounding commercial and industrial facilities are currently obligated to meet air quality and noise requirements at the vacant subject lands, including the use of mitigation measures if required (MECP Environmental Activity and Sector Registry - limits and other requirements for activities with air emissions Section 4.3.5; MECP NPC-300 Noise Guideline Part B). Provincial Regulatory assessments for Air Quality and Noise require assessment of the vacant lands based on the existing zoning by-law, the typical building pattern in the area, and/or an appropriate or likely future use of the vacant lot. As such, the proposed development does not introduce any additional permitting or regulatory burdens to the surrounding industrial uses.

As with any mixed-use area there are potential for nuisance complaints. However, considering the zoning of the subject lands, and the current regulatory obligations of the industrial lands, the proposed development does not alter the surrounding industries' ability to operate. Demonstrating compatibility at the existing residential homes and/or the subject lands is the responsibility of the industry.

To: Mohammad Alam, Supervisor, Development Planning – Norfolk County

From: Christine Demers, Technologist, Project Coordinator – Dillon Consulting Limited (Dillon)
Mina Yacoub, P.Eng., Project Engineer – Dillon

Date: December 6, 2023

Subject: Waverly Street, Delhi – Functional Servicing Report (Final)

Our File: 22-5115

1.0 Introduction

The purpose of this Functional Servicing Report (FSR) is to outline the proposed municipal servicing for the proposed subdivision at the east limit of Waverly Street, in the Town of Delhi. The Draft Plan of Subdivision is in Appendix A.

Being currently and historically undeveloped, the site does not have a municipal address. We will refer to it as the subject site.

To the knowledge of Dillon Consulting, there are no known Class Environmental Assessments that would be required by this proposed subdivision.

2.0 Storm Servicing

2.1. Existing Conditions

The subject site is approximately 3.20 ha in size. It is predominantly vacant and undeveloped, it is mostly filled with long grasses, and there is a small, abandoned asphalt parking area.

There is no existing storm sewer servicing to the subject site. For the existing site elevations, see the topographic survey from Kim Husted Surveying Ltd. (May 2023) in Appendix A. The subject site generally slopes to the Northeast corner.

Downstream of the subject site, James Street was reconstructed in the summer of 2023, which included replacing the storm sewers. The tender drawings from that project are attached in Appendix A. Note that after tendering but before installation, the storm sewer to Waverly Street was increased to 600 mm diameter to support the proposed development. This was coordinated with Norfolk County Engineering staff.

Coordinating with County staff, Dillon completed maintenance hole inspections on Waverly Street to confirm the existing storm sewer sizing and elevations. This information is shown in Figure 2 in Appendix B.

2.2. Proposed Conditions

Dillon has completed storm sewer capacity calculations of the existing storm sewers downstream of the subject site and compared them to the estimated flow rates. This is shown in Figure 1.0 in Appendix B. The storm sewer information for Waverly Street is based on Dillon's maintenance hole inspections, and the storm sewer information for James Street and Imperial Street were obtained from the James Street Reconstruction drawings.

All of the downstream storm sewers have enough capacity to convey the estimated 2-year storm event except for one length of sewer, identified as the 450 mm diameter storm sewer between EX CBMH-1 and EX CBMH-2. The proposed development will require increasing the capacity of this storm sewer. The final design of this storm sewer will be confirmed during detailed design, but as a preliminary design option, a 450 mm diameter storm sewer increased to 0.90% slope will provide enough capacity. This proposed storm sewer will service the site, receiving the stormwater released from the proposed stormwater management (SWM) pond. For more details, see the stormwater management report included with the Draft Plan of Subdivision application.

A block of land dedicated to the County for a storm sewer is proposed between lots 3 & 4, and 16 & 17. This is required for the southwest corner of the site, which will match the existing grades at the east limit of Brock Avenue, to drain by gravity sewers to the proposed SWM pond. The storm sewer is expected to be approximately 2.0 m deep to invert, so a 5.0 m wide block will meet Norfolk County Design Criteria.

3.0 Sanitary Servicing

3.1. Existing Conditions

The most recent record drawings of Waverly Street show a 200 mm sanitary sewer connecting at James Street. Coordinating with County Staff, Dillon completed maintenance hole inspections on Waverly Street to confirm the existing sanitary sewer size and elevations. This information is shown in Figure 2 of Appendix B.

Downstream from the subject site, James Street was reconstructed in the summer of 2023, which included the replacement of the sanitary sewers. This information can be found in Appendix A.

3.2. Proposed Conditions

The proposed residential development will be serviced by a 200 mm diameter sanitary sewer connecting to existing sanitary sewer on Waverly Street. Each lot will be serviced with a sanitary lateral in accordance with Norfolk County Design Standards.

Dillon has calculated the increase in sanitary flows based on the Norfolk County Design criteria. The proposed development flow calculations have estimated a population of 124 individuals, based on the proposed 45 lots and assuming 2.75 individuals per lot. In addition to the estimated infiltration, the total

proposed peak sanitary design flow from the subject site is 3.62 L/s. The Proposed Sanitary Flow Calculations can be found in Appendix C.

The sanitary modelling to confirm downstream sewer capacity will be completed by Norfolk County's third-party consultant based on the preliminary numbers in this report.

Water Servicing

3.3. Existing Conditions

There is an existing 200 mm diameter PVC watermain on Waverly Street, as well as a 150 mm diameter PVC watermain on Brock Avenue extending to the subject site. See Figure 2 in Appendix B.

3.4. Proposed Conditions

The proposed residential development would be serviced by a 200 mm watermain connecting to the existing watermains on Waverly Street and Brock Avenue, providing a looped watermain system. The watermain system, including appurtenances, crossing separations and depths, will be designed in accordance with Norfolk County Design Standards.

Refer to Figure 2 in Appendix B for the proposed watermain layout.

Norfolk County requires their third-party consultant to assess the capacity of the existing municipal watermain system to service the subject site. To assist with this analysis, the Average Daily Demand, Maximum Day Demand and Peak Hourly Demand were calculated in accordance with Norfolk County Design Criteria (February 2019) as follows:

Residential Water Demands:

- Average Day Demand = 38.8 L/min;
- Maximum Day Demand = 87.2 L/min; and,
- Peak Hour Demand = 155.0 L/min.

Refer to Appendix D for Residential Water Demand Calculations.

Using the Fire Underwriters Survey (FUS) Guideline calculations, the worst-case scenario will be for lots 8-12, which require a fire flow of 6,000 L/min (100 L/s). Therefore, the maximum demand for the subject site would be 6,087.2 L/min (6,000 L/min Fire Flow + 87.2 L/min Domestic). Refer to Appendix D for FUS Calculations.

It is worth to note that this value is greater than the recommended design fire flow of 83 L/s (5,000 L/min) for typical single-family residences in the County according to Norfolk County Integrated Sustainable Master Plan Report, September 2016. We believe that 83 L/s required fire flow is a more reasonable target value, which will be in line with the rest of the County's single-family residences developments and recommended values in other cities and municipalities throughout the province.

DILLON CONSULTING LIMITED

Mina Yacoub, P.Eng.
Project Engineer

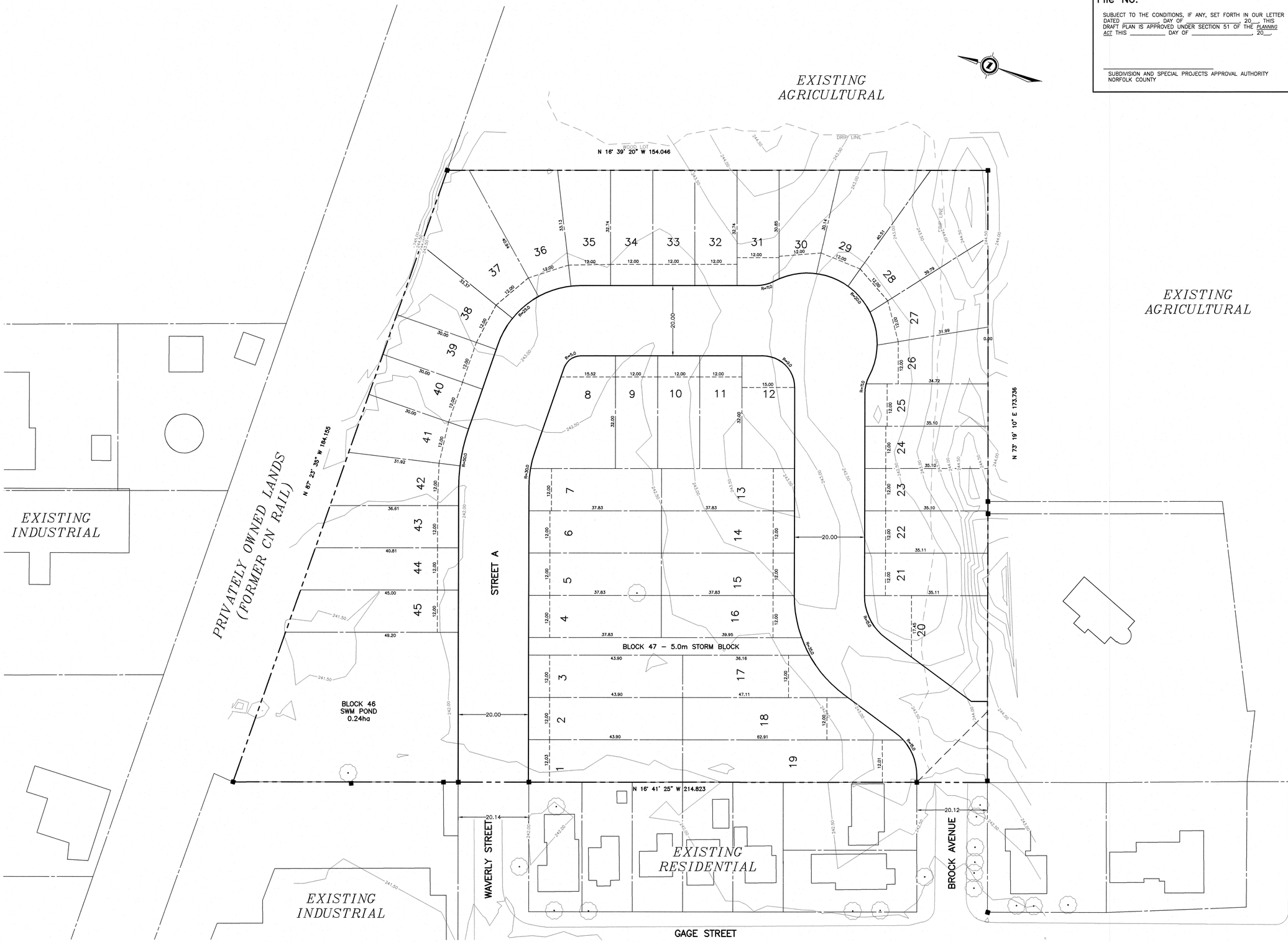
Christine Demers, Technologist
Project Coordinator

Appendix A

Background Drawings

DILLON CONSULTING

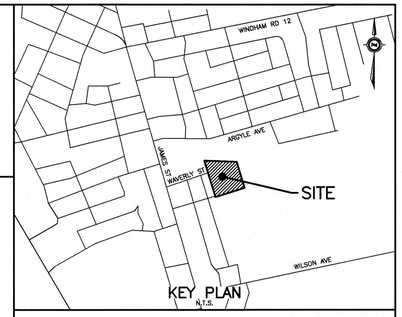
DocuSign Envelope ID: 30C6538F-DBF8-41F4-BABB-EFCF1A2CD979



File No.

SUBJECT TO THE CONDITIONS, IF ANY, SET FORTH IN OUR LETTER DATED _____, DAY OF _____, 20__, THIS DRAFT PLAN IS APPROVED UNDER SECTION 51 OF THE *PLANNING ACT* THIS _____ DAY OF _____, 20__.

_____
SUBDIVISION AND SPECIAL PROJECTS APPROVAL AUTHORITY
NORFOLK COUNTY



DRAFT PLAN OF SUBDIVISION

PART OF
LOT 24
CONCESSION 12
GEOGRAPHIC TOWNSHIP OF WINDHAM
(TOWN OF DELHI)
IN
NORFOLK COUNTY
PARTS 1 AND 2 DEPOSITED PLAN 37R–3287

OWNER'S CERTIFICATE:

I HEREBY SUBMIT THIS DRAFT PLAN OF SUBDIVISION.

DocuSigned by: Dec 5, 2023

AKHTAR SYED
LANDMARK HOMES INC.

DATE

I HAVE THE AUTHORITY TO BIND THE CORPORATION

SURVEYOR'S CERTIFICATE:

I CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED AS SHOWN ON THIS PLAN AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

Jamie Bockx — DEC 5, 2023

JAMIE G. BOCKX
ONTARIO LAND SURVEYOR

DATE

LAND USE SCHEDULE

SINGLE FAMILY RESIDENTIAL – 45 LOTS	2.19 ha
BLOCK 46 – SWM POND	0.24 ha
BLOCK 47 – 5.0m STORM BLOCK	0.04 ha
ROADS – STREET 'A'	0.73 ha
TOTAL AREA	3.20 ha

REQUIREMENTS OF SECTION 51(17) OF THE PLANNING ACT

(a) AS SHOWN ON PLAN	(g) AS SHOWN ON PLAN
(b) AS SHOWN ON PLAN	(h) MUNICIPAL WATER
(c) AS SHOWN ON KEY PLAN	(i) SAND, GRAVEL, SANDY SILT
(d) SINGLE, MULTI–FAMILY RESIDENTIAL	(j) AS SHOWN ON PLAN
(e) AS SHOWN ON PLAN	(k) MUNICIPAL SERVICES
(f) AS SHOWN ON PLAN	(l) AS SHOWN ON PLAN

PROJECT

WAVERLY STREET,
DELHI

LANDMARK HOMES INC.

DILLON CONSULTING

No.	REVISION	DATE	BY

DRAWN CD | CHECKED MTP | SCALE – 1 : 500 (5 0 10m) | DATE 2023-12-08

NOTE: DISTANCES SHOWN ON THIS PLAN ARE IN METERS AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

PROJECT No. 22–5115

November 29, 2023

C:\pw working directory\projects 2022\dillon_10cs\dms62516\225115-00-DP-DWG.dwg

TOPOGRAPHIC SURVEY
FOR: LANDMARK HOMES

SCALE - 1: 500

0 10 20 30 METRES

METRIC DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

KIM HUSTED SURVEYING LTD.

CAUTION

- THIS IS NOT A PLAN OF SURVEY OR SURVEYOR'S REPORT AND SHALL NOT BE USED FOR TRANSACTION OR FINANCING PURPOSES
- DO NOT CONVEY FROM THIS PLAN

NOTES

(1) - A SURVEY OF THE SUBJECT PROPERTY HAS NOT BEEN MADE AVAILABLE

(2) - SITE BENCHMARK TOP OF HYDRANT WEST OF SUBJECT PROPERTY, IN FRONT OF LOT 10, REGISTERED PLAN 261 WITH AN ELEVATION OF 242.76 metres

(3) - IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE ELEVATION OF THE UPPER LIMIT OF THE GROUND WATER TABLE, SOIL BEARING CAPACITY AND THE ELEVATION OF THE UNDER SIDE OF FOOTING PRIOR TO EXCAVATION.

(4) - IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE SITE BENCH MARK PRIOR TO EXCAVATION

(5) - THE VARIOUS UTILITY LOCATIONS SHOWN ON THIS PLAN ARE BASED ON PHYSICAL LOCATES OF ABOVE GROUND SERVICES. PRIOR TO ANY ON SITE CONSTRUCTION ACTIVITY A VERIFICATION LOCATE OF UNDERGROUND SERVICES IS BOTH RECOMMENDED AND ADVISED.

SURVEYOR'S CERTIFICATE

I CERTIFY THAT

(1) - THIS SKETCH WAS PREPARED FROM FIELD WORK COMPLETED ON THE 23rd DAY OF APRIL, 2023

MAY 15, 2023
DATE

JAMIE G. DOCKX
ONTARIO LAND SURVEYOR

LEGEND

■	DENOTES	SURVEY MONUMENT FOUND
□	DENOTES	SURVEY MONUMENT SET
SIB	DENOTES	STANDARD IRON BAR
IB	DENOTES	IRON BAR
RIB	DENOTES	ROUND IRON BAR
CM	DENOTES	CONCRETE MONUMENT
(WIT.)	DENOTES	WITNESS
(700)	DENOTES	JEWITT AND DIXON LTD.
(413)	DENOTES	ROGER MELVILLE LEE
P.I.N.	DENOTES	PROPERTY IDENTIFIER NUMBER
BF	DENOTES	BOARD FENCE
WRF	DENOTES	WOOD RAIL FENCE
MF	DENOTES	METAL FENCE
CF	DENOTES	CHAIN LINK FENCE
OH	DENOTES	OVER HEAD UTILITIES
	DENOTES	GUY WIRE
●	DENOTES	UTILITY POLE
	DENOTES	DELETERIOUS TREE
	DENOTES	DECIDUOUS TREE

PROPERTY DESCRIPTION
PART OF LOT 24
CONCESSION 12
GEOGRAPHIC TOWNSHIP OF WINDHAM
(TOWN OF DELHI)
IN
NORFOLK COUNTY
PARTS 1 AND 2 DEPOSITED PLAN 37R-3287

KIM HUSTED SURVEYING LTD.
ONTARIO LAND SURVEYOR
30 HARVEY STREET, TILLSONBURG ONTARIO, N4G 3J8
PHONE:519-842-3638 FAX: 519-842-3639

PROJECT: 23-18462TOPO	LAND MARK HOMES DELHI	REF: FILE	DWG. GES CKD. JGD

E:\OSOFT141\Wayne\Greg's Dwg's\23-18462TOPO.dwg

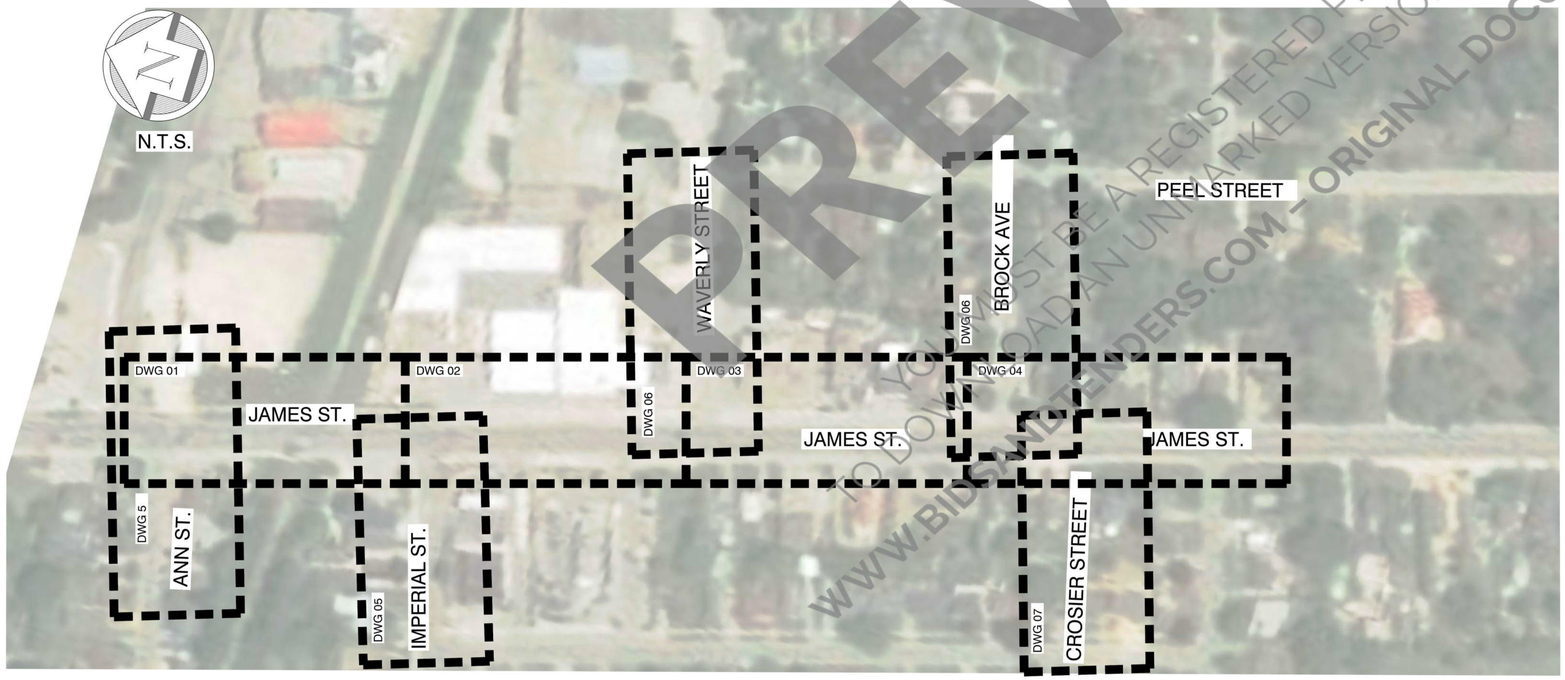
EIS - ENG - 23 - 37

JAMES STREET RECONSTRUCTION

DELHI

NORFOLK COUNTY

Norfolk COUNTY



PREVIEW
TO DOWNLOAD AN UNMARKED VERSION OF THIS FILE YOU MUST BE A REGISTERED PLAN TAKER
WWW.BIDSANDTENDERS.COM - ORIGINAL DOCUMENT SOURCE

DRAWING LIST	
DWG	DWG TITLE
COV	COVER PAGE
01	PLAN AND PROFILE 0+000 – 0+150
02	PLAN AND PROFILE 0+150 – 0+290
03	PLAN AND PROFILE 0+290 – 0+450
04	PLAN AND PROFILE 0+450 – END
05	PLAN AND PROFILE ANN AND IMPERIAL
06	PLAN AND PROFILE WAVERLY AND BROCK
07	PLAN AND PROFILE CROSIER
08	INTERSECTION GRADING PLAN
09	PAVEMENT MARKINGS–SIGNAGE
10	CROSS SECTIONS – 1
11	CROSS SECTIONS – 2
12	CROSS SECTIONS – 3
13	CROSS SECTIONS – 4
14	CROSS SECTIONS – 5
15	CROSS SECTIONS – 6
16	GN GENERAL NOTES
STA	STORM AREAS
SA1	SANITARY AREAS 1
SA2	SANITARY AREAS 2

REV. No.	DATE	REVISION
0	10/14/22	ISSUED FOR COUNTY REVIEW
1	12/02/22	ISSUED TO COUNTY FOR REVIEW
2	01/27/23	ISSUED FOR TENDER

NOTE:
THE CONTRACTOR IS CAUTIONED THAT ALL OF THE EXISTING UTILITIES ARE NOT INDICATED ON THIS DRAWING. THE CONTRACTOR MUST ARRANGE FOR LOCATES FROM EACH AREA UTILITY COMPANY PRIOR TO ANY CONSTRUCTION OR EXCAVATION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE PROTECTION OF ALL UTILITIES INCLUDING THOSE NOT INDICATED ON THIS DRAWING. G. DOUGLAS VALLEE LTD. CAN NOT ACCEPT RESPONSIBILITY FOR DAMAGE TO ANY EXISTING UTILITY WHICH MAY OR MAY NOT BE INDICATED ON THIS DRAWING.

BENCHMARKS:

BM 1: SPIKE, 0.1m ABOVE GRADE, IN SOUTH FACE OF HYDRO POLE AT SOUTHEAST CORNER OF JAMES ST AND ARGYLE STREET
ELEV.....237.65m

BM 2: 2 SPIKES, 0.2m ABOVE GRADE, IN NORTH FACE OF BELL POLE AT THE SOUTHWEST CORNER OF IMPERIAL AND JAMES STREETS
ELEV.....237.61m

BM 3: SPIKE, 0.15m ABOVE GRADE, IN EAST FACE OF HYDRO POLE ON WEST SIDE OF JAMES STREET, 25m ± NORTH OF CENTRELINE OF WAVERLY STREET
ELEV.....238.25m

BM 4: SPIKE, 0.2± ABOVE GRADE, IN SOUTHWEST FACE OF HYDRO POLE AT NORTHEAST CORNER OF JAMES ST AND BROCK STREET
ELEV.....240.12m

BM 5: SPIKE, 0.2m± ABOVE GRADE, IN EAST FACE OF HYDRO POLE AT SOUTHWEST CORNER OF JAMES ST AND CROSIER ST.
ELEV.....240.83

vallee
Consulting Engineers, Architects & Planners
G. DOUGLAS VALLEE LIMITED
2 TALBOT STREET NORTH
SIMCOE, ONTARIO N3Y 3W4
(519) 426-6270

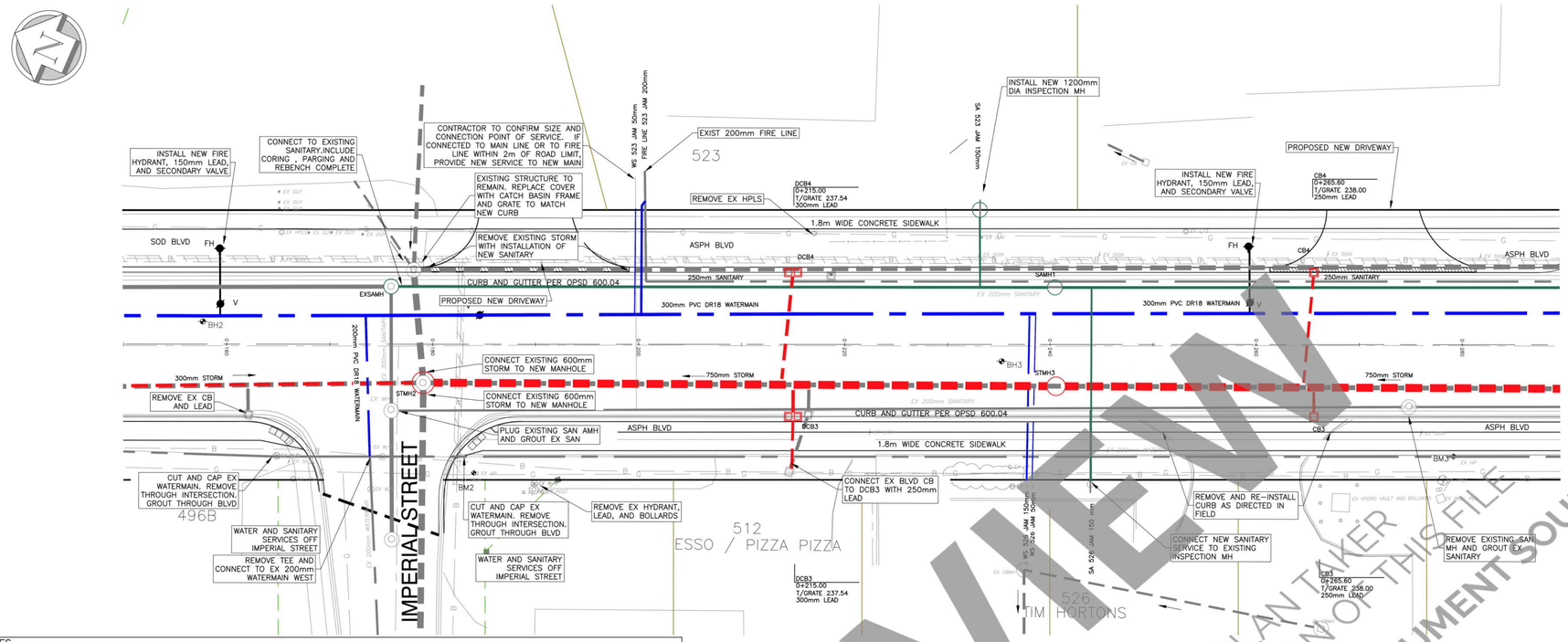
Stamp
LICENCED PROFESSIONAL ENGINEER
T. G. SMITH
2023-01-11
92104
PROVINCE OF ONTARIO

Project Title
EIS - ENG - 23 - 37
JAMES STREET RECONSTRUCTION
JAMES STREET
DELHI - NORFOLK COUNTY

Drawing Title
COVER PAGE

Designed by : AC/TGS	Drawn By : RCS
Checked by : TGS	Date Started : 11/01/22
Drawing Scale : AS SHOWN	Drawing No. COV
Project No. 22-104	

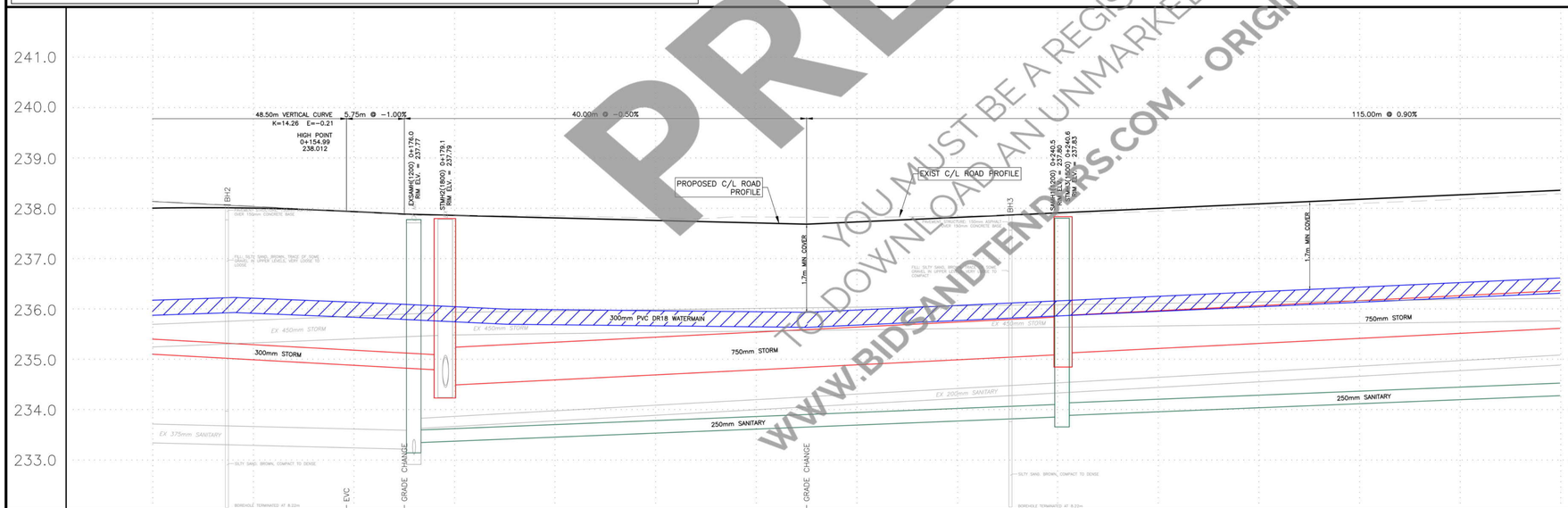
DATE LAST PLOTTED :



NOTES
1. ALL EXISTING STORM, WATER, AND SANITARY TO BE REMOVED UNLESS OTHERWISE NOTED.
2. REFER TO DWG GN FOR RESTORATION DETAILS.
3. REFER TO ARBORISTS REPORT FOR TREE PROTECTION PLAN/DETAILS.
4. SERVICE LOCATIONS TO BE EXCAVATED USING HYDROVAC WHERE NEAR TREES, TO BE DETERMINED IN THE FIELD WHEN EXACT SERVICE LOCATIONS ARE CONFIRMED.
5. REFER TO DWG GN FOR WATERMAIN RESTRAINTS TABLE. ALL BENDS TO BE TIED-IN AND SHOWN ON AS-CONSTRUCTED DRAWINGS.
6. CONTRACTOR TO MAINTAIN 2.5m HORIZONTAL SEPARATIONS AND 0.5m VERTICAL SEPARATIONS BETWEEN WATERMAIN AND SANITARY/STORM SEWERS.
7. NEW SANITARY SERVICES TO EXTEND 1.0m BEYOND PROPERTY LINE.
8. ALL STORM WITH LESS THAN 1.0m COVER TO BE INSULATED PER DETAIL ON GENERAL NOTES PAGE.
9. ALL WATER WITH LESS THAN 1.7m COVER TO BE INSULATED PER DETAIL ON GENERAL NOTES PAGE,

NOTE
WATERMAIN TO BE INSTALLED AND COMMISSIONED FROM ARGYLE TO 0+200±,INCLUDING FIRE LINE TO #523 PRIOR TO TAKING WATERMAIN SOUTH OF 0+200 OUT OF SERVICE.,

NOTE
MANHOLE SIZES NOTED ARE FOR REFERENCE ONLY. THE CONTRACTOR SHALL PROVIDE THE APPROPRIATE SIZE FOR THE CONFIGURATION SHOWN AND OPSD REQUIREMENTS.



CHAINAGE	0+150	0+160	0+169.3 0+170	0+175.0	0+180	0+190	0+200	0+210	0+215.0	0+220	0+230	0+240	0+250	0+260	0+270	0+280	0+290
FINAL CENTRE LINE ROAD ELEVATIONS	238.00	238.00	237.94 237.93	237.88	237.86	237.81	237.76	237.71	237.68	237.73	237.82	237.91	238.00	238.09	238.18	238.27	238.36
STORM SEWER	92.8m OF 300mm ULTRA RIB STORM WITH CLASS B BEDDING @ 1.10%				234.485 234.78N	61.5m OF 750mm CLASS 65-D CONCRETE STORM WITH CLASS B BEDDING @ 1.00%						235.10N 235.12S	64.6m OF 750mm CLASS 65-D CONCRETE STORM WITH CLASS B BEDDING @ 1.00%					
SANITARY SEWER	EX 233.21N EX 233.11S EX 233.11N			233.345		64.5m OF 250mm PVC SDR 35 SANITARY WITH CLASS B BEDDING @ 0.80%						233.88N 233.88S	60.0m OF 250mm PVC SDR 35 SANITARY WITH CLASS B BEDDING @ 0.80%				

REV. No.	DATE	REVISION
0	10/14/22	ISSUED FOR COUNTY REVIEW
1	12/02/22	ISSUED TO COUNTY FOR REVIEW
2	01/27/23	ISSUED FOR TENDER

NOTE:
THE CONTRACTOR IS CAUTIONED THAT ALL OF THE EXISTING UTILITIES ARE NOT INDICATED ON THIS DRAWING. THE CONTRACTOR MUST ARRANGE FOR LOCATES FROM EACH AREA UTILITY COMPANY PRIOR TO ANY CONSTRUCTION OR EXCAVATION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE PROTECTION OF ALL UTILITIES INCLUDING THOSE NOT INDICATED ON THIS DRAWING. G. DOUGLAS VALLEE LTD. CAN NOT ACCEPT RESPONSIBILITY FOR DAMAGE TO ANY EXISTING UTILITY WHICH MAY OR MAY NOT BE INDICATED ON THIS DRAWING.

BENCHMARKS:

BM 1: SPIKE, 0.1m ABOVE GRADE, IN SOUTH FACE OF HYDRO POLE AT SOUTHEAST CORNER OF JAMES ST AND ARGYLE STREET
ELEV.....237.65m

BM 2: 2 SPIKES, 0.2m ABOVE GRADE, IN NORTH FACE OF BELL POLE AT THE SOUTHWEST CORNER OF IMPERIAL AND JAMES STREETS
ELEV.....237.61m

BM 3: SPIKE, 0.15m ABOVE GRADE, IN EAST FACE OF HYDRO POLE ON WEST SIDE OF JAMES STREET, 25m ± NORTH OF CENTRELINE OF WAVERLY STREET
ELEV.....238.25m

BM 4: SPIKE, 0.2± ABOVE GRADE, IN SOUTHWEST FACE OF HYDRO POLE AT NORTHEAST CORNER OF JAMES ST AND BROCK AVE
ELEV.....240.12m

BM 5: SPIKE, 0.2m± ABOVE GRADE, IN EAST FACE OF HYDRO POLE AT SOUTHWEST CORNER OF JAMES ST AND CROSIER ST.
ELEV.....240.83

SERVICE LABELS

*WS/SA 01 JAM (29m) DISTANCE TO DOWNSTREAM SANITARY MANHOLE
1ST 3 LETTERS OF STREET
MUNICIPAL STREET #
WS - WATER SERVICE
SA - SANITARY SERVICE
LOCATION TO BE CONFIRMED BY CONTRACTOR IN FIELD

SCALE:
HORIZONTAL : 1:250 (0 5 10 15)
VERTICAL : 1:50 (0 1 2 3)

vallee
Consulting Engineers, Architects & Planners
G. DOUGLAS VALLEE LIMITED
2 TALBOT STREET NORTH
SIMCOE, ONTARIO N3Y 3W4
(519) 426-6270

Stamp
LICENSED PROFESSIONAL ENGINEER
T. G. SMITH
2023-01-11
22104
PROVINCE OF ONTARIO

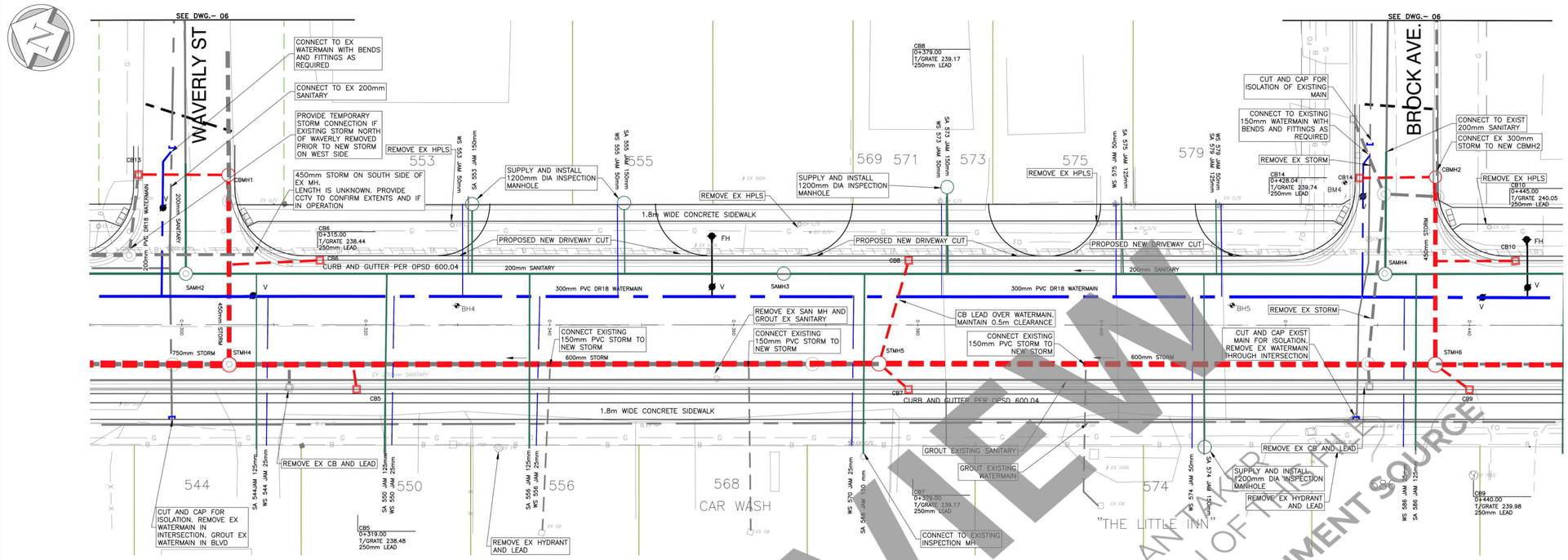
Project Title
EIS - ENG - 23 - 37
JAMES STREET RECONSTRUCTION
JAMES STREET
DELHI - NORFOLK COUNTY

Drawing Title
PLAN AND PROFILE 0+150 - 0+290

Designed by :	Drawn By :
AC/TGS	RCS
Checked by :	Date Started :
TGS	11/01/22
Drawing Scale :	Drawing No.
AS SHOWN	02
Project No.	
22-104	

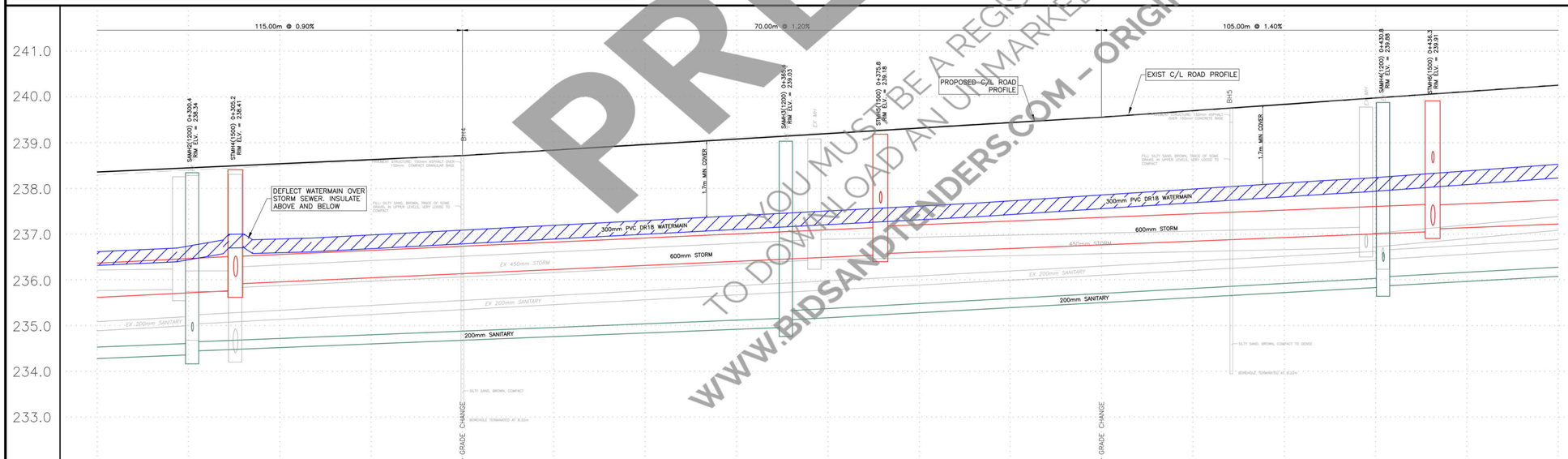
DATE LAST PLOTTED : January 10, 2023

PREVIEW
YOU MUST BE A REGISTERED PLAN TAKER TO DOWNLOAD AN UNMARKED VERSION OF THIS FILE
WWW.BIDSANDTENDERS.COM - ORIGINAL DOCUMENT SOURCE



NOTES
1. ALL EXISTING STORM, WATER, AND SANITARY TO BE REMOVED UNLESS OTHERWISE NOTED.
2. REFER TO DWG GN FOR RESTORATION DETAILS.
3. REFER TO ARBORISTS REPORT FOR TREE PROTECTION PLAN/DETAILS.
4. SERVICE LOCATIONS TO BE EXCAVATED USING HYDROVAC WHERE NEAR TREES, TO BE DETERMINED IN THE FIELD WHEN EXACT SERVICE LOCATIONS ARE CONFIRMED.
5. REFER TO DWG GN FOR WATERMAIN RESTRAINTS TABLE. ALL BENDS TO BE TIED-IN AND SHOWN ON AS-CONSTRUCTED DRAWINGS.
6. CONTRACTOR TO MAINTAIN 2.5m HORIZONTAL SEPARATIONS AND 0.5m VERTICAL SEPARATIONS BETWEEN WATERMAIN AND SANITARY/STORM SEWERS.
7. NEW SANITARY SERVICES TO EXTEND 1.0m BEYOND PROPERTY LINE.
8. ALL STORM WITH LESS THAN 1.0m COVER TO BE INSULATED PER DETAIL ON GENERAL NOTES PAGE.
9. ALL WATER WITH LESS THAN 1.7m COVER TO BE INSULATED PER DETAIL ON GENERAL NOTES PAGE,

NOTE
MANHOLE SIZES NOTED ARE FOR REFERENCE ONLY. THE CONTRACTOR SHALL PROVIDE THE APPROPRIATE SIZE FOR THE CONFIGURATION SHOWN AND OPSD REQUIREMENTS.



CHAINAGE	0+290	0+300	0+310	0+320	0+330.0	0+340	0+350	0+360	0+370	0+380	0+390	0+400.0	0+410	0+420	0+430	0+440	0+450
FINAL CENTRE LINE ROAD ELEVATIONS	238.36	238.45	238.54	238.63	238.72	238.84	238.96	239.08	239.20	239.32	239.44	239.56	239.70	239.84	239.98	240.12	240.26
STORM SEWER	235.77N 235.91S 236.07E	70.6m OF 600mm CLASS 65-D CONCRETE STORM WITH CLASS B BEDDING @ 0.90%								256.55N 256.57S 237.58E	60.5m OF 600mm CLASS 65-D CONCRETE STORM WITH CLASS B BEDDING @ 0.80%				237.05N 237.11E 238.56S	93.4m OF 525mm CLASS 65-D CONCRETE STORM WITH CLASS B BEDDING @ 0.80%	
SANITARY SEWER	234.36N 234.44S 234.87E	65.0m OF 200mm PVC SDR 35 SANITARY WITH CLASS B BEDDING @ 0.80%						234.96N 235.12S		65.4m OF 200mm PVC SDR 35 SANITARY WITH CLASS B BEDDING @ 1.10%					236.43N 236.43S 236.50E	100.7m OF 200mm PVC SDR 35 SANITARY WITH CLASS B BEDDING @ 1.10%	

DATE LAST PLOTTED : January 10, 2023

REV. No.	DATE	REVISION
0	10/14/22	ISSUED FOR COUNTY REVIEW
1	12/02/22	ISSUED TO COUNTY FOR REVIEW
2	01/27/23	ISSUED FOR TENDER

NOTE:
THE CONTRACTOR IS CAUTIONED THAT ALL OF THE EXISTING UTILITIES ARE NOT INDICATED ON THIS DRAWING. THE CONTRACTOR MUST ARRANGE FOR LOCATES FROM EACH AREA UTILITY COMPANY PRIOR TO ANY CONSTRUCTION OR EXCAVATION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE PROTECTION OF ALL UTILITIES INCLUDING THOSE NOT INDICATED ON THIS DRAWING. G. DOUGLAS VALLEE LTD. CAN NOT ACCEPT RESPONSIBILITY FOR DAMAGE TO ANY EXISTING UTILITY WHICH MAY OR MAY NOT BE INDICATED ON THIS DRAWING.

BENCHMARKS:

BM 1: SPIKE, 0.1m ABOVE GRADE, IN SOUTH FACE OF HYDRO POLE AT SOUTHEAST CORNER OF JAMES ST AND ARGYLE STREET
ELEV.....237.65m

BM 2: 2 SPIKES, 0.2m ABOVE GRADE, IN NORTH FACE OF BELL POLE AT THE SOUTHWEST CORNER OF IMPERIAL AND JAMES STREETS
ELEV.....237.61m

BM 3: SPIKE, 0.15m ABOVE GRADE, IN EAST FACE OF HYDRO POLE ON WEST SIDE OF JAMES STREET, 25m ± NORTH OF CENTRELINE OF WAVERLY STREET
ELEV.....238.25m

BM 4: SPIKE, 0.2± ABOVE GRADE, IN SOUTHWEST FACE OF HYDRO POLE AT NORTHEAST CORNER OF JAMES ST AND BROCK AVE.
ELEV.....240.12m

BM 5: SPIKE, 0.2m± ABOVE GRADE, IN EAST FACE OF HYDRO POLE AT SOUTHWEST CORNER OF JAMES ST AND CROSIER ST.
ELEV.....240.83

SERVICE LABELS
*WS/SA 01 JAM (29m) DISTANCE TO DOWNSTREAM SANITARY MANHOLE
1ST 3 LETTERS OF STREET MUNICIPAL STREET #
WS - WATER SERVICE
SA - SANITARY SERVICE
LOCATION TO BE CONFIRMED BY CONTRACTOR IN FIELD

SCALE:
HORIZONTAL : 1 : 250 (0, 5, 10, 15)
VERTICAL : 1 : 50 (0, 1, 2, 3)

vallee
Consulting Engineers, Architects & Planners
G. DOUGLAS VALLEE LIMITED
2 TALBOT STREET NORTH
SIMCOE, ONTARIO N3Y 3W4
(519) 426-6270

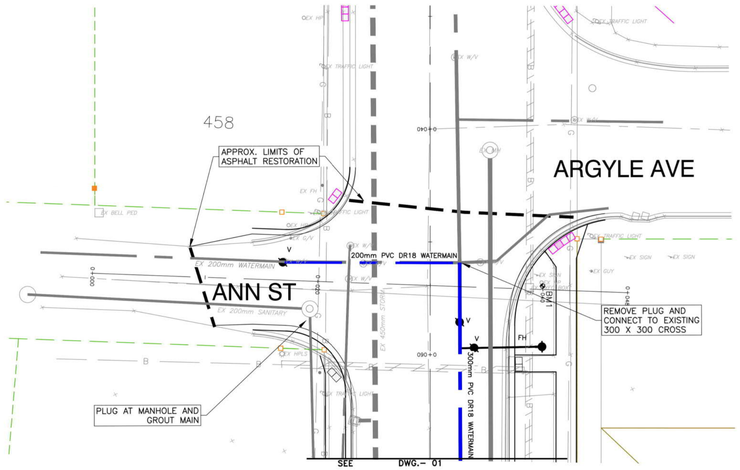
Stamp
LICENSED PROFESSIONAL ENGINEER
T. G. SMITH
2023-01-11
22104
PROVINCE OF ONTARIO

Project Title
EIS - ENG - 23 - 37
JAMES STREET RECONSTRUCTION
JAMES STREET
DELHI - NORFOLK COUNTY

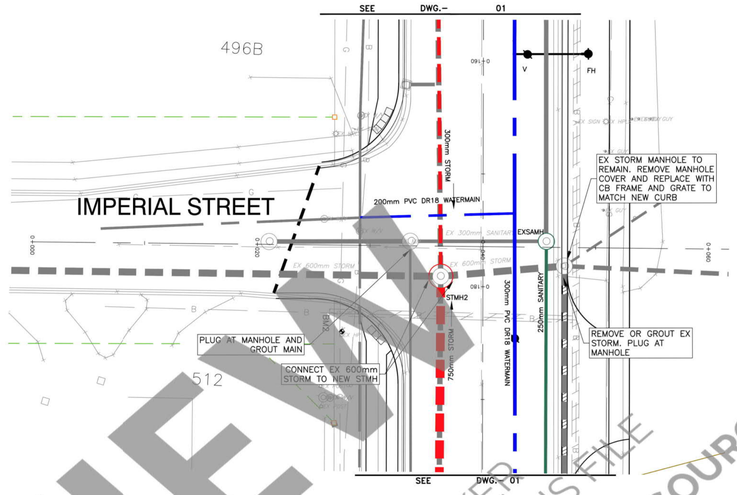
Drawing Title
PLAN AND PROFILE 0+290 - 0+450

Designed by :	Drawn By :
AC/TGS	RCS
Checked by :	Date Started :
TGS	11/01/22
Drawing Scale :	Drawing No.
AS SHOWN	03
Project No.	
22-104	

PREVIEW
YOU MUST BE A REGISTERED PLAN TAKER TO DOWNLOAD AN UNMARKED VERSION OF THIS FILE
WWW.BIDSANDTENDERS.COM - ORIGINAL DOCUMENT SOURCE



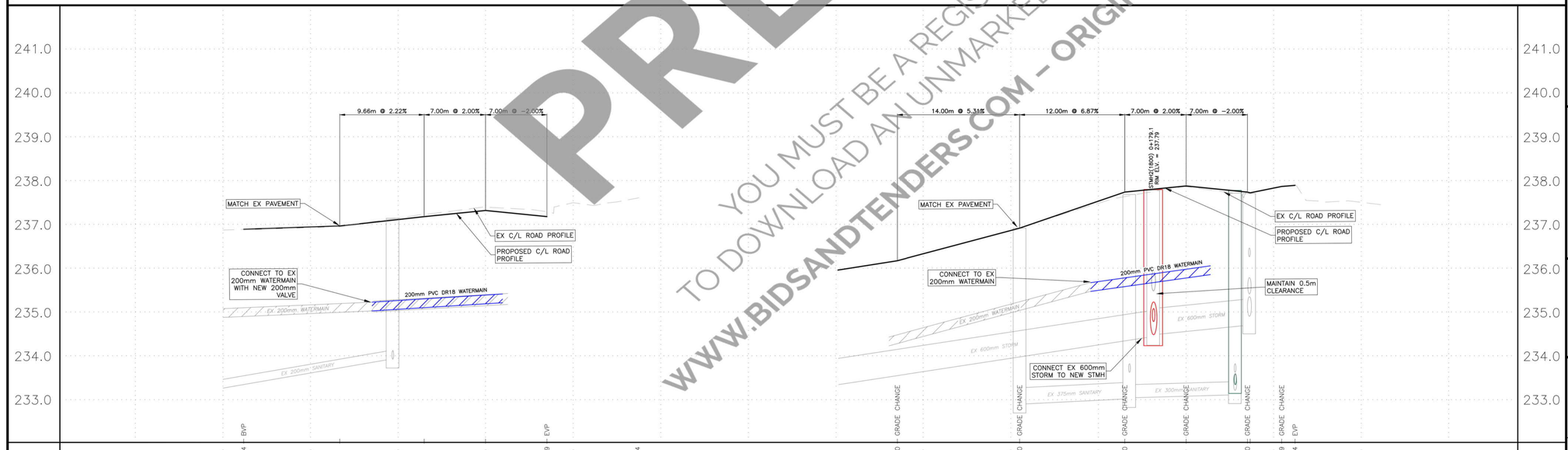
ANN ST. / ARGYLE AVE.



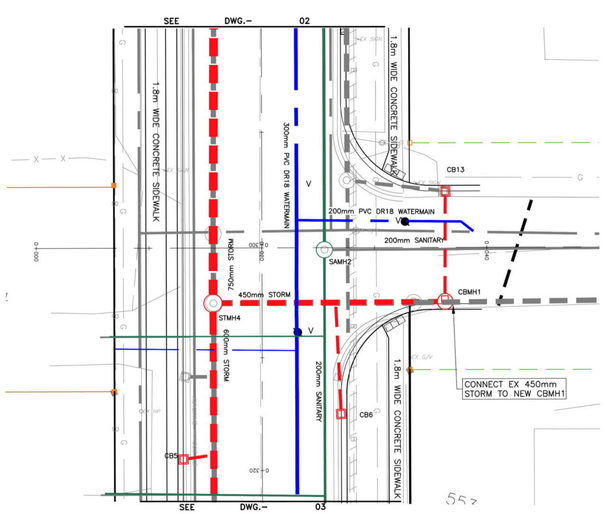
IMPERIAL ST.

NOTES
1. ALL EXISTING STORM, WATER, AND SANITARY TO BE REMOVED UNLESS OTHERWISE NOTED.
2. REFER TO DWG GN FOR RESTORATION DETAILS.
3. REFER TO ARBORISTS REPORT FOR TREE PROTECTION PLAN/DETAILS.
4. SERVICE LOCATIONS TO BE EXCAVATED USING HYDROVAC WHERE NEAR TREES, TO BE DETERMINED IN THE FIELD WHEN EXACT SERVICE LOCATIONS ARE CONFIRMED.
5. REFER TO DWG GN FOR WATERMAIN RESTRAINTS TABLE. ALL BENDS TO BE TIED–IN AND SHOWN ON AS–CONSTRUCTED DRAWINGS.
6. CONTRACTOR TO MAINTAIN 2.5m HORIZONTAL SEPARATIONS AND 0.5m VERTICAL SEPARATIONS BETWEEN WATERMAIN AND SANITARY/STORM SEWERS.
7. NEW SANITARY SERVICES TO EXTEND 1.0m BEYOND PROPERTY LINE.
8. ALL STORM WITH LESS THAN 1.0m COVER TO BE INSULATED PER DETAIL ON GENERAL NOTES PAGE.
9. ALL WATER WITH LESS THAN 1.7m COVER TO BE INSULATED PER DETAIL ON GENERAL NOTES PAGE,

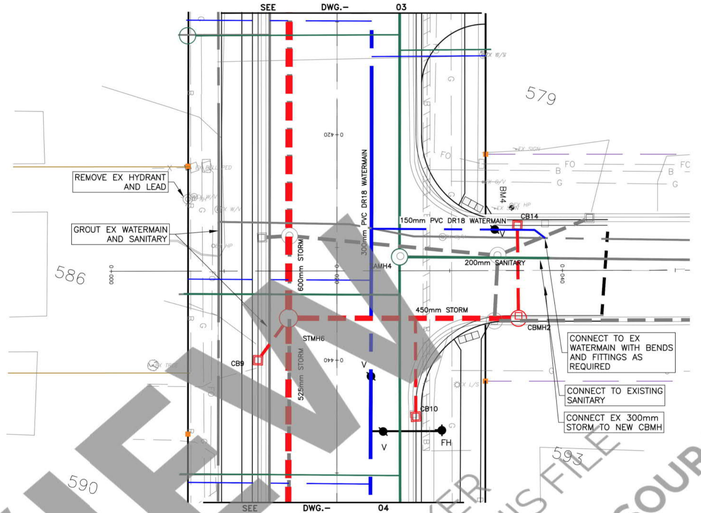
NOTE
MANHOLE SIZES NOTED ARE FOR REFERENCE ONLY. THE CONTRACTOR SHALL PROVIDE THE APPROPRIATE SIZE FOR THE CONFIGURATION SHOWN AND OPSD REQUIREMENTS.



| | | |



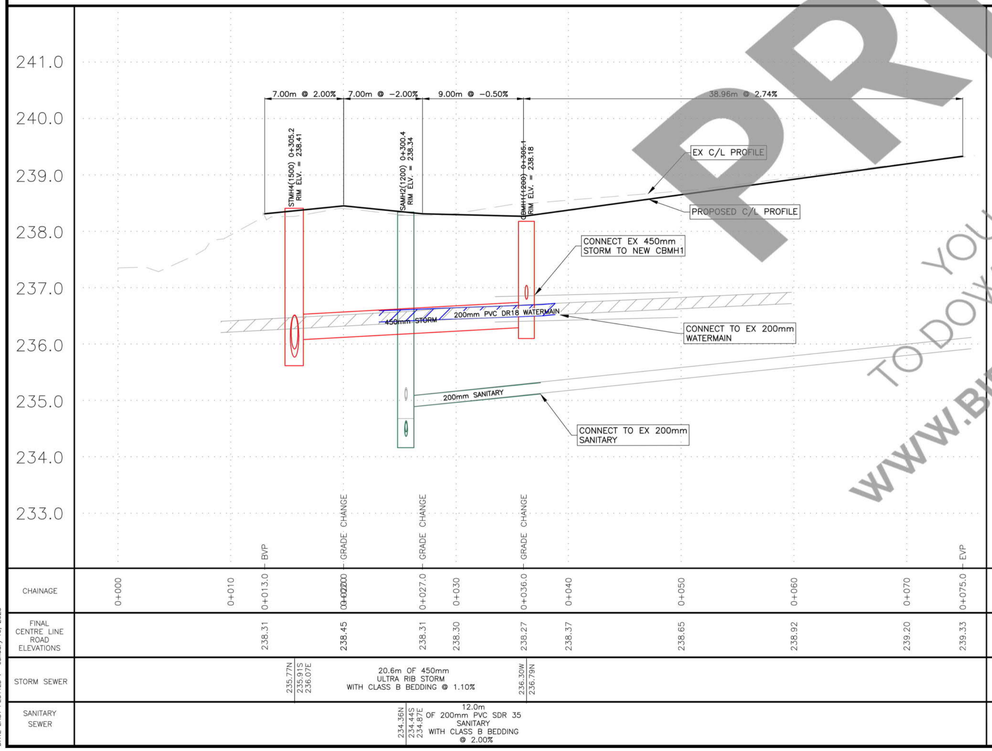
WAVERLY STREET

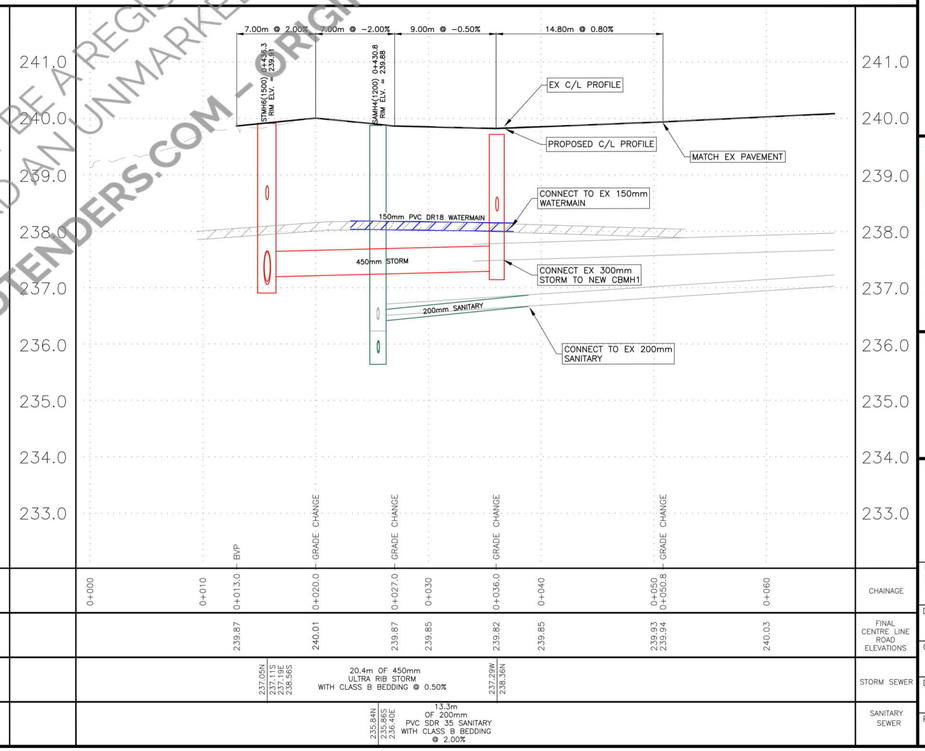


BROCK AVE

NOTES
1. ALL EXISTING STORM, WATER, AND SANITARY TO BE REMOVED UNLESS OTHERWISE NOTED.
2. REFER TO DWG GN FOR RESTORATION DETAILS.
3. REFER TO ARBORISTS REPORT FOR TREE PROTECTION PLAN/DETAILS.
4. SERVICE LOCATIONS TO BE EXCAVATED USING HYDROVAC WHERE NEAR TREES, TO BE DETERMINED IN THE FIELD WHEN EXACT SERVICE LOCATIONS ARE CONFIRMED.
5. REFER TO DWG GN FOR WATERMAIN RESTRAINTS TABLE. ALL BENDS TO BE TIED–IN AND SHOWN ON AS–CONSTRUCTED DRAWINGS.
6. CONTRACTOR TO MAINTAIN 2.5m HORIZONTAL SEPARATIONS AND 0.5m VERTICAL SEPARATIONS BETWEEN WATERMAIN AND SANITARY/STORM SEWERS.
7. NEW SANITARY SERVICES TO EXTEND 1.0m BEYOND PROPERTY LINE.
8. ALL STORM WITH LESS THAN 1.0m COVER TO BE INSULATED PER DETAIL ON GENERAL NOTES PAGE.
9. ALL WATER WITH LESS THAN 1.7m COVER TO BE INSULATED PER DETAIL ON GENERAL NOTES PAGE,

NOTE
MANHOLE SIZES NOTED ARE FOR REFERENCE ONLY. THE CONTRACTOR SHALL PROVIDE THE APPROPRIATE SIZE FOR THE CONFIGURATION SHOWN AND OPSD REQUIREMENTS.





DATE LAST PLOTTED : January 10, 2023

REV. No.	DATE	REVISION
0	10/14/22	ISSUED FOR COUNTY REVIEW
1	12/02/22	ISSUED TO COUNTY FOR REVIEW
2	01/27/23	ISSUED FOR TENDER

NOTE:
THE CONTRACTOR IS CAUTIONED THAT ALL OF THE EXISTING UTILITIES ARE NOT INDICATED ON THIS DRAWING. THE CONTRACTOR MUST ARRANGE FOR LOCATES FROM EACH AREA UTILITY COMPANY PRIOR TO ANY CONSTRUCTION OR EXCAVATION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE PROTECTION OF ALL UTILITIES INCLUDING THOSE NOT INDICATED ON THIS DRAWING. G. DOUGLAS VALLEE LTD. CAN NOT ACCEPT RESPONSIBILITY FOR DAMAGE TO ANY EXISTING UTILITY WHICH MAY OR MAY NOT BE INDICATED ON THIS DRAWING.

BENCHMARKS:

BM 1: SPIKE, 0.1m ABOVE GRADE, IN SOUTH FACE OF HYDRO POLE AT SOUTHEAST CORNER OF JAMES ST AND ARGYLE STREET
ELEV.....237.65m

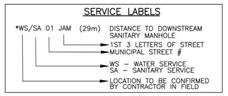
BM 2: 2 SPIKES, 0.2m ABOVE GRADE, IN NORTH FACE OF BELL POLE AT THE SOUTHWEST CORNER OF IMPERIAL AND JAMES STREETS
ELEV.....237.61m

BM 3: SPIKE, 0.15m ABOVE GRADE, IN EAST FACE OF HYDRO POLE ON WEST SIDE OF JAMES STREET, 25m ± NORTH OF CENTRELINE OF WAVERLY STREET
ELEV.....238.25m

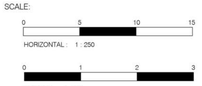
BM 4: SPIKE, 0.2± ABOVE GRADE, IN SOUTHWEST FACE OF HYDRO POLE AT NORTHEAST CORNER OF JAMES ST AND BROCK AVE.
ELEV.....240.12m

BM 5: SPIKE, 0.2m± ABOVE GRADE, IN EAST FACE OF HYDRO POLE AT SOUTHWEST CORNER OF JAMES ST AND CROSIER ST.
ELEV.....240.83

SERVICE LABELS



SCALE:



vallee
Consulting Engineers, Architects & Planners
G. DOUGLAS VALLEE LIMITED
2 TALBOT STREET NORTH
SIMCOE, ONTARIO N3Y 3W4
(519) 426-6270

Stamp
LICENSED PROFESSIONAL ENGINEER
T. G. SMITH
2023-01-11
22104
PROVINCE OF ONTARIO

Project Title
EIS - ENG - 23 - 37
JAMES STREET RECONSTRUCTION
JAMES STREET
DELHI - NORFOLK COUNTY

Drawing Title
PLAN AND PROFILE WAVERLY AND BROCK

Designed by :	Drawn By :
AC/TGS	RCS
Checked by :	Date Started :
TGS	11/01/22
Drawing Scale :	Drawing No.
AS SHOWN	06
Project No.	
22-104	

PREVIEW
YOU MUST BE A REGISTERED PLAN TAKER
TO DOWNLOAD AN UNMARKED VERSION OF THIS FILE
WWW.BIDSANDTENDERS.COM – ORIGINAL DOCUMENT SOURCE

STORM SEWER DESIGN SHEET

Storm 2-year Delhi
A= 566.5794 B= 4.286194 C= 0.7692
Pipe Material PVC<=450, Concrete >450
n 0.013

Project James Street - Delhi
Town/County Delhi - Norfolk County

Date Sept. 28, 2022
Designed by RCS
Checked by TGS
Sheet of : 1 of

Location			Area		Individual	Cumlative	Time	Rainfall	Flow	Sewer Design						
Area	From	To			R*A	R*A	of		2.78*I*A*R	Size	Slope	Cap	Vel	Length	%	Time
			Ha	Ha			Conc.	mm/hr							Cap	
			0.35	0.9			min		L/s	mm	%	L/s	m/s	m		min
A1	STMH7	STMH6	5.25		1.84	1.84	15.00	58.16	297.1	525	0.80%	384.659	1.777	93.4	77%	0.88
A2	CBMH2	STMH6	2.76		0.97	0.97	15.00	58.16	156.2	450	0.50%	201.6	1.268	20.3	77%	0.27
A3	STMH6	STMH5	0.23		0.08	2.88	15.88	56.21	450.7	600	0.80%	549.189	1.942	58.1	82%	0.50
A4	STMH5	STMH4	0.91		0.32	3.20	16.37	55.16	491.1	600	0.90%	582.502	2.06	70.6	84%	0.57
A5	CBMH1	STMH4	4.55		1.59	1.59	15.00	58.16	257.5	450	1.10%	299.022	1.88	20.6	86%	0.18
A6	STMH4	STMH3	0.34		0.119	4.91	16.95	54.02	737.9	750	1.00%	1113.28	2.52	64.6	66%	0.43
A7	STMH3	STMH2	2.97		1.0395	5.95	17.37	53.20	880.4	750	1.00%	1113.28	2.52	61.5	79%	0.41
A8	STMH1	STMH2	0.91		0.3185	0.32	15.00	58.16	51.5	300	1.10%	101.421	1.435	92.8	51%	1.08
A9	STMH2	EX (IMPERIAL)	0		0.00	6.27	17.78	52.44	914.4	600	3.10%	1081.08	3.824	88.96	85%	0.39

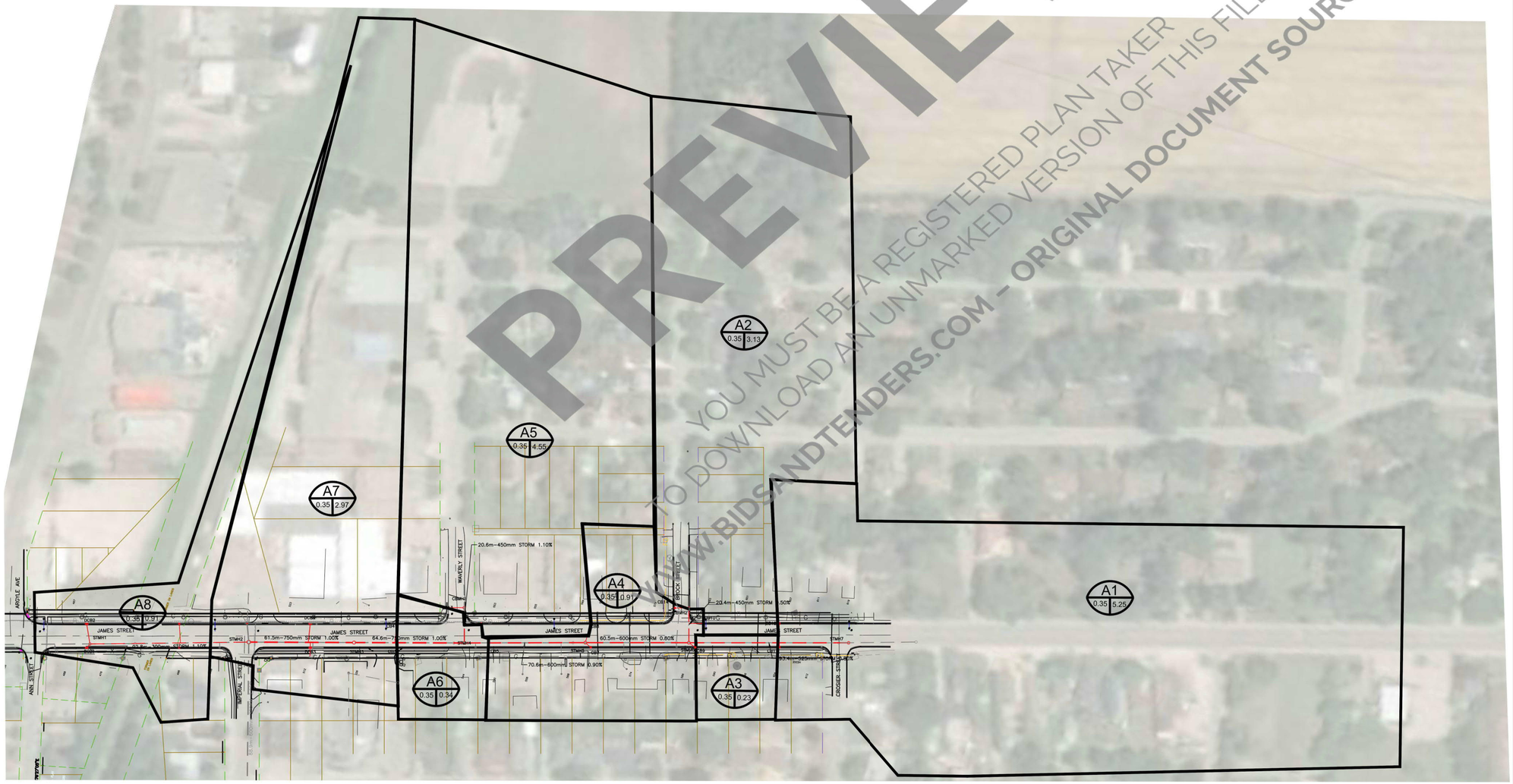
17.92

Note
Design storm is the 2-year MTO District 2 storm used by Norfolk County for the design of the Imperial Street Storm Sewer in 2007.
Inlet time of 15min used by Norfolk County in the design of the Imperial Street Storm sewer

Existing Pipe
Formula

Comparison to Imperial Street Design

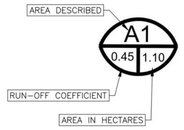
	Imperial	James
Contributing Area	18.5	17.92
Design Flow	1047	949
tc	15	17.63



PREVIEW
YOU MUST BE A REGISTERED PLAN TAKER
TO DOWNLOAD AN UNMARKED VERSION OF THIS FILE
WWW.BIDSANDTENDERS.COM – ORIGINAL DOCUMENT SOURCE

REV. No.	DATE	REVISION
0	10/14/22	ISSUED FOR COUNTY REVIEW
1	12/02/22	ISSUED TO COUNTY FOR REVIEW
2	01/27/23	ISSUED FOR TENDER

NOTE:
THE CONTRACTOR IS CAUTIONED THAT ALL OF THE EXISTING UTILITIES ARE NOT INDICATED ON THIS DRAWING. THE CONTRACTOR MUST ARRANGE FOR LOCATES FROM EACH AREA UTILITY COMPANY PRIOR TO ANY CONSTRUCTION OR EXCAVATION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE PROTECTION OF ALL UTILITIES INCLUDING THOSE NOT INDICATED ON THIS DRAWING. G. DOUGLAS VALLEE LTD. CAN NOT ACCEPT RESPONSIBILITY FOR DAMAGE TO ANY EXISTING UTILITY WHICH MAY OR MAY NOT BE INDICATED ON THIS DRAWING.



SCALE:
HORIZONTAL : 1 : 250
VERTICAL : 1 : 50

vallee
Consulting Engineers, Architects & Planners
G. DOUGLAS VALLEE LIMITED
2 TALBOT STREET NORTH
SIMCOE, ONTARIO N3Y 3W4
(519) 426-6270

Stamp
LICENCED PROFESSIONAL ENGINEER
T. G. SMITH
2023-01-11
22104
PROVINCE OF ONTARIO

Project Title
EIS - ENG - 23 - 37
JAMES STREET RECONSTRUCTION
JAMES STREET
DELHI - NORFOLK COUNTY

Drawing Title
STORM AREAS

Designed by : AC/TGS	Drawn By : RCS
Checked by : TGS	Date Started : 11/01/22
Drawing Scale : AS SHOWN	Drawing No. STA
Project No. 22-104	

DATE LAST PLOTTED : January 10, 2023

SANITARY SEWER DESIGN SHEET

Pipe Material PVC
N 0.013

Project: James Street - Argyle Ave to Crosier

Job No. 22104

Date 01-Oct-22
Designed by RS / TGS
Checked by TGS
Sheet of : 1 of 1

	Location			Total Area		Industrial Area		Units		Equiv	Equiv	Resid.	Indust.	Flow				Sewer Design						
Area	Street	From	To	Section	Cumul.	Section	Cumul.	Section	Cumul	Resid.	Indust.	M+Peak	Peak	Q(i)	Q(sr)	Q(si)	Q(d)	Material	Size	Length	N	Slope	Cap	% Cap	Full V
		MH	MH	Ha	Ha	Ha	Ha	Units	Units	Pop.	Pop.	Factor	Factor	L/s	L/s	L/s	L/s		mm	m		%	L/s		m/s
1	Future (Urban Residential)	Future Area	SAMH 17	14	14.00	0.00	0.00	280	280	770	0	3.8703	4.3	3.92	15.522	0	19.442								
2	Argyle Ave	SAMH 17	SAMH 16	1.13	15.13	0.92	0.92	0	280	770.00	110.40	3.87	4.03	4.24	15.52	2.36	22.12	PVC	200	77.3	0.013	0.70%	27.44		0.87
3	Argyle Ave	SAMH 16	SAMH 15	9.11	24.24	0.00	0.92	80	360	990.00	110.40	3.80	4.03	6.79	19.61	2.36	28.76	PVC	200	101.3	0.013	1.00%	32.80		1.04
4	Industrial Dr	EX.SAMH	SAMH 18	9.76	9.76	9.76	9.76	0	0	0.00	1171.20	4.50	3.55	2.73	0.00	22.09	24.82	AC	200	232.0	0.013	0.50%	23.19		0.74
5	Huggins Ave	SAMH 18	SAMH 15	2.02	11.78	2.02	11.78	0	0	0.00	1413.60	4.50	3.50	3.30	0.00	26.23	29.53	PVC	250	120.3	0.013	0.30%	32.57		0.66
6	Argyle Ave	SAMH 15	SAMH 14	0.19	36.21	0.00	12.70	1	361	992.75	1524.00	3.80	3.47	10.14	19.66	28.09	57.89	PVC	375	48.9	0.013	0.30%	96.03		0.87
7	Argyle Ave	SAMH 14	SAMH 13	0.36	36.57	0.00	12.70	2	363	998.25	1524.00	3.80	3.47	10.24	19.76	28.09	58.09	PVC	375	93.4	0.013	0.30%	96.03		0.87
8	Argyle Ave	SAMH 13	SAMH 12	2.38	38.95	1.91	14.61	4	367	1009.25	1753.20	3.80	3.43	10.91	19.96	31.90	62.76	PVC	375	98.0	0.013	0.30%	96.03		0.87
9	Argyle Ave	SAMH 12	SAMH 11	0.84	39.79	0.43	15.04	4	371	1020.25	1804.80	3.79	3.42	11.14	20.16	32.74	64.05	PVC	375	89.8	0.013	0.30%	96.03		0.87
10	Argyle Ave	SAMH 11	SAMH 10	2.83	42.62	2.35	17.39	3	374	1028.50	2086.80	3.79	3.37	11.93	20.31	37.32	69.57	PVC	375	110.2	0.013	0.30%	96.03		0.87
11	Argyle Ave	SAMH 10	SAMH 9	0.39	43.01	0.00	17.39	3	377	1036.75	2086.80	3.79	3.37	12.04	20.46	37.32	69.83	PVC	375	83.4	0.013	0.30%	96.03		0.87
12	Argyle Ave	SAMH 9	SAMH 8	3.32	46.33	2.83	20.22	4	381	1047.75	2426.40	3.79	3.32	12.97	20.66	42.72	76.36	PVC	375	82.1	0.013	0.30%	96.03		0.87
11A	Ridgewood	SAMH8E	SAMH8A	0.14	0.14	0.00	0.00	1	1	2.75	0.00	4.45	4.30	0.04	0.06	0.00	0.10	PVC	200	8.6	0.013	10.00%	103.72		3.30
	Ridgewood	SAMH8A	SAMH8	0.00	0.14	0.00	0.00	0	1	2.75	0.00	4.45	4.30	0.04	0.06	0.00	0.10	PVC	200	14.8	0.013	0.50%	23.19		0.74
13	Argyle Ave	SAMH 8	SAMH 7	1.47	47.94	0.93	21.15	4	386	1061.50	2538.00	3.78	3.30	13.42	20.92	44.47	78.81	PVC	375	83.6	0.013	0.30%	96.03		0.87
14	Argyle Ave	SAMH 7	SAMH 6	0.82	48.76	0.43	21.58	2	388	1067.00	2589.60	3.78	3.30	13.65	21.02	45.28	79.95	PVC	375	74.9	0.013	0.30%	96.03		0.87
15	Argyle Ave	SAMH 6	SAMH 5	1.00	49.76	0.56	22.14	3	391	1075.25	2656.80	3.78	3.29	13.93	21.17	46.32	81.42	PVC	375	63.9	0.013	0.30%	96.03		0.87
16	Argyle Ave	SAMH 5	SAMH 4	1.33	51.09	0.41	22.55	6	397	1091.75	2706.00	3.78	3.28	14.31	21.47	47.08	82.86	PVC	375	89.1	0.013	0.30%	96.03		0.87
17	Argyle Ave	SAMH 4	SAMH 3	0.77	51.86	0.54	23.09	0	397	1091.75	2770.80	3.78	3.27	14.52	21.47	48.09	84.07	PVC	375	84.1	0.013	0.30%	96.03		0.87
18	James St	SAMH 3A	SAMH 3	0.89	0.89	0.51	0.51	4	4	11.00	61.20	4.41	4.10	0.25	0.25	1.33	1.83	PVC	200	44.5	0.013	0.60%	25.41		0.81
19	James St	SAMH 3	SAMH 2	0.29	53.04	0.00	23.60	2	403	1108.25	2832.00	3.77	3.26	14.85	21.77	49.03	85.65	PVC	375	63.9	0.013	0.30%	96.03		0.87
20	James St	SAMH 2	SAMH 1	0.17	53.21	0.00	23.60	0	403	1108.25	2832.00	3.77	3.26	14.90	21.77	49.03	85.69	PVC	375	70.0	0.013	0.30%	96.03		0.87
A1	Brock	Connection	SAMH5	26.94	26.94	0.11	0.11	201	201	552.75	13.20	3.99	4.20	7.54	11.38	0.29	19.21	PVC	200	14.3	0.013	2.00%	46.38	41%	1.48
A2	James St	SAMH6	SAMH5	0.92	0.92	0.00	0.00	8	8	22.00	0.00	4.37	4.30	0.26	0.50	0.00	0.76	PVC	200	92.9	0.013	1.10%	34.40	2%	1.09
A3	James St	SAMH5	SAMH4	0.57	28.43	0.32	0.43	3	212	583.00	51.60	3.94	4.11	7.96	11.96	1.13	21.05	PVC	200	57.7	0.013	1.10%	34.40	61%	1.09
A4	James St	SAMH4	SAMH3	0.65	29.08	0.42	0.85	5	217	596.75	102.00	3.93	4.09	8.14	12.23	2.19	22.55	PVC	200	72.9	0.013	0.80%	29.34	77%	0.93
A5	Waverly	Connection	SAMH3	7.83	7.83	6.06	6.06	23	23	63.25	727.20	4.09	3.68	2.19	1.41	14.22	17.82	PVC	200	12.9	0.013	0.80%	29.34	61%	0.93
A6	James St	SAMH3	SAMH2	0.69	37.60	0.66	7.57	2	242	665.50	998.40	3.91	3.53	10.53	13.54	17.48	41.55	PVC	250	57.5	0.013	0.80%	53.19	78%	1.08
A7	James St	SAMH2	SAMH1	0.38	37.98	0.38	7.95	0	242	665.50	954.00	3.91	3.61	10.63	13.54	18.29	42.46	PVC	250	66.8	0.013	0.80%	53.19	80%	1.08
	James ST/Imperial	SAMH1	SAMH1A	0.00	91.19	0.00	31.55	0	645	1773.75	3786.00	3.63	3.15	24.93	33.50	63.36	122.39	PVC	375	12.1	0.013	1.00%	175.33		1.59
	Imperial	SAMH1A	NEW MH	0.00	91.19	0.00	31.55	0	645	1773.75	3786.00	3.63	3.15	25.53	33.50	63.36	122.39	PVC	375	12.0	0.013	1.00%	175.33		1.59

Note:
1) Area 1 - Future area unit count based on 14.0 ha at 55 persons/ha and 2.75 persons per unit for a total of 280 units.
2) Total area column used to determine infiltration flow and includes both industrial and residential areas.
2) Industrial area column only used to determine industrial sewage flow.

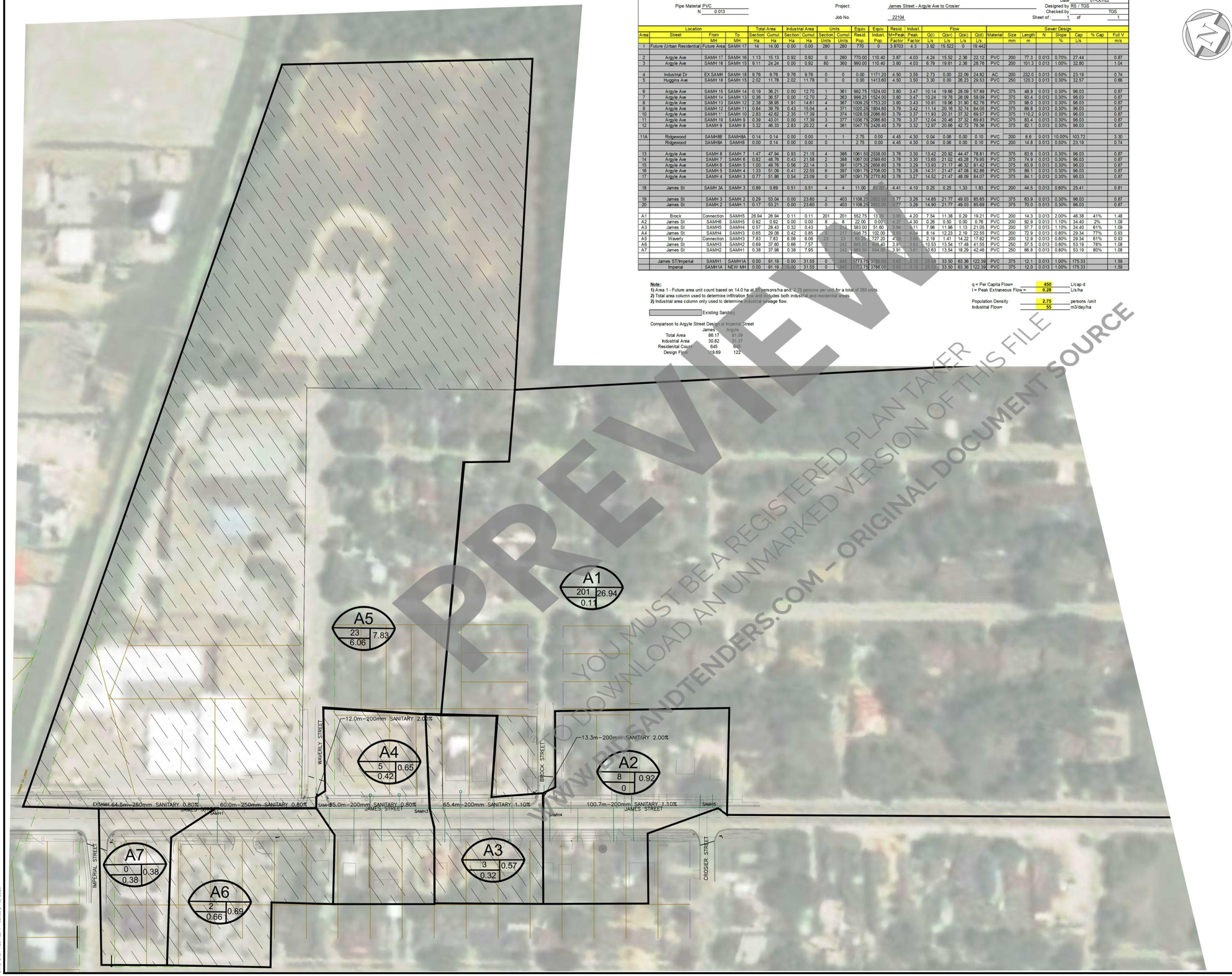
Existing Sanitary

Comparison to Argyle Street Design at Imperial Street

	James	Argyle
Total Area	86.17	91.09
Industrial Area	30.82	31.37
Residential Count	645	645
Design Flow	119.69	122

q = Per Capita Flow= 450 L/cap d
I = Peak Extraneous Flow = 0.28 L/s/ha

Population Density 2.75 persons /unit
Industrial Flow= 55 m3/day/ha



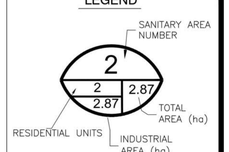
PREVIEW
YOU MUST BE A REGISTERED PLAN TAKER TO DOWNLOAD AN UNMARKED VERSION OF THIS FILE
WWW.BIDSANDTENDERS.COM - ORIGINAL DOCUMENT SOURCE

DATE LAST PLOTTED : January 10, 2023

REV. No.	DATE	REVISION
0	10/14/22	ISSUED FOR COUNTY REVIEW
1	12/02/22	ISSUED TO COUNTY FOR REVIEW
2	01/27/23	ISSUED FOR TENDER

NOTE:
THE CONTRACTOR IS CAUTIONED THAT ALL OF THE EXISTING UTILITIES ARE NOT INDICATED ON THIS DRAWING. THE CONTRACTOR MUST ARRANGE FOR LOCATES FROM EACH AREA UTILITY COMPANY PRIOR TO ANY CONSTRUCTION OR EXCAVATION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE PROTECTION OF ALL UTILITIES INCLUDING THOSE NOT INDICATED ON THIS DRAWING. G. DOUGLAS VALLEE LTD. CAN NOT ACCEPT RESPONSIBILITY FOR DAMAGE TO ANY EXISTING UTILITY WHICH MAY OR MAY NOT BE INDICATED ON THIS DRAWING.

LEGEND



SAMH10 PROPOSED DEVELOPMENT MANHOLE

INDUSTRIAL AREA

SCALE:

HORIZONTAL : 1 : 250
0 5 10 15

VERTICAL : 1 : 50
0 1 2 3

vallee
Consulting Engineers, Architects & Planners
G. DOUGLAS VALLEE LIMITED
2 TALBOT STREET NORTH
SIMCOE, ONTARIO N3Y 3W4
(519) 426-6270

Stamp
LICENCED PROFESSIONAL ENGINEER
T. G. SMITH
2023-01-11
22104
PROVINCE OF ONTARIO

Project Title
EIS - ENG - 23 - 37
JAMES STREET RECONSTRUCTION
JAMES STREET
DELHI - NORFOLK COUNTY

Drawing Title
SANITARY AREAS 1

Designed by : AC/TGS	Drawn By : RCS
Checked by : TGS	Date Started : 1/5/23
Drawing Scale : AS SHOWN	Drawing No. SA1
Project No. 22-104	

Appendix B

Servicing Plans

DILLON CONSULTING

DISCHARGE

Q = 2.78CIA

Q = RUNOFF IN LITRES PER SECOND
C = RUNOFF COEFFICIENT
I = RAINFALL INTENSITY
A = AREA IN HECTARES

RUNOFF COEFFICIENT " C "

PARKS: 0.20
SINGLE-FAMILY RESIDENTIAL : 0.45-0.60
MULTI-FAMILY RESIDENTIAL: 0.75
APARTMENTS: 0.75
COMMERCIAL & INDUSTRIAL: 0.8-0.9

STORM SEWER DESIGN SHEET
WAVERLY STREET
DELHI, ONTARIO

2 YEAR RETURN

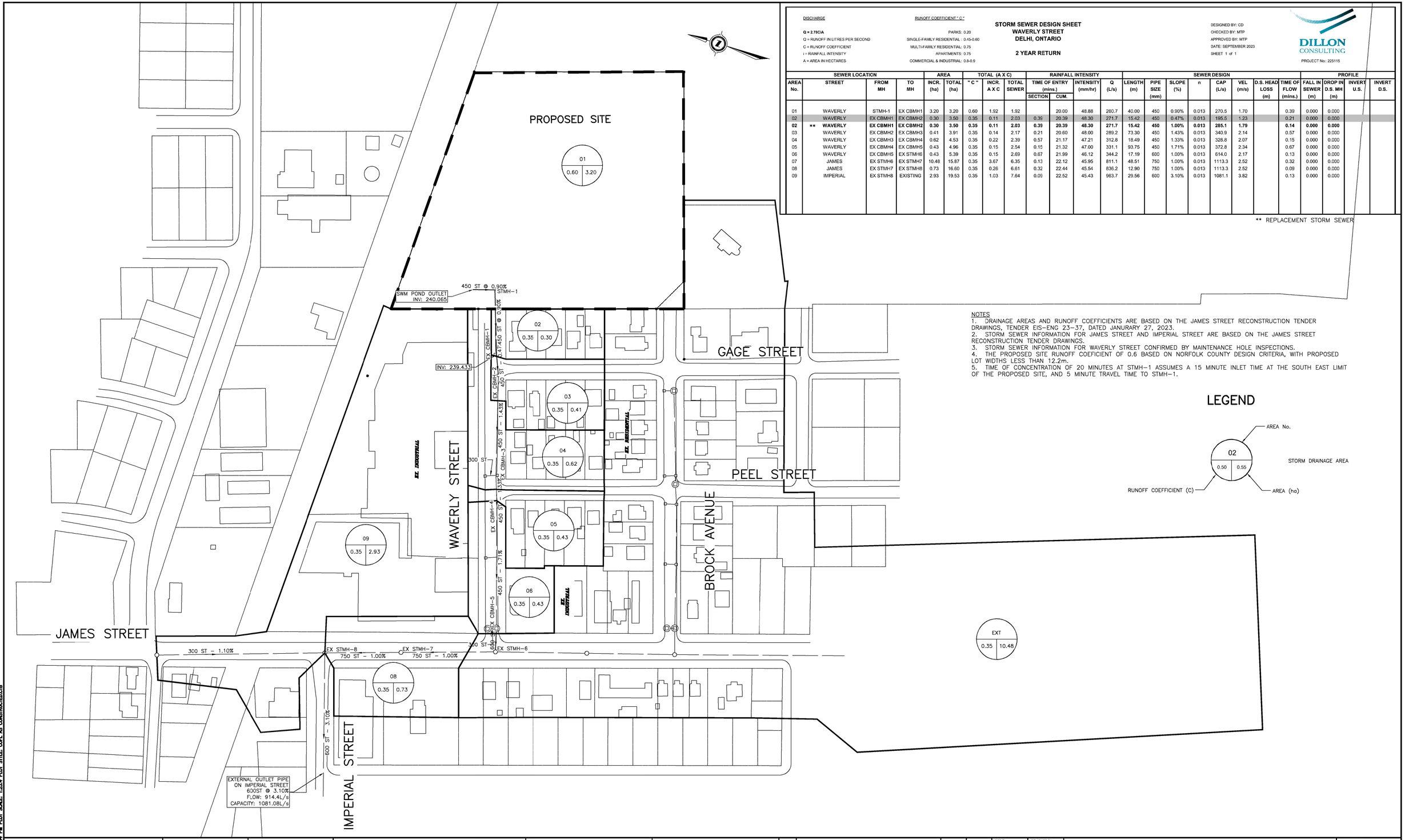
DESIGNED BY: CD
CHECKED BY: MTP
APPROVED BY: MTP
DATE: SEPTEMBER 2023
SHEET 1 of 1

DILLON CONSULTING

PROJECT No: 225115

SEWER LOCATION				AREA		TOTAL (A X C)			RAINFALL INTENSITY				SEWER DESIGN								PROFILE			
AREA No.	STREET	FROM MH	TO MH	INCR. (ha)	TOTAL (ha)	" C "	INCR. A X C	TOTAL SEWER	TIME OF ENTRY (mins.) SECTION	TIME OF ENTRY (mins.) CUM.	INTENSITY (mm/hr)	Q (L/s)	LENGTH (m)	PIPE SIZE (mm)	SLOPE (%)	n	CAP (L/s)	VEL (m/s)	D.S. HEAD LOSS (m)	TIME OF FLOW (mins.)	FALL IN SEWER (m)	DROP IN D.S. MH (m)	INVERT U.S.	INVERT D.S.
01	WAVERLY	STMH-1	EX CBMH1	3.20	3.20	0.60	1.92	1.92		20.00	48.88	260.7	40.00	450	0.90%	0.013	270.5	1.70		0.39	0.000	0.000		
02	WAVERLY	EX CBMH1	EX CBMH2	0.30	3.50	0.35	0.11	2.03	0.39	20.39	48.30	271.7	15.42	450	0.47%	0.013	195.5	1.23		0.21	0.000	0.000		
02	**** WAVERLY**	**EX CBMH1**	**EX CBMH2**	**0.30**	**3.50**	**0.35**	**0.11**	**2.03**	**0.39**	**20.39**	**48.30**	**271.7**	**15.42**	**450**	**1.00%**	**0.013**	**285.1**	**1.79**		**0.14**	**0.000**	**0.000**		
03	WAVERLY	EX CBMH2	EX CBMH3	0.41	3.91	0.35	0.14	2.17	0.21	20.60	48.00	289.2	73.30	450	1.43%	0.013	340.9	2.14		0.57	0.000	0.000		
04	WAVERLY	EX CBMH3	EX CBMH4	0.62	4.53	0.35	0.22	2.39	0.57	21.17	47.21	312.8	18.49	450	1.33%	0.013	328.8	2.07		0.15	0.000	0.000		
05	WAVERLY	EX CBMH4	EX CBMH5	0.43	4.96	0.35	0.15	2.54	0.15	21.32	47.00	331.1	93.75	450	1.71%	0.013	372.8	2.34		0.67	0.000	0.000		
06	WAVERLY	EX CBMH5	EX STMH6	0.43	5.39	0.35	0.15	2.69	0.67	21.99	46.12	344.2	17.19	600	1.00%	0.013	614.0	2.17		0.13	0.000	0.000		
07	JAMES	EX STMH6	EX STMH7	10.48	15.87	0.35	3.67	6.35	0.13	22.12	45.95	811.1	48.51	750	1.00%	0.013	1113.3	2.52		0.32	0.000	0.000		
08	JAMES	EX STMH7	EX STMH8	0.73	16.60	0.35	0.26	6.61	0.32	22.44	45.54	836.2	12.90	750	1.00%	0.013	1113.3	2.52		0.09	0.000	0.000		
09	IMPERIAL	EX STMH8	EXISTING	2.93	19.53	0.35	1.03	7.64	0.09	22.52	45.43	963.7	29.56	600	3.10%	0.013	1081.1	3.82		0.13	0.000	0.000		

** REPLACEMENT STORM SEWER



NOTES

1. DRAINAGE AREAS AND RUNOFF COEFFICIENTS ARE BASED ON THE JAMES STREET RECONSTRUCTION TENDER DRAWINGS, TENDER EIS-ENG 23-37, DATED JANURARY 27, 2023.
2. STORM SEWER INFORMATION FOR JAMES STREET AND IMPERIAL STREET ARE BASED ON THE JAMES STREET RECONSTRUCTION TENDER DRAWINGS.
3. STORM SEWER INFORMATION FOR WAVERLY STREET CONFIRMED BY MAINTENANCE HOLE INSPECTIONS.
4. THE PROPOSED SITE RUNOFF COEFICIENT OF 0.6 BASED ON NORFOLK COUNTY DESIGN CRITERIA, WITH PROPOSED LOT WIDTHS LESS THAN 12.2m.
5. TIME OF CONCENTRATION OF 20 MINUTES AT STMH-1 ASSUMES A 15 MINUTE INLET TIME AT THE SOUTH EAST LIMIT OF THE PROPOSED SITE, AND 5 MINUTE TRAVEL TIME TO STMH-1.

LEGEND

Conditions of Use

Verify elevations and/or dimensions on drawing prior to use. Report any discrepancies to Dillon Consulting Limited.

Do not scale dimensions from drawing.

Do not modify drawing, re-use it, or use it for purposes other than those intended at the time of its preparation without prior written permission from Dillon Consulting Limited.

DILLON CONSULTING

No.	ISSUED FOR	DATE	BY

DESIGN: CD | REVIEWED BY: CD
DRAWN: JT | CHECKED BY: MTP
DATE: OCT 2023
SCALE: H 1:1250 — 12.5 0 25m

WAVERLY STREET, DELHI

STORM AREA PLAN AND CALCULATIONS

PROJECT NO. 22-5115

SHEET NO. **FIG 1**

FILENAME: C:\PW WORKING DIRECTORY\PROJECTS 2022\DILLON - UOD\DM825816\225115-02-FIG.DWG PLOTTED BY: DEMERS, CHRISTINE
PLOT DATE: 2023-10-19 @ 12:35:04 PM PLOT STYLE: COPY AS CONSTRUCTED.CTB SCALE: 1:25.4 PLOT

FILENAME: C:\PW WORKING DIRECTORY\PROJECTS 2022\DILLON-1000\DAS2016\225115-00-RG-RESLDWG PLOTTED BY: DEMERS, CHRISTINE
PLOT DATE: 2023-12-04 @ 9:29:39 AM PLOT SCALE: 1.0 PLOT STYLE: COLOR.CTB

Conditions of Use

Verify elevations and/or dimensions on drawing prior to use. Report any discrepancies to Dillon Consulting Limited.

Do not scale dimensions from drawing.

Do not modify drawing, re-use it, or use it for purposes other than those intended at the time of its preparation without prior written permission from Dillon Consulting Limited.

DILLON CONSULTING

No.	ISSUED FOR	DATE	BY

DESIGN: CD	REVIEWED BY: MTP
DRAWN: CD	CHECKED BY: MTP
DATE: DEC 2023	
SCALE: H 1:500 (5 0 10m)	

WAVERLY STREET, DELHI

GENERAL PLAN OF SERVICES

PROJECT NO. 22-5115

SHEET NO. **FIG 2**

Appendix C

Estimates Sanitary Flow Calculations

DILLON
CONSULTING

Waverly Street, Delhi

Project No: 22-5115
Date: October 24, 2023
Design By: Christine Demers
Checked By: Mina Yacoub, P.Eng.

DILLON CONSULTING

CALCULATION SHEET

Estimated Sanitary Flow Calculations

As per Norfolk County Engineering Design Guidelines

Design flow = (Population in Thousands x Average Daily Flow x Peaking Factor)/86.4 + (Infiltration Rate x Area)

Design Criteria:

Residential Density	2.75	Persons/Lot

Flow Design Parameters

Average flow	450	litres/person/day
Infiltration	0.28	litres/second/ha

Site Data

Number of Units	45	Detached Homes
Site Area	3.20	ha

Calculated Population 124 Persons

Harmon Peaking Factor

PF = 1 + (14/(4+(P/1000)$^{1/2}$))

Residential Population	Harmon Peak Factor
124	4.22

Residential Flow	2.72	l/s
Infiltration	0.90	l/s
Total Peak Flow	**3.62**	**l/s**

Appendix D

Water Demand Calculations Required Fire Flow Worksheet

DILLON
CONSULTING

Waverly Street, Delhi

Project No:	22-5115
Date:	October 24, 2023
Design By:	Christine Demers
Checked By:	Mina Yacoub, P.Eng.

DILLON CONSULTING

CALCULATION SHEET

Design Criteria:

Residential Density 2.75 Persons/Lot

Residentail Per Capita Demand

Average Demand 450 litres/person/day

Peaking Factors

Land Use	Maximum Hour	Maximum Day
Residential	4.00	2.25

Site Data

Number of Units	45	Detached Homes
Site Area	3.20	ha

Calculated Population 124 Persons

Water Demand

Land Use	Population	Average Daily Demand (L/min)	Maximum Day (L/min)	Peak Hour (L/min)	Fire Flow Required (L/min)	Max Day + Fire Flow (L/min)
Residential	124	38.8	87.2	155.0	**6000.0**	**6087**

Waverly Street, Delhi

Project No: 22-5115
Date: December 6, 2023
Design By: Christine Demers
Checked By: Mina Yacoub, P.Eng.

DILLON CONSULTING

CALCULATION SHEET

Water Supply for Public Fire Protection
Guide for Determination of Required Flows for Public Fire Protection in Canada, 2020

$$RFF = 220C\sqrt{A}$$

Where:

RFF = the Required Fire Flow in litres per minutes (LPM)
C = the Construction Coefficient is related to the type of construction of the building
A = the Total Effective Floor Area (effective building area) in square metres of the building

A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

Legend

Construction Class
- WF wood frame construction
- OC ordinary construction
- NC non-combustible construction
- FC fire-resistive construction

Contents Factor
- NC non-combustible
- LC limited combustible
- C combustible
- FB free burning
- RB rapid burning

Non-Combustible	-25%	Free Burning	+15%
Limited Combustible	-15%	Rapid Burning	+25%
Combustible	No Charge		

1) Fire Flow

Type of Construction:	WF			
C=	1.5			
A*=	275	m^2		Typical House effective Area
F=	**5,472**	**L/min**		
F=	5,000			

2) Occupancy Reduction/Surcharge

Contents Factor:	LC				
Reduction/Surcharge of	-15%		=	-750	L/min
F=	**5000L/min +**	**-750**	**L/min**	=	**4,250** **L/min**

3) System Type Reduction

NFPA 13 Sprinkler:	NO	0%			
Standard Water Supply:	NO	0%			
Fully Supervised:	NO	0%			
Total		0%			
Reduction of	0%	L/min	=	0	L/min
F=	**4250L/min -**	**0**	**L/min**	=	**4,250** **L/min**

4) Separation Charge

Building Face	Dist.(m)	Charge
North	2.4	16%
East	45	0%
South	2.4	16%
West	22	2%
Total		34%

Values are based on Table 6 Exposure Adjustment Charges for Type V Wood Frame Construction and a length-height factor of 21-40

of 4250 L/min = 1,445 L/min
(max exposure charge can be 75%)

F= 4250L/min + 1445L/min = 5,695 L/min (2,000L/min<F<45,000L/min)

F=	**6,000**	**L/min**
F=	**100**	**L/s**
F=	**1,585**	**gpm**

(round to the nearest 1,000L/min)

Memo

To: Norfolk County
Planning Department

From: Lucas Arnold, P.Eng., Associate, Dillon Consulting Limited (Dillon)
Hamish Corbett-Hains., Associate, Dillon

Date: October 31, 2023

Subject: Waverly Street, Delhi
MECP D-Series Land Use Compatibility Review

Our File: 22-5115

Dillon Consulting Limited (Dillon) was retained by Landmark Homes Inc. (Landmark) to complete a Land Use Compatibility review in support of a Draft Plan submission for a proposed residential development.

The subject lands are located to the east of James Street, at the eastern end of Waverly Street in Delhi, Ontario. Per the Norfolk County Zoning By-Law, the subject lands are surrounded by General Industrial (MG) to the north, northeast, and northwest, with Urban Residential Type 1 (R1) to the southwest and west, and Agricultural (A) to the east, southeast, and south.

The subject lands are zoned for Urban Residential Type 2 (R2). Per the Norfolk County Zoning By-law, the following permitted uses are currently permitted:

- Dwelling, single detached;
- Dwelling, semi-detached;
- Dwelling, duplex;
- Bed and breakfast, subject to subsection 3.4;
- Day care nursery;
- Home occupation; and,
- Accessory residential dwelling unit, subject to subsection 3.2.2.

The Ministry of the Environment, Conservation and Parks' (MECP) land-use compatibility guidelines (D-series) are intended to prevent or minimize the encroachment of sensitive land uses upon industrial/commercial land uses and vice versa, as these two types of land uses are normally incompatible, due to possible adverse effects on the sensitive land use. As per the guideline, potential impacts from industrial establishments within the potential influence area or recommended minimum separation distance, as outlined in D-6 (see **Table 1**), should be assessed.

Table 1: Guideline D-6 Potential Influence Area and Recommended Minimum Separation Distance

Industrial Classification	Area of Influence	Recommended Minimum Separation Distance
Class I	70 m	20 m
Class II	300 m	70 m
Class III	1000 m	300 m

Characteristics of a Class I, II, and III industry, per MECP D-6-1, is presented below in **Table 2**.

Table 2: Industrial Classification

Class	Outputs	Scale	Process	Operations/Intensity	Possible Examples
I	• Noise: Sound not audible off property • Dust and/or Odour: Infrequent and not intense • Vibration: No ground borne vibration on plant property	• No outside storage • Small scale plant or scale is irrelevant in relation to all other criteria for this Class	• Self-contained plant or building which produces/stores a packaged product. Low probability of fugitive emissions	• Daytime operations only • Infrequent movement of products and/or heavy trucks	• Electronics manufacturing and repair • Furniture repair and refinishing • Beverages bottling • Auto parts supply
II	• Noise: Sound occasionally audible off property • Dust and/or Odour: Frequent and occasionally intense • Vibration: Possible ground-borne vibration, but cannot be perceived off property	• Outside storage permitted • Medium level of production allowed	• Open process • Periodic outputs of minor annoyance • Low probability of fugitive emissions	• Shift operations permitted • Frequent movement of products and/or heavy trucks with the majority of movements during daytime hours	• Magazine printing • Paint spray booths • Metal command • Electrical production manufacturing • Manufacturing of dairy products

Class	Outputs	Scale	Process	Operations/Intensity	Possible Examples
III	• Noise: sound frequently audible off property • Dust and/or Odour: Persistent and/or intense • Vibration: Ground-borne vibration can frequently be perceived off property	• Outside storage of raw and finished products • Large production levels	• Open process • Frequent outputs of major annoyances • High probability of fugitive emissions	• Continuous movement of products and employees • Daily shift operations permitted	• Manufacturing of paint and varnish • Organic chemicals manufacturing • Solvent recovery plants • Metal manufacturing

Based on a review of zoning by-laws and aerial imagery, there are multiple Class I and Class II industrial operations located within the Potential Area of Influence and/or Recommended Minimum Separation Distance of the proposed development. There are no Class III industries within 1 km of the subject lands.

The agricultural operations with proximity to the proposed development are typically not considered as an industrial facility. Agricultural operations are exempt from the requirement of the *Environmental Protection Act* to obtain approval to operate. Additionally, the *Farming and Food Protection Act* provides agricultural uses protection from liability with respect to nuisance operations in accordance with good farming practice. Nuisance impacts may be expected from time to time as a result of agricultural operations, but such impacts are not typically considered to represent a compatibility concern. Notwithstanding the above, planning authorities are advised to consider proximity to agricultural uses when dedicating lands for sensitive uses.

Typically, when a land use change is proposed, at the zoning by-law amendment phase a detailed compatibility assessment evaluating potential impacts from industrial operations within the Potential Area of Influence would be recommended for the proposed sensitive use. The purpose is to prevent or minimize the encroachment of sensitive land uses upon industrial/commercial land uses and vice versa. However, as the subject lands are currently zoned for sensitive uses (R2), and the proposed development will be aligned and in compliance with the existing zoning by-law, new noise sensitive land permissions are not being introduced.

As the subject lands currently allow sensitive uses, the surrounding commercial and industrial facilities are currently obligated to meet air quality and noise requirements at the vacant subject lands, including the use of mitigation measures if required. Provincial Regulatory assessments for Air Quality and Noise require assessment of the vacant lands based on the existing zoning by-law, the typical building pattern in the area, and/or an appropriate or likely future use of the vacant lot. As such, the proposed development does not introduce any additional permitting or regulatory burdens to the surrounding industrial uses.

As with any mixed-use area there are potential for nuisance complaints. However, considering the zoning of the subject lands, and the current regulatory obligations of the industrial lands, the proposed development does not alter the surrounding industries' ability to operate. Any compatibility issues which may be present at the existing residential homes and/or the subject lands are typically the responsibility of the surrounding industries.

Landmark Homes

130 Guelph Avenue
Cambridge, Ontario
N3C 1A4

Attention: Mike Pletch

Limited Phase II Environmental Site Assessment
Waverly Street
Delhi, Ontario

Project Number
LON-23003355-A0

Prepared By:
EXP Services Inc.
15701 Robin's Hill Road
London, Ontario
N5V 0A5 Canada

Date Submitted
April 24, 2023

Executive Summary

EXP Services Inc. (EXP) was retained by Landmark Homes to complete a Limited Phase II Environmental Site Assessment (ESA) at the property located at Waverly Street – Lot 24, Concession 12, in the Town of Delhi, Ontario, hereinafter referred to as the "Site". It is EXP's understanding that the Limited Phase II Environmental Site Assessment (ESA) was required for due diligence purposes and that a Record of Site Condition (RSC) is not required at this time.

The Limited Phase II ESA was completed in general accordance to CSA Standard Z769-00, November 2001 (R 2018). Subject to this standard of care, EXP makes no express or implied warranties regarding its services and no third-party beneficiaries are intended. Limitation of liability, scope of report and third-party reliance are outlined in Section 7 of this report.

The Site is located within Lot 24, Concession 12 at the east end of Waverly Street in the Town of Delhi, Ontario (Figure 1 – Site Plan). The Site is irregular in shape and measures approximately 3.14 hectares (7.80 acres) in area with a lot frontage of approximately 20 metres (65 feet) along Waverly Street. At the time of the Site visit the property consisted mainly of vacant grassland with the remnants of a former paved parking lot comprised of a combination of gravel and deteriorating asphalt near the Waverly Street entrance. The former parking lot covered an area of approximately 2,600 square metres. The forested lot located to the south of the Site encroached onto the south perimeter of the property.

Based on a review of historical aerial photographs, historical maps, and other records review, the Site was predominantly a vacant/agricultural lot until the late 1990s at which time the paved parking lot was constructed on Site.

Surrounding properties have historically been occupied by mainly commercial/industrial developments and residential dwellings. Notable surrounding properties included a Building Material Factory, several commercial properties and railway tracks located on the north of the Site, as well as several commercial developments on west and northwest of the Site. The former Delhi Solac plant, a manufacturer of antennas, was shown on the adjacent property to the west between around 1955 and the present.

The Limited Phase II ESA was undertaken to assess potential impacts to the soil and groundwater conditions at the Site as a result of fill materials on-Site, former railways operations off-Site, the historical presence of the Delhi-Solac plant on the adjacent property to the west, HWIN generators and retail fuel outlets up- and trans-gradient to the Site.

The fieldwork for the Limited Phase II ESA was completed on March 27, 2023, and March 29, 2023. On March 27, 2023, three (3) boreholes were advanced and two (2) monitoring wells were installed and on March 29, 2023, three (3) boreholes were advanced at the Site by London Soil test Ltd. under the full-time supervision of EXP staff. A track-mounted D50 drill rig equipped with continuous flight ("standard") augers with split spoon samplers was used to advance all eight (8) of the boreholes. No petroleum-based greases or solvents were used during drilling activities. Boreholes were advanced to completion depths of approximately 3.5 to 12.2 m (11.5 to 40 feet) below ground surface (bgs). The general stratigraphy at the Site, as observed in the boreholes, consisted of topsoil overlying a native sand with sandy silt till layers to termination.

Four (4) soil samples recovered from BH4 SA1, BH5 SA1, BH6 SA1 and BH8 SA1 were evaluated for metals. All metals concentrations were measured at levels below the 2011 MECP Table 2 SCSs.

Two (2) soil samples recovered from BH4 SA1 and BH5 SA1 were evaluated for PAHs. All PAHs concentrations were measured at levels below the 2011 MECP Table 2 SCSs.

One (1) soil sample recovered from BH5 SA5 was evaluated for VOC, including BTEX. All VOC concentrations were measured at concentrations below the reported detection limits (RDLs) and hence, below the 2011 MECP Table 2 SCSs.

The above noted soil samples were also evaluated for Petroleum Hydrocarbons (PHCs) Fractions 1-4. All PHC concentrations were measured at concentrations below the RDLs and hence, below the 2011 MECP Table 2 SCSs.

Three (3) soil samples recovered from BH1 SA1, BH2 SA1 and BH3 SA1 were evaluated for OC Pesticides. All OC Pesticide concentrations were measured at concentrations below the RDLs and hence, below the 2011 MECP Table 2 SCS.

The two (2) groundwater monitoring wells installed in Borehole 1 (BH1/MW) and Borehole 2 (BH2/MW) were developed on April 3, 2023 and sampled using bailers on April 13, 2023. Water samples obtained from the monitoring well were clear, colourless and odourless with no light non-aqueous phase liquid present, however, some silt was present.

Two (2) groundwater samples recovered from the monitoring well BH1/MW and BH2/MW were submitted for analysis of VOC, including BTEX, PHCs and OC Pesticides. All the groundwater sample submitted for analysis was measured at concentrations below the RDLs and hence, below the 2011 MECP Table 2 SCSs.

The findings of the Limited Phase II ESA indicated that the analytical results for the soil and groundwater samples tested were within the Table 2 SCS criteria for Residential/Parkland/Institutional Property Use with coarse textured soil in a Potable groundwater condition “Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act” (“the SGWS Standards”), Ministry of the Environment, Conservation and Parks (MECP), July 1, 2011 (Ontario Regulation 153/04 as amended).

No evidence of significant environmental impact was identified within the depth of investigation of soil or groundwater on the basis of the analytical results reported for the sampling program. No conditions that are perceived as risks to human health or the environment were revealed by this investigation.

Table of Contents

Executive Summary ..... **i**

1 Introduction **1**

1.1 Background 1
1.2 Scope of Work 3
1.3 Site Assessment Criteria 3

2 Methodology **5**

2.1 Drilling and Soil Sampling 5
2.2 Groundwater Sampling 6

3 Findings **8**

3.1 Subsurface Conditions 8
3.1.1 Fill Materials 8
3.1.2 Native Materials 8
3.2 Total Combustible Vapour Readings 8

4 Soil and Groundwater Quality **10**

4.1 General 10
4.2 Soil/Fill Quality 10
4.2.1 Metals 10
4.2.2 Polycyclic Aromatic Hydrocarbons 10
4.2.3 Volatile Organic Compounds, including Benzene, Toluene, Ethylbenzene and Xylene 10
4.2.4 Petroleum Hydrocarbons (Fractions F1-F4) 10
4.2.5 Organochlorine Pesticide (OC Pest) 11
4.3 Groundwater Quality 11
4.3.1 Volatile Organic Compounds (VOCs), including Benzene, Toluene, Ethylbenzene, Xylene (BTEX) 11
4.3.2 Petroleum Hydrocarbons (Fractions F1-F4) 11
4.3.3 Organochlorine Pesticide (OC Pest) 11
4.3.4 Quality Assurance 11

5 Conclusions and Recommendations **13**

6 References **14**

7 General Limitations **15**

8 Closure **16**

List of Figures

Figure 1: Site Location Plan
Figure 2: Borehole and Monitoring Well Location Plan

List of Appendices

Appendix A: Borehole Logs
Appendix B: Laboratory Certificate of Analysis Sheets - Soil
Appendix C: Laboratory Certificate of Analysis Sheets - Groundwater

1 Introduction

EXP Services Inc. (EXP) was retained by Landmark Homes to complete a Limited Phase II Environmental Site Assessment (ESA) at the property located at Waverly Street – Lot 24, Concession 12, in the Town of Delhi, Ontario, hereinafter referred to as the "Site". It is EXP's understanding that the Limited Phase II Environmental Site Assessment (ESA) was required for due diligence purposes and that a Record of Site Condition (RSC) is not required at this time.

The Limited Phase II ESA was completed in general accordance to CSA Standard Z769-00, November 2001 (R 2018). Subject to this standard of care, EXP makes no express or implied warranties regarding its services and no third-party beneficiaries are intended. Limitation of liability, scope of report and third-party reliance are outlined in Section 7 of this report.

1.1 Background

The Site is located within Lot 24, Concession 12 at the east end of Waverly Street in the Town of Delhi, Ontario (Figure 1 – Site Plan). The Site is irregular in shape and measures approximately 3.14 hectares (7.80 acres) in area with a lot frontage of approximately 20 metres (65 feet) along Waverly Street. At the time of the Site visit the property consisted mainly of vacant grassland with the remnants of a former paved parking lot comprised of a combination of gravel and deteriorating asphalt near the Waverly Street entrance. The former parking lot covered an area of approximately 2,600 square metres. The forested lot located to the south of the Site encroached onto the south perimeter of the property.

Based on a review of historical aerial photographs, historical maps, and other records review, the Site was predominantly a vacant/agricultural lot until the late 1990s at which time the paved parking lot was constructed on Site.

Surrounding properties have historically been occupied by mainly commercial/industrial developments and residential dwellings. Notable surrounding properties included a Building Material Factory, several commercial properties and railway tracks located on the north of the Site, as well as several commercial developments on west and northwest of the Site. The former Delhi Solac plant, a manufacturer of antennas, was shown on the adjacent property to the west between around 1955 and the present.

Based on the Phase I ESA findings, the potential environmental concerns associated with the Site were as follows:

Areas of Potential Environmental Concern	Media and Potential Contaminants of Concern	Comments
Site		
Unknown quality of fill on Site	Soil and Groundwater VOCs, PHCs, Polycyclic Aromatic Hydrocarbons (PAHs) and Metals	Fill material may have been imported for Site grading and servicing. The potential environmental concern associated with the fill materials is considered to be low to moderate.
Surrounding Properties		

Areas of Potential Environmental Concern	Media and Potential Contaminants of Concern	Comments
65 Waverly Street - Delhi-Solac Inc., located adjacent west to the Site was an industrial complex dating back to the 1950's and was registered as HWIN generator of multiple waste classes between at least 1986 – 2014	Soil and Groundwater Volatile Organic Compounds (VOCs), Petroleum Hydrocarbons (PHCs), Polycyclic Aromatic Hydrocarbons (PAHs)	Any spills or leaks from former storage tanks on the property could have migrated onto the Site. Due to separation distance and general topography sloping towards west/northwest of the Site, the potential environmental impact is considered to be low.
Former retail fuel outlets on the northeast and southeast corner of corner of James Street and Waverly Street, approximately 215 metres west of the Site and former commercial operation "General Tabaco Trading Co. Ltd." located on 23 Waverly Street.	Soil and Groundwater Volatile Organic Compounds (VOCs) and Petroleum Hydrocarbons (PHCs)	Due to the close proximity to the Site and high permeable soils comprised of glaciolacustrine sand, gravel, minor silt and clay contaminants could have migrated towards or on to the Site, the potential environmental impact is considered to be moderate to high.
Former Railway tracks, located adjacent north of the Site	Soil Metals and Inorganics, Polycyclic Aromatic Hydrocarbons (PAHs)	Due to the close proximity to the Site and high permeable soils comprised of glaciolacustrine sand, gravel, minor silt and clay contaminants could have migrated towards or on to the Site, the potential environmental impact is considered to be moderate to high.
523 James Street - located 225 m west was involved in metal fabrication, commercial/industrial fans, blowers, air purification equipment manufacturing 50 Argyle Avenue – located 100 m northwest - AST Enterprises was involved in metal fabrication and ornamental metal product manufacturing. Windham Harvest Specialities was registered as HWIN Generator of multiple waste classes.	Soil and Groundwater Volatile Organic Compounds (VOCs), Petroleum Hydrocarbons (PHCs), Polycyclic Aromatic Hydrocarbons (PAHs)	Any spills or leaks from former manufacturing activities could have migrated towards or on to the Site. Due to separation distance and general topography sloping towards west/northwest of the Site, the potential environmental impact is considered to be low.

The Limited Phase II ESA was undertaken to assess potential impacts to the soil and groundwater conditions at the Site as a result of fill materials on-Site, former railways operations off-Site, the historical presence of the Delhi-Solac plant on the adjacent property to the west, HWIN generators and retail fuel outlets up- and trans-gradient to the Site.

1.2 Scope of Work

The proposed scope of work for the Limited Phase II ESA was as follows:

- Request local utility locating companies (cable, telephone, gas, hydro) to mark any underground utilities present at the Site;
- Retain a private utility locating company to mark any underground utilities present in the vicinity of the borehole locations and to clear the individual borehole locations;
- Advance a total of eight (8) boreholes on the property;
- Install monitoring wells in two (2) selected boreholes;
- Collect representative soil samples for analysis of Metals and Inorganics, Volatile Organic Compounds (VOCs), including Benzene, Toluene, Ethylbenzene, Xylene (BTEX), Petroleum Hydrocarbons (PHCs) Fraction 1-4, Polycyclic Aromatic Hydrocarbons (PAHs), Organochlorine Pesticides (OC Pest) and pHs;
- Develop the monitoring wells and recover groundwater samples for testing of VOCs, BTEX/PHCs (F1 – F4), OC Pesticides;
- Prepare a report of the findings.

EXP understands that this work is not being completed for the purposes of filing of a Record of Site Condition (RSC) for the Site with the Ontario Ministry of the Environment, Conservation and Parks (MECP). Should an RSC be required for this Site or a change to a more sensitive land use is planned, which would require the filing of an RSC, additional work may be required to support the filing of an RSC.

1.3 Site Assessment Criteria

The assessment criteria (Site Condition Standards (SCSs) applicable to a given site in Ontario are established under subsection 168.4(1) of the Environmental Protection Act. Tabulated generic criteria are provided in “Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act” (“the SGWS Standards”), Ministry of the Environment, Conservation and Parks (MECP), effective July 1, 2011. These criteria are based on site sensitivity (sensitive or non-sensitive), ground water use (potable or non-potable), property use (residential, parkland, institutional, commercial, industrial, community and agricultural/other), soil type (coarse or medium/fine textured) and restoration depth (full or stratified restoration). In addition, site specific criteria may be established on the basis of the findings of a Risk Assessment carried out in accordance with Part IX and Schedule C of Ontario Regulation 153/04 (O.Reg.) 153/04), as amended.

The SGWS Standards specify SCSs for soil, groundwater and sediment that are tabulated as follows:

- Table 1 - Full Depth Background Site Condition Standards;
- Table 2 - Full Depth Generic Site Condition Standards in a Potable Groundwater Condition;
- Table 3 - Full Depth Generic Site Condition Standards in a Non-potable Groundwater Condition;
- Table 4 - Stratified Site Condition Standards in a Potable Groundwater Condition;

- Table 5 - Stratified Site Condition Standards in a Non-Potable Groundwater Condition;
- Table 6 - Generic Site Condition Standards for Shallow Soils in a Potable Groundwater Condition;
- Table 7 - Generic Site Condition Standards for Shallow Soils in a Non-Potable Groundwater Condition;
- Table 8 - Generic Site Condition Standards for use within 30 m of a Water Body in a Potable Groundwater Condition; and
- Table 9 - Generic Site Condition Standards for use within 30 m of a Water Body in a Non-Potable Groundwater Condition.

For assessment purposes, EXP selected the Table 2 Site Condition Standards (SCSs) for Residential/Parkland/Institutional Property Use with coarse textured soils in a potable groundwater condition for the Site.

The selection of this category is based on the following factors:

- The Site is not considered a sensitive site;
- The Site is located in an area of potable groundwater use;
- The Site soil is generally considered to be fine grained sand and/or sandy silt till however some coarse textured soils (ie. sand and gravel) were present;
- The Property Use of the Site is Agricultural with a planned change in land use to Residential;
- There is no intention to carry out a stratified restoration at the Site.

2 Methodology

2.1 Drilling and Soil Sampling

Prior to the commencement of drilling and test pitting activities, the locations of underground utilities including telephone, natural gas and electrical lines were marked out by a private utility locating service that also cleared the individual borehole locations. Public utility locates were also marked in the field, with locate documentation forwarded to our London office for reference.

The fieldwork for the Limited Phase II ESA was completed on March 27, 2023, and March 29, 2023. On March 27, 2023, three (3) boreholes were advanced and two (2) monitoring wells were installed and on March 29, 2023, three (3) boreholes were advanced at the Site by London Soil test Ltd. under the full-time supervision of EXP staff. A track-mounted D50 drill rig equipped with continuous flight ("standard") augers with split spoon samplers was used to advance all eight (8) of the boreholes. No petroleum-based greases or solvents were used during drilling activities. Boreholes were advanced to completion depths of approximately 3.5 to 12.2 m (11.5 to 40 feet) below ground surface (bgs).

The approximate locations of the boreholes and monitoring wells are shown on Figure 2 (Borehole and Monitoring Well Location Plan). The rationale for the selection of boreholes and monitoring wells was determined to provide coverage of the Site.

EXP continuously monitored the drilling activities to record the physical characteristics of the soil, depth of soil sample collection and total depth of boreholes. Field observations are summarized on the borehole logs provided in Appendix A. Representative soil samples were recovered in the overburden of the boreholes at regular intervals using a continuous core sampler with PVC liners. No visual or olfactory evidence of environmental impact was noted in any of the Borehole samples.

Dedicated Nitrile gloves (i.e., one pair per sample) were used during sample handling. A portion of each soil core was placed in a sealed plastic bag and allowed to reach ambient temperature prior to field screening using an RKI Eagle II total combustible vapour meter, recently calibrated with hexane. The measurements were made by inserting the instrument's probe into the plastic bag while manipulating the sample to ensure volatilization of the soil gases. These readings provide a real-time indication of the relative concentration of combustible vapours encountered in the subsurface during drilling and are used to aid in the assessment of the vertical and horizontal extent of contamination and the selection of soil samples for analysis. The vapour readings, in parts per million (ppm), are provided on the borehole logs in Appendix A. These samples were subsequently delivered to EXP's laboratory for visual, textural and olfactory classification. Collected soil samples were stored in laboratory-supplied hermetically sealed, soil core samplers and glass jars.

Soil samples intended for analysis of Volatile Organic Compounds (VOC's), including Benzene, Toluene, Ethylbenzene, and Xylene (BTEX) were collected by means of core samplers. The core samplers provide a soil sample with virtually no head-space thus reducing the potential for induced volatilization during storage and transport to the laboratory. Individual core samplers were used to collect a soil sample at each interval. Samples collected by the core sampler were injected into a vial containing methanol and the vial immediately capped. By being submerged in the methanol, volatilization of VOC's within the soil sample is reduced prior to analysis. Soil samples intended for analysis of non-volatile chemical parameters were placed directly into pre-cleaned, laboratory supplied glass jars. All soil samples were placed in clean ice-packed coolers prior to and during transportation

to the subcontract laboratory, AGAT Laboratories. The samples were transported/submitted under Chain of Custody documentation.

Soil samples were selected for laboratory analysis on the basis of their visual or olfactory evidence of impacts or potential water-bearing zones. The soil samples submitted for laboratory analysis are summarized in the following table:

Table 2.1: Summary of Soil Samples Submitted for Chemical Analyses

Sample Identification	Depth (m bgs)	Rationale for Sample	Analysis
BH1/MW SA1	0.8 – 1.5	Upgradient HWIN Generator, Former Railway tracks	OC Pesticides
BH2/MW SA1	0.0 – 0.6	Upgradient HWIN Generator, Former Railway tracks	OC Pesticides
BH3 SA1	0.8 – 1.5	Fill Material	OC Pesticides
BH4 SA1	0.0 – 0.6	Fill Material	Metals, PAHs
BH5 SA1	0.0 – 0.6	Fill Material	Metals, PAHs
BH5 SA5	3.0 – 3.5	Inferred Water Table Depth	VOCs, PHCs, pH
BH6 SA1	0.0 – 0.6	Fill Material	Metals
BH8 SA1	0.8 – 1.5	Fill Material	Metals

Note:
VOCs = Volatile Organic Compounds
PHCs = Petroleum Hydrocarbons
PAHs = Polycyclic Aromatic Hydrocarbons
OC Pest = Organochlorine Pesticide

2.2 Groundwater Sampling

Two (2) groundwater monitoring wells were installed in Borehole 1 and Borehole 2 at the Site. The monitoring wells were installed in general accordance with the Ontario Water Resources Act - R.R.O. 1990, Regulation 903 - Amended to O. Reg. 128/03 and were installed by a licensed well contractor (“London Soil Test Ltd.”).

The monitoring wells installed on-Site was constructed of 50 mm Schedule 40 PVC screen and riser. 3.1m long screens and an appropriate length of riser pipe were used in the well construction. Details of the individual well installation are provided on the borehole logs in Appendix A. The well screen has a slot size of approximately 0.25 mm (slot 10) and was sealed at the base with a PVC end cap. The annular space around each well screen was backfilled with #3 silica sand to an average height of 0.3 m above the top of the screen. The sand pack was extended above the screen to allow for compaction of the sand pack and expansion of the overlying well seal. A granular Bentonite (“Hole Plug”) seal was placed in the borehole annulus from the top of the sand pack to just below ground surface. The well

was finished at surface with a stick-up well casing. The void within the casing was also filled with #3 silica sand. Lubricants and adhesives were not used when constructing the monitoring well.

The two (2) groundwater monitoring wells installed in Borehole 1 (BH1/MW) and Borehole 2 (BH2/MW) were developed on April 3, 2023, and sampled using bailers on April 13, 2023. Water samples obtained from the monitoring wells were clear, colourless and odourless with no light non-aqueous phase liquid present, however, it should be noted that the groundwater samples obtained did contain some silt. Groundwater samples were collected from the monitoring wells, placed into laboratory-supplied glass jars, immediately placed in a clean ice packed cooler and submitted under chain of custody procedures to Bureau Veritas Laboratories for analysis of VOCs including BTEX, PHCs (Fractions F1-F4) and OC Pest.

Details of the analysis performed on the selected groundwater samples are summarized in the following table:

Table 2.2: Groundwater Samples Submitted for Analysis

Sample Identification	Analysis
BH1/MW	VOCs, BTEX/PHCs (F1 – F4), OC Pesticides
BH2/MW	VOCs, BTEX/PHCs (F1 – F4), OC Pesticides

Note:
PHC = Petroleum Hydrocarbons
BTEX = Benzene, Toluene, Ethylbenzene, Xylene
VOC = Volatile Organic Compounds
OC Pest = Organochlorine Pesticides

3 Findings

3.1 Subsurface Conditions

The detailed soil profiles encountered in each borehole are provided on the attached borehole logs (Appendix A). Boundaries of soil indicated on the log sheets are intended to reflect transition zones for the purpose of environmental assessment and should not be interpreted as exact planes of geological change. The general stratigraphy at the Site, as observed in the boreholes, consisted of topsoil overlying a native sand with sandy silt till layers to termination.

3.1.1 Fill Materials

A surface layer of asphalt approximately 30mm thick was encountered at Boreholes 4 and 5. Fill materials were encountered beneath the asphalt in Boreholes 4 and 5 and at the surface of Borehole 6 to a depth of approximately 1.4 to 3.2 m bgs. A sand and gravel fill layer associated with the former parking lot was encountered beneath the asphalt in Boreholes 4 and 5 to depth of approximately 1.4 m bgs and had inclusions such as some clay and silt. A sandy silt fill was encountered underlying the topsoil in BH6 to depth of 3.2 m bgs and had inclusions including clay and some topsoil.

No petroleum odours or staining were noted in any of the fill samples recovered from the boreholes.

3.1.2 Native Materials

Underlying the topsoil and/or fill materials, where present, all boreholes encountered a native sand with some layers of sandy silt till to termination. A layer of native sand and gravel was found in the upper soils in Boreholes 3, 4, 5, 7 and 8 to a depth of 1.4 to 2.0 m bgs.

The native sand was fine to medium grained, brown, moist and compact to dense becoming wet at about 10.1 m bgs. The sandy silt till layers were brown with trace clay and trace gravel, dense and very moist.

No petroleum odours or staining were noted in any of the native samples recovered from the boreholes.

3.2 Total Combustible Vapour Readings

Field screening involved using an RKI GX – 6000 total combustible vapour meter to measure the total combustible vapour (TCV) concentrations in part per million (ppm). The headspace readings were obtained by inserting the plastic tube of the device into the soil sample bag and recording the TCV readings. The results are presented on the attached borehole logs. As indicated, vapour concentrations in the soil samples from the boreholes were between 0 to 1.3 ppm and are indicative of natural background conditions.

3.3 Groundwater Elevations

The depth to groundwater was measured in the monitoring wells (BH1/MW and BH2/MW). The depth to water was measured at 10.14 (BH1/MW) and 10.90 (BH2/MW). It should be noted that only one (1) round of measurements was taken, and the existence of equilibrium conditions (quasi-static water levels) has not been confirmed. On April 3, 2023, ground surface elevations at the borehole locations were surveyed to the top of spindle of fire hydrant located in the north boulevard of Waverly Street, just

west of Site. A geodetic elevation of 242.714 m was established for the benchmark by EXP using a SOKKIA GCX3 Receiver.

Table 3.3: Summary of Ground Water Levels

Well No.	Elevation (m) (Ground Surface)	Water Table Depth (m)	Groundwater Elevation (m)
BH1/MW	241.76	10.14	231.62
BH2/MW	243.24	10.90	232.34

4 Soil and Groundwater Quality

4.1 General

In accordance with the scope of work, chemical analyses were performed on selected soil and groundwater samples recovered from the boreholes and monitoring wells. The selection of representative "worst case" soil samples from each borehole was based on field screening for organic vapours and visual or olfactory evidence of impacts as detailed in Table 2.1.

4.2 Soil/Fill Quality

Copies of the laboratory Certificates of Analysis for the tested soil samples are provided in Appendix C (boreholes). The 2011 MECP Table 2 Site Condition Standards (SCSs) for Residential/Parkland/Institutional Property Use with coarse textured soil in a potable groundwater condition are included on the Certificates of Analysis.

The 2011 MECP Table 2 SCSs are considered suitable for use if soil pH is in the range of 5 to 9 for surface soil (less than 1.5m below soil surface) and 5 to 11 for subsurface soil (greater than 1.5 m below soil surface). The Certificates of Analysis include pH measurements taken on surface soil ranged from 7.26 to 7.55 and for subsurface soil sample is 7.44 which is within the acceptable range for the use of the Table 2 SCSs.

4.2.1 Metals

Four (4) soil samples recovered from BH4 SA1, BH5 SA1, BH6 SA1 and BH8 SA1 were evaluated for metals. All metals concentrations were measured at levels below the 2011 MECP Table 2 SCSs.

4.2.2 Polycyclic Aromatic Hydrocarbons

Two (2) soil samples recovered from BH4 SA1 and BH5 SA1 were evaluated for PAHs. All PAHs concentrations were measured at levels below the 2011 MECP Table 2 SCSs.

4.2.3 Volatile Organic Compounds, including Benzene, Toluene, Ethylbenzene and Xylene

One (1) soil sample recovered from BH5 SA5 was evaluated for VOC, including BTEX. All VOC concentrations were measured at concentrations below the reported detection limits (RDLs) and hence, below the 2011 MECP Table 2 SCSs.

4.2.4 Petroleum Hydrocarbons (Fractions F1-F4)

The above noted soil samples were also evaluated for Petroleum Hydrocarbons (PHCs) Fractions 1-4. All PHC concentrations were measured at concentrations below the RDLs and hence, below the 2011 MECP Table 2 SCSs.

4.2.5 Organochlorine Pesticide (OC Pest)

Three (3) soil samples recovered from BH1 SA1, BH2 SA1 and BH3 SA1 were evaluated for OC Pest. All OC Pest concentrations were measured at concentrations below the RDLs and hence, below the 2011 MECP Table 2 SCS.

4.3 Groundwater Quality

Copies of the laboratory Certificates of Analysis for the groundwater samples are provided in Appendix C. The 2011 MECP Table 2 SCSs with coarse textured soils are included on the Certificates of Analysis.

The monitoring well installed in Borehole 1 (BH1/MW) and Borehole 2 (BH2/MW) were developed on April 3, 2023 and sampled using bailers on April 13, 2022. The water samples obtained from the monitoring wells were clear, colourless and odourless with no light non-aqueous phase liquid present, however, some silt was present.

4.3.1 Volatile Organic Compounds (VOCs), including Benzene, Toluene, Ethylbenzene, Xylene (BTEX)

Two (2) groundwater samples recovered from the monitoring wells BH1/MW and BH2/MW were submitted for analysis of VOCs including BTEX. The groundwater samples submitted for VOCs including BTEX analysis was measured at concentrations below the RDLs and hence, below the 2011 MECP Table 2 SCSs.

4.3.2 Petroleum Hydrocarbons (Fractions F1-F4)

The above noted groundwater samples were also submitted for analysis of PHCs, Fractions 1-4. All PHC fractions in the sample were measured at concentrations below the RDLs and hence, below the 2011 MECP Table 2 SCSs

4.3.3 Organochlorine Pesticide (OC Pest)

The above noted groundwater samples were also evaluated for OC Pesticides. All OC Pesticide concentrations were measured at concentrations below the RDLs and hence, below the 2011 MECP Table 2 SCS.

4.3.4 Quality Assurance

Details regarding quality assurance measures taken in the field, including instrument calibration, decontamination procedures, use of dedicated equipment, sample storage and Chain of Custody documentation are provided in Section 2, Methodology.

The subcontract laboratory used during this investigation, AGAT Laboratories, is accredited by the Standards Council of Canada/Canadian Association of Environmental Analytical Laboratories (Accredited Laboratory No. 97) in accordance with ISO/IEC 17025:2017 – “General Requirements for

the Competence of Testing and Calibration Laboratories" for the analysis of all parameters for which SCS have been established under Ontario Regulation 153/04.

The "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" ("the Analytical Protocol"), MECP, March 2004, establishes criteria used in assessing the performance of analytical laboratories. These include maximum hold times for the extraction (where applicable) and analysis of samples, required methods of analysis, Required Detection Limits (RDLs), fixed recovery ranges for spiked samples and surrogates (compounds added to water samples in known concentrations for calibration purposes), quantified precision required when analyzing laboratory duplicate samples ("Between Run Precision") and the analysis of method blanks.

All samples were extracted, where applicable, and analyzed within the hold times established under the Analytical Protocol. These analytical results comprise portions of the Certificates of Analysis in Appendix B and Appendix C.

5 Conclusions and Recommendations

The findings of the Limited Phase II ESA indicated that the analytical results for the soil and groundwater samples tested were within the Table 2 SCS criteria for Residential/Parkland/Institutional Property Use with coarse textured soil in a Potable groundwater condition “Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act” (“the SGWS Standards”), Ministry of the Environment, Conservation and Parks (MECP), July 1, 2011 (Ontario Regulation 153/04 as amended).

No evidence of significant environmental impact was identified within the depth of investigation of soil or groundwater on the basis of the analytical results reported for the sampling program. No conditions that are perceived as risks to human health or the environment were revealed by this investigation.

6 References

This study was conducted in accordance with the applicable Regulations, Guidelines, Policies, Standards, Protocols and Objectives administered by the Ministry of the Environment. Specific reference is made to the following:

- "*Guideline on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario*", Ministry of the Environment of Ontario, December 1996;
- *The Ontario Water Resources Act - R.R.O. 1990, Regulation 903 - Amended to O. Reg. 128/03*, August 2003;
- *"Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act"*, 2011;
- *"Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act",* March 2004;
- *Ontario Regulation 153/04 (made under the Environmental Protection Act),* May 2004 (MECP) amended by Regulation 511/09;
- *Environmental Protection Act*, R.S.O. 1990, Chapter E.19, as amended, September 2004.
- *Phase II Environmental Site Assessment, CSA Group, Document No. Z769-00, November 2001 (Re-affirmed 2018);*
- *EXP Services Inc. "Phase I Environmental Site Assessment Lot 24, Concession 12, Waverly Street Property, Delhi, Ontario." EXP Project number: LON-22024237-A0, Date Submitted: November 4, 2022*

7 General Limitations

The information presented in this report is based on a limited investigation designed to provide information to support an assessment of the current environmental conditions within the subject property. The conclusions and recommendations presented in this report reflect Site conditions existing at the time of the investigation.

More specific information with respect to the conditions between samples, or the lateral and vertical extent of materials may become apparent during excavation operations. The interpretation of the borehole information must, therefore, be validated during any such excavation operations. Consequently, during the future development of the property, conditions not observed during this investigation may become apparent. Should this occur, exp Services Inc. should be contacted to assess the situation, and the need for additional testing and reporting. EXP has qualified personnel to provide assistance in regards to any future geotechnical and environmental issues related to this property.

The environmental investigation was carried out to address the intent of applicable provincial Regulations, Guidelines, Policies, Standards, Protocols and Objectives administered by the MECP. It should also be noted that current environmental Regulations, Guidelines, Policies, Standards, Protocols and Objectives are subject to change, and such changes, when put into effect, could alter the conclusions and recommendations noted throughout this report. Achieving the study objectives stated in this report has required us to arrive at conclusions based upon the best information presently known to us. No investigative method can completely eliminate the possibility of obtaining partially imprecise or incomplete information; it can only reduce the possibility to an acceptable level. Professional judgment was exercised in gathering and analyzing the information obtained and in the formulation of the conclusions. Like all professional persons rendering advice we do not act as absolute insurers of the conclusions we reach, but we commit ourselves to care and competence in reaching those conclusions.

Our undertaking at EXP Services Inc, therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the engineering profession. It is intended that the outcome of this investigation assist in reducing the client's risk associated with environmental impairment. Our work should not be considered 'risk mitigation'. No other warranty or representation, either expressed or implied, is included or intended in this report.

This report was prepared for the exclusive use of **Landmark Homes Inc.** and may not be reproduced in whole or in part, without the prior written consent of EXP, or used or relied upon in whole or in part by other parties for any purposes whatsoever. Any use which a third party makes of this report, or any part thereof, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

8 Closure

We trust this report satisfies your immediate requirements. If you have any questions regarding the information in this report, please do not hesitate to contact this office.

EXP Services Inc.

Milan Suthar, B.Sc., EPt
Environmental Technician
Environmental Division

Scott Aziz, P.Eng.
Senior Project Manager, Team Leader
Environmental Division

Figures

EXP Services Inc.
15701 Robin's Hill Road
London, Ontario
N5V 0A5

CLIENT:	LANDMARK HOMES INC.
SITE:	WAVERLY STREET, DELHI, ONTARIO
TITLE:	LIMITED PHASE II ESA - Site Location Plan
DATE: APRIL 2023	PROJECT No: LON-23003355-A0
FIG 1	

0 50 100
SCALE (METRES)

EXP Services Inc.
15701 Robin's Hill Road
London, Ontario
N5V 0A5

CLIENT: LANDMARK HOMES INC.

SITE: WAVERLY STREET, DELHI, ONTARIO

TITLE: LIMITED PHASE II ESA - Borehole/Monitoring Well Location Plan

DATE:	PROJECT No:	FIG
APRIL 2023	LON-23003355-A0	2

LEGEND:

- BH1/MW — MONITORING WELL LOCATION
- BH3 — BOREHOLE LOCATION

Appendix A:
Borehole Logs

BH1/MW
Sheet 1 of 1

BOREHOLE LOG

Client Landmark Homes Inc. **Project No.** LON-23003355-A0
Project Name Limited Phase II Environmental Site Assesment **Datum** Geodetic
Site Location Waverly Street, Delhi, ON **Boring Date** March 27, 2023

DEPTH (m bgs)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	TOV (ppm)	Lab Analysis
0	241.76							
	241.6	~~TOPSOIL~~: 150 mm						
		SAND: brown, fine to medium grained, some to trace silt, some to trace gravel, compact, moist						
1					SS	S1	0	Soil - OC Pest Groundwater - VOCs, PHCs, OC Pest
					SS	S2	0	
2					SS	S3	0	
		- becoming medium to coarse grained near 2.7 m bgs			SS	S4	0	
3								
	237.7							
4		**SANDY SILT TILL**: brown, trace clay, trace gravel, dilatant, compact, very moist						
					SS	S5	0	
5								
	236.2							
		SAND: brown, fine to medium grained, trace silt, dense, moist						
6					SS	S6	0	
7								
		- silty near 7.6 m bgs			SS	S7	0	
8								
9					SS	S8	0	
10		- becoming wet near 10.1 m bgs						
					SS	S9	0	
11								
12	229.6							
		End of Borehole at 12.2 m bgs.						
13								

NOTES

1) Borehole interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Limited Phase II Environmental Site Assessment report LON- 23003355-A0
2) bgs denotes: below ground surface.
3) TCV= Total Combustible Vapour Level (soil sample headspace)
4) SS = Split Spoon
5) VOCs = Volatile Organic Compounds; PHCs = Petroleum Hydrocarbons; OC Pest = Organochlorine Pesticides; BTEX = Benzene, Toluene, Ethylbenzene, Xylene; PAHs = Polycyclic Aromatic Hydrocarbons

Bentonite Seal From (m): 0.3 - 8.53
Monitoring Well Screened From (m): 9.14
Monitoring Well Screened To (m): 12.19
Water Level in Well (m): 10.14 (Elev 231.62)
Date of Measurement: April 13, 2023
Site Supervisor:

BH2/MW
Sheet 1 of 1

BOREHOLE LOG

Client Landmark Homes Inc. **Project No.** LON-23003355-A0
Project Name Limited Phase II Environmental Site Assesment **Datum** Geodetic
Site Location Waverly Street, Delhi, ON **Boring Date** March 27, 2023

DEPTH (m bgs)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	TOV (ppm)	Lab Analysis
0	243.24							
	243.0	**TOPSOIL**: 250 mm						
		SAND: brown, fine to medium grained, trace silt, trace gravel, loose, moist			SS	S1	0	Soil - OC Pest Groundwater - VOCs, PHCs, OC Pest
1		- becoming gravelly and dense to compact near 0.8 m bgs			SS	S2	0	
		- trace gravel below 1.4 m bgs			SS	S3	0	
2	241.1							
		SANDY SILT TILL: brown, trace clay, trace gravel, dense, very moist			SS	S4	0	
3					SS	S5	0	
4		- becoming dilatant, wet near 4.0 m bgs						
5					SS	S6	0	
	237.7							
6		**SAND**: brown, fine to medium grained, trace to some silt, compact, moist			SS	S7	0	
7								
8					SS	S8	0	
9					SS	S9	0	
10		- becoming wet near 10.1 m bgs						
11					SS	S10	0	
12	231.1							
		End of Borehole at 12.2 m bgs.						
13								

NOTES

1) Borehole interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Limited Phase II Environmental Site Assessment report LON- 23003355-A0
2) bgs denotes: below ground surface.
3) TCV= Total Combustible Vapour Level (soil sample headspace)
4) SS = Split Spoon
5) VOCs = Volatile Organic Compounds; PHCs = Petroleum Hydrocarbons; OC Pest = Organochlorine Pesticides; BTEX = Benzene, Toluene, Ethylbenzene, Xylene; PAHs = Polycyclic Aromatic Hydrocarbons

Bentonite Seal From (m): 0.3 - 8.53
Monitoring Well Screened From (m): 9.14
Monitoring Well Screened To (m): 12.19
Water Level in Well (m): 10.9 (Elev 232.34)
Date of Measurement: April 13, 2023
Site Supervisor:

BH3
Sheet 1 of 1

BOREHOLE LOG

Client Landmark Homes Inc. **Project No.** LON-23003355-A0
Project Name Limited Phase II Environmental Site Assesment **Datum** Geodetic
Site Location Waverly Street, Delhi, ON **Boring Date** March 27, 2023

DEPTH (m bgs)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	TOV (ppm)	Lab Analysis
	242.97							
0	242.7	**TOPSOIL**: 280 mm						
	242.4	**SILTY SAND**: brown, weathered						
1		**SAND & GRAVEL**: brown, trace silt, compact, moist			SS	S1	0	Soil - OC Pest
					SS	S2	0.5	
2	241.0	**SANDY SILT TILL**: brown, trace clay, trace to some gravel, compact to dense, moist			SS	S3	0.3	
3		- becoming grey near 2.9 m bgs			SS	S4	0.4	
4		- becoming brown with dilatant silt layering and very moist below 4.0 m bgs						
5					SS	S5	0.6	
	237.4	**SAND**: brown, fine to medium grained, trace silt, dense, moist						
6	236.4				SS	S6	0.3	
7		**End of Borehole at 6.6 m bgs.**						
8								
9								
10								
11								
12								
13								

NOTES

1) Borehole interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Limited Phase II Environmental Site Assessment report LON- 23003355-A0
2) bgs denotes: below ground surface.
3) TCV= Total Combustible Vapour Level (soil sample headspace)
4) SS = Split Spoon
5) VOCs = Volatile Organic Compounds; PHCs = Petroleum Hydrocarbons; OC Pest = Organochlorine Pesticides; BTEX = Benzene, Toluene, Ethylbenzene, Xylene; PAHs = Polycyclic Aromatic Hydrocarbons

Bentonite Seal From (m):
Monitoring Well Screened From (m):
Monitoring Well Screened To (m):
Water Level in Well (m):
Date of Measurement:
Site Supervisor:

BH4
Sheet 1 of 1

BOREHOLE LOG

Client Landmark Homes Inc. **Project No.** LON-23003355-A0
Project Name Limited Phase II Environmental Site Assesment **Datum** Geodetic
Site Location Waverly Street, Delhi, ON **Boring Date** March 29, 2023

DEPTH (m bgs)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	TOV (ppm)	Lab Analysis
0	242.25							
	242.2	**ASPHALT**: 30 mm						
	242.1	**GRANULAR**: 150 mm			SS	S1	0.6	Soil - Metals and Inorganic, PAHs
1		**FILL**: sand and gravel, brown, some silt, compact to very dense, moist			SS	S2	0.9	
	240.9							
		SAND & GRAVEL: brown, trace to some silt, compact, moist			SS	S3	0.7	
2	240.1							
		SANDY SILT TILL - brown, trace clay, trace gravel, dilatant, dense, moist to very moist			SS	S4	0.6	
3								
	238.7				SS	S5	0.7	
		End of Borehole at 3.5 m bgs.						
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								

NOTES

1) Borehole interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Limited Phase II Environmental Site Assessment report LON- 23003355-A0
2) bgs denotes: below ground surface.
3) TCV= Total Combustible Vapour Level (soil sample headspace)
4) SS = Split Spoon
5) VOCs = Volatile Organic Compounds; PHCs = Petroleum Hydrocarbons; OC Pest = Organochlorine Pesticides; BTEX = Benzene, Toluene, Ethylbenzene, Xylene; PAHs = Polycyclic Aromatic Hydrocarbons

Bentonite Seal From (m):
Monitoring Well Screened From (m):
Monitoring Well Screened To (m):
Water Level in Well (m):
Date of Measurement:
Site Supervisor:

BH5
Sheet 1 of 1

BOREHOLE LOG

Client Landmark Homes Inc. **Project No.** LON-23003355-A0
Project Name Limited Phase II Environmental Site Assesment **Datum** Geodetic
Site Location Waverly Street, Delhi, ON **Boring Date** March 29, 2023

DEPTH (m bgs)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	TOV (ppm)	Lab Analysis
0	242.06							
	242.0	**ASPHALT**: 25 mm						
	241.9	**GRANULAR**: 150 mm			SS	S1	0.7	Soil - Metals and Inorganics, PAHs
1		**FILL**: sand and gravel to sandy silt, trace to some clay, loose to compact, moist to very moist			SS	S2	0.9	
	240.7	- 100 mm organic layer encountered near 0.4 m bgs						
		SAND & GRAVEL: brown, trace silt, compact, moist			SS	S3	0.9	
2	239.9							
		SAND: brown, fine to medium grained, some silt to silty, compact, moist			SS	S4	0.7	
3	238.9							
	238.6	**SANDY SILT TILL**: brown, trace clay, trace gravel, compact, moist			SS	S5	0.7	Soil - VOCs, PHCs, pH
4		**End of Borehole at 3.5 m bgs.**						
5								
6								
7								
8								
9								
10								
11								
12								
13								

NOTES

1) Borehole interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Limited Phase II Environmental Site Assessment report LON- 23003355-A0
2) bgs denotes: below ground surface.
3) TCV= Total Combustible Vapour Level (soil sample headspace)
4) SS = Split Spoon
5) VOCs = Volatile Organic Compounds; PHCs = Petroleum Hydrocarbons; OC Pest = Organochlorine Pesticides; BTEX = Benzene, Toluene, Ethylbenzene, Xylene; PAHs = Polycyclic Aromatic Hydrocarbons

Bentonite Seal From (m):
Monitoring Well Screened From (m):
Monitoring Well Screened To (m):
Water Level in Well (m):
Date of Measurement:
Site Supervisor:

BH6
Sheet 1 of 1

BOREHOLE LOG

Client Landmark Homes Inc. **Project No.** LON-23003355-A0
Project Name Limited Phase II Environmental Site Assesment **Datum** Geodetic
Site Location Waverly Street, Delhi, ON **Boring Date** March 29, 2023

DEPTH (m bgs)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	TOV (ppm)	Lab Analysis
	242.49							
0	242.2	**TOPSOIL**: 300 mm			SS	S1	0.9	Soil - Metals and Inorganics
		FILL: sandy silt, brown, trace clay, trace gravel, very loose, moist to very moist						
1					SS	S2	0.7	
					SS	S3	1.1	
2								
		- trace to some organics encountered near 2.5 m bgs			SS	S4	0.9	
3	239.3							
	239.0	**SANDY SILT TILL**: brown, trace clay, trace gravel, dilatant, compact, very moist			SS	S5	0.7	
4		**End of Borehole at 3.5 m bgs.**						
5								
6								
7								
8								
9								
10								
11								
12								
13								

NOTES

1) Borehole interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Limited Phase II Environmental Site Assessment report LON- 23003355-A0
2) bgs denotes: below ground surface.
3) TCV= Total Combustible Vapour Level (soil sample headspace)
4) SS = Split Spoon
5) VOCs = Volatile Organic Compounds; PHCs = Petroleum Hydrocarbons; OC Pest = Organochlorine Pesticides; BTEX = Benzene, Toluene, Ethylbenzene, Xylene; PAHs = Polycyclic Aromatic Hydrocarbons

Bentonite Seal From (m):
Monitoring Well Screened From (m):
Monitoring Well Screened To (m):
Water Level in Well (m):
Date of Measurement:
Site Supervisor:

BH7
Sheet 1 of 1

BOREHOLE LOG

Client Landmark Homes Inc. **Project No.** LON-23003355-A0
Project Name Limited Phase II Environmental Site Assesment **Datum** Geodetic
Site Location Waverly Street, Delhi, ON **Boring Date** March 27, 2023

DEPTH (m bgs)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	TOV (ppm)	Lab Analysis
	242.43							
0	242.1	**TOPSOIL**: 300 mm			SS	S1	0.7	
	241.8	**SILTY SAND**: brown, weathered, loose, moist						
1		**SAND & GRAVEL**: brown, occasional cobbles, compact, moist			SS	S2	0	
	240.8				SS	S3	0	
2		**SAND**: brown, fine to medium grained, trace to some silt, very dense to compact, moist			SS	S4	0.6	
3	238.9				SS	S5	0.6	
4		**End of Borehole at 3.5 m bgs.**						
5								
6								
7								
8								
9								
10								
11								
12								
13								

NOTES

1) Borehole interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Limited Phase II Environmental Site Assessment report LON- 23003355-A0
2) bgs denotes: below ground surface.
3) TCV= Total Combustible Vapour Level (soil sample headspace)
4) SS = Split Spoon
5) VOCs = Volatile Organic Compounds; PHCs = Petroleum Hydrocarbons; OC Pest = Organochlorine Pesticides; BTEX = Benzene, Toluene, Ethylbenzene, Xylene; PAHs = Polycyclic Aromatic Hydrocarbons

Bentonite Seal From (m):
Monitoring Well Screened From (m):
Monitoring Well Screened To (m):
Water Level in Well (m):
Date of Measurement:
Site Supervisor:

BH8
Sheet 1 of 1

BOREHOLE LOG

Client Landmark Homes Inc. **Project No.** LON-23003355-A0
Project Name Limited Phase II Environmental Site Assesment **Datum** Geodetic
Site Location Waverly Street, Delhi, ON **Boring Date** March 27, 2023

DEPTH (m bgs)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	TOV (ppm)	Lab Analysis
0	242.37							
	242.1	**TOPSOIL**: 250 mm						
		SAND & GRAVEL: brown, trace silt, compact, moist						
1					SS	S1	1.3	Soil - Metals and Inorganics
	241.0							
		SAND: brown, fine to medium grained, trace silt, compact, moist			SS	S2	1.2	
2	240.2							
		SANDY SILT TILL: brown, trace clay, trace gravel, dense, moist to very moist			SS	S3	1.2	
3					SS	S4	1.2	
4								
5					SS	S5	1.1	
	236.8							
6		**SAND**: brown, fine to medium grained, trace silt, very dense, moist						
	235.8				SS	S6	1.1	
7		**End of Borehole at 6.6 m bgs.**						
8								
9								
10								
11								
12								
13								

NOTES

1) Borehole interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Limited Phase II Environmental Site Assessment report LON- 23003355-A0
2) bgs denotes: below ground surface.
3) TCV= Total Combustible Vapour Level (soil sample headspace)
4) SS = Split Spoon
5) VOCs = Volatile Organic Compounds; PHCs = Petroleum Hydrocarbons; OC Pest = Organochlorine Pesticides; BTEX = Benzene, Toluene, Ethylbenzene, Xylene; PAHs = Polycyclic Aromatic Hydrocarbons

Bentonite Seal From (m):
Monitoring Well Screened From (m):
Monitoring Well Screened To (m):
Water Level in Well (m):
Date of Measurement:
Site Supervisor:

Appendix B:
Laboratory Certificate of Analysis Sheets – Soil

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: EXP SERVICES INC
15701 Robin's Hill Road #2
LONDON, ON N5V0A5
(519) 963-3000
ATTENTION TO: SCOTT AZIZ
PROJECT: 23003150
AGAT WORK ORDER: 23L009098
SOIL ANALYSIS REVIEWED BY: Nivine Basily, Inorganics Report Writer
TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist
DATE REPORTED: Apr 11, 2023
PAGES (INCLUDING COVER): 22
VERSION*: 2

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes

VERSION 2:Version 2 supersedes work order 23L009098 , Version 1, issued April 3, 2023. 102,103,105,106 for M/I,099,100,101 for OCP, 104 for pH, F1-F4/VOC, 102,103 for PAHs.

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This Certificate shall not be reproduced except in full, without the written approval of the laboratory.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.*
- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*
- *For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.*

Member of: Association of Professional Engineers and Geoscientists of Alberta (APEGA)
Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. Measurement Uncertainty is not taken into consideration when stating conformity with a specified requirement.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 23L009098

PROJECT: 23003150

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Delhi

SAMPLED BY:M.S

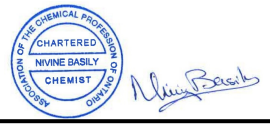
O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2023-03-31

DATE REPORTED: 2023-04-11

		SAMPLE DESCRIPTION:		BH4 SA1	BH5 SA1	BH6 SA1	BH8 SA1
		SAMPLE TYPE:		Soil	Soil	Soil	Soil
		DATE SAMPLED:		2023-03-29	2023-03-29	2023-03-29	2023-03-29
Parameter	Unit	G / S	RDL	4896102	4896103	4896105	4896106
Antimony	µg/g	1.3	0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	18	1	1	3	4	3
Barium	µg/g	220	2.0	11.4	25.3	32.0	18.3
Beryllium	µg/g	2.5	0.4	<0.4	<0.4	<0.4	<0.4
Boron	µg/g	36	5	<5	<5	<5	7
Boron (Hot Water Soluble)	µg/g	NA	0.10	<0.10	<0.10	<0.10	<0.10
Cadmium	µg/g	1.2	0.5	<0.5	<0.5	<0.5	<0.5
Chromium	µg/g	70	5	6	9	9	9
Cobalt	µg/g	21	0.5	2.1	3.2	2.6	4.1
Copper	µg/g	92	1.0	7.0	9.8	5.2	27.1
Lead	µg/g	120	1	3	8	11	5
Molybdenum	µg/g	2	0.5	<0.5	<0.5	<0.5	0.6
Nickel	µg/g	82	1	2	6	5	5
Selenium	µg/g	1.5	0.8	<0.8	<0.8	<0.8	<0.8
Silver	µg/g	0.5	0.5	<0.5	<0.5	<0.5	<0.5
Thallium	µg/g	1	0.5	<0.5	<0.5	<0.5	<0.5
Uranium	µg/g	2.5	0.50	<0.50	<0.50	<0.50	0.60
Vanadium	µg/g	86	0.4	12.1	20.4	19.0	15.9
Zinc	µg/g	290	5	15	38	38	60
Chromium, Hexavalent	µg/g	0.66	0.2	<0.2	<0.2	<0.2	<0.2
Cyanide, WAD	µg/g	0.051	0.040	<0.040	<0.040	<0.040	<0.040
Mercury	µg/g	0.27	0.10	<0.10	<0.10	<0.10	<0.10
Electrical Conductivity (2:1)	mS/cm	0.57	0.005	0.083	0.095	0.306	0.089
Sodium Adsorption Ratio (2:1) (Calc.)	N/A	2.4	N/A	0.028	0.022	0.025	0.044
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.55	7.42	7.26	7.46

Certified By:



Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 23L009098

PROJECT: 23003150

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Delhi

SAMPLED BY:M.S

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2023-03-31

DATE REPORTED: 2023-04-11

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4896102-4896106 EC was determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio. SAR is a calculated parameter.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 23L009098

PROJECT: 23003150

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Delhi

SAMPLED BY:M.S

O. Reg. 153(511) - ORPs (Soil)

DATE RECEIVED: 2023-03-31

DATE REPORTED: 2023-04-11

		SAMPLE DESCRIPTION:		BH5 SA5
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2023-03-29
Parameter	Unit	G / S	RDL	4896104
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.44

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4896104 pH was determined on the 0.01M CaCl2 extract obtained from 2:1 leaching procedure (2 parts extraction fluid:1 part wet soil).

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 23L009098

PROJECT: 23003150

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Delhi

SAMPLED BY:M.S

O. Reg. 153(511) - OC Pesticides (Soil)

DATE RECEIVED: 2023-03-31

DATE REPORTED: 2023-04-11

		SAMPLE DESCRIPTION:		BH1 SA1	BH2 SA1	BH3 SA1
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		2023-03-29	2023-03-29	2023-03-29
Parameter	Unit	G / S	RDL	4896099	4896100	4896101
Hexachloroethane	µg/g	0.01	0.005	<0.005	<0.005	<0.005
Gamma-Hexachlorocyclohexane	µg/g	0.01	0.005	<0.005	<0.005	<0.005
Heptachlor	µg/g	0.05	0.005	<0.005	<0.005	<0.005
Aldrin	µg/g	0.05	0.005	<0.005	<0.005	<0.005
Heptachlor Epoxide	µg/g	0.05	0.005	<0.005	<0.005	<0.005
Endosulfan I	µg/g		0.005	<0.005	<0.005	<0.005
Endosulfan II	µg/g		0.005	<0.005	<0.005	<0.005
Endosulfan	µg/g	0.04	0.005	<0.005	<0.005	<0.005
Alpha-Chlordane	µg/g		0.005	<0.005	<0.005	<0.005
gamma-Chlordane	µg/g		0.005	<0.005	<0.005	<0.005
Chlordane	µg/g	0.05	0.007	<0.007	<0.007	<0.007
op'-DDE	ug/g		0.005	<0.005	<0.005	<0.005
pp'-DDE	µg/g		0.005	<0.005	<0.005	<0.005
DDE	µg/g	0.05	0.007	<0.007	<0.007	<0.007
op'-DDD	µg/g		0.005	<0.005	<0.005	<0.005
pp'-DDD	µg/g		0.005	<0.005	<0.005	<0.005
DDD	µg/g	0.05	0.007	<0.007	<0.007	<0.007
op'-DDT	µg/g		0.005	<0.005	<0.005	<0.005
pp'-DDT	µg/g		0.005	<0.005	<0.005	<0.005
DDT (Total)	µg/g	1.4	0.007	<0.007	<0.007	<0.007
Dieldrin	µg/g	0.05	0.005	<0.005	<0.005	<0.005
Endrin	µg/g	0.04	0.005	<0.005	<0.005	<0.005
Methoxychlor	µg/g	0.05	0.005	<0.005	<0.005	<0.005
Hexachlorobenzene	µg/g	0.01	0.005	<0.005	<0.005	<0.005
Hexachlorobutadiene	µg/g	0.01	0.01	<0.01	<0.01	<0.01
Moisture Content	%		0.1	3.8	7.8	6.8
wet weight OC	g		0.005	10.4	10.7	10.4
Surrogate	Unit	Acceptable Limits				
TCMX	%	50-140		80	77	88
Decachlorobiphenyl	%	50-140		119	102	109

Certified By: NPopnikolof

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 23L009098

PROJECT: 23003150

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Delhi

SAMPLED BY:M.S

O. Reg. 153(511) - OC Pesticides (Soil)

DATE RECEIVED: 2023-03-31

DATE REPORTED: 2023-04-11

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4896099-4896101 Results are based on the dry weight of the soil.
DDT total is a calculated parameter. The calculated value is the sum of op'DDT and pp'DDT.
DDD total is a calculated parameter. The calculated value is the sum of op'DDD and pp'DDD.
DDE total is a calculated parameter. The calculated value is the sum of op'DDE and pp'DDE.
Endosulfan total is a calculated parameter. The calculated value is the sum of Endosulfan I and Endosulfan II.
Chlordane total is a calculated parameter. The calculated value is the sum of Alpha-Chlordane and Gamma-Chlordane.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: N Popnikolof

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 23L009098

PROJECT: 23003150

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Delhi

SAMPLED BY:M.S

O. Reg. 153(511) - PAHs (Soil)

DATE RECEIVED: 2023-03-31

DATE REPORTED: 2023-04-11

		SAMPLE DESCRIPTION:		BH4 SA1	BH5 SA1
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2023-03-29	2023-03-29
Parameter	Unit	G / S	RDL	4896102	4896103
Naphthalene	µg/g	0.09	0.05	<0.05	<0.05
Acenaphthylene	µg/g	0.093	0.05	<0.05	<0.05
Acenaphthene	µg/g	0.072	0.05	<0.05	<0.05
Fluorene	µg/g	0.12	0.05	<0.05	<0.05
Phenanthrene	µg/g	0.69	0.05	<0.05	<0.05
Anthracene	µg/g	0.16	0.05	<0.05	<0.05
Fluoranthene	µg/g	0.56	0.05	<0.05	<0.05
Pyrene	µg/g	1	0.05	<0.05	<0.05
Benz(a)anthracene	µg/g	0.36	0.05	<0.05	<0.05
Chrysene	µg/g	2.8	0.05	<0.05	<0.05
Benzo(b)fluoranthene	µg/g	0.47	0.05	<0.05	<0.05
Benzo(k)fluoranthene	µg/g	0.48	0.05	<0.05	<0.05
Benzo(a)pyrene	µg/g	0.3	0.05	<0.05	<0.05
Indeno(1,2,3-cd)pyrene	µg/g	0.23	0.05	<0.05	<0.05
Dibenz(a,h)anthracene	µg/g	0.1	0.05	<0.05	<0.05
Benzo(g,h,i)perylene	µg/g	0.68	0.05	<0.05	<0.05
1 and 2 Methlynaphthalene	µg/g	0.59	0.05	<0.05	<0.05
Moisture Content	%		0.1	3.7	11.8
Surrogate	Unit	Acceptable Limits			
Naphthalene-d8	%	50-140		85	85
Acridine-d9	%	50-140		90	95
Terphenyl-d14	%	50-140		100	95

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4896102-4896103 Results are based on the dry weight of the soil.
Note: The result for Benzo(b)Fluoranthene is the total of the Benzo(b)&j)Fluoranthene isomers because the isomers co-elute on the GC column.
2- and 1-Methyl Naphthalene is a calculated parameter. The calculated value is the sum of 2-Methyl Naphthalene and 1-Methyl Naphthalene.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: NPopnikolof

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 23L009098

PROJECT: 23003150

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Delhi

SAMPLED BY:M.S

O. Reg. 153(511) - PHCs F1 - F4 (with VOC) (Soil)

DATE RECEIVED: 2023-03-31

DATE REPORTED: 2023-04-11

		SAMPLE DESCRIPTION:		BH1 SA9	BH2 SA10	BH5 SA5
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		2023-03-27	2023-03-27	2023-03-29
Parameter	Unit	G / S	RDL	4882796	4882803	4896104
F1 (C6 - C10)	µg/g	25	5	<5	<5	<5
F1 (C6 to C10) minus BTEX	µg/g	25	5	<5	<5	<5
F2 (C10 to C16)	µg/g	10	10	<10	<10	<10
F3 (C16 to C34)	µg/g	240	50	59	<50	<50
F4 (C34 to C50)	µg/g	120	50	<50	<50	<50
Gravimetric Heavy Hydrocarbons	µg/g	120	50	NA	NA	NA
Moisture Content	%		0.1	16.1	18.2	14.1
Surrogate	Unit	Acceptable Limits				
Toluene-d8	%	50-140		102	100	100
Terphenyl	%	60-140		74	76	90

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4882796-4896104 Results are based on sample dry weight.
The C6-C10 fraction is calculated using toluene response factor.
C6–C10 (F1 minus BTEX) is a calculated parameter. The calculated value is F1 minus BTEX. The calculated parameter is non-accredited. The parameters that are components of the calculation are accredited.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX contribution.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified without the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: N Popnikolof

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 23L009098

PROJECT: 23003150

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Delhi

SAMPLED BY:M.S

O. Reg. 153(511) - VOCs (with PHC) (Soil)

DATE RECEIVED: 2023-03-31

DATE REPORTED: 2023-04-11

SAMPLE DESCRIPTION:				BH1 SA9	BH2 SA10	BH5 SA5
SAMPLE TYPE:				Soil	Soil	Soil
DATE SAMPLED:				2023-03-27	2023-03-27	2023-03-29
Parameter	Unit	G / S	RDL	4882796	4882803	4896104
Dichlorodifluoromethane	µg/g	0.05	0.05	<0.05	<0.05	<0.05
Vinyl Chloride	ug/g	0.02	0.02	<0.02	<0.02	<0.02
Bromomethane	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Trichlorofluoromethane	ug/g	0.25	0.05	<0.05	<0.05	<0.05
Acetone	ug/g	0.5	0.50	<0.50	<0.50	<0.50
1,1-Dichloroethylene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Methylene Chloride	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Trans- 1,2-Dichloroethylene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Methyl tert-butyl Ether	ug/g	0.05	0.05	<0.05	<0.05	<0.05
1,1-Dichloroethane	ug/g	0.05	0.02	<0.02	<0.02	<0.02
Methyl Ethyl Ketone	ug/g	0.5	0.50	<0.50	<0.50	<0.50
Cis- 1,2-Dichloroethylene	ug/g	0.05	0.02	<0.02	<0.02	<0.02
Chloroform	ug/g	0.05	0.04	<0.04	<0.04	<0.04
1,2-Dichloroethane	ug/g	0.05	0.03	<0.03	<0.03	<0.03
1,1,1-Trichloroethane	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Carbon Tetrachloride	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Benzene	ug/g	0.02	0.02	<0.02	<0.02	<0.02
1,2-Dichloropropane	ug/g	0.05	0.03	<0.03	<0.03	<0.03
Trichloroethylene	ug/g	0.05	0.03	<0.03	<0.03	<0.03
Bromodichloromethane	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Methyl Isobutyl Ketone	ug/g	0.5	0.50	<0.50	<0.50	<0.50
1,1,2-Trichloroethane	ug/g	0.05	0.04	<0.04	<0.04	<0.04
Toluene	ug/g	0.2	0.05	<0.05	<0.05	<0.05
Dibromochloromethane	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Ethylene Dibromide	ug/g	0.05	0.04	<0.04	<0.04	<0.04
Tetrachloroethylene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
1,1,1,2-Tetrachloroethane	ug/g	0.05	0.04	<0.04	<0.04	<0.04
Chlorobenzene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Ethylbenzene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
m & p-Xylene	ug/g		0.05	<0.05	<0.05	<0.05

Certified By: N Popnikolof

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 23L009098

PROJECT: 23003150

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Delhi

SAMPLED BY:M.S

O. Reg. 153(511) - VOCs (with PHC) (Soil)

DATE RECEIVED: 2023-03-31

DATE REPORTED: 2023-04-11

		SAMPLE DESCRIPTION:		BH1 SA9	BH2 SA10	BH5 SA5
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		2023-03-27	2023-03-27	2023-03-29
Parameter	Unit	G / S	RDL	4882796	4882803	4896104
Bromoform	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Styrene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
1,1,2,2-Tetrachloroethane	ug/g	0.05	0.05	<0.05	<0.05	<0.05
o-Xylene	ug/g		0.05	<0.05	<0.05	<0.05
1,3-Dichlorobenzene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
1,4-Dichlorobenzene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
1,2-Dichlorobenzene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Xylenes (Total)	ug/g	0.05	0.05	<0.05	<0.05	<0.05
1,3-Dichloropropene (Cis + Trans)	µg/g	0.05	0.05	<0.05	<0.05	<0.05
n-Hexane	µg/g	0.05	0.05	<0.05	<0.05	<0.05
Moisture Content	%		0.1	16.1	18.2	14.1
Surrogate	Unit	Acceptable Limits				
Toluene-d8	% Recovery	50-140		102	100	100
4-Bromofluorobenzene	% Recovery	50-140		78	78	76

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4882796-4896104 The sample was analyzed using the high level technique. The sample was extracted using methanol, a small amount of the methanol extract was diluted in water and the purge & trap GC/MS analysis was performed. Results are based on the dry weight of the soil.
Xylenes total is a calculated parameter. The calculated value is the sum of m&p-Xylene + o-Xylene.
1,3-Dichloropropene total is a calculated parameter. The calculated value is the sum of Cis-1,3-Dichloropropene and Trans-1,3-Dichloropropene.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: N Popnikolof

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: EXP SERVICES INC
PROJECT: 23003150
SAMPLING SITE:Delhi

AGAT WORK ORDER: 23L009098
ATTENTION TO: SCOTT AZIZ
SAMPLED BY:M.S

Soil Analysis

RPT Date: Apr 11, 2023			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	4897085		<0.8	<0.8	NA	< 0.8	105%	70%	130%	79%	80%	120%	75%	70%	130%
Arsenic	4897085		3	3	NA	< 1	118%	70%	130%	107%	80%	120%	108%	70%	130%
Barium	4897085		50.8	51.8	1.9%	< 2.0	110%	70%	130%	110%	80%	120%	112%	70%	130%
Beryllium	4897085		0.5	0.5	NA	< 0.4	102%	70%	130%	99%	80%	120%	109%	70%	130%
Boron	4897085		14	15	NA	< 5	86%	70%	130%	96%	80%	120%	101%	70%	130%
Boron (Hot Water Soluble)	4895999		0.67	0.63	6.2%	< 0.10	97%	60%	140%	99%	70%	130%	103%	60%	140%
Cadmium	4897085		<0.5	<0.5	NA	< 0.5	109%	70%	130%	107%	80%	120%	101%	70%	130%
Chromium	4897085		15	15	NA	< 5	103%	70%	130%	94%	80%	120%	101%	70%	130%
Cobalt	4897085		4.5	4.6	2.2%	< 0.5	94%	70%	130%	105%	80%	120%	107%	70%	130%
Copper	4897085		14.9	14.6	2.0%	< 1.0	99%	70%	130%	98%	80%	120%	89%	70%	130%
Lead	4897085		16	16	0.0%	< 1	107%	70%	130%	97%	80%	120%	92%	70%	130%
Molybdenum	4897085		0.6	0.6	NA	< 0.5	100%	70%	130%	103%	80%	120%	105%	70%	130%
Nickel	4897085		8	9	11.8%	< 1	95%	70%	130%	96%	80%	120%	91%	70%	130%
Selenium	4897085		<0.8	<0.8	NA	< 0.8	90%	70%	130%	114%	80%	120%	111%	70%	130%
Silver	4897085		<0.5	<0.5	NA	< 0.5	97%	70%	130%	100%	80%	120%	90%	70%	130%
Thallium	4897085		<0.5	<0.5	NA	< 0.5	96%	70%	130%	109%	80%	120%	102%	70%	130%
Uranium	4897085		0.53	0.54	NA	< 0.50	102%	70%	130%	108%	80%	120%	107%	70%	130%
Vanadium	4897085		20.9	20.8	0.5%	< 0.4	103%	70%	130%	102%	80%	120%	112%	70%	130%
Zinc	4897085		78	84	7.4%	< 5	103%	70%	130%	111%	80%	120%	87%	70%	130%
Chromium, Hexavalent	4896105	4896105	<0.2	<0.2	NA	< 0.2	104%	70%	130%	101%	80%	120%	91%	70%	130%
Cyanide, WAD	4891932		<0.040	<0.040	NA	< 0.040	109%	70%	130%	99%	80%	120%	91%	70%	130%
Mercury	4897085		<0.10	<0.10	NA	< 0.10	116%	70%	130%	106%	80%	120%	101%	70%	130%
Electrical Conductivity (2:1)	4897367		0.129	0.107	18.6%	< 0.005	84%	80%	120%						
Sodium Adsorption Ratio (2:1) (Calc.)	4896818		6.10	5.96	2.3%	NA									
pH, 2:1 CaCl2 Extraction	4900050		6.69	6.98	4.2%	NA	91%	80%	120%						

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.
Duplicate NA: results are under 5X the RDL and will not be calculated.

More than 90% of the elements met acceptance limits and overall data quality is acceptable for use. For a multi-element scan up to 10% of analytes may exceed the quoted limits by up to 10% absolute.

O. Reg. 153(511) - ORPs (Soil)															
pH, 2:1 CaCl2 Extraction	4900050		6.69	6.98	4.2%	NA	91%	80%	120%						

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.

Certified By:

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. RPDs calculated using raw data. The RPD may not be reflective of duplicate values shown, due to rounding of final results.

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 23L009098

PROJECT: 23003150

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Delhi

SAMPLED BY:M.S

Trace Organics Analysis

RPT Date: Apr 11, 2023			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - PHCs F1 - F4 (with VOC) (Soil)															
F1 (C6 - C10)	4887847		<5	<5	NA	< 5	127%	60%	140%	112%	60%	140%	89%	60%	140%
F2 (C10 to C16)	4870113		<10	<10	NA	< 10	104%	60%	140%	122%	60%	140%	127%	60%	140%
F3 (C16 to C34)	4870113		<50	<50	NA	< 50	109%	60%	140%	126%	60%	140%	124%	60%	140%
F4 (C34 to C50)	4870113		<50	<50	NA	< 50	84%	60%	140%	87%	60%	140%	106%	60%	140%
O. Reg. 153(511) - VOCs (with PHC) (Soil)															
Dichlorodifluoromethane	4887847		<0.05	<0.05	NA	< 0.05	99%	50%	140%	108%	50%	140%	78%	50%	140%
Vinyl Chloride	4887847		<0.02	<0.02	NA	< 0.02	90%	50%	140%	89%	50%	140%	98%	50%	140%
Bromomethane	4887847		<0.05	<0.05	NA	< 0.05	82%	50%	140%	109%	50%	140%	108%	50%	140%
Trichlorofluoromethane	4887847		<0.05	<0.05	NA	< 0.05	102%	50%	140%	70%	50%	140%	96%	50%	140%
Acetone	4887847		<0.50	<0.50	NA	< 0.50	79%	50%	140%	86%	50%	140%	79%	50%	140%
1,1-Dichloroethylene	4887847		<0.05	<0.05	NA	< 0.05	118%	50%	140%	109%	60%	130%	99%	50%	140%
Methylene Chloride	4887847		<0.05	<0.05	NA	< 0.05	81%	50%	140%	70%	60%	130%	82%	50%	140%
Trans- 1,2-Dichloroethylene	4887847		<0.05	<0.05	NA	< 0.05	104%	50%	140%	72%	60%	130%	91%	50%	140%
Methyl tert-butyl Ether	4887847		<0.05	<0.05	NA	< 0.05	103%	50%	140%	77%	60%	130%	73%	50%	140%
1,1-Dichloroethane	4887847		<0.02	<0.02	NA	< 0.02	75%	50%	140%	80%	60%	130%	71%	50%	140%
Methyl Ethyl Ketone	4887847		<0.50	<0.50	NA	< 0.50	83%	50%	140%	74%	50%	140%	75%	50%	140%
Cis- 1,2-Dichloroethylene	4887847		<0.02	<0.02	NA	< 0.02	104%	50%	140%	71%	60%	130%	105%	50%	140%
Chloroform	4887847		<0.04	<0.04	NA	< 0.04	114%	50%	140%	82%	60%	130%	72%	50%	140%
1,2-Dichloroethane	4887847		<0.03	<0.03	NA	< 0.03	119%	50%	140%	81%	60%	130%	73%	50%	140%
1,1,1-Trichloroethane	4887847		<0.05	<0.05	NA	< 0.05	72%	50%	140%	105%	60%	130%	98%	50%	140%
Carbon Tetrachloride	4887847		<0.05	<0.05	NA	< 0.05	114%	50%	140%	89%	60%	130%	89%	50%	140%
Benzene	4887847		<0.02	<0.02	NA	< 0.02	118%	50%	140%	79%	60%	130%	73%	50%	140%
1,2-Dichloropropane	4887847		<0.03	<0.03	NA	< 0.03	96%	50%	140%	86%	60%	130%	92%	50%	140%
Trichloroethylene	4887847		<0.03	<0.03	NA	< 0.03	110%	50%	140%	80%	60%	130%	72%	50%	140%
Bromodichloromethane	4887847		<0.05	<0.05	NA	< 0.05	96%	50%	140%	102%	60%	130%	89%	50%	140%
Methyl Isobutyl Ketone	4887847		<0.50	<0.50	NA	< 0.50	81%	50%	140%	85%	50%	140%	94%	50%	140%
1,1,2-Trichloroethane	4887847		<0.04	<0.04	NA	< 0.04	111%	50%	140%	76%	60%	130%	84%	50%	140%
Toluene	4887847		<0.05	<0.05	NA	< 0.05	112%	50%	140%	82%	60%	130%	81%	50%	140%
Dibromochloromethane	4887847		<0.05	<0.05	NA	< 0.05	108%	50%	140%	92%	60%	130%	112%	50%	140%
Ethylene Dibromide	4887847		<0.04	<0.04	NA	< 0.04	104%	50%	140%	71%	60%	130%	73%	50%	140%
Tetrachloroethylene	4887847		<0.05	<0.05	NA	< 0.05	115%	50%	140%	100%	60%	130%	91%	50%	140%
1,1,1,2-Tetrachloroethane	4887847		<0.04	<0.04	NA	< 0.04	109%	50%	140%	78%	60%	130%	88%	50%	140%
Chlorobenzene	4887847		<0.05	<0.05	NA	< 0.05	111%	50%	140%	79%	60%	130%	93%	50%	140%
Ethylbenzene	4887847		<0.05	<0.05	NA	< 0.05	104%	50%	140%	73%	60%	130%	83%	50%	140%
m & p-Xylene	4887847		<0.05	<0.05	NA	< 0.05	110%	50%	140%	116%	60%	130%	105%	50%	140%
Bromoform	4887847		<0.05	<0.05	NA	< 0.05	92%	50%	140%	72%	60%	130%	74%	50%	140%
Styrene	4887847		<0.05	<0.05	NA	< 0.05	101%	50%	140%	73%	60%	130%	74%	50%	140%
1,1,2,2-Tetrachloroethane	4887847		<0.05	<0.05	NA	< 0.05	98%	50%	140%	96%	60%	130%	103%	50%	140%
o-Xylene	4887847		<0.05	<0.05	NA	< 0.05	112%	50%	140%	73%	60%	130%	78%	50%	140%

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. RPDs calculated using raw data. The RPD may not be reflective of duplicate values shown, due to rounding of final results.

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: EXP SERVICES INC
PROJECT: 23003150
SAMPLING SITE:Delhi

AGAT WORK ORDER: 23L009098
ATTENTION TO: SCOTT AZIZ
SAMPLED BY:M.S

Trace Organics Analysis (Continued)

RPT Date: Apr 11, 2023

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
1,3-Dichlorobenzene	4887847		<0.05	<0.05	NA	< 0.05	114%	50%	140%	78%	60%	130%	76%	50%	140%
1,4-Dichlorobenzene	4887847		<0.05	<0.05	NA	< 0.05	91%	50%	140%	71%	60%	130%	72%	50%	140%
1,2-Dichlorobenzene	4887847		<0.05	<0.05	NA	< 0.05	120%	50%	140%	74%	60%	130%	73%	50%	140%
n-Hexane	4887847		<0.05	<0.05	NA	< 0.05	118%	50%	140%	116%	60%	130%	84%	50%	140%
Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).															
O. Reg. 153(511) - PHCs F1 - F4 (with VOC) (Soil)															
F1 (C6 - C10)	4890502		<5	<5	NA	< 5	116%	60%	140%	87%	60%	140%	109%	60%	140%
F2 (C10 to C16)	4891916		<10	<10	NA	< 10	97%	60%	140%	121%	60%	140%	101%	60%	140%
F3 (C16 to C34)	4891916		<50	<50	NA	< 50	105%	60%	140%	117%	60%	140%	95%	60%	140%
F4 (C34 to C50)	4891916		<50	<50	NA	< 50	88%	60%	140%	106%	60%	140%	89%	60%	140%
O. Reg. 153(511) - VOCs (with PHC) (Soil)															
Dichlorodifluoromethane	4890502		<0.05	<0.05	NA	< 0.05	71%	50%	140%	89%	50%	140%	100%	50%	140%
Vinyl Chloride	4890502		<0.02	<0.02	NA	< 0.02	105%	50%	140%	92%	50%	140%	110%	50%	140%
Bromomethane	4890502		<0.05	<0.05	NA	< 0.05	92%	50%	140%	109%	50%	140%	102%	50%	140%
Trichlorofluoromethane	4890502		<0.05	<0.05	NA	< 0.05	98%	50%	140%	97%	50%	140%	93%	50%	140%
Acetone	4890502		<0.50	<0.50	NA	< 0.50	101%	50%	140%	95%	50%	140%	87%	50%	140%
1,1-Dichloroethylene	4890502		< 0.05	< 0.05	NA	< 0.05	88%	50%	140%	83%	60%	130%	109%	50%	140%
Methylene Chloride	4890502		<0.05	<0.05	NA	< 0.05	103%	50%	140%	111%	60%	130%	105%	50%	140%
Trans- 1,2-Dichloroethylene	4890502		<0.05	<0.05	NA	< 0.05	89%	50%	140%	105%	60%	130%	94%	50%	140%
Methyl tert-butyl Ether	4890502		<0.05	<0.05	NA	< 0.05	73%	50%	140%	96%	60%	130%	88%	50%	140%
1,1-Dichloroethane	4890502		<0.02	<0.02	NA	< 0.02	91%	50%	140%	93%	60%	130%	97%	50%	140%
Methyl Ethyl Ketone	4890502		<0.50	<0.50	NA	< 0.50	97%	50%	140%	109%	50%	140%	102%	50%	140%
Cis- 1,2-Dichloroethylene	4890502		<0.02	<0.02	NA	< 0.02	79%	50%	140%	111%	60%	130%	104%	50%	140%
Chloroform	4890502		<0.04	<0.04	NA	< 0.04	86%	50%	140%	116%	60%	130%	113%	50%	140%
1,2-Dichloroethane	4890502		<0.03	<0.03	NA	< 0.03	99%	50%	140%	97%	60%	130%	85%	50%	140%
1,1,1-Trichloroethane	4890502		<0.05	<0.05	NA	< 0.05	81%	50%	140%	104%	60%	130%	92%	50%	140%
Carbon Tetrachloride	4890502		<0.05	<0.05	NA	< 0.05	79%	50%	140%	115%	60%	130%	106%	50%	140%
Benzene	4890502		<0.02	<0.02	NA	< 0.02	102%	50%	140%	87%	60%	130%	91%	50%	140%
1,2-Dichloropropane	4890502		<0.03	<0.03	NA	< 0.03	110%	50%	140%	94%	60%	130%	112%	50%	140%
Trichloroethylene	4890502		0.20	0.20	0.0%	< 0.03	81%	50%	140%	116%	60%	130%	104%	50%	140%
Bromodichloromethane	4890502		<0.05	<0.05	NA	< 0.05	97%	50%	140%	92%	60%	130%	115%	50%	140%
Methyl Isobutyl Ketone	4890502		<0.50	<0.50	NA	< 0.50	94%	50%	140%	119%	50%	140%	98%	50%	140%
1,1,2-Trichloroethane	4890502		<0.04	<0.04	NA	< 0.04	108%	50%	140%	110%	60%	130%	114%	50%	140%
Toluene	4890502		<0.05	<0.05	NA	< 0.05	93%	50%	140%	111%	60%	130%	118%	50%	140%
Dibromochloromethane	4890502		<0.05	<0.05	NA	< 0.05	87%	50%	140%	105%	60%	130%	84%	50%	140%
Ethylene Dibromide	4890502		<0.04	<0.04	NA	< 0.04	100%	50%	140%	113%	60%	130%	97%	50%	140%
Tetrachloroethylene	4890502		< 0.05	< 0.05	NA	< 0.05	111%	50%	140%	75%	60%	130%	97%	50%	140%
1,1,1,2-Tetrachloroethane	4890502		<0.04	<0.04	NA	< 0.04	77%	50%	140%	104%	60%	130%	90%	50%	140%

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. RPDs calculated using raw data. The RPD may not be reflective of duplicate values shown, due to rounding of final results.

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories
5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: EXP SERVICES INC
PROJECT: 23003150
SAMPLING SITE:Delhi

AGAT WORK ORDER: 23L009098
ATTENTION TO: SCOTT AZIZ
SAMPLED BY:M.S

Trace Organics Analysis (Continued)

RPT Date: Apr 11, 2023

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Chlorobenzene	4890502		<0.05	<0.05	NA	< 0.05	91%	50%	140%	119%	60%	130%	107%	50%	140%
Ethylbenzene	4890502		<0.05	<0.05	NA	< 0.05	82%	50%	140%	112%	60%	130%	105%	50%	140%
m & p-Xylene	4890502		<0.05	<0.05	NA	< 0.05	88%	50%	140%	109%	60%	130%	113%	50%	140%
Bromoform	4890502		<0.05	<0.05	NA	< 0.05	71%	50%	140%	72%	60%	130%	76%	50%	140%
Styrene	4890502		<0.05	<0.05	NA	< 0.05	72%	50%	140%	99%	60%	130%	83%	50%	140%
1,1,2,2-Tetrachloroethane	4890502		<0.05	<0.05	NA	< 0.05	118%	50%	140%	103%	60%	130%	108%	50%	140%
o-Xylene	4890502		<0.05	<0.05	NA	< 0.05	90%	50%	140%	91%	60%	130%	113%	50%	140%
1,3-Dichlorobenzene	4890502		<0.05	<0.05	NA	< 0.05	82%	50%	140%	109%	60%	130%	98%	50%	140%
1,4-Dichlorobenzene	4890502		<0.05	<0.05	NA	< 0.05	78%	50%	140%	107%	60%	130%	94%	50%	140%
1,2-Dichlorobenzene	4890502		<0.05	<0.05	NA	< 0.05	81%	50%	140%	102%	60%	130%	90%	50%	140%
n-Hexane	4890502		<0.05	<0.05	NA	< 0.05	112%	50%	140%	104%	60%	130%	103%	50%	140%
Moisture Content	1489094		11.20	11.27	0.6%	< 0.1									
O. Reg. 153(511) - OC Pesticides (Soil)															
Hexachloroethane	4891028		< 0.005	< 0.005	NA	< 0.005	88%	50%	140%	84%	50%	140%	94%	50%	140%
Gamma-Hexachlorocyclohexane	4891028		< 0.005	< 0.005	NA	< 0.005	101%	50%	140%	92%	50%	140%	103%	50%	140%
Heptachlor	4891028		< 0.005	< 0.005	NA	< 0.005	98%	50%	140%	104%	50%	140%	109%	50%	140%
Aldrin	4891028		< 0.005	< 0.005	NA	< 0.005	99%	50%	140%	108%	50%	140%	100%	50%	140%
Heptachlor Epoxide	4891028		< 0.005	< 0.005	NA	< 0.005	97%	50%	140%	108%	50%	140%	114%	50%	140%
Endosulfan I	4891028		< 0.005	< 0.005	NA	< 0.005	101%	50%	140%	109%	50%	140%	92%	50%	140%
Endosulfan II	4891028		< 0.005	< 0.005	NA	< 0.005	106%	50%	140%	102%	50%	140%	98%	50%	140%
Alpha-Chlordane	4891028		< 0.005	< 0.005	NA	< 0.005	100%	50%	140%	85%	50%	140%	106%	50%	140%
gamma-Chlordane	4891028		< 0.005	< 0.005	NA	< 0.005	103%	50%	140%	89%	50%	140%	93%	50%	140%
op'-DDE	4891028		< 0.005	< 0.005	NA	< 0.005	106%	50%	140%	92%	50%	140%	109%	50%	140%
pp'-DDE	4891028		< 0.005	< 0.005	NA	< 0.005	98%	50%	140%	102%	50%	140%	104%	50%	140%
op'-DDD	4891028		< 0.005	< 0.005	NA	< 0.005	114%	50%	140%	104%	50%	140%	95%	50%	140%
pp'-DDD	4891028		< 0.005	< 0.005	NA	< 0.005	102%	50%	140%	82%	50%	140%	89%	50%	140%
op'-DDT	4891028		< 0.005	< 0.005	NA	< 0.005	88%	50%	140%	102%	50%	140%	98%	50%	140%
pp'-DDT	4891028		< 0.005	< 0.005	NA	< 0.005	98%	50%	140%	96%	50%	140%	103%	50%	140%
Dieldrin	4891028		< 0.005	< 0.005	NA	< 0.005	96%	50%	140%	91%	50%	140%	89%	50%	140%
Endrin	4891028		< 0.005	< 0.005	NA	< 0.005	103%	50%	140%	92%	50%	140%	108%	50%	140%
Methoxychlor	4891028		< 0.005	< 0.005	NA	< 0.005	85%	50%	140%	96%	50%	140%	103%	50%	140%
Hexachlorobenzene	4891028		< 0.005	< 0.005	NA	< 0.005	114%	50%	140%	108%	50%	140%	109%	50%	140%
Hexachlorobutadiene	4891028		< 0.01	< 0.01	NA	< 0.01	103%	50%	140%	104%	50%	140%	102%	50%	140%
O. Reg. 153(511) - PAHs (Soil)															
Naphthalene	4896102	4896102	<0.05	<0.05	NA	< 0.05	110%	50%	140%	90%	50%	140%	88%	50%	140%
Acenaphthylene	4896102	4896102	<0.05	<0.05	NA	< 0.05	90%	50%	140%	80%	50%	140%	93%	50%	140%
Acenaphthene	4896102	4896102	<0.05	<0.05	NA	< 0.05	105%	50%	140%	105%	50%	140%	80%	50%	140%
Fluorene	4896102	4896102	<0.05	<0.05	NA	< 0.05	93%	50%	140%	73%	50%	140%	85%	50%	140%
Phenanthrene	4896102	4896102	<0.05	<0.05	NA	< 0.05	92%	50%	140%	78%	50%	140%	105%	50%	140%

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. RPDs calculated using raw data. The RPD may not be reflective of duplicate values shown, due to rounding of final results.

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 23L009098

PROJECT: 23003150

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Delhi

SAMPLED BY:M.S

Trace Organics Analysis (Continued)

RPT Date: Apr 11, 2023			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Anthracene	4896102	4896102	<0.05	<0.05	NA	< 0.05	107%	50%	140%	110%	50%	140%	78%	50%	140%
Fluoranthene	4896102	4896102	<0.05	<0.05	NA	< 0.05	78%	50%	140%	73%	50%	140%	88%	50%	140%
Pyrene	4896102	4896102	<0.05	<0.05	NA	< 0.05	76%	50%	140%	83%	50%	140%	73%	50%	140%
Benz(a)anthracene	4896102	4896102	<0.05	<0.05	NA	< 0.05	91%	50%	140%	75%	50%	140%	73%	50%	140%
Chrysene	4896102	4896102	<0.05	<0.05	NA	< 0.05	86%	50%	140%	80%	50%	140%	83%	50%	140%
Benzo(b)fluoranthene	4896102	4896102	<0.05	<0.05	NA	< 0.05	65%	50%	140%	118%	50%	140%	93%	50%	140%
Benzo(k)fluoranthene	4896102	4896102	<0.05	<0.05	NA	< 0.05	76%	50%	140%	105%	50%	140%	78%	50%	140%
Benzo(a)pyrene	4896102	4896102	<0.05	<0.05	NA	< 0.05	72%	50%	140%	110%	50%	140%	75%	50%	140%
Indeno(1,2,3-cd)pyrene	4896102	4896102	<0.05	<0.05	NA	< 0.05	78%	50%	140%	80%	50%	140%	103%	50%	140%
Dibenz(a,h)anthracene	4896102	4896102	<0.05	<0.05	NA	< 0.05	77%	50%	140%	78%	50%	140%	85%	50%	140%
Benzo(g,h,i)perylene	4896102	4896102	<0.05	<0.05	NA	< 0.05	109%	50%	140%	95%	50%	140%	88%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By: N Popnikolof

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. RPDs calculated using raw data. The RPD may not be reflective of duplicate values shown, due to rounding of final results.

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

QC Exceedance

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 23L009098

PROJECT: 23003150

ATTENTION TO: SCOTT AZIZ

RPT Date: Apr 11, 2023

PARAMETER	Sample Id	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
			Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)										
Antimony		105%	70%	130%	79%	80%	120%	75%	70%	130%

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.
Duplicate NA: results are under 5X the RDL and will not be calculated.

More than 90% of the elements met acceptance limits and overall data quality is acceptable for use. For a multi-element scan up to 10% of analytes may exceed the quoted limits by up to 10% absolute.

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 23L009098

PROJECT: 23003150

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Delhi

SAMPLED BY:M.S

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Arsenic	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Barium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Beryllium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Boron	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	modified from EPA 6010D and MSA PART 3, CH 21	ICP/OES
Cadmium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Chromium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Cobalt	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Copper	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Lead	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Molybdenum	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Nickel	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Selenium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Silver	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Thallium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Uranium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Vanadium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Zinc	MET 93 -6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Chromium, Hexavalent	INOR-93-6068	modified from EPA 3060 and EPA 7196	SPECTROPHOTOMETER
Cyanide, WAD	INOR-93-6052	modified from ON MOECC E3015, SM 4500-CN- I, G-387	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	modified from EPA 7471B and SM 3112 B	ICP-MS
Electrical Conductivity (2:1)	INOR-93-6075	modified from MSA PART 3, CH 14 and SM 2510 B	PC TITRATE
Sodium Adsorption Ratio (2:1) (Calc.)	INOR-93-6007	modified from EPA 6010D & Analytical Protocol	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6075	modified from EPA 9045D, MCKEAGUE 3.11 E3137	PC TITRATE

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 23L009098

PROJECT: 23003150

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Delhi

SAMPLED BY:M.S

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Hexachloroethane	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
Gamma-Hexachlorocyclohexane	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
Heptachlor	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
Aldrin	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
Heptachlor Epoxide	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
Endosulfan I	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
Endosulfan II	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
Endosulfan	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	CALCULATION
Alpha-Chlordane	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
gamma-Chlordane	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
Chlordane	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	CALCULATION
op'-DDE	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
pp'-DDE	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
DDE	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
op'-DDD	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
pp'-DDD	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
DDD	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	CALCULATION
op'-DDT	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
pp'-DDT	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
DDT (Total)	ORG-91-5113	modified from EPA 3570, 3620C & 8081B	CALCULATION
Dieldrin	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
Endrin	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
Methoxychlor	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
Hexachlorobenzene	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
Hexachlorobutadiene	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
TCMX	ORG-91-5112	modified from EPA 3570 & 3620C & 8081B	GC/ECD
Decachlorobiphenyl	ORG-91-5113	modified from EPA 3570 & 3620C & 8081B	GC/ECD
Moisture Content	VOL-91-5009	modified from CCME Tier 1 Method	BALANCE

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 23L009098

PROJECT: 23003150

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Delhi

SAMPLED BY:M.S

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
wet weight OC	ORG-91-5113		BALANCE
Naphthalene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Acenaphthylene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Acenaphthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Fluorene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Phenanthrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Anthracene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Fluoranthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Pyrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benz(a)anthracene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Chrysene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(b)fluoranthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(k)fluoranthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(a)pyrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Indeno(1,2,3-cd)pyrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Dibenz(a,h)anthracene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(g,h,i)perylene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
1 and 2 Methlynaphthalene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Naphthalene-d8	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Acridine-d9	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Terphenyl-d14	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
F1 (C6 - C10)	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/FID
F1 (C6 to C10) minus BTEX	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/FID
Toluene-d8	VOL-91- 5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
F2 (C10 to C16)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F3 (C16 to C34)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F4 (C34 to C50)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
Gravimetric Heavy Hydrocarbons	VOL-91-5009	modified from CCME Tier 1 Method	BALANCE
Terphenyl	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
Dichlorodifluoromethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Vinyl Chloride	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 23L009098

PROJECT: 23003150

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Delhi

SAMPLED BY:M.S

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Bromomethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Trichlorofluoromethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Acetone	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,1-Dichloroethylene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Methylene Chloride	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Trans- 1,2-Dichloroethylene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Methyl tert-butyl Ether	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,1-Dichloroethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Cis- 1,2-Dichloroethylene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Chloroform	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,1,1-Trichloroethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Benzene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,2-Dichloropropane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Trichloroethylene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Bromodichloromethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Methyl Isobutyl Ketone	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,1,2-Trichloroethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Toluene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Dibromochloromethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Ethylene Dibromide	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Tetrachloroethylene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,1,1,2-Tetrachloroethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Chlorobenzene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Ethylbenzene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
m & p-Xylene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 23L009098

PROJECT: 23003150

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Delhi

SAMPLED BY:M.S

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Bromoform	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Styrene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,1,2,2-Tetrachloroethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
o-Xylene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,3-Dichlorobenzene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Xylenes (Total)	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,3-Dichloropropene (Cis + Trans)	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
n-Hexane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Toluene-d8	VOL-91-5002	modified from EPA 5035A & EPA 8260D	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91-5002	modified from EPA 5035A & EPA 8260D	(P&T)GC/MS

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Report Information:

Company:
Contact:
Address:
Phone: Fax:
Reports to be sent to:
1. Email:
2. Email:

Regulatory Requirements:

(Please check all applicable boxes)

- [x] Regulation 153/04 — Table 2 (Indicate One) — [ ] Ind/Com [x] Res/Park [ ] Agriculture
- Soil Texture *(Check One)* [ ] Coarse [ ] Fine
- [ ] Excess Soils R406 — Table ____ (Indicate One)
- [ ] Regulation 558
- [ ] CCME
- [ ] Sewer Use [ ] Sanitary [ ] Storm — ____ (Region)
- [ ] Prov. Water Quality Objectives (PWQO)
- [ ] Other ____ (Indicate One)

Is this submission for a **Record of Site Condition?** [ ] Yes [x] No

Report Guideline on *Certificate of Analysis* [x] Yes [ ] No

Laboratory Use Only

Work Order #: 23L009098

Cooler Quantity: 1 med
Arrival Temperatures: 3.4 | 5.1 | 6.2 / 4.8 | 3.5 | 2.5
Custody Seal Intact: [ ] Yes [ ] No [x] N/A
Notes: on ice

Turnaround Time (TAT) Required:

Regular TAT [x] 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

[ ] 3 Business Days [ ] 2 Business Days [ ] Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 300 335
Site Location: Waverly St. Delhi
Sampled By: MS
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes [x] No [ ]

Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC (Y/N)	O. Reg 153: Metals & Inorganics	O. Reg 153: Metals - CrVI, Hg, HWSB	O. Reg 153: BTEX, F1-F4 PHCs	O. Reg 153: Analyze F4G if required	O. Reg 153: PAHs	O. Reg 153: PCBs	O. Reg 153: VOC	O. Reg 558: Landfill Disposal Characterization TCLP: M&I VOCs ABNs B(a)P PCBs	O. Reg 406: Excess Soils SPLP Rainwater Leach	O. Reg 406: Excess Soils SPLP: Metals VOCs SVOCs	O. Reg 406: Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Salt - EC/SAR	O.C. Pesticides							Potentially Hazardous or High Concentration (Y/N)
BH1 SA1	March 29	AM/PM	1																X						
BH2 SA1		AM/PM	1																X						
BH3 SA1		AM/PM	1																X						
BH4 SA1		AM/PM	2				X				X														
BH5 SA1		AM/PM	2				X				X														
BH5 SA5		AM/PM	2						X				X							X					
BH6 SA1		AM/PM	1				X																		
BH8 SA1		AM/PM	1				X																		
		AM/PM																							
		AM/PM																							
		AM/PM																							

Samples Relinquished By (Print Name and Sign): Milan Suthar — Date: March 29/23 — Time: PM
Samples Relinquished By (Print Name and Sign): — Date: — Time:
Samples Relinquished By (Print Name and Sign): — Date: — Time:

Samples Received By (Print Name and Sign): J Smith
Samples Received By (Print Name and Sign): Anuradha Jagota — Date: April-03-23 — Time: 4:15 pm
Samples Received By (Print Name and Sign): — Date: — Time:

Date: 23-3-31 — Time: 4:45

Appendix C:
Laboratory Certificate of Analysis Sheets – Groundwater

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: EXP SERVICES INC
15701 Robin's Hill Road #2
LONDON, ON N5V0A5
(519) 963-3000
ATTENTION TO: SCOTT AZIZ
PROJECT: 23003355
AGAT WORK ORDER: 23L014269
TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist
DATE REPORTED: Apr 21, 2023
PAGES (INCLUDING COVER): 12
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes

Disclaimer:

- All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.
- All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.
- AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.
- This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
- The test results reported herewith relate only to the samples as received by the laboratory.
- Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.
- All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.
- For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.

Member of: Association of Professional Engineers and Geoscientists of Alberta (APEGA)
Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. Measurement Uncertainty is not taken into consideration when stating conformity with a specified requirement.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 23L014269

PROJECT: 23003355

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Weavesly H. Delhi

SAMPLED BY:MS

O. Reg. 153(511) - OC Pesticides (Water)

DATE RECEIVED: 2023-04-13

DATE REPORTED: 2023-04-21

		SAMPLE DESCRIPTION:		BH1/MW	BH2/MW
		SAMPLE TYPE:		Water	Water
		DATE SAMPLED:		2023-04-13	2023-04-13
Parameter	Unit	G / S	RDL	4919081	4919083
Gamma-Hexachlorocyclohexane	µg/L		0.01	<0.01	<0.01
Heptachlor	µg/L		0.01	<0.01	<0.01
Aldrin	µg/L		0.01	<0.01	<0.01
Heptachlor Epoxide	µg/L		0.01	<0.01	<0.01
Endosulfan I	µg/L		0.05	<0.05	<0.05
Endosulfan II	µg/L		0.05	<0.05	<0.05
Endosulfan	µg/L		0.05	<0.05	<0.05
alpha - chlordane	µg/L		0.04	<0.04	<0.04
gamma-Chlordane	µg/L		0.04	<0.04	<0.04
Chlordane	µg/L		0.04	<0.04	<0.04
op'-DDE	µg/L		0.01	<0.01	<0.01
pp'-DDE	µg/L		0.01	<0.01	<0.01
DDE	µg/L		0.01	<0.01	<0.01
op'-DDD	µg/L		0.05	<0.05	<0.05
pp'-DDD	µg/L		0.05	<0.05	<0.05
DDD	µg/L		0.05	<0.05	<0.05
op'-DDT	µg/L		0.04	<0.04	<0.04
pp'-DDT	µg/L		0.05	<0.05	<0.05
DDT	µg/L		0.04	<0.04	<0.04
Dieldrin	µg/L		0.02	<0.02	<0.02
Endrin	µg/L		0.05	<0.05	<0.05
Methoxychlor	µg/L		0.04	<0.04	<0.04
Hexachlorobenzene	ug/L		0.01	<0.01	<0.01
Hexachlorobutadiene	ug/L		0.01	<0.01	<0.01
Hexachloroethane	ug/L		0.01	<0.01	<0.01
Surrogate	Unit	Acceptable Limits			
TCMX	%	50-140		73	77
Decachlorobiphenyl	%	60-140		85	89

Certified By: NPopowkolof

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 23L014269

PROJECT: 23003355

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Weavesly H. Delhi

SAMPLED BY:MS

O. Reg. 153(511) - OC Pesticides (Water)

DATE RECEIVED: 2023-04-13

DATE REPORTED: 2023-04-21

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

4919081-4919083 DDT total is a calculated parameter. The calculated value is the sum of op'DDT and pp'DDT.
DDD total is a calculated parameter. The calculated value is the sum of op'DDD and pp'DDD.
DDE total is a calculated parameter. The calculated value is the sum of op'DDE and pp'DDE.
Endosulfan total is a calculated parameter. The calculated value is the sum of Endosulfan I and Endosulfan II.
Chlordane total is a calculated parameter. The calculated value is the sum of Alpha-Chlordane and Gamma-Chlordane.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: N Popowkolof

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 23L014269

PROJECT: 23003355

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Weavesly H. Delhi

SAMPLED BY:MS

O. Reg. 153(511) - PHCs F1 - F4 (with VOC) (Water)

DATE RECEIVED: 2023-04-13

DATE REPORTED: 2023-04-21

		SAMPLE DESCRIPTION:		BH1/MW	BH2/MW
		SAMPLE TYPE:		Water	Water
		DATE SAMPLED:		2023-04-13	2023-04-13
Parameter	Unit	G / S	RDL	4919081	4919083
F1 (C6 - C10)	µg/L		25	<25	<25
F1 (C6 to C10) minus BTEX	µg/L		25	<25	<25
F2 (C10 to C16)	µg/L		100	<100	<100
F3 (C16 to C34)	µg/L		100	<100	<100
F4 (C34 to C50)	µg/L		100	<100	<100
Gravimetric Heavy Hydrocarbons	µg/L		500	NA	NA
Sediment				3	3
Surrogate	Unit	Acceptable Limits			
Toluene-d8	%	50-140		112	106
Terphenyl	% Recovery	60-140		88	80

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

4919081-4919083 The C6-C10 fraction is calculated using Toluene response factor.
Xylenes total is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.
C6–C10 (F1 minus BTEX) is a calculated parameter. The calculated value is F1 minus BTEX.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and nC34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16 - C50 and are only determined if the chromatogram of the C34 - C50 Hydrocarbons indicated that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6-C50 results are corrected for BTEX contribution.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153/04, results are considered valid without determining the PAH contribution if not requested by the client.
NA = Not Applicable

Sediment parameter is comment only based on visual inspection of the sample prior to extraction and is not an accredited test.
Legend: 1 = no sediment present; 2 = sediment present; 3 = sediment present in trace amounts

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: NPopnikolof

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 23L014269

PROJECT: 23003355

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Weavesly H. Delhi

SAMPLED BY:MS

O. Reg. 153(511) - VOCs (with PHC) (Water)

DATE RECEIVED: 2023-04-13

DATE REPORTED: 2023-04-21

		SAMPLE DESCRIPTION:		BH1/MW	BH2/MW
		SAMPLE TYPE:		Water	Water
		DATE SAMPLED:		2023-04-13	2023-04-13
Parameter	Unit	G / S	RDL	4919081	4919083
Acetone	µg/L		1.0	<1.0	<1.0
Benzene	µg/L		0.20	<0.20	<0.20
Bromodichloromethane	µg/L		0.20	<0.20	<0.20
Bromoform	µg/L		0.10	<0.10	<0.10
Bromomethane	µg/L		0.20	<0.20	<0.20
Carbon Tetrachloride	µg/L		0.20	<0.20	<0.20
Chlorobenzene	µg/L		0.10	<0.10	<0.10
Chloroform	µg/L		0.20	<0.20	<0.20
Dibromochloromethane	µg/L		0.10	<0.10	<0.10
1,4-Dichlorobenzene	µg/L		0.10	<0.10	<0.10
1,2-Dichlorobenzene	µg/L		0.10	<0.10	<0.10
1,3-Dichlorobenzene	µg/L		0.10	<0.10	<0.10
Dichlorodifluoromethane	µg/L		0.40	<0.40	<0.40
1,2-Dichloroethane	µg/L		0.20	<0.20	<0.20
1,1-Dichloroethane	µg/L		0.30	<0.30	<0.30
1,1-Dichloroethylene	µg/L		0.30	<0.30	<0.30
1,2-Dichloropropane	µg/L		0.20	<0.20	<0.20
1,3-Dichloropropene	µg/L		0.30	<0.30	<0.30
Ethylbenzene	µg/L		0.10	<0.10	<0.10
Ethylene Dibromide	µg/L		0.10	<0.10	<0.10
Methyl Ethyl Ketone	µg/L		1.0	<1.0	<1.0
Methyl Isobutyl Ketone	µg/L		1.0	<1.0	<1.0
Methyl tert-butyl ether	µg/L		0.20	<0.20	<0.20
Methylene Chloride	µg/L		0.30	<0.30	<0.30
Styrene	µg/L		0.10	<0.10	<0.10
1,1,2,2-Tetrachloroethane	µg/L		0.10	<0.10	<0.10
1,1,1,2-Tetrachloroethane	µg/L		0.10	<0.10	<0.10
Tetrachloroethylene	µg/L		0.20	<0.20	<0.20
Toluene	µg/L		0.20	<0.20	<0.20
1,1,2-Trichloroethane	µg/L		0.20	<0.20	<0.20

Certified By: N Popnikolof

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 23L014269

PROJECT: 23003355

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Weavesly H. Delhi

SAMPLED BY:MS

O. Reg. 153(511) - VOCs (with PHC) (Water)

DATE RECEIVED: 2023-04-13

DATE REPORTED: 2023-04-21

		SAMPLE DESCRIPTION:		BH1/MW	BH2/MW
		SAMPLE TYPE:		Water	Water
		DATE SAMPLED:		2023-04-13	2023-04-13
Parameter	Unit	G / S	RDL	4919081	4919083
1,1,1-Trichloroethane	µg/L		0.30	<0.30	<0.30
Trichloroethylene	µg/L		0.20	<0.20	<0.20
Trichlorofluoromethane	µg/L		0.40	<0.40	<0.40
Vinyl Chloride	µg/L		0.17	<0.17	<0.17
Xylenes (Total)	µg/L		0.20	<0.20	<0.20
cis- 1,2-Dichloroethylene	µg/L		0.20	<0.20	<0.20
m & p-Xylene	µg/L		0.20	<0.20	<0.20
n-Hexane	µg/L		0.20	<0.20	<0.20
o-Xylene	µg/L		0.10	<0.10	<0.10
trans- 1,2-Dichloroethylene	µg/L		0.20	<0.20	<0.20
Surrogate	Unit	Acceptable Limits			
4-Bromofluorobenzene	% Recovery	50-140		90	88
Toluene-d8	% Recovery	50-140		112	106

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

4919081-4919083 Xylenes total is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.
1,3-Dichloropropene total is a calculated parameter. The calculated value is the sum of Cis-1,3-Dichloropropene and Trans-1,3-Dichloropropene.
The calculated parameter is non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: N Popnikolof

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: EXP SERVICES INC
PROJECT: 23003355
SAMPLING SITE:Weavesly H. Delhi

AGAT WORK ORDER: 23L014269
ATTENTION TO: SCOTT AZIZ
SAMPLED BY:MS

Trace Organics Analysis

RPT Date: Apr 21, 2023

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - OC Pesticides (Water)															
Gamma-Hexachlorocyclohexane	4913013		< 0.01	< 0.01	NA	< 0.01	98%	50%	140%	91%	50%	140%	89%	50%	140%
Heptachlor	4913013		< 0.01	< 0.01	NA	< 0.01	97%	50%	140%	113%	50%	140%	114%	50%	140%
Aldrin	4913013		< 0.01	< 0.01	NA	< 0.01	100%	50%	140%	95%	50%	140%	100%	50%	140%
Heptachlor Epoxide	4913013		< 0.01	< 0.01	NA	< 0.01	99%	50%	140%	97%	50%	140%	91%	50%	140%
Endosulfan I	4913013		< 0.05	< 0.05	NA	< 0.05	97%	50%	140%	93%	50%	140%	86%	50%	140%
Endosulfan II	4913013		< 0.05	< 0.05	NA	< 0.05	95%	50%	140%	92%	50%	140%	85%	50%	140%
alpha - chlordane	4913013		< 0.04	< 0.04	NA	< 0.04	101%	50%	140%	98%	50%	140%	87%	50%	140%
gamma-Chlordane	4913013		< 0.04	< 0.04	NA	< 0.04	99%	50%	140%	97%	50%	140%	93%	50%	140%
op'-DDE	4913013		< 0.01	< 0.01	NA	< 0.01	109%	50%	140%	111%	50%	140%	104%	50%	140%
pp'-DDE	4913013		< 0.01	< 0.01	NA	< 0.01	98%	50%	140%	106%	50%	140%	100%	50%	140%
op'-DDD	4913013		< 0.05	< 0.05	NA	< 0.05	114%	50%	140%	100%	50%	140%	106%	50%	140%
pp'-DDD	4913013		< 0.05	< 0.05	NA	< 0.05	94%	50%	140%	98%	50%	140%	94%	50%	140%
op'-DDT	4913013		< 0.04	< 0.04	NA	< 0.04	111%	50%	140%	112%	50%	140%	117%	50%	140%
pp'-DDT	4913013		< 0.05	< 0.05	NA	< 0.05	96%	50%	140%	89%	50%	140%	90%	50%	140%
Dieldrin	4913013		< 0.02	< 0.02	NA	< 0.02	97%	50%	140%	93%	50%	140%	86%	50%	140%
Endrin	4913013		< 0.05	< 0.05	NA	< 0.05	81%	50%	140%	117%	50%	140%	109%	50%	140%
Methoxychlor	4913013		< 0.04	< 0.04	NA	< 0.04	118%	50%	140%	112%	50%	140%	83%	50%	140%
Hexachlorobenzene	4913013		< 0.01	< 0.01	NA	< 0.01	102%	50%	140%	109%	50%	140%	106%	50%	140%
Hexachlorobutadiene	4913013		< 0.01	< 0.01	NA	< 0.01	104%	50%	140%	89%	50%	140%	83%	50%	140%
Hexachloroethane	4913013		< 0.01	< 0.01	NA	< 0.01	82%	50%	140%	95%	50%	140%	82%	50%	140%
O. Reg. 153(511) - PHCs F1 - F4 (with VOC) (Water)															
F1 (C6 - C10)	4914689		<25	<25	NA	< 25	91%	60%	140%	113%	60%	140%	104%	60%	140%
F2 (C10 to C16)	4917273		<100	<100	NA	< 100	109%	60%	140%	78%	60%	140%	81%	60%	140%
F3 (C16 to C34)	4917273		2020	1610	22.6%	< 100	117%	60%	140%	80%	60%	140%	82%	60%	140%
F4 (C34 to C50)	4917273		190	138	NA	< 100	99%	60%	140%	84%	60%	140%	92%	60%	140%
O. Reg. 153(511) - VOCs (with PHC) (Water)															
Acetone	4914689		<1.0	<1.0	NA	< 1.0	82%	50%	140%	89%	50%	140%	95%	50%	140%
Benzene	4914689		<0.20	<0.20	NA	< 0.20	79%	50%	140%	74%	60%	130%	83%	50%	140%
Bromodichloromethane	4914689		<0.20	<0.20	NA	< 0.20	77%	50%	140%	76%	60%	130%	76%	50%	140%
Bromoform	4914689		<0.10	<0.10	NA	< 0.10	99%	50%	140%	116%	60%	130%	107%	50%	140%
Bromomethane	4914689		<0.20	<0.20	NA	< 0.20	104%	50%	140%	116%	50%	140%	99%	50%	140%
Carbon Tetrachloride	4914689		<0.20	<0.20	NA	< 0.20	91%	50%	140%	73%	60%	130%	86%	50%	140%
Chlorobenzene	4914689		<0.10	<0.10	NA	< 0.10	73%	50%	140%	89%	60%	130%	93%	50%	140%
Chloroform	4914689		<0.20	<0.20	NA	< 0.20	95%	50%	140%	115%	60%	130%	117%	50%	140%
Dibromochloromethane	4914689		<0.10	<0.10	NA	< 0.10	115%	50%	140%	118%	60%	130%	109%	50%	140%
1,4-Dichlorobenzene	4914689		<0.10	<0.10	NA	< 0.10	90%	50%	140%	93%	60%	130%	105%	50%	140%
1,2-Dichlorobenzene	4914689		<0.10	<0.10	NA	< 0.10	88%	50%	140%	89%	60%	130%	102%	50%	140%
1,3-Dichlorobenzene	4914689		<0.10	<0.10	NA	< 0.10	88%	50%	140%	93%	60%	130%	101%	50%	140%
Dichlorodifluoromethane	4914689		<0.40	<0.40	NA	< 0.40	79%	50%	140%	98%	50%	140%	84%	50%	140%

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. RPDs calculated using raw data. The RPD may not be reflective of duplicate values shown, due to rounding of final results.

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: EXP SERVICES INC
PROJECT: 23003355
SAMPLING SITE:Weavesly H. Delhi

AGAT WORK ORDER: 23L014269
ATTENTION TO: SCOTT AZIZ
SAMPLED BY:MS

Trace Organics Analysis (Continued)

RPT Date: Apr 21, 2023			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
1,2-Dichloroethane	4914689		<0.20	<0.20	NA	< 0.20	91%	50%	140%	99%	60%	130%	111%	50%	140%
1,1-Dichloroethane	4914689		<0.30	<0.30	NA	< 0.30	96%	50%	140%	104%	60%	130%	107%	50%	140%
1,1-Dichloroethylene	4914689		<0.30	<0.30	NA	< 0.30	97%	50%	140%	104%	60%	130%	115%	50%	140%
1,2-Dichloropropane	4914689		<0.20	<0.20	NA	< 0.20	106%	50%	140%	111%	60%	130%	89%	50%	140%
Ethylbenzene	4914689		<0.10	<0.10	NA	< 0.10	71%	50%	140%	76%	60%	130%	82%	50%	140%
Ethylene Dibromide	4914689		<0.10	<0.10	NA	< 0.10	84%	50%	140%	85%	60%	130%	100%	50%	140%
Methyl Ethyl Ketone	4914689		<1.0	<1.0	NA	< 1.0	97%	50%	140%	93%	50%	140%	90%	50%	140%
Methyl Isobutyl Ketone	4914689		<1.0	<1.0	NA	< 1.0	74%	50%	140%	113%	50%	140%	84%	50%	140%
Methyl tert-butyl ether	4914689		<0.20	<0.20	NA	< 0.20	85%	50%	140%	87%	60%	130%	87%	50%	140%
Methylene Chloride	4914689		<0.30	<0.30	NA	< 0.30	103%	50%	140%	107%	60%	130%	110%	50%	140%
Styrene	4914689		<0.10	<0.10	NA	< 0.10	77%	50%	140%	87%	60%	130%	87%	50%	140%
1,1,2,2-Tetrachloroethane	4914689		<0.10	<0.10	NA	< 0.10	85%	50%	140%	87%	60%	130%	100%	50%	140%
1,1,1,2-Tetrachloroethane	4914689		<0.10	<0.10	NA	< 0.10	90%	50%	140%	100%	60%	130%	95%	50%	140%
Tetrachloroethylene	4914689		<0.20	<0.20	NA	< 0.20	84%	50%	140%	87%	60%	130%	94%	50%	140%
Toluene	4914689		<0.20	<0.20	NA	< 0.20	79%	50%	140%	83%	60%	130%	87%	50%	140%
1,1,2-Trichloroethane	4914689		<0.20	<0.20	NA	< 0.20	92%	50%	140%	93%	60%	130%	107%	50%	140%
1,1,1-Trichloroethane	4914689		<0.30	<0.30	NA	< 0.30	98%	50%	140%	99%	60%	130%	113%	50%	140%
Trichloroethylene	4914689		<0.20	<0.20	NA	< 0.20	86%	50%	140%	74%	60%	130%	78%	50%	140%
Trichlorofluoromethane	4914689		<0.40	<0.40	NA	< 0.40	100%	50%	140%	109%	50%	140%	114%	50%	140%
Vinyl Chloride	4914689		<0.17	<0.17	NA	< 0.17	109%	50%	140%	118%	50%	140%	102%	50%	140%
cis- 1,2-Dichloroethylene	4914689		<0.20	<0.20	NA	< 0.20	108%	50%	140%	115%	60%	130%	107%	50%	140%
m & p-Xylene	4914689		<0.20	<0.20	NA	< 0.20	81%	50%	140%	97%	60%	130%	82%	50%	140%
n-Hexane	4914689		<0.20	<0.20	NA	< 0.20	89%	50%	140%	113%	60%	130%	85%	50%	140%
o-Xylene	4914689		<0.10	<0.10	NA	< 0.10	71%	50%	140%	80%	60%	130%	87%	50%	140%
trans- 1,2-Dichloroethylene	4914689		<0.20	<0.20	NA	< 0.20	107%	50%	140%	103%	60%	130%	114%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By: N Popnikolof

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. RPDs calculated using raw data. The RPD may not be reflective of duplicate values shown, due to rounding of final results.

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 23L014269

PROJECT: 23003355

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Weavesly H. Delhi

SAMPLED BY:MS

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Gamma-Hexachlorocyclohexane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Heptachlor	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Aldrin	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Heptachlor Epoxide	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endosulfan I	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endosulfan II	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endosulfan	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
alpha - chlordane	ORG-91-5112	modified from EPA SW846 3510C & 8081B	GC/ECD
gamma-Chlordane	ORG-91-5112	modified from EPA SW846 3510C & 8081B	GC/ECD
Chlordane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
op'-DDE	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
pp'-DDE	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
DDE	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
op'-DDD	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
pp'-DDD	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
DDD	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
op'-DDT	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
pp'-DDT	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
DDT	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
Dieldrin	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endrin	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Methoxychlor	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Hexachlorobenzene	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Hexachlorobutadiene	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Hexachloroethane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
TCMX	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Decachlorobiphenyl	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
F1 (C6 - C10)	VOL-91-5010	modified from MOE PHC-E3421	(P&T)GC/FID

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 23L014269

PROJECT: 23003355

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Weavesly H. Delhi

SAMPLED BY:MS

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
F1 (C6 to C10) minus BTEX	VOL-91-5010	modified from MOE PHC-E3421	(P&T)GC/FID
Toluene-d8	VOL-91- 5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
F2 (C10 to C16)	VOL-91-5010	modified from MOE PHC-E3421	GC/FID
F3 (C16 to C34)	VOL-91-5010	modified from MOE PHC-E3421	GC/FID
F4 (C34 to C50)	VOL-91-5010	modified from MOE PHC-E3421	GC/FID
Gravimetric Heavy Hydrocarbons	VOL-91-5010	modified from MOE PHC-E3421	BALANCE
Terphenyl	VOL-91-5010	modified from MOE PHC-E3421	GC/FID
Sediment			N/A
Acetone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Benzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Bromodichloromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Bromoform	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Bromomethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Chlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Chloroform	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Dibromochloromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,3-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Dichlorodifluoromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1-Dichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichloropropane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,3-Dichloropropene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Ethylbenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Ethylene Dibromide	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methyl Isobutyl Ketone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 23L014269

PROJECT: 23003355

ATTENTION TO: SCOTT AZIZ

SAMPLING SITE:Weavesly H. Delhi

SAMPLED BY:MS

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Methyl tert-butyl ether	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methylene Chloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Styrene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,2,2-Tetrachloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,1,2-Tetrachloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Tetrachloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Toluene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Toluene-d8	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,2-Trichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,1-Trichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Trichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Trichlorofluoromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Vinyl Chloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Xylenes (Total)	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
cis- 1,2-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
m & p-Xylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
n-Hexane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
o-Xylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
trans- 1,2-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 23L014269

Cooler Quantity: 1 mod

Arrival Temperatures: 5.6 | 7.6 | 8.8 / 7.6 | 7.3 | 6.5

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes: on ice

Report Information:

Company: exp Services Inc.
Contact: Scott Aziz
Address: 1701 Robinson Hill Road.

Phone: 5199633000 Fax:

Reports to be sent to:
1. Email: scott.aziz@exp.com, Jennifer.Ellison@exp.com
2. Email: milan.suthar@exp.com

Regulatory Requirements:

(Please check all applicable boxes)

☑ Regulation 153/04
Table (Indicate One): ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One): ☐ Coarse ☐ Fine

☐ Excess Soils R406
Table (Indicate One)

☐ Regulation 558

☐ CCME

☐ Sewer Use ☐ Sanitary ☐ Storm
Region

☐ Prov. Water Quality Objectives (PWQO)

☐ Other
Indicate One

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on *Certificate of Analysis* ☑ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
*TAT is exclusive of weekends and statutory holidays

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 2300335
Site Location: Waverly St., Rothesay
Sampled By: MS
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☐ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC (Y/N)	O. Reg 153: Metals & Inorganics	O. Reg 153: Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	O. Reg 153: BTEX, F1-F4 PHCs	Analyze F4G if required ☐ Yes ☐ No	O. Reg 153: PAHs	O. Reg 153: PCBs	O. Reg 153: VOC	O. Reg 558: Landfill Disposal Characterization TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406: Excess Soils SPLP Rainwater Leach ☐ Metals ☐ VOCs ☐ SVOCs	O. Reg 406: Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Salt - EC/SAR	Potentially Hazardous or High Concentration (Y/N)
BH1/MW	Apr 3/23	AM	7	GW	Silty Sample				X				X				X VOC Rush	
BH2/MW	11	AM	7	GW	Silty Sample				X				X				X	
		AM PM																
		AM PM																
		AM PM																
		AM PM																
		AM PM																
		AM PM																
		AM PM																
		AM PM																
		AM PM																
		AM PM																

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Milan Suthar	Apr 3/23	PM	J. Smith	23-4-13	4:30
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
			duyNET V	04/14/23	5:30pm
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time

Page 1 of 1

Nº: T 128786

DILLON CONSULTING

LANDMARK HOMES INC.

Stormwater Management Report

Proposed Waverly Street Subdivision, Delhi

November 2023 – 22-5115

Table of Contents

1.0 Introduction 1

1.1 Background Information 1
1.1 SWM Design Criteria 1
1.1.1 Quantity Control 1
1.1.2 Quality Control 1
1.1.3 Runoff Volume Control 1

2.0 Existing Conditions 2

1.2 Soils and Groundwater 2
1.3 Existing Conditions Peak Flows 2

3.0 Proposed Conditions 4

3.1 Preliminary SWM Strategy 4
3.2 Minor System 5
3.3 Major System 5
3.4 LID Measures 5
3.5 Dry SWM Pond 6
3.5.1 Quantity Control 6
3.5.2 Quality Control 7

4.0 Conclusions and Recommendations 8

Tables

Table 1: Existing Conditions Calculated Peak Flows 3
Table 2: Calculated Peak Flow Comparison 6
Table 3: Preliminary Dry Pond Design 7

Figures

Figure 1: Existing Drainage Condition
Figure 2: Proposed Drainage Condition

Appendices

A Existing Conditions
B Proposed Conditions
C Calculations

1.0 Introduction

Dillon Consulting Limited (Dillon) has been retained by Landmark Homes Inc. to prepare a stormwater management (SWM) report to support a proposed residential subdivision located east of the Highway 3 (James Street) at Waverly Street intersection and the Highway 3 (James Street) at Brock Avenue intersection in the south end of Delhi, Ontario, in the municipality of Norfolk County. The proposed subdivision includes 45 single-detached dwelling units.

1.1 Background Information

The information presented in the following background documents was used to assist with the development of the proposed SWM strategy.

Norfolk County Integrated Sustainable Master Plan (ISMP) Report, prepared by MMM Group, September 2016.

Geotechnical Investigation, Landmark Homes Inc., prepared by EXP Services Inc., May 2023

1.1 SWM Design Criteria

Stormwater design criteria were developed based on the guidance presented in the Norfolk County Design Criteria (2007), the ISMP, and as-built drawings of the downstream drainage system.

1.1.1 Quantity Control

The peak stormwater flows from the proposed development are attenuated to the available capacity of the existing downstream Waverly Street storm sewer for all evaluated design events up to and including the 100-year storm.

1.1.2 Quality Control

In accordance with the guidance presented in the Norfolk County Design Criteria (2007) the preliminary stormwater management strategy provides “Enhanced” Protection Level water quality treatment to remove 80% of total suspended solids (TSS) from the site runoff.

1.1.3 Runoff Volume Control

The Norfok County Design Criteria states: “The volume of runoff discharged from the site during the 25 mm storm shall not increase as a result of the proposed development. Infiltration measures shall be employed where soils and water table conditions support such measures. “

2.0 Existing Conditions

The existing site is a vacant former industrial property bounded by a former CN rail corridor to the north, a woodlot to the east and south, and both industrial and residential development to the west. Most of the site is currently grassed, with an approximately 0.25 ha concrete pad located near the northwest site corner.

The existing conditions drainage plan shown on Figure 1 shows that stormwater from the subject site drains generally westward to the Waverly Street and Brock Avenue right-of-ways. Stormwater from the site is collected and conveyed to Big Creek by the existing downstream drainage infrastructure.

A brief summary of the existing drainage catchments shown on **Figure 1** is provided below.

Catchment EXT – This external drainage area is comprised of woodlot. Runoff from this catchment travels to the subject property as shallow overland flow.

Catchment 100 – This catchment represents the subject site. All runoff travels westward as shallow overland flow to the existing Waverly Street and Brock Avenue right-of-ways. There are no SWM controls on the existing site.

1.2 Soils and Groundwater

Based on the information presented in the site geotechnical investigation, the existing soils are generally comprised of a layer of topsoil ranging in thickness from 150 mm to 300 mm overlying sands. Groundwater monitoring information suggests that the local groundwater levels are more than 10 m below the ground surface.

1.3 Existing Conditions Peak Flows

Existing conditions hydrologic calculations were calculated using Visual OTTHYMO to estimate the peak flows from the subject site. Design storms were created for the 2-year, 5-year, 10-year, 25-year, 50-year and 100-year event based on the Norfolk County Design Criteria IDF curve and a 4-hour Chicago rainfall distribution. The corresponding existing conditions hydrologic calculations are presented in **Appendix A** and the results are summarized in **Table 1**.

Table 1: Existing Conditions Calculated Peak Flows

Design Event	Peak Discharge from Subject Site (m^3/s)
25 mm	0.006
2-year	0.013
5-year	0.026
10-year	0.037
25-year	0.053
50-year	0.074
100-year	0.082

3.0 Proposed Conditions

The proposed development is low density residential subdivision with 45 single family lots and a SWM block.

3.1 Preliminary SWM Strategy

A preliminary SWM strategy was prepared to control the runoff from the proposed development in accordance with the design SWM control criteria. The proposed SWM strategy is shown on **Figure 2** and includes:

- Local storm sewers to collect and convey the peak flows from all storms up to and including the 5-year event;
- A major system to collect and convey overland flows from storms up to and including the 100-year event;
- Low Impact Development (LID) measures located in the grassed boulevards to provide water quality treatment and runoff volume control; and
- A proposed offline dry SWM pond to provide peak flow control, water quality treatment and runoff volume control.

The proposed SWM strategy is shown on Figure 1 and the corresponding drainage catchments are described in detail below.

Catchment EXT - Both major and minor flows from the external drainage area is collected by proposed rear lot catchbasins and conveyed downstream to Catchment 201. Water quality treatment, runoff volume control, and peak flow control is provided to the runoff from this catchment by the proposed offline dry SWM pond.

Catchment 200 – Both major and minor flows from the proposed rear yards and portions of the proposed rooftops is collected by proposed rear lot catchbasins and conveyed downstream to Catchment 201. Water quality treatment, runoff volume control, and peak flow control is provided to the runoff from this catchment by the proposed offline dry SWM pond.

Catchment 201 – Runoff from the proposed single-family lots and roadways is directed to LID measures located in the proposed boulevards. The proposed LID measures provide water quality treatment, runoff volume control.

Stormwater that is not captured by the proposed LID measures is conveyed downstream by the proposed major and minor system to the proposed dry SWM pond which provides peak flow control.

3.2 Minor System

Minor flows from the development are collected and conveyed by a proposed storm sewer designed to convey the 5-year peak discharge. The proposed storm sewer discharges to the existing Waverly Street storm sewer. A proposed orifice plate limits the peak flows entering the existing Waverly Street storm sewer to pre-development magnitudes. The preliminary storm sewer alignment is shown on **Figure 2**.

3.3 Major System

Major flows from the proposed development are conveyed by the proposed right-of-ways and overland flow routes to the proposed dry SWM pond. The proposed major system is designed to accommodate the runoff from all design events up to and including the 100-year storm. The proposed overland flow route is shown on **Figure 2**.

3.4 LID Measures

LID measures located in the proposed boulevards provide water quality treatment and runoff volume control to the stormwater from Catchment 201. The proposed LID measures are designed to capture the runoff from the 25 mm water quality design storm event. The captured stormwater infiltrates into the native sandy soils. By capturing and infiltrating the runoff from the 25 mm design event, the proposed LID measures meet the requirements for "Enhanced" Protection Level water quality treatment.

Preliminary design calculations were completed to calculate the storage volume and total required footprint of the proposed LID measures. Based on the information presented in the site geotechnical investigation, the anticipated infiltration rates of the existing subsurface soils range from approximately 60 mm/hr to 115 mm/hr. A safety factor of 2 was applied to the minimum reported value, resulting in a design infiltration rate of 30 mm/hr.

Preliminary LID sizing calculations were completed using Visual OTTHYMO to estimate the minimum storage volume required to capture the 25 mm storm event runoff from Catchment 201. The post-development model results presented in Appendix B suggest that approximately 230 m^3 of storage is required. Supporting calculations for the total proposed LID measure footprint are provided in **Appendix C**.

Detailed design of the proposed LID measures will be completed at the subdivision design stage. The proposed LID measure design will incorporate either pre-treatment measures or a filtration strategy to reduce the possibility of suspended sediment entering the subsurface media and negatively affecting the system performance.

3.5 Dry SWM Pond

A proposed offline dry SWM pond provides:

- Peak flow control for all evaluated design events up to and including the 100-year storm; and
- Peak flow control and water quality treatment to the runoff from Catchments 200 and EXT.

The preliminary proposed dry SWM pond design was developed in accordance with both provincial design guidance and the Norfolk County Design Criteria and incorporates:

- 5:1 side slopes;
- 5 m buffers from the pond block limit to the top of pond to accommodate approach grading; and
- 0.3 m of freeboard from the design HWL to the top of pond.

The preliminary stage/storage/discharge curve presented in Appendix C shows that the proposed pond footprint is approximately 0.18 ha, which is smaller than the Draft Plan SWM block area of 0.24 ha.

3.5.1 Quantity Control

The proposed dry SWM pond operates as an offline facility. Peak flows to the existing downstream Waverly Street storm sewer are controlled by a proposed orifice plate located at the site outlet.

The proposed dry SWM pond provides sufficient storage to attenuate the flow from all design events up to and including the 100-year storm.

Hydrologic calculations were completed using Visual OTTHYMO to verify that the proposed dry SWM pond meets the peak discharge requirements. The calculation results are presented in Appendix B and a comparison of the existing conditions and proposed conditions calculated peak flows is presented in the following table.

Table 2: Calculated Peak Flow Comparison

Design Event	Existing Conditions Peak Discharge (m^3/s)	Proposed Conditions Peak Discharge to Waverly Street Storm Sewer (m^3/s)
25 mm	0.006	0.000
2-year	0.013	0.014
5-year	0.026	0.026
10-year	0.037	0.031
25-year	0.053	0.051
50-year	0.074	0.068
100-year	0.082	0.072

A summary of the preliminary pond design volumes and elevations is provided in the following table.

Table 3: Preliminary Dry Pond Design

Design Level	Volume (m^3)	Elevation (m)
Bottom of Pond	0	239.60
25mm Water Level	40	239.80
2-year Water Level	90	240.00
5-year Water Level	220	240.36
10-year Water Level	330	240.60
25-year Water Level	440	240.79
50-year Water Level	570	240.98
100-year Water Level	620	241.05
HWL	810	241.20
Top of Pond	1,010	241.50

3.5.2 Quality Control

The proposed dry SWM pond provides water quality treatment the runoff from Catchments EXT and 200. The proposed dry SWM pond includes approximately 40 m^3 of storage located 0.2 m below the downstream storm sewer outlet control orifice. This storage volume is sufficient to capture the 25 mm design storm event runoff from Catchments EXT and 200. The captured runoff is released from the proposed dry SWM facility via infiltration. By capturing and infiltrating the runoff from the 25 mm design event, the proposed pond meets the requirements for "Enhanced" Protection Level water quality treatment.

4.0 Conclusions and Recommendations

The proposed Waverly Street development is a proposed 45 single family lot residential subdivision. The proposed preliminary SWM strategy includes both infiltration LID measures and a dry SWM pond. The proposed SWM strategy provides peak flow control, water quality treatment, and runoff volume control in accordance with the Norfolk County SWM design criteria.

Detailed design of the proposed SWM strategy will be completed at the subdivision application stage. The proposed LID measures will be designed in consultation with Norfolk County to verify that the proposed system meets the County's requirements for performance and operation and maintenance.

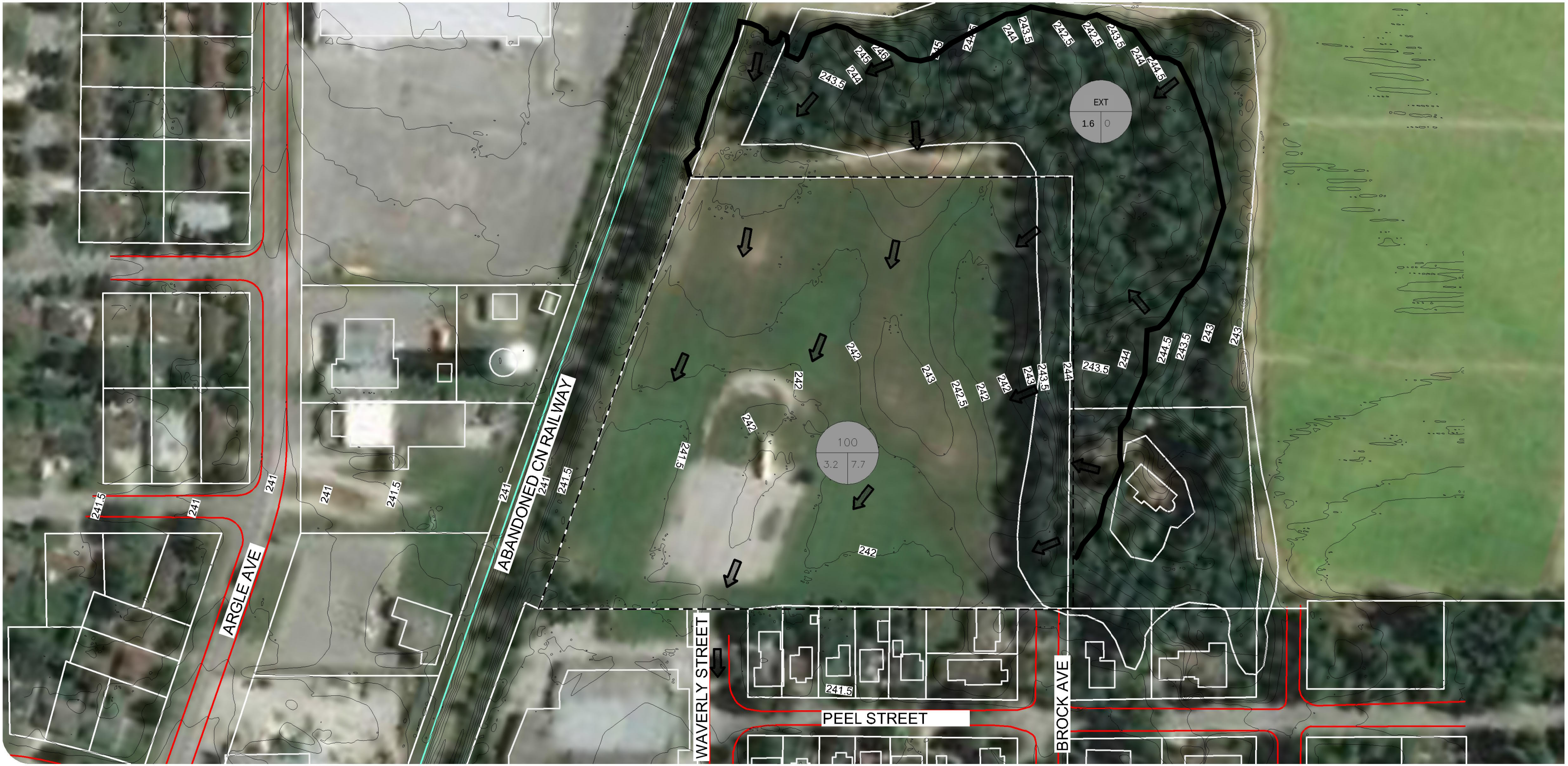
DILLON CONSULTING LIMITED

Prepared by:

Nick Emery, P.Eng.

Water Resources Engineer

Figures



LANDMARK HOMES INC.
WAVERLY STREET, DELHI

FIGURE 1
EXISTING DRAINAGE CONDITIONS

SUBJECT SITE
3.2 ha

OVERLAND FLOW

DRAINAGE BOUNDARY

100
1.00 | 50
CATCHMENT ID
AREA (Ha)
PERCENT IMPERVIOUS

File Location:
c:\pw working directory\projects 2022\dillon_10mn\dms62516\225115-existing conditions - concept 3.dwg
November, 06, 2023 5:26 PM

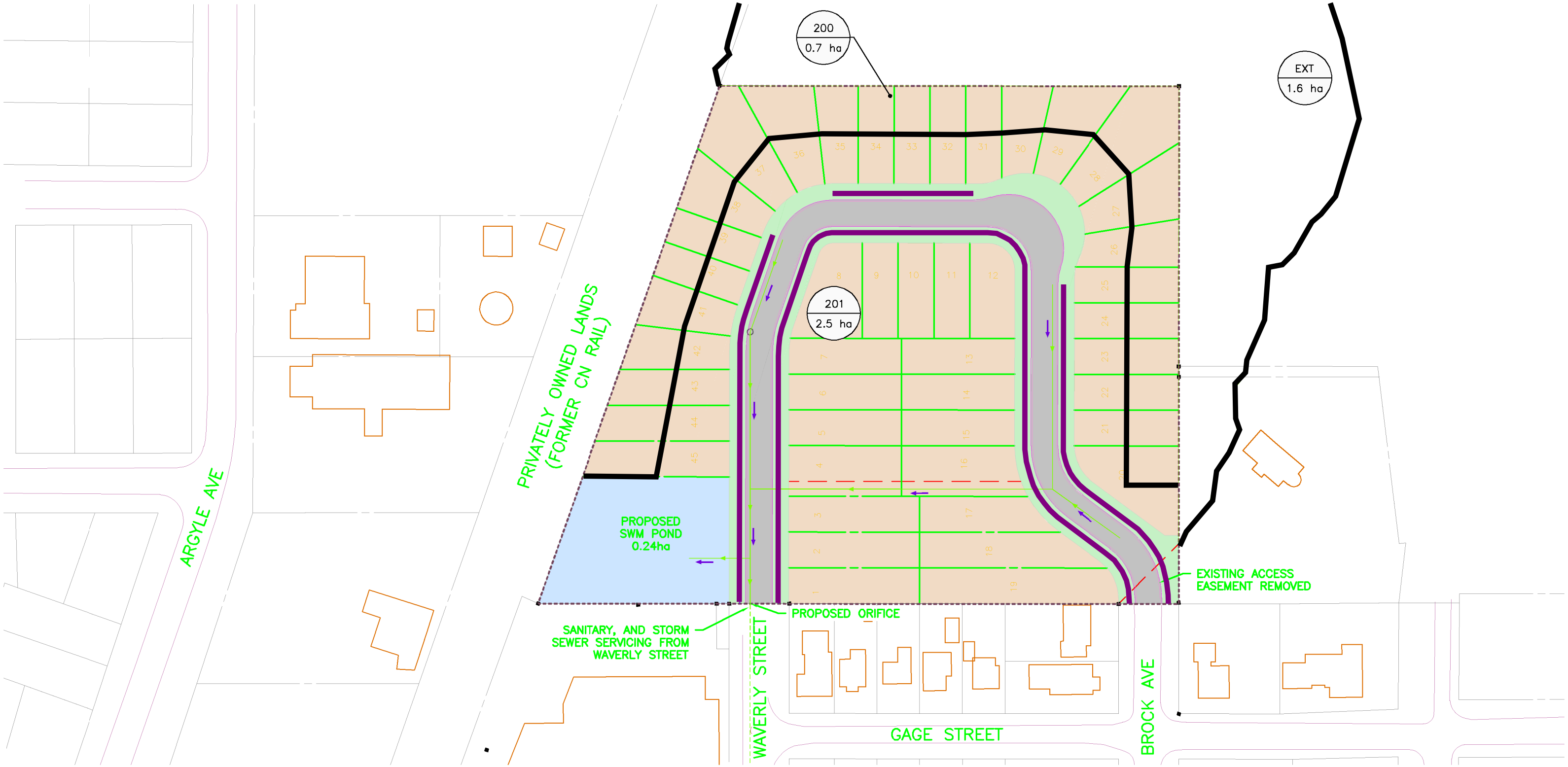
MAP/DRAWING INFORMATION
THIS DRAWING IS FOR INFORMATION PURPOSES ONLY. ALL DIMENSIONS AND BOUNDARY INFORMATION SHOULD BE VERIFIED BY AN O.L.S PRIOR TO CONSTRUCTION.
CREATED BY:
CHECKED BY:
DESIGNED BY:

30 0 30
SCALE 1:1,500 METRES

N E S W

DILLON CONSULTING

PROJECT: 22-5115
STATUS: FINAL
DATE: 08/15/2023



LANDMARK HOMES INC.
WAVERLY STREET, DELHI

FIGURE 2
PROPOSED DRAINAGE CONDITIONS

SUBJECT SITE
3.2 ha

SINGLE DETACHED

PROPOSED ROAD AND SIDEWALK

PROPOSED SWM POND

PROPOSED BOULEVARD

OVERLAND FLOW DIRECTION

POTENTIAL LID LOCATIONS

PROPOSED STORM SEWER

201
2.5 ha
CATCHMENT ID
AREA

File Location:
c:\pw working directory\projects 2022\dillon_10mn\dms62516\concept oct 2023.dwg
October, 31, 2023 11:48 PM

MAP/DRAWING INFORMATION
THIS DRAWING IS FOR INFORMATION PURPOSES ONLY. ALL DIMENSIONS AND BOUNDARY INFORMATION SHOULD BE VERIFIED BY AN O.L.S PRIOR TO CONSTRUCTION.
CREATED BY: CD
CHECKED BY: MTP
DESIGNED BY: CD

SCALE: 1:1250

DILLON CONSULTING

PROJECT: 22-5115
STATUS: DRAFT
DATE: 10/23/2023

Appendix A

Existing Conditions

Subject: Existing Conditions Visual OTTHYMO Inputs
Project: Waverly Street, Delhi
Project No: 22-5115
Client: Landmark Homes Inc.
Date: November 1, 2022

Catchment ID	Area (ha)	SCS Curve Number	Initial Abstraction (mm)	Time to Peak (hr)
EXT	1.60	39	10	0.2
100	3.20	44	5	0.5

```
================================================================================================================

       V    V   I    SSSSS  U   U    A    L             (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\7183a9d9-53c2-499a-a323-
9c91505b5390\scenari
  Summary filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\7183a9d9-53c2-499a-a323-
9c91505b5390\scenari


DATE: 11-03-2023                          TIME: 03:21:36

USER:


COMMENTS: _____________________________________________________

----------------------------------------------------------------------------------------------------------------
  ***********************************************
  ** SIMULATION : 10 YR 3-HR Chicago - County o **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 670.324
| Ptotal= 52.98 mm |                          B=   3.007
--------------------                          C=   0.698
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	5.96	0.75	23.29	1.50	13.58	2.25	7.38
0.08	6.40	0.83	47.83	1.58	12.29	2.33	7.07
0.17	6.92	0.92	156.91	1.67	11.26	2.42	6.78
0.25	7.55	1.00	60.27	1.75	10.41	2.50	6.52
0.33	8.36	1.08	35.44	1.83	9.71	2.58	6.28
0.42	9.40	1.17	25.89	1.92	9.11	2.67	6.07
0.50	10.83	1.25	20.75	2.00	8.59	2.75	5.87
0.58	12.92	1.33	17.50	2.08	8.14	2.83	5.68
0.67	16.35	1.42	15.24	2.17	7.74	2.92	5.51

```
| CALIB             |
| NASHYD   (  0999)|   Area     (ha)=   1.60   Curve Number    (CN)= 30.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=  10.00   # of Linear Res.(N)= 3.00
                     U.H. Tp(hrs)=   0.20

     Unit Hyd Qpeak  (cms)=   0.306

     PEAK FLOW       (cms)=   0.011 (i)
     TIME TO PEAK    (hrs)=   1.250
     RUNOFF VOLUME    (mm)=   2.901
     TOTAL RAINFALL   (mm)=  52.982
     RUNOFF COEFFICIENT   =   0.055

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| ROUTE CHN(  0500)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
```

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	100.50	0.0500	Main Channel
50.00	100.00	0.0500	Main Channel
100.00	100.50	0.0500	Main Channel

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.03	100.03	.173E+02	0.0	0.12	35.64
0.05	100.05	.692E+02	0.1	0.19	22.45
0.08	100.08	.156E+03	0.2	0.24	17.13
0.11	100.11	.277E+03	0.3	0.29	14.14
0.13	100.13	.433E+03	0.6	0.34	12.19

```
       0.16   100.16    .623E+03       1.0          0.39      10.79
       0.18   100.18    .848E+03       1.5          0.43       9.74
       0.21   100.21    .111E+04       2.1          0.47       8.91
       0.24   100.24    .140E+04       2.8          0.51       8.24
       0.26   100.26    .173E+04       3.8          0.54       7.68
       0.29   100.29    .209E+04       4.8          0.58       7.21
       0.32   100.32    .249E+04       6.1          0.61       6.80
       0.34   100.34    .293E+04       7.6          0.65       6.45
       0.37   100.37    .339E+04       9.2          0.68       6.14
       0.39   100.39    .390E+04      11.1          0.71       5.86
       0.42   100.42    .443E+04      13.2          0.74       5.61
       0.45   100.45    .500E+04      15.5          0.77       5.39
       0.47   100.47    .561E+04      18.0          0.80       5.19
       0.50   100.50    .625E+04      20.8          0.83       5.01

                                  <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
   INFLOW : ID= 2 (  0999)    1.60     0.01    1.25   2.90      0.03      0.12
   OUTFLOW: ID= 1 (  0500)    1.60     0.01    1.83   2.79      0.02      0.12



--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0100)|   Area     (ha)=   3.20   Curve Number    (CN)= 44.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.50

     Unit Hyd Qpeak  (cms)=   0.244

     PEAK FLOW       (cms)=   0.031 (i)
     TIME TO PEAK    (hrs)=   1.750
     RUNOFF VOLUME    (mm)=   6.201
     TOTAL RAINFALL   (mm)=  52.982
     RUNOFF COEFFICIENT   =   0.117

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0200)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0100):     3.20   0.031     1.75     6.20
      + ID2= 2 (  0500):     1.60   0.006     1.83     2.79
        ================================================
        ID = 3 (  0200):     4.80   0.037     1.75     5.06
```

```
     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
==============================================================================

       V    V   I    SSSSS  U   U    A    L             (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\49806a83-69f5-41f3-94dd-
33445fa652f4\scenari
  Summary filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\49806a83-69f5-41f3-94dd-
33445fa652f4\scenari


DATE: 11-03-2023                          TIME: 03:21:35

USER:


COMMENTS: _____________________________________________________________


------------------------------------------------------------------------------------------------------------------------
  ***********************************************
  ** SIMULATION : 100 YR 3-HR Chicago - County  **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 801.041
| Ptotal= 78.82 mm |                          B=   1.501
--------------------                          C=   0.657
                       used in:   INTENSITY =  A / (t + B)^C
```

```
                        Duration of storm  =  3.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    9.80 |  0.75   33.56 |  1.50   20.74 |  2.25   11.93
                0.08   10.46 |  0.83   64.21 |  1.58   18.96 |  2.33   11.46
                0.17   11.24 |  0.92  234.17 |  1.67   17.52 |  2.42   11.03
                0.25   12.18 |  1.00   79.66 |  1.75   16.33 |  2.50   10.64
                0.33   13.36 |  1.08   48.82 |  1.83   15.32 |  2.58   10.29
                0.42   14.87 |  1.17   36.89 |  1.92   14.45 |  2.67    9.96
                0.50   16.91 |  1.25   30.30 |  2.00   13.70 |  2.75    9.66
                0.58   19.83 |  1.33   26.03 |  2.08   13.04 |  2.83    9.38
                0.67   24.50 |  1.42   23.01 |  2.17   12.46 |  2.92    9.12


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0999)|   Area    (ha)=   1.60   Curve Number   (CN)= 30.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

     Unit Hyd Qpeak  (cms)=   0.306

     PEAK FLOW       (cms)=   0.027 (i)
     TIME TO PEAK    (hrs)=   1.250
     RUNOFF VOLUME    (mm)=   7.145
     TOTAL RAINFALL   (mm)=  78.816
     RUNOFF COEFFICIENT   =   0.091

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0500)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00        100.50        0.0500      Main Channel
                  50.00        100.00        0.0500      Main Channel
                 100.00        100.50        0.0500      Main Channel

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
         (m)     (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.03   100.03    .173E+02       0.0          0.12      35.64
       0.05   100.05    .692E+02       0.1          0.19      22.45
```

```
       0.08   100.08    .156E+03       0.2          0.24      17.13
       0.11   100.11    .277E+03       0.3          0.29      14.14
       0.13   100.13    .433E+03       0.6          0.34      12.19
       0.16   100.16    .623E+03       1.0          0.39      10.79
       0.18   100.18    .848E+03       1.5          0.43       9.74
       0.21   100.21    .111E+04       2.1          0.47       8.91
       0.24   100.24    .140E+04       2.8          0.51       8.24
       0.26   100.26    .173E+04       3.8          0.54       7.68
       0.29   100.29    .209E+04       4.8          0.58       7.21
       0.32   100.32    .249E+04       6.1          0.61       6.80
       0.34   100.34    .293E+04       7.6          0.65       6.45
       0.37   100.37    .339E+04       9.2          0.68       6.14
       0.39   100.39    .390E+04      11.1          0.71       5.86
       0.42   100.42    .443E+04      13.2          0.74       5.61
       0.45   100.45    .500E+04      15.5          0.77       5.39
       0.47   100.47    .561E+04      18.0          0.80       5.19
       0.50   100.50    .625E+04      20.8          0.83       5.01

                                  <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
   INFLOW : ID= 2 (  0999)    1.60     0.03    1.25   7.15      0.04      0.14
   OUTFLOW: ID= 1 (  0500)    1.60     0.02    1.75   7.03      0.03      0.12



--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0100)|   Area     (ha)=   3.20   Curve Number    (CN)= 44.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.50

     Unit Hyd Qpeak  (cms)=   0.244

     PEAK FLOW       (cms)=   0.067 (i)
     TIME TO PEAK    (hrs)=   1.667
     RUNOFF VOLUME    (mm)=  13.721
     TOTAL RAINFALL   (mm)=  78.816
     RUNOFF COEFFICIENT   =   0.174

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0200)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0100):     3.20   0.067     1.67    13.72
```

```
      + ID2= 2 (  0500):     1.60   0.015     1.75     7.03
        ================================================
        ID = 3 (  0200):     4.80   0.082     1.67    11.49

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
================================================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\d93736f2-a730-4467-8fc1-
b2e2f9d2f863\scenari
  Summary filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\d93736f2-a730-4467-8fc1-
b2e2f9d2f863\scenari


DATE: 11-03-2023                          TIME: 03:21:36

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------------------------------------------
  ********************************************
  ** SIMULATION : 2 YR 3-HR Chicago - County of **
  ********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 529.711
| Ptotal= 32.58 mm |                          B=   4.501
```

```
--------------------                            C=   0.745
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  3.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =  0.33

                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.00    3.22 |  0.75   14.72 |  1.50    8.03 |  2.25    4.07
                  0.08    3.48 |  0.83   32.16 |  1.58    7.18 |  2.33    3.88
                  0.17    3.79 |  0.92   98.99 |  1.67    6.51 |  2.42    3.71
                  0.25    4.18 |  1.00   40.96 |  1.75    5.97 |  2.50    3.55
                  0.33    4.67 |  1.08   23.39 |  1.83    5.52 |  2.58    3.41
                  0.42    5.32 |  1.17   16.55 |  1.92    5.14 |  2.67    3.28
                  0.50    6.23 |  1.25   12.92 |  2.00    4.82 |  2.75    3.16
                  0.58    7.59 |  1.33   10.68 |  2.08    4.53 |  2.83    3.05
                  0.67    9.90 |  1.42    9.14 |  2.17    4.29 |  2.92    2.95


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0999)|   Area    (ha)=   1.60   Curve Number   (CN)= 30.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

     Unit Hyd Qpeak  (cms)=   0.306

     PEAK FLOW       (cms)=   0.003 (i)
     TIME TO PEAK    (hrs)=   1.333
     RUNOFF VOLUME    (mm)=   0.827
     TOTAL RAINFALL   (mm)=  32.578
     RUNOFF COEFFICIENT   =   0.025

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0500)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00        100.50        0.0500      Main Channel
                  50.00        100.00        0.0500      Main Channel
                 100.00        100.50        0.0500      Main Channel

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
```

```
        (m)       (m)      (cu.m.)       (cms)         (m/s)       (min)
       0.03    100.03    .173E+02        0.0          0.12       35.64
       0.05    100.05    .692E+02        0.1          0.19       22.45
       0.08    100.08    .156E+03        0.2          0.24       17.13
       0.11    100.11    .277E+03        0.3          0.29       14.14
       0.13    100.13    .433E+03        0.6          0.34       12.19
       0.16    100.16    .623E+03        1.0          0.39       10.79
       0.18    100.18    .848E+03        1.5          0.43        9.74
       0.21    100.21    .111E+04        2.1          0.47        8.91
       0.24    100.24    .140E+04        2.8          0.51        8.24
       0.26    100.26    .173E+04        3.8          0.54        7.68
       0.29    100.29    .209E+04        4.8          0.58        7.21
       0.32    100.32    .249E+04        6.1          0.61        6.80
       0.34    100.34    .293E+04        7.6          0.65        6.45
       0.37    100.37    .339E+04        9.2          0.68        6.14
       0.39    100.39    .390E+04       11.1          0.71        5.86
       0.42    100.42    .443E+04       13.2          0.74        5.61
       0.45    100.45    .500E+04       15.5          0.77        5.39
       0.47    100.47    .561E+04       18.0          0.80        5.19
       0.50    100.50    .625E+04       20.8          0.83        5.01

                                  <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
   INFLOW : ID= 2 (  0999)    1.60     0.00    1.33   0.83      0.01      0.12
   OUTFLOW: ID= 1 (  0500)    1.60     0.00    1.92   0.76      0.01      0.12


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0100)|   Area     (ha)=   3.20   Curve Number    (CN)= 44.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.50

     Unit Hyd Qpeak  (cms)=   0.244

     PEAK FLOW       (cms)=   0.011 (i)
     TIME TO PEAK    (hrs)=   1.750
     RUNOFF VOLUME    (mm)=   2.167
     TOTAL RAINFALL   (mm)=  32.578
     RUNOFF COEFFICIENT   =   0.067

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0200)|
```

```
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)      (mm)
        ID1= 1 (  0100):     3.20   0.011     1.75     2.17
      + ID2= 2 (  0500):     1.60   0.002     1.92     0.76
        ================================================
        ID = 3 (  0200):     4.80   0.013     1.75     1.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

 FINISH
================================================================================================================

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\78998ea5-13fc-4221-a4ef-
77cd58dd4cdd\scenari
  Summary filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\78998ea5-13fc-4221-a4ef-
77cd58dd4cdd\scenari


DATE: 11-03-2023                          TIME: 03:21:36

USER:


COMMENTS: _____________________________________________________

--------------------------------------------------------------------------------------------------------------
```

```
  ********************************************
  ** SIMULATION : 25 YR 3-HR Chicago - County o **
  ********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 721.533
| Ptotal= 63.14 mm |                          B=   2.253
--------------------                          C=   0.679
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    7.44 |  0.75   27.30 |  1.50   16.36 |  2.25    9.15
                0.08    7.97 |  0.83   54.38 |  1.58   14.88 |  2.33    8.77
                0.17    8.59 |  0.92  187.92 |  1.67   13.69 |  2.42    8.43
                0.25    9.35 |  1.00   68.12 |  1.75   12.71 |  2.50    8.12
                0.33   10.29 |  1.08   40.69 |  1.83   11.88 |  2.58    7.83
                0.42   11.52 |  1.17   30.18 |  1.92   11.18 |  2.67    7.57
                0.50   13.19 |  1.25   24.47 |  2.00   10.57 |  2.75    7.33
                0.58   15.60 |  1.33   20.82 |  2.08   10.04 |  2.83    7.11
                0.67   19.52 |  1.42   18.26 |  2.17    9.57 |  2.92    6.90


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0999)|   Area    (ha)=   1.60   Curve Number   (CN)= 30.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

     Unit Hyd Qpeak  (cms)=   0.306

     PEAK FLOW       (cms)=   0.016 (i)
     TIME TO PEAK    (hrs)=   1.250
     RUNOFF VOLUME    (mm)=   4.364
     TOTAL RAINFALL   (mm)=  63.140
     RUNOFF COEFFICIENT   =   0.069

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0500)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
```

Distance	Elevation	Manning	
0.00	100.50	0.0500	Main Channel
50.00	100.00	0.0500	Main Channel
100.00	100.50	0.0500	Main Channel

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.03	100.03	.173E+02	0.0	0.12	35.64
0.05	100.05	.692E+02	0.1	0.19	22.45
0.08	100.08	.156E+03	0.2	0.24	17.13
0.11	100.11	.277E+03	0.3	0.29	14.14
0.13	100.13	.433E+03	0.6	0.34	12.19
0.16	100.16	.623E+03	1.0	0.39	10.79
0.18	100.18	.848E+03	1.5	0.43	9.74
0.21	100.21	.111E+04	2.1	0.47	8.91
0.24	100.24	.140E+04	2.8	0.51	8.24
0.26	100.26	.173E+04	3.8	0.54	7.68
0.29	100.29	.209E+04	4.8	0.58	7.21
0.32	100.32	.249E+04	6.1	0.61	6.80
0.34	100.34	.293E+04	7.6	0.65	6.45
0.37	100.37	.339E+04	9.2	0.68	6.14
0.39	100.39	.390E+04	11.1	0.71	5.86
0.42	100.42	.443E+04	13.2	0.74	5.61
0.45	100.45	.500E+04	15.5	0.77	5.39
0.47	100.47	.561E+04	18.0	0.80	5.19
0.50	100.50	.625E+04	20.8	0.83	5.01

	<---- hydrograph ----> AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	<-pipe / channel-> MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0999)	1.60	0.02	1.25	4.36	0.03	0.13
OUTFLOW: ID= 1 (0500)	1.60	0.01	1.75	4.26	0.03	0.12

CALIB NASHYD (0100) ID= 1 DT= 5.0 min	Area (ha)= 3.20	Curve Number (CN)= 44.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.50	

Unit Hyd Qpeak (cms)= 0.244

PEAK FLOW (cms)= 0.044 (i)
TIME TO PEAK (hrs)= 1.667
RUNOFF VOLUME (mm)= 8.862
TOTAL RAINFALL (mm)= 63.140
RUNOFF COEFFICIENT = 0.140

```
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0200)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)      (mm)
        ID1= 1 (  0100):     3.20   0.044     1.67     8.86
      + ID2= 2 (  0500):     1.60   0.009     1.75     4.26
        ================================================
        ID = 3 (  0200):     4.80   0.053     1.75     7.33

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
==============================================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\99e332d6-e777-45f4-b6ca-
55d615d5bdc8\scenari
  Summary filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\99e332d6-e777-45f4-b6ca-
55d615d5bdc8\scenari


DATE: 11-03-2023                          TIME: 03:21:35

USER:


COMMENTS: _____________________________________________________________
```

```
---------------------------------------------------------------------------------------------------------------
  **********************************************
  ** SIMULATION : 25mm Water Quality Event      **
  **********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 538.850
| Ptotal= 25.05 mm |                          B=   6.331
--------------------                          C=   0.809
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    1.42 |  1.00    6.93 |  2.00    4.25 |  3.00    1.92
                0.08    1.51 |  1.08   10.96 |  2.08    3.84 |  3.08    1.84
                0.17    1.61 |  1.17   25.75 |  2.17    3.51 |  3.17    1.77
                0.25    1.74 |  1.25   75.61 |  2.25    3.23 |  3.25    1.71
                0.33    1.88 |  1.33   33.15 |  2.33    2.99 |  3.33    1.64
                0.42    2.06 |  1.42   18.38 |  2.42    2.79 |  3.42    1.59
                0.50    2.27 |  1.50   12.51 |  2.50    2.62 |  3.50    1.53
                0.58    2.54 |  1.58    9.43 |  2.58    2.47 |  3.58    1.49
                0.67    2.89 |  1.67    7.56 |  2.67    2.33 |  3.67    1.44
                0.75    3.36 |  1.75    6.32 |  2.75    2.21 |  3.75    1.40
                0.83    4.04 |  1.83    5.43 |  2.83    2.11 |  3.83    1.36
                0.92    5.09 |  1.92    4.76 |  2.92    2.01 |  3.92    1.32


---------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0999)|   Area    (ha)=   1.60   Curve Number   (CN)= 30.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

     Unit Hyd Qpeak  (cms)=   0.306

     PEAK FLOW       (cms)=   0.001 (i)
     TIME TO PEAK    (hrs)=   1.750
     RUNOFF VOLUME    (mm)=   0.372
     TOTAL RAINFALL   (mm)=  25.047
     RUNOFF COEFFICIENT   =   0.015

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0500)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00        100.50        0.0500      Main Channel
                  50.00        100.00        0.0500      Main Channel
                 100.00        100.50        0.0500      Main Channel

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
         (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.03   100.03    .173E+02       0.0          0.12      35.64
       0.05   100.05    .692E+02       0.1          0.19      22.45
       0.08   100.08    .156E+03       0.2          0.24      17.13
       0.11   100.11    .277E+03       0.3          0.29      14.14
       0.13   100.13    .433E+03       0.6          0.34      12.19
       0.16   100.16    .623E+03       1.0          0.39      10.79
       0.18   100.18    .848E+03       1.5          0.43       9.74
       0.21   100.21    .111E+04       2.1          0.47       8.91
       0.24   100.24    .140E+04       2.8          0.51       8.24
       0.26   100.26    .173E+04       3.8          0.54       7.68
       0.29   100.29    .209E+04       4.8          0.58       7.21
       0.32   100.32    .249E+04       6.1          0.61       6.80
       0.34   100.34    .293E+04       7.6          0.65       6.45
       0.37   100.37    .339E+04       9.2          0.68       6.14
       0.39   100.39    .390E+04      11.1          0.71       5.86
       0.42   100.42    .443E+04      13.2          0.74       5.61
       0.45   100.45    .500E+04      15.5          0.77       5.39
       0.47   100.47    .561E+04      18.0          0.80       5.19
       0.50   100.50    .625E+04      20.8          0.83       5.01

                                  <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
   INFLOW : ID= 2 (  0999)    1.60     0.00    1.75   0.37      0.00      0.12
   OUTFLOW: ID= 1 (  0500)    1.60     0.00    2.25   0.35      0.00      0.12



--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0100)|   Area     (ha)=   3.20   Curve Number    (CN)= 44.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.50

     Unit Hyd Qpeak  (cms)=   0.244
```

```
     PEAK FLOW       (cms)=   0.006 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=   1.170
     TOTAL RAINFALL   (mm)=  25.047
     RUNOFF COEFFICIENT   =   0.047

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0200)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)      (mm)
        ID1= 1 (  0100):     3.20   0.006     2.08     1.17
      + ID2= 2 (  0500):     1.60   0.001     2.25     0.35
        ====================================================
        ID = 3 (  0200):     4.80   0.006     2.08     0.90

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
================================================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\57c45b3b-5756-4e6c-be79-
abfc8f28e2bb\scenari
  Summary filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\57c45b3b-5756-4e6c-be79-
abfc8f28e2bb\scenari


DATE: 11-03-2023                          TIME: 03:21:35
```

USER:

COMMENTS: _____

```
---------------------------------------------------------------------------------------------------------------
  ***********************************************
  ** SIMULATION : 5 YR 3-HR Chicago - County of **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 583.071
| Ptotal= 44.90 mm |                          B=   3.007
--------------------                          C=   0.703
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  3.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    4.98 |  0.75   19.68 |  1.50   11.41 |  2.25    6.17
                0.08    5.34 |  0.83   40.72 |  1.58   10.32 |  2.33    5.91
                0.17    5.78 |  0.92  135.08 |  1.67    9.45 |  2.42    5.67
                0.25    6.32 |  1.00   51.41 |  1.75    8.73 |  2.50    5.45
                0.33    6.99 |  1.08   30.07 |  1.83    8.14 |  2.58    5.25
                0.42    7.87 |  1.17   21.89 |  1.92    7.63 |  2.67    5.06
                0.50    9.08 |  1.25   17.51 |  2.00    7.19 |  2.75    4.90
                0.58   10.85 |  1.33   14.74 |  2.08    6.81 |  2.83    4.74
                0.67   13.77 |  1.42   12.83 |  2.17    6.47 |  2.92    4.60


---------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0999)|   Area    (ha)=   1.60   Curve Number   (CN)= 30.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

     Unit Hyd Qpeak  (cms)=   0.306

     PEAK FLOW       (cms)=   0.007 (i)
     TIME TO PEAK    (hrs)=   1.333
     RUNOFF VOLUME    (mm)=   1.937
     TOTAL RAINFALL   (mm)=  44.901
     RUNOFF COEFFICIENT   =   0.043
```

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0500)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00        100.50        0.0500      Main Channel
                  50.00        100.00        0.0500      Main Channel
                 100.00        100.50        0.0500      Main Channel

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
         (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.03   100.03    .173E+02       0.0          0.12      35.64
       0.05   100.05    .692E+02       0.1          0.19      22.45
       0.08   100.08    .156E+03       0.2          0.24      17.13
       0.11   100.11    .277E+03       0.3          0.29      14.14
       0.13   100.13    .433E+03       0.6          0.34      12.19
       0.16   100.16    .623E+03       1.0          0.39      10.79
       0.18   100.18    .848E+03       1.5          0.43       9.74
       0.21   100.21    .111E+04       2.1          0.47       8.91
       0.24   100.24    .140E+04       2.8          0.51       8.24
       0.26   100.26    .173E+04       3.8          0.54       7.68
       0.29   100.29    .209E+04       4.8          0.58       7.21
       0.32   100.32    .249E+04       6.1          0.61       6.80
       0.34   100.34    .293E+04       7.6          0.65       6.45
       0.37   100.37    .339E+04       9.2          0.68       6.14
       0.39   100.39    .390E+04      11.1          0.71       5.86
       0.42   100.42    .443E+04      13.2          0.74       5.61
       0.45   100.45    .500E+04      15.5          0.77       5.39
       0.47   100.47    .561E+04      18.0          0.80       5.19
       0.50   100.50    .625E+04      20.8          0.83       5.01

                                  <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
   INFLOW : ID= 2 (  0999)   1.60     0.01    1.33   1.94      0.02      0.12
   OUTFLOW: ID= 1 (  0500)   1.60     0.00    1.83   1.82      0.01      0.12


--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0100)|   Area     (ha)=   3.20   Curve Number    (CN)= 44.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
```

```
--------------------   U.H. Tp(hrs)=   0.50

     Unit Hyd Qpeak  (cms)=   0.244

     PEAK FLOW       (cms)=   0.022 (i)
     TIME TO PEAK    (hrs)=   1.750
     RUNOFF VOLUME    (mm)=   4.383
     TOTAL RAINFALL   (mm)=  44.901
     RUNOFF COEFFICIENT   =   0.098

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0200)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)      (mm)
       ID1= 1 (  0100):     3.20   0.022     1.75     4.38
     + ID2= 2 (  0500):     1.60   0.004     1.83     1.82
       ================================================
       ID = 3 (  0200):     4.80   0.026     1.75     3.53

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
================================================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\cb89f9da-bf8c-4501-b3c9-
922f5c588d45\scenari
  Summary filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\cb89f9da-bf8c-4501-b3c9-
922f5c588d45\scenari
```

```
DATE: 11-03-2023                          TIME: 03:21:36

USER:


COMMENTS: _____________________________________________________

--------------------------------------------------------------------------------------------------------------------
  ***********************************************
  ** SIMULATION : 50 YR 3-HR Chicago - County o **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 766.038
| Ptotal= 75.22 mm |                          B=   1.898
--------------------                          C=   0.657
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00   10.16 |  0.83  150.54 |  1.67   15.55 |  2.50    9.82
                0.17   11.90 |  1.00   46.46 |  1.83   13.78 |  2.67    9.22
                0.33   14.65 |  1.17   28.76 |  2.00   12.44 |  2.83    8.70
                0.50   19.94 |  1.33   21.88 |  2.17   11.38 |
                0.67   37.59 |  1.50   18.04 |  2.33   10.53 |


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0999)|   Area    (ha)=   1.60   Curve Number   (CN)= 30.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083   10.16 | 0.833   37.59 | 1.583   18.04 |  2.33   11.38
               0.167   10.16 | 0.917  150.54 | 1.667   18.04 |  2.42   10.53
```

```
                0.250   11.90 | 1.000  150.54 | 1.750   15.55 |  2.50   10.53
                0.333   11.90 | 1.083   46.46 | 1.833   15.55 |  2.58    9.82
                0.417   14.65 | 1.167   46.46 | 1.917   13.78 |  2.67    9.82
                0.500   14.65 | 1.250   28.76 | 2.000   13.78 |  2.75    9.22
                0.583   19.94 | 1.333   28.76 | 2.083   12.44 |  2.83    9.22
                0.667   19.94 | 1.417   21.88 | 2.167   12.44 |  2.92    8.70
                0.750   37.59 | 1.500   21.88 | 2.250   11.38 |  3.00    8.70

     Unit Hyd Qpeak  (cms)=   0.306

     PEAK FLOW       (cms)=   0.023 (i)
     TIME TO PEAK    (hrs)=   1.167
     RUNOFF VOLUME    (mm)=   6.453
     TOTAL RAINFALL   (mm)=  75.222
     RUNOFF COEFFICIENT   =   0.086

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0500)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00        100.50        0.0500      Main Channel
                  50.00        100.00        0.0500      Main Channel
                 100.00        100.50        0.0500      Main Channel

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
         (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        0.03   100.03    .173E+02       0.0          0.12      35.64
        0.05   100.05    .692E+02       0.1          0.19      22.45
        0.08   100.08    .156E+03       0.2          0.24      17.13
        0.11   100.11    .277E+03       0.3          0.29      14.14
        0.13   100.13    .433E+03       0.6          0.34      12.19
        0.16   100.16    .623E+03       1.0          0.39      10.79
        0.18   100.18    .848E+03       1.5          0.43       9.74
        0.21   100.21    .111E+04       2.1          0.47       8.91
        0.24   100.24    .140E+04       2.8          0.51       8.24
        0.26   100.26    .173E+04       3.8          0.54       7.68
        0.29   100.29    .209E+04       4.8          0.58       7.21
        0.32   100.32    .249E+04       6.1          0.61       6.80
        0.34   100.34    .293E+04       7.6          0.65       6.45
        0.37   100.37    .339E+04       9.2          0.68       6.14
        0.39   100.39    .390E+04      11.1          0.71       5.86
        0.42   100.42    .443E+04      13.2          0.74       5.61
        0.45   100.45    .500E+04      15.5          0.77       5.39
        0.47   100.47    .561E+04      18.0          0.80       5.19
```

```
       0.50   100.50    .625E+04      20.8          0.83       5.01

                                  <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
   INFLOW : ID= 2 (  0999)    1.60     0.02    1.17   6.45      0.04      0.13
   OUTFLOW: ID= 1 (  0500)    1.60     0.01    1.67   6.34      0.03      0.12



--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0100)|   Area    (ha)=   3.20   Curve Number   (CN)= 44.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.50

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083   10.16 | 0.833   37.59 | 1.583   18.04 |  2.33   11.38
               0.167   10.16 | 0.917  150.54 | 1.667   18.04 |  2.42   10.53
               0.250   11.90 | 1.000  150.54 | 1.750   15.55 |  2.50   10.53
               0.333   11.90 | 1.083   46.46 | 1.833   15.55 |  2.58    9.82
               0.417   14.65 | 1.167   46.46 | 1.917   13.78 |  2.67    9.82
               0.500   14.65 | 1.250   28.76 | 2.000   13.78 |  2.75    9.22
               0.583   19.94 | 1.333   28.76 | 2.083   12.44 |  2.83    9.22
               0.667   19.94 | 1.417   21.88 | 2.167   12.44 |  2.92    8.70
               0.750   37.59 | 1.500   21.88 | 2.250   11.38 |  3.00    8.70

     Unit Hyd Qpeak  (cms)=   0.244

     PEAK FLOW       (cms)=   0.061 (i)
     TIME TO PEAK    (hrs)=   1.667
     RUNOFF VOLUME    (mm)=  12.531
     TOTAL RAINFALL   (mm)=  75.222
     RUNOFF COEFFICIENT   =   0.167

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0200)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)      (mm)
        ID1= 1 (  0100):     3.20   0.061     1.67    12.53
```

```
      + ID2= 2 (  0500):     1.60   0.013     1.67      6.34
        ================================================
        ID = 3 (  0200):     4.80   0.074     1.67     10.47

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
```

Appendix B

Proposed Conditions

Subject: Proposed Conditions Visual OTTHYMO Inputs
Project: Waverly Street, Delhi
Project No: 22-5115
Client: Landmark Homes Inc.
Date: November 1, 2022

Catchment ID	Area (ha)	TIMP	XIMP	SCS Curve Number	Pervious Depression Storage (mm)	Pervious Slope (%)	Pervious Flow Length (m)	Pervious Roughness	Impervious Depression Storage (mm)	Impervious Slope (%)	impervious Flow Length (m)	Impervious Roughness	Initial Abstraction (mm)	Time to Peak (min)
EXT	1.60												10	0.2
200	0.70	0.55	0.20	39	5	2	20	0.25	2	1	20	0.013		
201	2.50	0.55	0.45	39	5	2	35	0.25	2	1	130	0.013		

```
================================================================================================================

       V    V   I    SSSSS  U   U    A    L             (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\44c863cd-61fd-46b0-9afe-
c84b20abdef2\scenari
  Summary filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\44c863cd-61fd-46b0-9afe-
c84b20abdef2\scenari


DATE: 11-06-2023                          TIME: 03:25:22

USER:


COMMENTS: _____________________________________________________

----------------------------------------------------------------------------------------------------------------
  ********************************************
  ** SIMULATION : 10 YR 3-HR Chicago - County o **
  ********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 670.324
| Ptotal= 52.98 mm |                          B=   3.007
--------------------                          C=   0.698
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	5.96	0.75	23.29	1.50	13.58	2.25	7.38
0.08	6.40	0.83	47.83	1.58	12.29	2.33	7.07
0.17	6.92	0.92	156.91	1.67	11.26	2.42	6.78
0.25	7.55	1.00	60.27	1.75	10.41	2.50	6.52
0.33	8.36	1.08	35.44	1.83	9.71	2.58	6.28
0.42	9.40	1.17	25.89	1.92	9.11	2.67	6.07
0.50	10.83	1.25	20.75	2.00	8.59	2.75	5.87
0.58	12.92	1.33	17.50	2.08	8.14	2.83	5.68
0.67	16.35	1.42	15.24	2.17	7.74	2.92	5.51

CALIB	STANDHYD (0201)	ID= 1 DT= 1.0 min

Area (ha)= 2.50
Total Imp(%)= 55.00 Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	1.38	1.12
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	130.00	35.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	5.96	0.767	23.29	1.517	13.58	2.27	7.38
0.033	5.96	0.783	23.29	1.533	13.58	2.28	7.38
0.050	5.96	0.800	23.29	1.550	13.58	2.30	7.38
0.067	5.96	0.817	23.29	1.567	13.58	2.32	7.38
0.083	5.96	0.833	23.29	1.583	13.58	2.33	7.38
0.100	6.40	0.850	47.83	1.600	12.29	2.35	7.07
0.117	6.40	0.867	47.83	1.617	12.29	2.37	7.07
0.133	6.40	0.883	47.83	1.633	12.29	2.38	7.07
0.150	6.40	0.900	47.83	1.650	12.29	2.40	7.07
0.167	6.40	0.917	47.83	1.667	12.29	2.42	7.07
0.183	6.92	0.933	156.91	1.683	11.26	2.43	6.78
0.200	6.92	0.950	156.91	1.700	11.26	2.45	6.78
0.217	6.92	0.967	156.91	1.717	11.26	2.47	6.78
0.233	6.92	0.983	156.91	1.733	11.26	2.48	6.78
0.250	6.92	1.000	156.91	1.750	11.26	2.50	6.78
0.267	7.55	1.017	60.27	1.767	10.41	2.52	6.52
0.283	7.55	1.033	60.27	1.783	10.41	2.53	6.52

0.300	7.55	1.050	60.27	1.800	10.41	2.55	6.52
0.317	7.55	1.067	60.27	1.817	10.41	2.57	6.52
0.333	7.55	1.083	60.27	1.833	10.41	2.58	6.52
0.350	8.36	1.100	35.44	1.850	9.71	2.60	6.28
0.367	8.36	1.117	35.44	1.867	9.71	2.62	6.28
0.383	8.36	1.133	35.44	1.883	9.71	2.63	6.28
0.400	8.36	1.150	35.44	1.900	9.71	2.65	6.28
0.417	8.36	1.167	35.44	1.917	9.71	2.67	6.28
0.433	9.40	1.183	25.89	1.933	9.11	2.68	6.07
0.450	9.40	1.200	25.89	1.950	9.11	2.70	6.07
0.467	9.40	1.217	25.89	1.967	9.11	2.72	6.07
0.483	9.40	1.233	25.89	1.983	9.11	2.73	6.07
0.500	9.40	1.250	25.89	2.000	9.11	2.75	6.07
0.517	10.83	1.267	20.75	2.017	8.59	2.77	5.87
0.533	10.83	1.283	20.75	2.033	8.59	2.78	5.87
0.550	10.83	1.300	20.75	2.050	8.59	2.80	5.87
0.567	10.83	1.317	20.75	2.067	8.59	2.82	5.87
0.583	10.83	1.333	20.75	2.083	8.59	2.83	5.87
0.600	12.92	1.350	17.50	2.100	8.14	2.85	5.68
0.617	12.92	1.367	17.50	2.117	8.14	2.87	5.68
0.633	12.92	1.383	17.50	2.133	8.14	2.88	5.68
0.650	12.92	1.400	17.50	2.150	8.14	2.90	5.68
0.667	12.92	1.417	17.50	2.167	8.14	2.92	5.68
0.683	16.35	1.433	15.24	2.183	7.74	2.93	5.51
0.700	16.35	1.450	15.24	2.200	7.74	2.95	5.51
0.717	16.35	1.467	15.24	2.217	7.74	2.97	5.51
0.733	16.35	1.483	15.24	2.233	7.74	2.98	5.51
0.750	16.35	1.500	15.24	2.250	7.74	3.00	5.51

Max.Eff.Inten.(mm/hr)=	156.91	13.44	
over (min)	5.00	8.00	
Storage Coeff. (min)=	2.50 (ii)	7.94 (ii)	
Unit Hyd. Tpeak (min)=	5.00	8.00	
Unit Hyd. peak (cms)=	0.34	0.14	
			TOTALS
PEAK FLOW (cms)=	0.39	0.03	0.408 (iii)
TIME TO PEAK (hrs)=	1.03	1.12	1.03
RUNOFF VOLUME (mm)=	50.98	6.39	26.46
TOTAL RAINFALL (mm)=	52.98	52.98	52.98
RUNOFF COEFFICIENT =	0.96	0.12	0.50

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 39.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
| RESERVOIR(  0800)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  1.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0060      0.0230
                          0.0060     0.0010   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      2.500      0.408      1.03      26.46
   OUTFLOW: ID= 1 (  0800)      1.096      0.006      0.52      26.45
   OVERFLOW:ID= 3 (  0003)      1.404      0.311      1.08      26.45

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =   123
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  2.05
                  PERCENTAGE OF TIME OVERFLOWING   (%) = 13.76

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.47
                  TIME SHIFT OF PEAK FLOW         (min)=-31.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0230

--------------------------------------------------------------------------------

  --------------------------
  | Junction Command(0017) |
  --------------------------

                           AREA     QPEAK   TPEAK     R.V.
                           (ha)     (cms)    (hrs)     (mm)
  INFLOW : ID= 1(  0800)    1.10     0.01    0.52    26.45
  OUTFLOW: ID= 2(  0017)    1.10     0.01    0.52    26.45

  --------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0200)|   Area    (ha)=   0.70
|ID= 1 DT= 1.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  20.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.39         0.31
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      20.00        20.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
```

hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.017	5.96	0.767	23.29	1.517	13.58	2.27	7.38
0.033	5.96	0.783	23.29	1.533	13.58	2.28	7.38
0.050	5.96	0.800	23.29	1.550	13.58	2.30	7.38
0.067	5.96	0.817	23.29	1.567	13.58	2.32	7.38
0.083	5.96	0.833	23.29	1.583	13.58	2.33	7.38
0.100	6.40	0.850	47.83	1.600	12.29	2.35	7.07
0.117	6.40	0.867	47.83	1.617	12.29	2.37	7.07
0.133	6.40	0.883	47.83	1.633	12.29	2.38	7.07
0.150	6.40	0.900	47.83	1.650	12.29	2.40	7.07
0.167	6.40	0.917	47.83	1.667	12.29	2.42	7.07
0.183	6.92	0.933	156.91	1.683	11.26	2.43	6.78
0.200	6.92	0.950	156.91	1.700	11.26	2.45	6.78
0.217	6.92	0.967	156.91	1.717	11.26	2.47	6.78
0.233	6.92	0.983	156.91	1.733	11.26	2.48	6.78
0.250	6.92	1.000	156.91	1.750	11.26	2.50	6.78
0.267	7.55	1.017	60.27	1.767	10.41	2.52	6.52
0.283	7.55	1.033	60.27	1.783	10.41	2.53	6.52
0.300	7.55	1.050	60.27	1.800	10.41	2.55	6.52
0.317	7.55	1.067	60.27	1.817	10.41	2.57	6.52
0.333	7.55	1.083	60.27	1.833	10.41	2.58	6.52
0.350	8.36	1.100	35.44	1.850	9.71	2.60	6.28
0.367	8.36	1.117	35.44	1.867	9.71	2.62	6.28
0.383	8.36	1.133	35.44	1.883	9.71	2.63	6.28
0.400	8.36	1.150	35.44	1.900	9.71	2.65	6.28
0.417	8.36	1.167	35.44	1.917	9.71	2.67	6.28
0.433	9.40	1.183	25.89	1.933	9.11	2.68	6.07
0.450	9.40	1.200	25.89	1.950	9.11	2.70	6.07
0.467	9.40	1.217	25.89	1.967	9.11	2.72	6.07
0.483	9.40	1.233	25.89	1.983	9.11	2.73	6.07
0.500	9.40	1.250	25.89	2.000	9.11	2.75	6.07
0.517	10.83	1.267	20.75	2.017	8.59	2.77	5.87
0.533	10.83	1.283	20.75	2.033	8.59	2.78	5.87
0.550	10.83	1.300	20.75	2.050	8.59	2.80	5.87
0.567	10.83	1.317	20.75	2.067	8.59	2.82	5.87
0.583	10.83	1.333	20.75	2.083	8.59	2.83	5.87
0.600	12.92	1.350	17.50	2.100	8.14	2.85	5.68
0.617	12.92	1.367	17.50	2.117	8.14	2.87	5.68
0.633	12.92	1.383	17.50	2.133	8.14	2.88	5.68
0.650	12.92	1.400	17.50	2.150	8.14	2.90	5.68
0.667	12.92	1.417	17.50	2.167	8.14	2.92	5.68
0.683	16.35	1.433	15.24	2.183	7.74	2.93	5.51
0.700	16.35	1.450	15.24	2.200	7.74	2.95	5.51
0.717	16.35	1.467	15.24	2.217	7.74	2.97	5.51
0.733	16.35	1.483	15.24	2.233	7.74	2.98	5.51
0.750	16.35	1.500	15.24	2.250	7.74	3.00	5.51

Max.Eff.Inten.(mm/hr)=	156.91	29.14
over (min)	5.00	7.00
Storage Coeff. (min)=	0.81 (ii)	6.19 (ii)

```
     Unit Hyd. Tpeak (min)=       5.00         7.00
     Unit Hyd. peak  (cms)=       0.50         0.18
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.06         0.02          0.069 (iii)
     TIME TO PEAK    (hrs)=       1.02         1.10           1.02
     RUNOFF VOLUME    (mm)=      50.98         9.20          17.55
     TOTAL RAINFALL   (mm)=      52.98        52.98          52.98
     RUNOFF COEFFICIENT   =       0.96         0.17           0.33

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  39.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0999)|   Area    (ha)=   1.60   Curve Number   (CN)= 30.0
|ID= 1 DT= 1.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.017    5.96 | 0.767   23.29 | 1.517   13.58 |  2.27    7.38
               0.033    5.96 | 0.783   23.29 | 1.533   13.58 |  2.28    7.38
               0.050    5.96 | 0.800   23.29 | 1.550   13.58 |  2.30    7.38
               0.067    5.96 | 0.817   23.29 | 1.567   13.58 |  2.32    7.38
               0.083    5.96 | 0.833   23.29 | 1.583   13.58 |  2.33    7.38
               0.100    6.40 | 0.850   47.83 | 1.600   12.29 |  2.35    7.07
               0.117    6.40 | 0.867   47.83 | 1.617   12.29 |  2.37    7.07
               0.133    6.40 | 0.883   47.83 | 1.633   12.29 |  2.38    7.07
               0.150    6.40 | 0.900   47.83 | 1.650   12.29 |  2.40    7.07
               0.167    6.40 | 0.917   47.83 | 1.667   12.29 |  2.42    7.07
               0.183    6.92 | 0.933  156.91 | 1.683   11.26 |  2.43    6.78
               0.200    6.92 | 0.950  156.91 | 1.700   11.26 |  2.45    6.78
               0.217    6.92 | 0.967  156.91 | 1.717   11.26 |  2.47    6.78
               0.233    6.92 | 0.983  156.91 | 1.733   11.26 |  2.48    6.78
               0.250    6.92 | 1.000  156.91 | 1.750   11.26 |  2.50    6.78
               0.267    7.55 | 1.017   60.27 | 1.767   10.41 |  2.52    6.52
               0.283    7.55 | 1.033   60.27 | 1.783   10.41 |  2.53    6.52
               0.300    7.55 | 1.050   60.27 | 1.800   10.41 |  2.55    6.52
```

```
                0.317    7.55 | 1.067   60.27 | 1.817   10.41 |  2.57    6.52
                0.333    7.55 | 1.083   60.27 | 1.833   10.41 |  2.58    6.52
                0.350    8.36 | 1.100   35.44 | 1.850    9.71 |  2.60    6.28
                0.367    8.36 | 1.117   35.44 | 1.867    9.71 |  2.62    6.28
                0.383    8.36 | 1.133   35.44 | 1.883    9.71 |  2.63    6.28
                0.400    8.36 | 1.150   35.44 | 1.900    9.71 |  2.65    6.28
                0.417    8.36 | 1.167   35.44 | 1.917    9.71 |  2.67    6.28
                0.433    9.40 | 1.183   25.89 | 1.933    9.11 |  2.68    6.07
                0.450    9.40 | 1.200   25.89 | 1.950    9.11 |  2.70    6.07
                0.467    9.40 | 1.217   25.89 | 1.967    9.11 |  2.72    6.07
                0.483    9.40 | 1.233   25.89 | 1.983    9.11 |  2.73    6.07
                0.500    9.40 | 1.250   25.89 | 2.000    9.11 |  2.75    6.07
                0.517   10.83 | 1.267   20.75 | 2.017    8.59 |  2.77    5.87
                0.533   10.83 | 1.283   20.75 | 2.033    8.59 |  2.78    5.87
                0.550   10.83 | 1.300   20.75 | 2.050    8.59 |  2.80    5.87
                0.567   10.83 | 1.317   20.75 | 2.067    8.59 |  2.82    5.87
                0.583   10.83 | 1.333   20.75 | 2.083    8.59 |  2.83    5.87
                0.600   12.92 | 1.350   17.50 | 2.100    8.14 |  2.85    5.68
                0.617   12.92 | 1.367   17.50 | 2.117    8.14 |  2.87    5.68
                0.633   12.92 | 1.383   17.50 | 2.133    8.14 |  2.88    5.68
                0.650   12.92 | 1.400   17.50 | 2.150    8.14 |  2.90    5.68
                0.667   12.92 | 1.417   17.50 | 2.167    8.14 |  2.92    5.68
                0.683   16.35 | 1.433   15.24 | 2.183    7.74 |  2.93    5.51
                0.700   16.35 | 1.450   15.24 | 2.200    7.74 |  2.95    5.51
                0.717   16.35 | 1.467   15.24 | 2.217    7.74 |  2.97    5.51
                0.733   16.35 | 1.483   15.24 | 2.233    7.74 |  2.98    5.51
                0.750   16.35 | 1.500   15.24 | 2.250    7.74 |  3.00    5.51

     Unit Hyd Qpeak  (cms)=   0.306

     PEAK FLOW       (cms)=   0.011 (i)
     TIME TO PEAK    (hrs)=   1.317
     RUNOFF VOLUME    (mm)=   2.906
     TOTAL RAINFALL   (mm)=  52.982
     RUNOFF COEFFICIENT   =   0.055

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0801)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)     (cms)    (hrs)      (mm)
        ID1= 1 (  0200):     0.70   0.069     1.02    17.55
      + ID2= 2 (  0800):     1.40   0.311     1.08    26.45
        ================================================
        ID = 3 (  0801):     2.10   0.358     1.08    23.49

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0801)|
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)      (mm)
        ID1= 3 (  0801):     2.10   0.358     1.08    23.49
      + ID2= 2 (  0999):     1.60   0.011     1.32     2.91
        ================================================
        ID = 1 (  0801):     3.70   0.363     1.08    14.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0803)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  1.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0280      0.0240
                          0.0010     0.0000   |   0.0300      0.0280
                          0.0010     0.0020   |   0.0320      0.0330
                          0.0010     0.0040   |   0.0420      0.0390
                          0.0080     0.0060   |   0.0550      0.0450
                          0.0150     0.0090   |   0.0630      0.0510
                          0.0190     0.0120   |   0.0700      0.0580
                          0.0220     0.0160   |   0.0760      0.0660
                          0.0250     0.0190   |   0.0820      0.0740

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0801)      3.704      0.363      1.08      14.60
   OUTFLOW: ID= 1 (  0803)      3.704      0.032      2.52      14.60

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.79
                  TIME SHIFT OF PEAK FLOW         (min)= 86.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0328

--------------------------------------------------------------------------------
================================================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\bd68c118-629a-4714-b13b-c4b9ecf58b50\scenari
Summary filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\bd68c118-629a-4714-b13b-c4b9ecf58b50\scenari

DATE: 11-06-2023 TIME: 03:25:22

USER:

COMMENTS: _____

****
** SIMULATION : 100 YR 3-HR Chicago - County **
****

| CHICAGO STORM |
| Ptotal= 78.82 mm |

IDF curve parameters: A= 801.041
B= 1.501
C= 0.657
used in: INTENSITY = A / (t + B)^C

Duration of storm = 3.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	9.80	0.75	33.56	1.50	20.74	2.25	11.93
0.08	10.46	0.83	64.21	1.58	18.96	2.33	11.46
0.17	11.24	0.92	234.17	1.67	17.52	2.42	11.03
0.25	12.18	1.00	79.66	1.75	16.33	2.50	10.64
0.33	13.36	1.08	48.82	1.83	15.32	2.58	10.29
0.42	14.87	1.17	36.89	1.92	14.45	2.67	9.96
0.50	16.91	1.25	30.30	2.00	13.70	2.75	9.66
0.58	19.83	1.33	26.03	2.08	13.04	2.83	9.38
0.67	24.50	1.42	23.01	2.17	12.46	2.92	9.12

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   2.50
|ID= 1 DT= 1.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  45.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.38         1.12
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     130.00        35.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	9.80	0.767	33.56	1.517	20.74	2.27	11.93
0.033	9.80	0.783	33.56	1.533	20.74	2.28	11.93
0.050	9.80	0.800	33.56	1.550	20.74	2.30	11.93
0.067	9.80	0.817	33.56	1.567	20.74	2.32	11.93
0.083	9.80	0.833	33.56	1.583	20.74	2.33	11.93
0.100	10.46	0.850	64.21	1.600	18.96	2.35	11.46
0.117	10.46	0.867	64.21	1.617	18.96	2.37	11.46
0.133	10.46	0.883	64.21	1.633	18.96	2.38	11.46
0.150	10.46	0.900	64.21	1.650	18.96	2.40	11.46
0.167	10.46	0.917	64.21	1.667	18.96	2.42	11.46
0.183	11.24	0.933	234.16	1.683	17.52	2.43	11.03
0.200	11.24	0.950	234.17	1.700	17.52	2.45	11.03
0.217	11.24	0.967	234.17	1.717	17.52	2.47	11.03
0.233	11.24	0.983	234.17	1.733	17.52	2.48	11.03
0.250	11.24	1.000	234.17	1.750	17.52	2.50	11.03
0.267	12.18	1.017	79.66	1.767	16.33	2.52	10.64
0.283	12.18	1.033	79.66	1.783	16.33	2.53	10.64
0.300	12.18	1.050	79.66	1.800	16.33	2.55	10.64
0.317	12.18	1.067	79.66	1.817	16.33	2.57	10.64
0.333	12.18	1.083	79.66	1.833	16.33	2.58	10.64
0.350	13.36	1.100	48.82	1.850	15.32	2.60	10.29
0.367	13.36	1.117	48.82	1.867	15.32	2.62	10.29
0.383	13.36	1.133	48.82	1.883	15.32	2.63	10.29
0.400	13.36	1.150	48.82	1.900	15.32	2.65	10.29
0.417	13.36	1.167	48.82	1.917	15.32	2.67	10.29
0.433	14.87	1.183	36.89	1.933	14.45	2.68	9.96
0.450	14.87	1.200	36.89	1.950	14.45	2.70	9.96
0.467	14.87	1.217	36.89	1.967	14.45	2.72	9.96
0.483	14.87	1.233	36.89	1.983	14.45	2.73	9.96

```
               0.500   14.87 | 1.250   36.89 | 2.000   14.45 |  2.75    9.96
               0.517   16.91 | 1.267   30.30 | 2.017   13.70 |  2.77    9.66
               0.533   16.91 | 1.283   30.30 | 2.033   13.70 |  2.78    9.66
               0.550   16.91 | 1.300   30.30 | 2.050   13.70 |  2.80    9.66
               0.567   16.91 | 1.317   30.30 | 2.067   13.70 |  2.82    9.66
               0.583   16.91 | 1.333   30.30 | 2.083   13.70 |  2.83    9.66
               0.600   19.83 | 1.350   26.03 | 2.100   13.04 |  2.85    9.38
               0.617   19.83 | 1.367   26.03 | 2.117   13.04 |  2.87    9.38
               0.633   19.83 | 1.383   26.03 | 2.133   13.04 |  2.88    9.38
               0.650   19.83 | 1.400   26.03 | 2.150   13.04 |  2.90    9.38
               0.667   19.83 | 1.417   26.03 | 2.167   13.04 |  2.92    9.38
               0.683   24.50 | 1.433   23.01 | 2.183   12.46 |  2.93    9.12
               0.700   24.50 | 1.450   23.01 | 2.200   12.46 |  2.95    9.12
               0.717   24.50 | 1.467   23.01 | 2.217   12.46 |  2.97    9.12
               0.733   24.50 | 1.483   23.01 | 2.233   12.46 |  2.98    9.12
               0.750   24.50 | 1.500   23.01 | 2.250   12.46 |  3.00    9.12

     Max.Eff.Inten.(mm/hr)=     234.17        29.20
               over (min)         5.00         7.00
     Storage Coeff.  (min)=       2.13 (ii)    6.76 (ii)
     Unit Hyd. Tpeak (min)=       5.00         7.00
     Unit Hyd. peak  (cms)=       0.36         0.17
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.59         0.07          0.644 (iii)
     TIME TO PEAK    (hrs)=       1.03         1.10           1.03
     RUNOFF VOLUME    (mm)=      76.82        13.97          42.25
     TOTAL RAINFALL   (mm)=      78.82        78.82          78.82
     RUNOFF COEFFICIENT   =       0.97         0.18           0.54


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  39.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0800)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  1.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0060      0.0230
                         0.0060     0.0010   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      2.500      0.644      1.03      42.25
   OUTFLOW: ID= 1 (  0800)      0.695      0.006      0.37      42.23
   OVERFLOW:ID= 3 (  0003)      1.805      0.638      1.03      42.23
```

```
                    TOTAL NUMBER OF SIMULATION OVERFLOW  =   129
                    CUMULATIVE TIME OF OVERFLOW  (HOURS) =  2.15
                    PERCENTAGE OF TIME OVERFLOWING   (%) = 14.40

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.93
                    TIME SHIFT OF PEAK FLOW         (min)=-40.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0230

--------------------------------------------------------------------------------

  --------------------------
  | Junction Command(0017) |
  --------------------------

                           AREA     QPEAK   TPEAK     R.V.
                           (ha)     (cms)    (hrs)    (mm)
  INFLOW : ID= 1(  0800)    0.69     0.01    0.37    42.23
  OUTFLOW: ID= 2(  0017)    0.69     0.01    0.37    42.23

  ------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0200)|   Area    (ha)=   0.70
|ID= 1 DT= 1.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  20.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.39         0.31
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      20.00        20.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.017    9.80 | 0.767   33.56 | 1.517   20.74 |  2.27   11.93
               0.033    9.80 | 0.783   33.56 | 1.533   20.74 |  2.28   11.93
               0.050    9.80 | 0.800   33.56 | 1.550   20.74 |  2.30   11.93
               0.067    9.80 | 0.817   33.56 | 1.567   20.74 |  2.32   11.93
               0.083    9.80 | 0.833   33.56 | 1.583   20.74 |  2.33   11.93
               0.100   10.46 | 0.850   64.21 | 1.600   18.96 |  2.35   11.46
               0.117   10.46 | 0.867   64.21 | 1.617   18.96 |  2.37   11.46
               0.133   10.46 | 0.883   64.21 | 1.633   18.96 |  2.38   11.46
               0.150   10.46 | 0.900   64.21 | 1.650   18.96 |  2.40   11.46
               0.167   10.46 | 0.917   64.21 | 1.667   18.96 |  2.42   11.46
               0.183   11.24 | 0.933  234.16 | 1.683   17.52 |  2.43   11.03
```

0.200	11.24	0.950	234.17	1.700	17.52	2.45	11.03
0.217	11.24	0.967	234.17	1.717	17.52	2.47	11.03
0.233	11.24	0.983	234.17	1.733	17.52	2.48	11.03
0.250	11.24	1.000	234.17	1.750	17.52	2.50	11.03
0.267	12.18	1.017	79.66	1.767	16.33	2.52	10.64
0.283	12.18	1.033	79.66	1.783	16.33	2.53	10.64
0.300	12.18	1.050	79.66	1.800	16.33	2.55	10.64
0.317	12.18	1.067	79.66	1.817	16.33	2.57	10.64
0.333	12.18	1.083	79.66	1.833	16.33	2.58	10.64
0.350	13.36	1.100	48.82	1.850	15.32	2.60	10.29
0.367	13.36	1.117	48.82	1.867	15.32	2.62	10.29
0.383	13.36	1.133	48.82	1.883	15.32	2.63	10.29
0.400	13.36	1.150	48.82	1.900	15.32	2.65	10.29
0.417	13.36	1.167	48.82	1.917	15.32	2.67	10.29
0.433	14.87	1.183	36.89	1.933	14.45	2.68	9.96
0.450	14.87	1.200	36.89	1.950	14.45	2.70	9.96
0.467	14.87	1.217	36.89	1.967	14.45	2.72	9.96
0.483	14.87	1.233	36.89	1.983	14.45	2.73	9.96
0.500	14.87	1.250	36.89	2.000	14.45	2.75	9.96
0.517	16.91	1.267	30.30	2.017	13.70	2.77	9.66
0.533	16.91	1.283	30.30	2.033	13.70	2.78	9.66
0.550	16.91	1.300	30.30	2.050	13.70	2.80	9.66
0.567	16.91	1.317	30.30	2.067	13.70	2.82	9.66
0.583	16.91	1.333	30.30	2.083	13.70	2.83	9.66
0.600	19.83	1.350	26.03	2.100	13.04	2.85	9.38
0.617	19.83	1.367	26.03	2.117	13.04	2.87	9.38
0.633	19.83	1.383	26.03	2.133	13.04	2.88	9.38
0.650	19.83	1.400	26.03	2.150	13.04	2.90	9.38
0.667	19.83	1.417	26.03	2.167	13.04	2.92	9.38
0.683	24.50	1.433	23.01	2.183	12.46	2.93	9.12
0.700	24.50	1.450	23.01	2.200	12.46	2.95	9.12
0.717	24.50	1.467	23.01	2.217	12.46	2.97	9.12
0.733	24.50	1.483	23.01	2.233	12.46	2.98	9.12
0.750	24.50	1.500	23.01	2.250	12.46	3.00	9.12

Max.Eff.Inten.(mm/hr)=	234.17	60.70	
over (min)	5.00	6.00	
Storage Coeff. (min)=	0.69 (ii)	5.27 (ii)	
Unit Hyd. Tpeak (min)=	5.00	6.00	
Unit Hyd. peak (cms)=	0.51	0.20	
			TOTALS
PEAK FLOW (cms)=	0.09	0.04	0.119 (iii)
TIME TO PEAK (hrs)=	1.02	1.08	1.02
RUNOFF VOLUME (mm)=	76.82	19.29	30.79
TOTAL RAINFALL (mm)=	78.82	78.82	78.82
RUNOFF COEFFICIENT =	0.97	0.24	0.39

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  39.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0999)|   Area    (ha)=   1.60   Curve Number   (CN)= 30.0
|ID= 1 DT= 1.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	9.80	0.767	33.56	1.517	20.74	2.27	11.93
0.033	9.80	0.783	33.56	1.533	20.74	2.28	11.93
0.050	9.80	0.800	33.56	1.550	20.74	2.30	11.93
0.067	9.80	0.817	33.56	1.567	20.74	2.32	11.93
0.083	9.80	0.833	33.56	1.583	20.74	2.33	11.93
0.100	10.46	0.850	64.21	1.600	18.96	2.35	11.46
0.117	10.46	0.867	64.21	1.617	18.96	2.37	11.46
0.133	10.46	0.883	64.21	1.633	18.96	2.38	11.46
0.150	10.46	0.900	64.21	1.650	18.96	2.40	11.46
0.167	10.46	0.917	64.21	1.667	18.96	2.42	11.46
0.183	11.24	0.933	234.16	1.683	17.52	2.43	11.03
0.200	11.24	0.950	234.17	1.700	17.52	2.45	11.03
0.217	11.24	0.967	234.17	1.717	17.52	2.47	11.03
0.233	11.24	0.983	234.17	1.733	17.52	2.48	11.03
0.250	11.24	1.000	234.17	1.750	17.52	2.50	11.03
0.267	12.18	1.017	79.66	1.767	16.33	2.52	10.64
0.283	12.18	1.033	79.66	1.783	16.33	2.53	10.64
0.300	12.18	1.050	79.66	1.800	16.33	2.55	10.64
0.317	12.18	1.067	79.66	1.817	16.33	2.57	10.64
0.333	12.18	1.083	79.66	1.833	16.33	2.58	10.64
0.350	13.36	1.100	48.82	1.850	15.32	2.60	10.29
0.367	13.36	1.117	48.82	1.867	15.32	2.62	10.29
0.383	13.36	1.133	48.82	1.883	15.32	2.63	10.29
0.400	13.36	1.150	48.82	1.900	15.32	2.65	10.29
0.417	13.36	1.167	48.82	1.917	15.32	2.67	10.29
0.433	14.87	1.183	36.89	1.933	14.45	2.68	9.96
0.450	14.87	1.200	36.89	1.950	14.45	2.70	9.96
0.467	14.87	1.217	36.89	1.967	14.45	2.72	9.96
0.483	14.87	1.233	36.89	1.983	14.45	2.73	9.96
0.500	14.87	1.250	36.89	2.000	14.45	2.75	9.96

```
               0.517   16.91 | 1.267   30.30 | 2.017   13.70 |  2.77    9.66
               0.533   16.91 | 1.283   30.30 | 2.033   13.70 |  2.78    9.66
               0.550   16.91 | 1.300   30.30 | 2.050   13.70 |  2.80    9.66
               0.567   16.91 | 1.317   30.30 | 2.067   13.70 |  2.82    9.66
               0.583   16.91 | 1.333   30.30 | 2.083   13.70 |  2.83    9.66
               0.600   19.83 | 1.350   26.03 | 2.100   13.04 |  2.85    9.38
               0.617   19.83 | 1.367   26.03 | 2.117   13.04 |  2.87    9.38
               0.633   19.83 | 1.383   26.03 | 2.133   13.04 |  2.88    9.38
               0.650   19.83 | 1.400   26.03 | 2.150   13.04 |  2.90    9.38
               0.667   19.83 | 1.417   26.03 | 2.167   13.04 |  2.92    9.38
               0.683   24.50 | 1.433   23.01 | 2.183   12.46 |  2.93    9.12
               0.700   24.50 | 1.450   23.01 | 2.200   12.46 |  2.95    9.12
               0.717   24.50 | 1.467   23.01 | 2.217   12.46 |  2.97    9.12
               0.733   24.50 | 1.483   23.01 | 2.233   12.46 |  2.98    9.12
               0.750   24.50 | 1.500   23.01 | 2.250   12.46 |  3.00    9.12

     Unit Hyd Qpeak  (cms)=   0.306

     PEAK FLOW       (cms)=   0.027 (i)
     TIME TO PEAK    (hrs)=   1.283
     RUNOFF VOLUME    (mm)=   7.159
     TOTAL RAINFALL   (mm)=  78.816
     RUNOFF COEFFICIENT   =   0.091

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0801)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)      (mm)
        ID1= 1 (  0200):     0.70   0.119     1.02    30.79
      + ID2= 2 (  0800):     1.81   0.638     1.03    42.23
        ================================================
        ID = 3 (  0801):     2.51   0.756     1.03    39.03

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0801)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)      (mm)
        ID1= 3 (  0801):     2.51   0.756     1.03    39.03
      + ID2= 2 (  0999):     1.60   0.027     1.28     7.16
        ================================================
        ID = 1 (  0801):     4.11   0.765     1.03    26.61

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0803)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  1.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0280      0.0240
                         0.0010     0.0000   |   0.0300      0.0280
                         0.0010     0.0020   |   0.0320      0.0330
                         0.0010     0.0040   |   0.0420      0.0390
                         0.0080     0.0060   |   0.0550      0.0450
                         0.0150     0.0090   |   0.0630      0.0510
                         0.0190     0.0120   |   0.0700      0.0580
                         0.0220     0.0160   |   0.0760      0.0660
                         0.0250     0.0190   |   0.0820      0.0740

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0801)      4.105     0.765      1.03      26.61
   OUTFLOW: ID= 1 (  0803)      4.105     0.073      2.25      26.61

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  9.57
                  TIME SHIFT OF PEAK FLOW         (min)= 73.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0623

--------------------------------------------------------------------------------
================================================================================================================

       V    V   I    SSSSS  U   U    A    L             (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\f5760df5-ca78-4a6b-90f3-
531a897741a8\scenari
```

```
  Summary filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\f5760df5-ca78-4a6b-90f3-
531a897741a8\scenari


DATE: 11-06-2023                          TIME: 03:25:22

USER:


COMMENTS: _____________________________________________________

--------------------------------------------------------------------------------------------------------------------
  ***********************************************
  ** SIMULATION : 2 YR 3-HR Chicago - County of **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 529.711
| Ptotal= 32.58 mm |                          B=   4.501
--------------------                          C=   0.745
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  3.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    3.22 |  0.75   14.72 |  1.50    8.03 |  2.25    4.07
                0.08    3.48 |  0.83   32.16 |  1.58    7.18 |  2.33    3.88
                0.17    3.79 |  0.92   98.99 |  1.67    6.51 |  2.42    3.71
                0.25    4.18 |  1.00   40.96 |  1.75    5.97 |  2.50    3.55
                0.33    4.67 |  1.08   23.39 |  1.83    5.52 |  2.58    3.41
                0.42    5.32 |  1.17   16.55 |  1.92    5.14 |  2.67    3.28
                0.50    6.23 |  1.25   12.92 |  2.00    4.82 |  2.75    3.16
                0.58    7.59 |  1.33   10.68 |  2.08    4.53 |  2.83    3.05
                0.67    9.90 |  1.42    9.14 |  2.17    4.29 |  2.92    2.95


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   2.50
|ID= 1 DT= 1.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  45.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.38         1.12
     Dep. Storage     (mm)=       2.00         5.00
```

Average Slope	(%)=	1.00	2.00
Length	(m)=	130.00	35.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	3.22	0.767	14.72	1.517	8.03	2.27	4.07
0.033	3.22	0.783	14.72	1.533	8.03	2.28	4.07
0.050	3.22	0.800	14.72	1.550	8.03	2.30	4.07
0.067	3.22	0.817	14.72	1.567	8.03	2.32	4.07
0.083	3.22	0.833	14.72	1.583	8.03	2.33	4.07
0.100	3.48	0.850	32.16	1.600	7.18	2.35	3.88
0.117	3.48	0.867	32.16	1.617	7.18	2.37	3.88
0.133	3.48	0.883	32.16	1.633	7.18	2.38	3.88
0.150	3.48	0.900	32.16	1.650	7.18	2.40	3.88
0.167	3.48	0.917	32.16	1.667	7.18	2.42	3.88
0.183	3.79	0.933	98.99	1.683	6.51	2.43	3.71
0.200	3.79	0.950	98.99	1.700	6.51	2.45	3.71
0.217	3.79	0.967	98.99	1.717	6.51	2.47	3.71
0.233	3.79	0.983	98.99	1.733	6.51	2.48	3.71
0.250	3.79	1.000	98.99	1.750	6.51	2.50	3.71
0.267	4.18	1.017	40.96	1.767	5.97	2.52	3.55
0.283	4.18	1.033	40.96	1.783	5.97	2.53	3.55
0.300	4.18	1.050	40.96	1.800	5.97	2.55	3.55
0.317	4.18	1.067	40.96	1.817	5.97	2.57	3.55
0.333	4.18	1.083	40.96	1.833	5.97	2.58	3.55
0.350	4.67	1.100	23.39	1.850	5.52	2.60	3.41
0.367	4.67	1.117	23.39	1.867	5.52	2.62	3.41
0.383	4.67	1.133	23.39	1.883	5.52	2.63	3.41
0.400	4.67	1.150	23.39	1.900	5.52	2.65	3.41
0.417	4.67	1.167	23.39	1.917	5.52	2.67	3.41
0.433	5.32	1.183	16.55	1.933	5.14	2.68	3.28
0.450	5.32	1.200	16.55	1.950	5.14	2.70	3.28
0.467	5.32	1.217	16.55	1.967	5.14	2.72	3.28
0.483	5.32	1.233	16.55	1.983	5.14	2.73	3.28
0.500	5.32	1.250	16.55	2.000	5.14	2.75	3.28
0.517	6.23	1.267	12.92	2.017	4.82	2.77	3.16
0.533	6.23	1.283	12.92	2.033	4.82	2.78	3.16
0.550	6.23	1.300	12.92	2.050	4.82	2.80	3.16
0.567	6.23	1.317	12.92	2.067	4.82	2.82	3.16
0.583	6.23	1.333	12.92	2.083	4.82	2.83	3.16
0.600	7.59	1.350	10.68	2.100	4.53	2.85	3.05
0.617	7.59	1.367	10.68	2.117	4.53	2.87	3.05
0.633	7.59	1.383	10.68	2.133	4.53	2.88	3.05
0.650	7.59	1.400	10.68	2.150	4.53	2.90	3.05
0.667	7.59	1.417	10.68	2.167	4.53	2.92	3.05

```
               0.683    9.90 | 1.433    9.14 | 2.183    4.29 |  2.93    2.95
               0.700    9.90 | 1.450    9.14 | 2.200    4.29 |  2.95    2.95
               0.717    9.90 | 1.467    9.14 | 2.217    4.29 |  2.97    2.95
               0.733    9.90 | 1.483    9.14 | 2.233    4.29 |  2.98    2.95
               0.750    9.90 | 1.500    9.14 | 2.250    4.29 |  3.00    2.95

     Max.Eff.Inten.(mm/hr)=      98.99         4.85
               over (min)         5.00        10.00
     Storage Coeff.  (min)=       3.00 (ii)    9.54 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.12
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.24         0.01          0.242 (iii)
     TIME TO PEAK    (hrs)=       1.03         1.20           1.03
     RUNOFF VOLUME    (mm)=      30.58         2.30          15.02
     TOTAL RAINFALL   (mm)=      32.58        32.58          32.58
     RUNOFF COEFFICIENT   =       0.94         0.07           0.46


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  39.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0800)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  1.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0060      0.0230
                          0.0060     0.0010   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      2.500      0.242      1.03      15.02
   OUTFLOW: ID= 1 (  0800)      1.886      0.006      0.73      15.05
   OVERFLOW:ID= 3 (  0003)      0.614      0.056      1.35      15.05

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =   104
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  1.73
                  PERCENTAGE OF TIME OVERFLOWING   (%) = 11.69

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  2.48
                  TIME SHIFT OF PEAK FLOW         (min)=-18.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0230

--------------------------------------------------------------------------------
```

```
  --------------------------
  | Junction Command(0017) |
  --------------------------

                           AREA     QPEAK   TPEAK     R.V.
                           (ha)     (cms)    (hrs)    (mm)
  INFLOW : ID= 1(  0800)    1.89     0.01    0.73    15.05
  OUTFLOW: ID= 2(  0017)    1.89     0.01    0.73    15.05

  ------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0200)|   Area    (ha)=   0.70
|ID= 1 DT= 1.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  20.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.39         0.31
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      20.00        20.00
     Mannings n             =    0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
      TIME     RAIN |  TIME     RAIN |'  TIME     RAIN |  TIME     RAIN
       hrs   mm/hr |   hrs    mm/hr |'   hrs    mm/hr |   hrs    mm/hr
     0.017    3.22 | 0.767   14.72 | 1.517    8.03 |  2.27    4.07
     0.033    3.22 | 0.783   14.72 | 1.533    8.03 |  2.28    4.07
     0.050    3.22 | 0.800   14.72 | 1.550    8.03 |  2.30    4.07
     0.067    3.22 | 0.817   14.72 | 1.567    8.03 |  2.32    4.07
     0.083    3.22 | 0.833   14.72 | 1.583    8.03 |  2.33    4.07
     0.100    3.48 | 0.850   32.16 | 1.600    7.18 |  2.35    3.88
     0.117    3.48 | 0.867   32.16 | 1.617    7.18 |  2.37    3.88
     0.133    3.48 | 0.883   32.16 | 1.633    7.18 |  2.38    3.88
     0.150    3.48 | 0.900   32.16 | 1.650    7.18 |  2.40    3.88
     0.167    3.48 | 0.917   32.16 | 1.667    7.18 |  2.42    3.88
     0.183    3.79 | 0.933   98.99 | 1.683    6.51 |  2.43    3.71
     0.200    3.79 | 0.950   98.99 | 1.700    6.51 |  2.45    3.71
     0.217    3.79 | 0.967   98.99 | 1.717    6.51 |  2.47    3.71
     0.233    3.79 | 0.983   98.99 | 1.733    6.51 |  2.48    3.71
     0.250    3.79 | 1.000   98.99 | 1.750    6.51 |  2.50    3.71
     0.267    4.18 | 1.017   40.96 | 1.767    5.97 |  2.52    3.55
     0.283    4.18 | 1.033   40.96 | 1.783    5.97 |  2.53    3.55
     0.300    4.18 | 1.050   40.96 | 1.800    5.97 |  2.55    3.55
     0.317    4.18 | 1.067   40.96 | 1.817    5.97 |  2.57    3.55
     0.333    4.18 | 1.083   40.96 | 1.833    5.97 |  2.58    3.55
     0.350    4.67 | 1.100   23.39 | 1.850    5.52 |  2.60    3.41
     0.367    4.67 | 1.117   23.39 | 1.867    5.52 |  2.62    3.41
```

```
                0.383    4.67 | 1.133   23.39 | 1.883    5.52 |  2.63    3.41
                0.400    4.67 | 1.150   23.39 | 1.900    5.52 |  2.65    3.41
                0.417    4.67 | 1.167   23.39 | 1.917    5.52 |  2.67    3.41
                0.433    5.32 | 1.183   16.55 | 1.933    5.14 |  2.68    3.28
                0.450    5.32 | 1.200   16.55 | 1.950    5.14 |  2.70    3.28
                0.467    5.32 | 1.217   16.55 | 1.967    5.14 |  2.72    3.28
                0.483    5.32 | 1.233   16.55 | 1.983    5.14 |  2.73    3.28
                0.500    5.32 | 1.250   16.55 | 2.000    5.14 |  2.75    3.28
                0.517    6.23 | 1.267   12.92 | 2.017    4.82 |  2.77    3.16
                0.533    6.23 | 1.283   12.92 | 2.033    4.82 |  2.78    3.16
                0.550    6.23 | 1.300   12.92 | 2.050    4.82 |  2.80    3.16
                0.567    6.23 | 1.317   12.92 | 2.067    4.82 |  2.82    3.16
                0.583    6.23 | 1.333   12.92 | 2.083    4.82 |  2.83    3.16
                0.600    7.59 | 1.350   10.68 | 2.100    4.53 |  2.85    3.05
                0.617    7.59 | 1.367   10.68 | 2.117    4.53 |  2.87    3.05
                0.633    7.59 | 1.383   10.68 | 2.133    4.53 |  2.88    3.05
                0.650    7.59 | 1.400   10.68 | 2.150    4.53 |  2.90    3.05
                0.667    7.59 | 1.417   10.68 | 2.167    4.53 |  2.92    3.05
                0.683    9.90 | 1.433    9.14 | 2.183    4.29 |  2.93    2.95
                0.700    9.90 | 1.450    9.14 | 2.200    4.29 |  2.95    2.95
                0.717    9.90 | 1.467    9.14 | 2.217    4.29 |  2.97    2.95
                0.733    9.90 | 1.483    9.14 | 2.233    4.29 |  2.98    2.95
                0.750    9.90 | 1.500    9.14 | 2.250    4.29 |  3.00    2.95

     Max.Eff.Inten.(mm/hr)=      98.99        11.29
               over (min)        5.00         8.00
     Storage Coeff.  (min)=      0.98 (ii)    7.44 (ii)
     Unit Hyd. Tpeak (min)=      5.00         8.00
     Unit Hyd. peak  (cms)=      0.48         0.15
                                                        *TOTALS*
     PEAK FLOW       (cms)=      0.04         0.01         0.039 (iii)
     TIME TO PEAK    (hrs)=      1.02         1.13          1.02
     RUNOFF VOLUME    (mm)=     30.58         3.50          8.91
     TOTAL RAINFALL   (mm)=     32.58        32.58         32.58
     RUNOFF COEFFICIENT   =      0.94         0.11          0.27

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  39.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0999)|   Area    (ha)=   1.60   Curve Number   (CN)= 30.0
```

```
|ID= 1 DT= 1.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	3.22	0.767	14.72	1.517	8.03	2.27	4.07
0.033	3.22	0.783	14.72	1.533	8.03	2.28	4.07
0.050	3.22	0.800	14.72	1.550	8.03	2.30	4.07
0.067	3.22	0.817	14.72	1.567	8.03	2.32	4.07
0.083	3.22	0.833	14.72	1.583	8.03	2.33	4.07
0.100	3.48	0.850	32.16	1.600	7.18	2.35	3.88
0.117	3.48	0.867	32.16	1.617	7.18	2.37	3.88
0.133	3.48	0.883	32.16	1.633	7.18	2.38	3.88
0.150	3.48	0.900	32.16	1.650	7.18	2.40	3.88
0.167	3.48	0.917	32.16	1.667	7.18	2.42	3.88
0.183	3.79	0.933	98.99	1.683	6.51	2.43	3.71
0.200	3.79	0.950	98.99	1.700	6.51	2.45	3.71
0.217	3.79	0.967	98.99	1.717	6.51	2.47	3.71
0.233	3.79	0.983	98.99	1.733	6.51	2.48	3.71
0.250	3.79	1.000	98.99	1.750	6.51	2.50	3.71
0.267	4.18	1.017	40.96	1.767	5.97	2.52	3.55
0.283	4.18	1.033	40.96	1.783	5.97	2.53	3.55
0.300	4.18	1.050	40.96	1.800	5.97	2.55	3.55
0.317	4.18	1.067	40.96	1.817	5.97	2.57	3.55
0.333	4.18	1.083	40.96	1.833	5.97	2.58	3.55
0.350	4.67	1.100	23.39	1.850	5.52	2.60	3.41
0.367	4.67	1.117	23.39	1.867	5.52	2.62	3.41
0.383	4.67	1.133	23.39	1.883	5.52	2.63	3.41
0.400	4.67	1.150	23.39	1.900	5.52	2.65	3.41
0.417	4.67	1.167	23.39	1.917	5.52	2.67	3.41
0.433	5.32	1.183	16.55	1.933	5.14	2.68	3.28
0.450	5.32	1.200	16.55	1.950	5.14	2.70	3.28
0.467	5.32	1.217	16.55	1.967	5.14	2.72	3.28
0.483	5.32	1.233	16.55	1.983	5.14	2.73	3.28
0.500	5.32	1.250	16.55	2.000	5.14	2.75	3.28
0.517	6.23	1.267	12.92	2.017	4.82	2.77	3.16
0.533	6.23	1.283	12.92	2.033	4.82	2.78	3.16
0.550	6.23	1.300	12.92	2.050	4.82	2.80	3.16
0.567	6.23	1.317	12.92	2.067	4.82	2.82	3.16
0.583	6.23	1.333	12.92	2.083	4.82	2.83	3.16
0.600	7.59	1.350	10.68	2.100	4.53	2.85	3.05
0.617	7.59	1.367	10.68	2.117	4.53	2.87	3.05
0.633	7.59	1.383	10.68	2.133	4.53	2.88	3.05
0.650	7.59	1.400	10.68	2.150	4.53	2.90	3.05
0.667	7.59	1.417	10.68	2.167	4.53	2.92	3.05
0.683	9.90	1.433	9.14	2.183	4.29	2.93	2.95

```
                0.700    9.90 | 1.450    9.14 | 2.200    4.29 |  2.95    2.95
                0.717    9.90 | 1.467    9.14 | 2.217    4.29 |  2.97    2.95
                0.733    9.90 | 1.483    9.14 | 2.233    4.29 |  2.98    2.95
                0.750    9.90 | 1.500    9.14 | 2.250    4.29 |  3.00    2.95

     Unit Hyd Qpeak  (cms)=   0.306

     PEAK FLOW       (cms)=   0.003 (i)
     TIME TO PEAK    (hrs)=   1.367
     RUNOFF VOLUME    (mm)=   0.828
     TOTAL RAINFALL   (mm)=  32.578
     RUNOFF COEFFICIENT   =   0.025

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0801)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)      (mm)
        ID1= 1 (  0200):     0.70   0.039     1.02     8.91
      + ID2= 2 (  0800):     0.61   0.056     1.35    15.05
        ====================================================
        ID = 3 (  0801):     1.31   0.065     1.35    11.78

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0801)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)      (mm)
        ID1= 3 (  0801):     1.31   0.065     1.35    11.78
      + ID2= 2 (  0999):     1.60   0.003     1.37     0.83
        ====================================================
        ID = 1 (  0801):     2.91   0.068     1.35     5.77

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0803)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  1.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0280      0.0240
                          0.0010     0.0000   |   0.0300      0.0280
                          0.0010     0.0020   |   0.0320      0.0330
                          0.0010     0.0040   |   0.0420      0.0390
                          0.0080     0.0060   |   0.0550      0.0450
```

```
                          0.0150     0.0090   |   0.0630      0.0510
                          0.0190     0.0120   |   0.0700      0.0580
                          0.0220     0.0160   |   0.0760      0.0660
                          0.0250     0.0190   |   0.0820      0.0740

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0801)      2.914      0.068      1.35       5.77
   OUTFLOW: ID= 1 (  0803)      2.914      0.015      2.23       5.77

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.36
                  TIME SHIFT OF PEAK FLOW         (min)= 53.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0092

--------------------------------------------------------------------------------

 FINISH
================================================================================================================

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\cd91e5eb-6339-4498-9e60-
1bf0b9ae9b5f\scenari
  Summary filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\cd91e5eb-6339-4498-9e60-
1bf0b9ae9b5f\scenari


DATE: 11-06-2023                          TIME: 03:25:22

USER:
```

COMMENTS: _____

```
  ************************************************
  ** SIMULATION : 25 YR 3-HR Chicago - County o **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 721.533
| Ptotal= 63.14 mm |                          B=   2.253
--------------------                          C=   0.679
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  3.00 hrs
                         Storm time step    =  5.00 min
                         Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	7.44	0.75	27.30	1.50	16.36	2.25	9.15
0.08	7.97	0.83	54.38	1.58	14.88	2.33	8.77
0.17	8.59	0.92	187.92	1.67	13.69	2.42	8.43
0.25	9.35	1.00	68.12	1.75	12.71	2.50	8.12
0.33	10.29	1.08	40.69	1.83	11.88	2.58	7.83
0.42	11.52	1.17	30.18	1.92	11.18	2.67	7.57
0.50	13.19	1.25	24.47	2.00	10.57	2.75	7.33
0.58	15.60	1.33	20.82	2.08	10.04	2.83	7.11
0.67	19.52	1.42	18.26	2.17	9.57	2.92	6.90

```
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   2.50
|ID= 1 DT= 1.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  45.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.38         1.12
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     130.00        35.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.

                              ---- TRANSFORMED HYETOGRAPH ----
```

Visual OTTHYMO Output - Proposed Conditions

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	7.44	0.767	27.30	1.517	16.36	2.27	9.15
0.033	7.44	0.783	27.30	1.533	16.36	2.28	9.15
0.050	7.44	0.800	27.30	1.550	16.36	2.30	9.15
0.067	7.44	0.817	27.30	1.567	16.36	2.32	9.15
0.083	7.44	0.833	27.30	1.583	16.36	2.33	9.15
0.100	7.97	0.850	54.38	1.600	14.88	2.35	8.77
0.117	7.97	0.867	54.38	1.617	14.88	2.37	8.77
0.133	7.97	0.883	54.38	1.633	14.88	2.38	8.77
0.150	7.97	0.900	54.38	1.650	14.88	2.40	8.77
0.167	7.97	0.917	54.38	1.667	14.88	2.42	8.77
0.183	8.59	0.933	187.91	1.683	13.69	2.43	8.43
0.200	8.59	0.950	187.92	1.700	13.69	2.45	8.43
0.217	8.59	0.967	187.92	1.717	13.69	2.47	8.43
0.233	8.59	0.983	187.92	1.733	13.69	2.48	8.43
0.250	8.59	1.000	187.92	1.750	13.69	2.50	8.43
0.267	9.35	1.017	68.12	1.767	12.71	2.52	8.12
0.283	9.35	1.033	68.12	1.783	12.71	2.53	8.12
0.300	9.35	1.050	68.12	1.800	12.71	2.55	8.12
0.317	9.35	1.067	68.12	1.817	12.71	2.57	8.12
0.333	9.35	1.083	68.12	1.833	12.71	2.58	8.12
0.350	10.29	1.100	40.69	1.850	11.88	2.60	7.83
0.367	10.29	1.117	40.69	1.867	11.88	2.62	7.83
0.383	10.29	1.133	40.69	1.883	11.88	2.63	7.83
0.400	10.29	1.150	40.69	1.900	11.88	2.65	7.83
0.417	10.29	1.167	40.69	1.917	11.88	2.67	7.83
0.433	11.52	1.183	30.18	1.933	11.18	2.68	7.57
0.450	11.52	1.200	30.18	1.950	11.18	2.70	7.57
0.467	11.52	1.217	30.18	1.967	11.18	2.72	7.57
0.483	11.52	1.233	30.18	1.983	11.18	2.73	7.57
0.500	11.52	1.250	30.18	2.000	11.18	2.75	7.57
0.517	13.19	1.267	24.47	2.017	10.57	2.77	7.33
0.533	13.19	1.283	24.47	2.033	10.57	2.78	7.33
0.550	13.19	1.300	24.47	2.050	10.57	2.80	7.33
0.567	13.19	1.317	24.47	2.067	10.57	2.82	7.33
0.583	13.19	1.333	24.47	2.083	10.57	2.83	7.33
0.600	15.60	1.350	20.82	2.100	10.04	2.85	7.11
0.617	15.60	1.367	20.82	2.117	10.04	2.87	7.11
0.633	15.60	1.383	20.82	2.133	10.04	2.88	7.11
0.650	15.60	1.400	20.82	2.150	10.04	2.90	7.11
0.667	15.60	1.417	20.82	2.167	10.04	2.92	7.11
0.683	19.52	1.433	18.26	2.183	9.57	2.93	6.90
0.700	19.52	1.450	18.26	2.200	9.57	2.95	6.90
0.717	19.52	1.467	18.26	2.217	9.57	2.97	6.90
0.733	19.52	1.483	18.26	2.233	9.57	2.98	6.90
0.750	19.52	1.500	18.26	2.250	9.57	3.00	6.90

Max.Eff.Inten.(mm/hr)=	187.92	19.08
over (min)	5.00	8.00

```
     Storage Coeff.  (min)=       2.32 (ii)    7.38 (ii)
     Unit Hyd. Tpeak (min)=       5.00         8.00
     Unit Hyd. peak  (cms)=       0.35         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.47         0.04          0.498 (iii)
     TIME TO PEAK    (hrs)=       1.03         1.12           1.03
     RUNOFF VOLUME    (mm)=      61.14         9.08          32.50
     TOTAL RAINFALL   (mm)=      63.14        63.14          63.14
     RUNOFF COEFFICIENT   =       0.97         0.14           0.51


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  39.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0800)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  1.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0060      0.0230
                          0.0060     0.0010   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      2.500      0.498      1.03      32.50
   OUTFLOW: ID= 1 (  0800)      0.898      0.006      0.43      32.50
   OVERFLOW:ID= 3 (  0003)      1.602      0.475      1.05      32.50

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =   126
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  2.10
                  PERCENTAGE OF TIME OVERFLOWING   (%) = 14.06

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.21
                  TIME SHIFT OF PEAK FLOW         (min)=-36.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0230

--------------------------------------------------------------------------------

  --------------------------
  | Junction Command(0017) |
  --------------------------

                           AREA     QPEAK   TPEAK     R.V.
                           (ha)     (cms)    (hrs)     (mm)
  INFLOW : ID= 1(  0800)    0.90      0.01    0.43    32.50
  OUTFLOW: ID= 2(  0017)    0.90      0.01    0.43    32.50
```

```
  ------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0200)|   Area     (ha)=   0.70
|ID= 1 DT= 1.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  20.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.39         0.31
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      20.00        20.00
     Mannings n             =    0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
  TIME     RAIN |  TIME     RAIN |'  TIME     RAIN |  TIME     RAIN
   hrs    mm/hr |   hrs    mm/hr |'   hrs    mm/hr |   hrs    mm/hr
 0.017     7.44 | 0.767    27.30 | 1.517    16.36 |  2.27     9.15
 0.033     7.44 | 0.783    27.30 | 1.533    16.36 |  2.28     9.15
 0.050     7.44 | 0.800    27.30 | 1.550    16.36 |  2.30     9.15
 0.067     7.44 | 0.817    27.30 | 1.567    16.36 |  2.32     9.15
 0.083     7.44 | 0.833    27.30 | 1.583    16.36 |  2.33     9.15
 0.100     7.97 | 0.850    54.38 | 1.600    14.88 |  2.35     8.77
 0.117     7.97 | 0.867    54.38 | 1.617    14.88 |  2.37     8.77
 0.133     7.97 | 0.883    54.38 | 1.633    14.88 |  2.38     8.77
 0.150     7.97 | 0.900    54.38 | 1.650    14.88 |  2.40     8.77
 0.167     7.97 | 0.917    54.38 | 1.667    14.88 |  2.42     8.77
 0.183     8.59 | 0.933   187.91 | 1.683    13.69 |  2.43     8.43
 0.200     8.59 | 0.950   187.92 | 1.700    13.69 |  2.45     8.43
 0.217     8.59 | 0.967   187.92 | 1.717    13.69 |  2.47     8.43
 0.233     8.59 | 0.983   187.92 | 1.733    13.69 |  2.48     8.43
 0.250     8.59 | 1.000   187.92 | 1.750    13.69 |  2.50     8.43
 0.267     9.35 | 1.017    68.12 | 1.767    12.71 |  2.52     8.12
 0.283     9.35 | 1.033    68.12 | 1.783    12.71 |  2.53     8.12
 0.300     9.35 | 1.050    68.12 | 1.800    12.71 |  2.55     8.12
 0.317     9.35 | 1.067    68.12 | 1.817    12.71 |  2.57     8.12
 0.333     9.35 | 1.083    68.12 | 1.833    12.71 |  2.58     8.12
 0.350    10.29 | 1.100    40.69 | 1.850    11.88 |  2.60     7.83
 0.367    10.29 | 1.117    40.69 | 1.867    11.88 |  2.62     7.83
 0.383    10.29 | 1.133    40.69 | 1.883    11.88 |  2.63     7.83
 0.400    10.29 | 1.150    40.69 | 1.900    11.88 |  2.65     7.83
 0.417    10.29 | 1.167    40.69 | 1.917    11.88 |  2.67     7.83
 0.433    11.52 | 1.183    30.18 | 1.933    11.18 |  2.68     7.57
 0.450    11.52 | 1.200    30.18 | 1.950    11.18 |  2.70     7.57
 0.467    11.52 | 1.217    30.18 | 1.967    11.18 |  2.72     7.57
 0.483    11.52 | 1.233    30.18 | 1.983    11.18 |  2.73     7.57
 0.500    11.52 | 1.250    30.18 | 2.000    11.18 |  2.75     7.57
```

```
               0.517   13.19 | 1.267   24.47 | 2.017   10.57 |  2.77    7.33
               0.533   13.19 | 1.283   24.47 | 2.033   10.57 |  2.78    7.33
               0.550   13.19 | 1.300   24.47 | 2.050   10.57 |  2.80    7.33
               0.567   13.19 | 1.317   24.47 | 2.067   10.57 |  2.82    7.33
               0.583   13.19 | 1.333   24.47 | 2.083   10.57 |  2.83    7.33
               0.600   15.60 | 1.350   20.82 | 2.100   10.04 |  2.85    7.11
               0.617   15.60 | 1.367   20.82 | 2.117   10.04 |  2.87    7.11
               0.633   15.60 | 1.383   20.82 | 2.133   10.04 |  2.88    7.11
               0.650   15.60 | 1.400   20.82 | 2.150   10.04 |  2.90    7.11
               0.667   15.60 | 1.417   20.82 | 2.167   10.04 |  2.92    7.11
               0.683   19.52 | 1.433   18.26 | 2.183    9.57 |  2.93    6.90
               0.700   19.52 | 1.450   18.26 | 2.200    9.57 |  2.95    6.90
               0.717   19.52 | 1.467   18.26 | 2.217    9.57 |  2.97    6.90
               0.733   19.52 | 1.483   18.26 | 2.233    9.57 |  2.98    6.90
               0.750   19.52 | 1.500   18.26 | 2.250    9.57 |  3.00    6.90

     Max.Eff.Inten.(mm/hr)=     187.92        40.58
               over (min)         5.00         6.00
     Storage Coeff.  (min)=       0.76 (ii)    5.76 (ii)
     Unit Hyd. Tpeak (min)=       5.00         6.00
     Unit Hyd. peak  (cms)=       0.51         0.19
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.07         0.03          0.089 (iii)
     TIME TO PEAK    (hrs)=       1.02         1.08           1.02
     RUNOFF VOLUME    (mm)=      61.14        12.82          22.48
     TOTAL RAINFALL   (mm)=      63.14        63.14          63.14
     RUNOFF COEFFICIENT   =       0.97         0.20           0.36

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  39.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0999)|   Area     (ha)=   1.60   Curve Number    (CN)= 30.0
|ID= 1 DT= 1.0 min |   Ia       (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
```

hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.017	7.44	0.767	27.30	1.517	16.36	2.27	9.15
0.033	7.44	0.783	27.30	1.533	16.36	2.28	9.15
0.050	7.44	0.800	27.30	1.550	16.36	2.30	9.15
0.067	7.44	0.817	27.30	1.567	16.36	2.32	9.15
0.083	7.44	0.833	27.30	1.583	16.36	2.33	9.15
0.100	7.97	0.850	54.38	1.600	14.88	2.35	8.77
0.117	7.97	0.867	54.38	1.617	14.88	2.37	8.77
0.133	7.97	0.883	54.38	1.633	14.88	2.38	8.77
0.150	7.97	0.900	54.38	1.650	14.88	2.40	8.77
0.167	7.97	0.917	54.38	1.667	14.88	2.42	8.77
0.183	8.59	0.933	187.91	1.683	13.69	2.43	8.43
0.200	8.59	0.950	187.92	1.700	13.69	2.45	8.43
0.217	8.59	0.967	187.92	1.717	13.69	2.47	8.43
0.233	8.59	0.983	187.92	1.733	13.69	2.48	8.43
0.250	8.59	1.000	187.92	1.750	13.69	2.50	8.43
0.267	9.35	1.017	68.12	1.767	12.71	2.52	8.12
0.283	9.35	1.033	68.12	1.783	12.71	2.53	8.12
0.300	9.35	1.050	68.12	1.800	12.71	2.55	8.12
0.317	9.35	1.067	68.12	1.817	12.71	2.57	8.12
0.333	9.35	1.083	68.12	1.833	12.71	2.58	8.12
0.350	10.29	1.100	40.69	1.850	11.88	2.60	7.83
0.367	10.29	1.117	40.69	1.867	11.88	2.62	7.83
0.383	10.29	1.133	40.69	1.883	11.88	2.63	7.83
0.400	10.29	1.150	40.69	1.900	11.88	2.65	7.83
0.417	10.29	1.167	40.69	1.917	11.88	2.67	7.83
0.433	11.52	1.183	30.18	1.933	11.18	2.68	7.57
0.450	11.52	1.200	30.18	1.950	11.18	2.70	7.57
0.467	11.52	1.217	30.18	1.967	11.18	2.72	7.57
0.483	11.52	1.233	30.18	1.983	11.18	2.73	7.57
0.500	11.52	1.250	30.18	2.000	11.18	2.75	7.57
0.517	13.19	1.267	24.47	2.017	10.57	2.77	7.33
0.533	13.19	1.283	24.47	2.033	10.57	2.78	7.33
0.550	13.19	1.300	24.47	2.050	10.57	2.80	7.33
0.567	13.19	1.317	24.47	2.067	10.57	2.82	7.33
0.583	13.19	1.333	24.47	2.083	10.57	2.83	7.33
0.600	15.60	1.350	20.82	2.100	10.04	2.85	7.11
0.617	15.60	1.367	20.82	2.117	10.04	2.87	7.11
0.633	15.60	1.383	20.82	2.133	10.04	2.88	7.11
0.650	15.60	1.400	20.82	2.150	10.04	2.90	7.11
0.667	15.60	1.417	20.82	2.167	10.04	2.92	7.11
0.683	19.52	1.433	18.26	2.183	9.57	2.93	6.90
0.700	19.52	1.450	18.26	2.200	9.57	2.95	6.90
0.717	19.52	1.467	18.26	2.217	9.57	2.97	6.90
0.733	19.52	1.483	18.26	2.233	9.57	2.98	6.90
0.750	19.52	1.500	18.26	2.250	9.57	3.00	6.90

Unit Hyd Qpeak (cms)= 0.306

PEAK FLOW (cms)= 0.017 (i)

```
     TIME TO PEAK    (hrs)=   1.300
     RUNOFF VOLUME    (mm)=   4.372
     TOTAL RAINFALL   (mm)=  63.140
     RUNOFF COEFFICIENT   =   0.069

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0801)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)      (mm)
        ID1= 1 (  0200):     0.70   0.089     1.02    22.48
      + ID2= 2 (  0800):     1.60   0.475     1.05    32.50
        ================================================
        ID = 3 (  0801):     2.30   0.557     1.05    29.45

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0801)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)      (mm)
        ID1= 3 (  0801):     2.30   0.557     1.05    29.45
      + ID2= 2 (  0999):     1.60   0.017     1.30     4.37
        ================================================
        ID = 1 (  0801):     3.90   0.563     1.05    19.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0803)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  1.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0280      0.0240
                         0.0010     0.0000   |   0.0300      0.0280
                         0.0010     0.0020   |   0.0320      0.0330
                         0.0010     0.0040   |   0.0420      0.0390
                         0.0080     0.0060   |   0.0550      0.0450
                         0.0150     0.0090   |   0.0630      0.0510
                         0.0190     0.0120   |   0.0700      0.0580
                         0.0220     0.0160   |   0.0760      0.0660
                         0.0250     0.0190   |   0.0820      0.0740

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0801)      3.902      0.563      1.05      19.17
```

```
   OUTFLOW: ID= 1 (  0803)      3.902      0.052      2.22      19.17

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  9.25
                  TIME SHIFT OF PEAK FLOW         (min)= 70.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0437

--------------------------------------------------------------------------------
================================================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\0790415d-f730-4902-885a-
375fca2a0341\scenari
  Summary filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\0790415d-f730-4902-885a-
375fca2a0341\scenari


DATE: 11-06-2023                          TIME: 03:25:22

USER:


COMMENTS: _____________________________________________________________

--------------------------------------------------------------------------------------------------------------------
  ********************************************
  ** SIMULATION : 25mm Water Quality Event      **
  ********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 538.850
```

```
| Ptotal= 25.05 mm |                          B=   6.331
--------------------                          C=   0.809
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.42	1.00	6.93	2.00	4.25	3.00	1.92
0.08	1.51	1.08	10.96	2.08	3.84	3.08	1.84
0.17	1.61	1.17	25.75	2.17	3.51	3.17	1.77
0.25	1.74	1.25	75.61	2.25	3.23	3.25	1.71
0.33	1.88	1.33	33.15	2.33	2.99	3.33	1.64
0.42	2.06	1.42	18.38	2.42	2.79	3.42	1.59
0.50	2.27	1.50	12.51	2.50	2.62	3.50	1.53
0.58	2.54	1.58	9.43	2.58	2.47	3.58	1.49
0.67	2.89	1.67	7.56	2.67	2.33	3.67	1.44
0.75	3.36	1.75	6.32	2.75	2.21	3.75	1.40
0.83	4.04	1.83	5.43	2.83	2.11	3.83	1.36
0.92	5.09	1.92	4.76	2.92	2.01	3.92	1.32

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   2.50
|ID= 1 DT= 1.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  45.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.38         1.12
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     130.00        35.00
     Mannings n             =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	1.42	1.017	6.93	2.017	4.25	3.02	1.92
0.033	1.42	1.033	6.93	2.033	4.25	3.03	1.92
0.050	1.42	1.050	6.93	2.050	4.25	3.05	1.92
0.067	1.42	1.067	6.93	2.067	4.25	3.07	1.92
0.083	1.42	1.083	6.93	2.083	4.25	3.08	1.92
0.100	1.51	1.100	10.96	2.100	3.84	3.10	1.84
0.117	1.51	1.117	10.96	2.117	3.84	3.12	1.84

0.133	1.51	1.133	10.96	2.133	3.84	3.13	1.84
0.150	1.51	1.150	10.96	2.150	3.84	3.15	1.84
0.167	1.51	1.167	10.96	2.167	3.84	3.17	1.84
0.183	1.61	1.183	25.75	2.183	3.51	3.18	1.77
0.200	1.61	1.200	25.75	2.200	3.51	3.20	1.77
0.217	1.61	1.217	25.75	2.217	3.51	3.22	1.77
0.233	1.61	1.233	25.75	2.233	3.51	3.23	1.77
0.250	1.61	1.250	25.75	2.250	3.51	3.25	1.77
0.267	1.74	1.267	75.61	2.267	3.23	3.27	1.71
0.283	1.74	1.283	75.61	2.283	3.23	3.28	1.71
0.300	1.74	1.300	75.61	2.300	3.23	3.30	1.71
0.317	1.74	1.317	75.61	2.317	3.23	3.32	1.71
0.333	1.74	1.333	75.61	2.333	3.23	3.33	1.71
0.350	1.88	1.350	33.15	2.350	2.99	3.35	1.64
0.367	1.88	1.367	33.15	2.367	2.99	3.37	1.64
0.383	1.88	1.383	33.15	2.383	2.99	3.38	1.64
0.400	1.88	1.400	33.15	2.400	2.99	3.40	1.64
0.417	1.88	1.417	33.15	2.417	2.99	3.42	1.64
0.433	2.06	1.433	18.38	2.433	2.79	3.43	1.59
0.450	2.06	1.450	18.38	2.450	2.79	3.45	1.59
0.467	2.06	1.467	18.38	2.467	2.79	3.47	1.59
0.483	2.06	1.483	18.38	2.483	2.79	3.48	1.59
0.500	2.06	1.500	18.38	2.500	2.79	3.50	1.59
0.517	2.27	1.517	12.51	2.517	2.62	3.52	1.53
0.533	2.27	1.533	12.51	2.533	2.62	3.53	1.53
0.550	2.27	1.550	12.51	2.550	2.62	3.55	1.53
0.567	2.27	1.567	12.51	2.567	2.62	3.57	1.53
0.583	2.27	1.583	12.51	2.583	2.62	3.58	1.53
0.600	2.54	1.600	9.43	2.600	2.47	3.60	1.49
0.617	2.54	1.617	9.43	2.617	2.47	3.62	1.49
0.633	2.54	1.633	9.43	2.633	2.47	3.63	1.49
0.650	2.54	1.650	9.43	2.650	2.47	3.65	1.49
0.667	2.54	1.667	9.43	2.667	2.47	3.67	1.49
0.683	2.89	1.683	7.56	2.683	2.33	3.68	1.44
0.700	2.89	1.700	7.56	2.700	2.33	3.70	1.44
0.717	2.89	1.717	7.56	2.717	2.33	3.72	1.44
0.733	2.89	1.733	7.56	2.733	2.33	3.73	1.44
0.750	2.89	1.750	7.56	2.750	2.33	3.75	1.44
0.767	3.36	1.767	6.32	2.767	2.21	3.77	1.40
0.783	3.36	1.783	6.32	2.783	2.21	3.78	1.40
0.800	3.36	1.800	6.32	2.800	2.21	3.80	1.40
0.817	3.36	1.817	6.32	2.817	2.21	3.82	1.40
0.833	3.36	1.833	6.32	2.833	2.21	3.83	1.40
0.850	4.04	1.850	5.43	2.850	2.11	3.85	1.36
0.867	4.04	1.867	5.43	2.867	2.11	3.87	1.36
0.883	4.04	1.883	5.43	2.883	2.11	3.88	1.36
0.900	4.04	1.900	5.43	2.900	2.11	3.90	1.36
0.917	4.04	1.917	5.43	2.917	2.11	3.92	1.36
0.933	5.09	1.933	4.76	2.933	2.01	3.93	1.32
0.950	5.09	1.950	4.76	2.950	2.01	3.95	1.32

```
               0.967    5.09 | 1.967    4.76 | 2.967    2.01 |  3.97    1.32
               0.983    5.09 | 1.983    4.76 | 2.983    2.01 |  3.98    1.32
               1.000    5.09 | 2.000    4.76 | 3.000    2.01 |  4.00    1.32

     Max.Eff.Inten.(mm/hr)=      75.61         2.61
               over (min)         5.00        11.00
     Storage Coeff.  (min)=       3.34 (ii)   10.63 (ii)
     Unit Hyd. Tpeak (min)=       5.00        11.00
     Unit Hyd. peak  (cms)=       0.29         0.11
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.18         0.00          0.179 (iii)
     TIME TO PEAK    (hrs)=       1.37         1.57           1.37
     RUNOFF VOLUME    (mm)=      23.05         1.27          11.07
     TOTAL RAINFALL   (mm)=      25.05        25.05          25.05
     RUNOFF COEFFICIENT   =       0.92         0.05           0.44


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  39.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT)  SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0800)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  1.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0060      0.0230
                          0.0060     0.0010   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      2.500      0.179      1.37      11.07
   OUTFLOW: ID= 1 (  0800)      2.500      0.006      1.17      11.05
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                  PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.35
                  TIME SHIFT OF PEAK FLOW         (min)=-12.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0213

--------------------------------------------------------------------------------

  --------------------------
  | Junction Command(0017) |
```

```
  --------------------------

                          AREA     QPEAK   TPEAK     R.V.
                          (ha)     (cms)    (hrs)    (mm)
  INFLOW : ID= 1(  0800)    2.50     0.01    1.17    11.05
  OUTFLOW: ID= 2(  0017)    2.50     0.01    1.17    11.05

  ------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0200)|   Area    (ha)=   0.70
|ID= 1 DT= 1.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  20.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.39         0.31
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      20.00        20.00
     Mannings n             =    0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME     RAIN |  TIME     RAIN |'  TIME     RAIN |  TIME     RAIN
                 hrs    mm/hr |   hrs    mm/hr |'   hrs    mm/hr |   hrs    mm/hr
               0.017     1.42 | 1.017     6.93 | 2.017     4.25 |  3.02     1.92
               0.033     1.42 | 1.033     6.93 | 2.033     4.25 |  3.03     1.92
               0.050     1.42 | 1.050     6.93 | 2.050     4.25 |  3.05     1.92
               0.067     1.42 | 1.067     6.93 | 2.067     4.25 |  3.07     1.92
               0.083     1.42 | 1.083     6.93 | 2.083     4.25 |  3.08     1.92
               0.100     1.51 | 1.100    10.96 | 2.100     3.84 |  3.10     1.84
               0.117     1.51 | 1.117    10.96 | 2.117     3.84 |  3.12     1.84
               0.133     1.51 | 1.133    10.96 | 2.133     3.84 |  3.13     1.84
               0.150     1.51 | 1.150    10.96 | 2.150     3.84 |  3.15     1.84
               0.167     1.51 | 1.167    10.96 | 2.167     3.84 |  3.17     1.84
               0.183     1.61 | 1.183    25.75 | 2.183     3.51 |  3.18     1.77
               0.200     1.61 | 1.200    25.75 | 2.200     3.51 |  3.20     1.77
               0.217     1.61 | 1.217    25.75 | 2.217     3.51 |  3.22     1.77
               0.233     1.61 | 1.233    25.75 | 2.233     3.51 |  3.23     1.77
               0.250     1.61 | 1.250    25.75 | 2.250     3.51 |  3.25     1.77
               0.267     1.74 | 1.267    75.61 | 2.267     3.23 |  3.27     1.71
               0.283     1.74 | 1.283    75.61 | 2.283     3.23 |  3.28     1.71
               0.300     1.74 | 1.300    75.61 | 2.300     3.23 |  3.30     1.71
               0.317     1.74 | 1.317    75.61 | 2.317     3.23 |  3.32     1.71
               0.333     1.74 | 1.333    75.61 | 2.333     3.23 |  3.33     1.71
               0.350     1.88 | 1.350    33.15 | 2.350     2.99 |  3.35     1.64
               0.367     1.88 | 1.367    33.15 | 2.367     2.99 |  3.37     1.64
               0.383     1.88 | 1.383    33.15 | 2.383     2.99 |  3.38     1.64
               0.400     1.88 | 1.400    33.15 | 2.400     2.99 |  3.40     1.64
```

0.417	1.88	1.417	33.15	2.417	2.99	3.42	1.64
0.433	2.06	1.433	18.38	2.433	2.79	3.43	1.59
0.450	2.06	1.450	18.38	2.450	2.79	3.45	1.59
0.467	2.06	1.467	18.38	2.467	2.79	3.47	1.59
0.483	2.06	1.483	18.38	2.483	2.79	3.48	1.59
0.500	2.06	1.500	18.38	2.500	2.79	3.50	1.59
0.517	2.27	1.517	12.51	2.517	2.62	3.52	1.53
0.533	2.27	1.533	12.51	2.533	2.62	3.53	1.53
0.550	2.27	1.550	12.51	2.550	2.62	3.55	1.53
0.567	2.27	1.567	12.51	2.567	2.62	3.57	1.53
0.583	2.27	1.583	12.51	2.583	2.62	3.58	1.53
0.600	2.54	1.600	9.43	2.600	2.47	3.60	1.49
0.617	2.54	1.617	9.43	2.617	2.47	3.62	1.49
0.633	2.54	1.633	9.43	2.633	2.47	3.63	1.49
0.650	2.54	1.650	9.43	2.650	2.47	3.65	1.49
0.667	2.54	1.667	9.43	2.667	2.47	3.67	1.49
0.683	2.89	1.683	7.56	2.683	2.33	3.68	1.44
0.700	2.89	1.700	7.56	2.700	2.33	3.70	1.44
0.717	2.89	1.717	7.56	2.717	2.33	3.72	1.44
0.733	2.89	1.733	7.56	2.733	2.33	3.73	1.44
0.750	2.89	1.750	7.56	2.750	2.33	3.75	1.44
0.767	3.36	1.767	6.32	2.767	2.21	3.77	1.40
0.783	3.36	1.783	6.32	2.783	2.21	3.78	1.40
0.800	3.36	1.800	6.32	2.800	2.21	3.80	1.40
0.817	3.36	1.817	6.32	2.817	2.21	3.82	1.40
0.833	3.36	1.833	6.32	2.833	2.21	3.83	1.40
0.850	4.04	1.850	5.43	2.850	2.11	3.85	1.36
0.867	4.04	1.867	5.43	2.867	2.11	3.87	1.36
0.883	4.04	1.883	5.43	2.883	2.11	3.88	1.36
0.900	4.04	1.900	5.43	2.900	2.11	3.90	1.36
0.917	4.04	1.917	5.43	2.917	2.11	3.92	1.36
0.933	5.09	1.933	4.76	2.933	2.01	3.93	1.32
0.950	5.09	1.950	4.76	2.950	2.01	3.95	1.32
0.967	5.09	1.967	4.76	2.967	2.01	3.97	1.32
0.983	5.09	1.983	4.76	2.983	2.01	3.98	1.32
1.000	5.09	2.000	4.76	3.000	2.01	4.00	1.32

Max.Eff.Inten.(mm/hr)=	75.61	6.45	
over (min)	5.00	9.00	
Storage Coeff. (min)=	1.09 (ii)	8.29 (ii)	
Unit Hyd. Tpeak (min)=	5.00	9.00	
Unit Hyd. peak (cms)=	0.46	0.13	
			TOTALS
PEAK FLOW (cms)=	0.03	0.00	0.028 (iii)
TIME TO PEAK (hrs)=	1.35	1.52	1.35
RUNOFF VOLUME (mm)=	23.05	2.01	6.21
TOTAL RAINFALL (mm)=	25.05	25.05	25.05
RUNOFF COEFFICIENT =	0.92	0.08	0.25

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%

```
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  39.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0999)|   Area     (ha)=   1.60   Curve Number    (CN)= 30.0
|ID= 1 DT= 1.0 min |   Ia       (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	1.42	1.017	6.93	2.017	4.25	3.02	1.92
0.033	1.42	1.033	6.93	2.033	4.25	3.03	1.92
0.050	1.42	1.050	6.93	2.050	4.25	3.05	1.92
0.067	1.42	1.067	6.93	2.067	4.25	3.07	1.92
0.083	1.42	1.083	6.93	2.083	4.25	3.08	1.92
0.100	1.51	1.100	10.96	2.100	3.84	3.10	1.84
0.117	1.51	1.117	10.96	2.117	3.84	3.12	1.84
0.133	1.51	1.133	10.96	2.133	3.84	3.13	1.84
0.150	1.51	1.150	10.96	2.150	3.84	3.15	1.84
0.167	1.51	1.167	10.96	2.167	3.84	3.17	1.84
0.183	1.61	1.183	25.75	2.183	3.51	3.18	1.77
0.200	1.61	1.200	25.75	2.200	3.51	3.20	1.77
0.217	1.61	1.217	25.75	2.217	3.51	3.22	1.77
0.233	1.61	1.233	25.75	2.233	3.51	3.23	1.77
0.250	1.61	1.250	25.75	2.250	3.51	3.25	1.77
0.267	1.74	1.267	75.61	2.267	3.23	3.27	1.71
0.283	1.74	1.283	75.61	2.283	3.23	3.28	1.71
0.300	1.74	1.300	75.61	2.300	3.23	3.30	1.71
0.317	1.74	1.317	75.61	2.317	3.23	3.32	1.71
0.333	1.74	1.333	75.61	2.333	3.23	3.33	1.71
0.350	1.88	1.350	33.15	2.350	2.99	3.35	1.64
0.367	1.88	1.367	33.15	2.367	2.99	3.37	1.64
0.383	1.88	1.383	33.15	2.383	2.99	3.38	1.64
0.400	1.88	1.400	33.15	2.400	2.99	3.40	1.64
0.417	1.88	1.417	33.15	2.417	2.99	3.42	1.64
0.433	2.06	1.433	18.38	2.433	2.79	3.43	1.59
0.450	2.06	1.450	18.38	2.450	2.79	3.45	1.59
0.467	2.06	1.467	18.38	2.467	2.79	3.47	1.59
0.483	2.06	1.483	18.38	2.483	2.79	3.48	1.59

```
                0.500    2.06 | 1.500   18.38 | 2.500    2.79 |  3.50    1.59
                0.517    2.27 | 1.517   12.51 | 2.517    2.62 |  3.52    1.53
                0.533    2.27 | 1.533   12.51 | 2.533    2.62 |  3.53    1.53
                0.550    2.27 | 1.550   12.51 | 2.550    2.62 |  3.55    1.53
                0.567    2.27 | 1.567   12.51 | 2.567    2.62 |  3.57    1.53
                0.583    2.27 | 1.583   12.51 | 2.583    2.62 |  3.58    1.53
                0.600    2.54 | 1.600    9.43 | 2.600    2.47 |  3.60    1.49
                0.617    2.54 | 1.617    9.43 | 2.617    2.47 |  3.62    1.49
                0.633    2.54 | 1.633    9.43 | 2.633    2.47 |  3.63    1.49
                0.650    2.54 | 1.650    9.43 | 2.650    2.47 |  3.65    1.49
                0.667    2.54 | 1.667    9.43 | 2.667    2.47 |  3.67    1.49
                0.683    2.89 | 1.683    7.56 | 2.683    2.33 |  3.68    1.44
                0.700    2.89 | 1.700    7.56 | 2.700    2.33 |  3.70    1.44
                0.717    2.89 | 1.717    7.56 | 2.717    2.33 |  3.72    1.44
                0.733    2.89 | 1.733    7.56 | 2.733    2.33 |  3.73    1.44
                0.750    2.89 | 1.750    7.56 | 2.750    2.33 |  3.75    1.44
                0.767    3.36 | 1.767    6.32 | 2.767    2.21 |  3.77    1.40
                0.783    3.36 | 1.783    6.32 | 2.783    2.21 |  3.78    1.40
                0.800    3.36 | 1.800    6.32 | 2.800    2.21 |  3.80    1.40
                0.817    3.36 | 1.817    6.32 | 2.817    2.21 |  3.82    1.40
                0.833    3.36 | 1.833    6.32 | 2.833    2.21 |  3.83    1.40
                0.850    4.04 | 1.850    5.43 | 2.850    2.11 |  3.85    1.36
                0.867    4.04 | 1.867    5.43 | 2.867    2.11 |  3.87    1.36
                0.883    4.04 | 1.883    5.43 | 2.883    2.11 |  3.88    1.36
                0.900    4.04 | 1.900    5.43 | 2.900    2.11 |  3.90    1.36
                0.917    4.04 | 1.917    5.43 | 2.917    2.11 |  3.92    1.36
                0.933    5.09 | 1.933    4.76 | 2.933    2.01 |  3.93    1.32
                0.950    5.09 | 1.950    4.76 | 2.950    2.01 |  3.95    1.32
                0.967    5.09 | 1.967    4.76 | 2.967    2.01 |  3.97    1.32
                0.983    5.09 | 1.983    4.76 | 2.983    2.01 |  3.98    1.32
                1.000    5.09 | 2.000    4.76 | 3.000    2.01 |  4.00    1.32

     Unit Hyd Qpeak  (cms)=   0.306

     PEAK FLOW       (cms)=   0.001 (i)
     TIME TO PEAK    (hrs)=   1.767
     RUNOFF VOLUME    (mm)=   0.372
     TOTAL RAINFALL   (mm)=  25.047
     RUNOFF COEFFICIENT   =   0.015

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0801)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0800 <ID= 2> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0003 = HYDROGRAPH 0001
```

```
        ID1= 1 (  0200):     0.70   0.028     1.35     6.21
      + ID2= 2 (  0800):     0.00   0.000     0.00     0.00
        ================================================
        ID = 3 (  0801):     0.70   0.028     1.35     6.21

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0801)|
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0801):     0.70   0.028     1.35     6.21
      + ID2= 2 (  0999):     1.60   0.001     1.77     0.37
        ================================================
        ID = 1 (  0801):     2.30   0.028     1.35     2.15

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0803)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  1.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |    (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0280      0.0240
                          0.0010     0.0000   |   0.0300      0.0280
                          0.0010     0.0020   |   0.0320      0.0330
                          0.0010     0.0040   |   0.0420      0.0390
                          0.0080     0.0060   |   0.0550      0.0450
                          0.0150     0.0090   |   0.0630      0.0510
                          0.0190     0.0120   |   0.0700      0.0580
                          0.0220     0.0160   |   0.0760      0.0660
                          0.0250     0.0190   |   0.0820      0.0740

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0801)      2.300      0.028      1.35       2.15
   OUTFLOW: ID= 1 (  0803)      2.300      0.001      0.97       2.15

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.51
                  TIME SHIFT OF PEAK FLOW         (min)=-23.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0038

--------------------------------------------------------------------------------
================================================================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
```

```
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\724d577d-4fdf-4df0-ac00-
5b3898d9fdc7\scenari
  Summary filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\724d577d-4fdf-4df0-ac00-
5b3898d9fdc7\scenari


DATE: 11-06-2023                          TIME: 03:25:22

USER:


COMMENTS: _____________________________________________________________

-------------------------------------------------------------------------------------------------------------------
  ***********************************************
  ** SIMULATION : 5 YR 3-HR Chicago - County of **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 583.071
| Ptotal= 44.90 mm |                          B=   3.007
--------------------                          C=   0.703
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    4.98 |  0.75   19.68 |'  1.50   11.41 |  2.25    6.17
                0.08    5.34 |  0.83   40.72 |'  1.58   10.32 |  2.33    5.91
                0.17    5.78 |  0.92  135.08 |'  1.67    9.45 |  2.42    5.67
```

0.25	6.32	1.00	51.41	1.75	8.73	2.50	5.45
0.33	6.99	1.08	30.07	1.83	8.14	2.58	5.25
0.42	7.87	1.17	21.89	1.92	7.63	2.67	5.06
0.50	9.08	1.25	17.51	2.00	7.19	2.75	4.90
0.58	10.85	1.33	14.74	2.08	6.81	2.83	4.74
0.67	13.77	1.42	12.83	2.17	6.47	2.92	4.60

CALIB	
STANDHYD (0201)	Area (ha)= 2.50
ID= 1 DT= 1.0 min	Total Imp(%)= 55.00 Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	1.38	1.12
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	130.00	35.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	4.98	0.767	19.68	1.517	11.41	2.27	6.17
0.033	4.98	0.783	19.68	1.533	11.41	2.28	6.17
0.050	4.98	0.800	19.68	1.550	11.41	2.30	6.17
0.067	4.98	0.817	19.68	1.567	11.41	2.32	6.17
0.083	4.98	0.833	19.68	1.583	11.41	2.33	6.17
0.100	5.34	0.850	40.72	1.600	10.32	2.35	5.91
0.117	5.34	0.867	40.72	1.617	10.32	2.37	5.91
0.133	5.34	0.883	40.72	1.633	10.32	2.38	5.91
0.150	5.34	0.900	40.72	1.650	10.32	2.40	5.91
0.167	5.34	0.917	40.72	1.667	10.32	2.42	5.91
0.183	5.78	0.933	135.08	1.683	9.45	2.43	5.67
0.200	5.78	0.950	135.08	1.700	9.45	2.45	5.67
0.217	5.78	0.967	135.08	1.717	9.45	2.47	5.67
0.233	5.78	0.983	135.08	1.733	9.45	2.48	5.67
0.250	5.78	1.000	135.08	1.750	9.45	2.50	5.67
0.267	6.32	1.017	51.42	1.767	8.73	2.52	5.45
0.283	6.32	1.033	51.41	1.783	8.73	2.53	5.45
0.300	6.32	1.050	51.41	1.800	8.73	2.55	5.45
0.317	6.32	1.067	51.41	1.817	8.73	2.57	5.45
0.333	6.32	1.083	51.41	1.833	8.73	2.58	5.45
0.350	6.99	1.100	30.07	1.850	8.14	2.60	5.25
0.367	6.99	1.117	30.07	1.867	8.14	2.62	5.25
0.383	6.99	1.133	30.07	1.883	8.14	2.63	5.25

```
               0.400    6.99 | 1.150   30.07 | 1.900    8.14 |  2.65    5.25
               0.417    6.99 | 1.167   30.07 | 1.917    8.14 |  2.67    5.25
               0.433    7.87 | 1.183   21.89 | 1.933    7.63 |  2.68    5.06
               0.450    7.87 | 1.200   21.89 | 1.950    7.63 |  2.70    5.06
               0.467    7.87 | 1.217   21.89 | 1.967    7.63 |  2.72    5.06
               0.483    7.87 | 1.233   21.89 | 1.983    7.63 |  2.73    5.06
               0.500    7.87 | 1.250   21.89 | 2.000    7.63 |  2.75    5.06
               0.517    9.08 | 1.267   17.51 | 2.017    7.19 |  2.77    4.90
               0.533    9.08 | 1.283   17.51 | 2.033    7.19 |  2.78    4.90
               0.550    9.08 | 1.300   17.51 | 2.050    7.19 |  2.80    4.90
               0.567    9.08 | 1.317   17.51 | 2.067    7.19 |  2.82    4.90
               0.583    9.08 | 1.333   17.51 | 2.083    7.19 |  2.83    4.90
               0.600   10.85 | 1.350   14.74 | 2.100    6.81 |  2.85    4.74
               0.617   10.85 | 1.367   14.74 | 2.117    6.81 |  2.87    4.74
               0.633   10.85 | 1.383   14.74 | 2.133    6.81 |  2.88    4.74
               0.650   10.85 | 1.400   14.74 | 2.150    6.81 |  2.90    4.74
               0.667   10.85 | 1.417   14.74 | 2.167    6.81 |  2.92    4.74
               0.683   13.77 | 1.433   12.83 | 2.183    6.47 |  2.93    4.60
               0.700   13.77 | 1.450   12.83 | 2.200    6.47 |  2.95    4.60
               0.717   13.77 | 1.467   12.83 | 2.217    6.47 |  2.97    4.60
               0.733   13.77 | 1.483   12.83 | 2.233    6.47 |  2.98    4.60
               0.750   13.77 | 1.500   12.83 | 2.250    6.47 |  3.00    4.60

     Max.Eff.Inten.(mm/hr)=     135.08         9.55
               over (min)         5.00         9.00
     Storage Coeff.  (min)=       2.65 (ii)    8.43 (ii)
     Unit Hyd. Tpeak (min)=       5.00         9.00
     Unit Hyd. peak  (cms)=       0.33         0.13
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.33         0.02          0.341 (iii)
     TIME TO PEAK    (hrs)=       1.03         1.15           1.03
     RUNOFF VOLUME    (mm)=      42.90         4.55          21.81
     TOTAL RAINFALL   (mm)=      44.90        44.90          44.90
     RUNOFF COEFFICIENT   =       0.96         0.10           0.49


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  39.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0800)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  1.0 min     |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)    |    (cms)     (ha.m.)
                         0.0000     0.0000    |   0.0060      0.0230
                         0.0060     0.0010    |   0.0000      0.0000
```

```
                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)    2.500      0.341      1.03      21.81
   OUTFLOW: ID= 1 (  0800)    1.302      0.006      0.58      22.11
   OVERFLOW:ID= 3 (  0003)    1.198      0.270      1.12      22.11

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =   120
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  2.00
                  PERCENTAGE OF TIME OVERFLOWING   (%) = 13.45

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.76
                  TIME SHIFT OF PEAK FLOW         (min)=-27.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0230

--------------------------------------------------------------------------------

  --------------------------
  | Junction Command(0017) |
  --------------------------

                           AREA     QPEAK   TPEAK     R.V.
                           (ha)     (cms)    (hrs)     (mm)
  INFLOW : ID= 1(  0800)    1.30      0.01    0.58    22.11
  OUTFLOW: ID= 2(  0017)    1.30      0.01    0.58    22.11

  ------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0200)|   Area    (ha)=   0.70
|ID= 1 DT= 1.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  20.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.39         0.31
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      20.00        20.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.


                            ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.017    4.98 | 0.767   19.68 | 1.517   11.41 |  2.27    6.17
               0.033    4.98 | 0.783   19.68 | 1.533   11.41 |  2.28    6.17
               0.050    4.98 | 0.800   19.68 | 1.550   11.41 |  2.30    6.17
               0.067    4.98 | 0.817   19.68 | 1.567   11.41 |  2.32    6.17
               0.083    4.98 | 0.833   19.68 | 1.583   11.41 |  2.33    6.17
```

0.100	5.34	0.850	40.72	1.600	10.32	2.35	5.91
0.117	5.34	0.867	40.72	1.617	10.32	2.37	5.91
0.133	5.34	0.883	40.72	1.633	10.32	2.38	5.91
0.150	5.34	0.900	40.72	1.650	10.32	2.40	5.91
0.167	5.34	0.917	40.72	1.667	10.32	2.42	5.91
0.183	5.78	0.933	135.08	1.683	9.45	2.43	5.67
0.200	5.78	0.950	135.08	1.700	9.45	2.45	5.67
0.217	5.78	0.967	135.08	1.717	9.45	2.47	5.67
0.233	5.78	0.983	135.08	1.733	9.45	2.48	5.67
0.250	5.78	1.000	135.08	1.750	9.45	2.50	5.67
0.267	6.32	1.017	51.42	1.767	8.73	2.52	5.45
0.283	6.32	1.033	51.41	1.783	8.73	2.53	5.45
0.300	6.32	1.050	51.41	1.800	8.73	2.55	5.45
0.317	6.32	1.067	51.41	1.817	8.73	2.57	5.45
0.333	6.32	1.083	51.41	1.833	8.73	2.58	5.45
0.350	6.99	1.100	30.07	1.850	8.14	2.60	5.25
0.367	6.99	1.117	30.07	1.867	8.14	2.62	5.25
0.383	6.99	1.133	30.07	1.883	8.14	2.63	5.25
0.400	6.99	1.150	30.07	1.900	8.14	2.65	5.25
0.417	6.99	1.167	30.07	1.917	8.14	2.67	5.25
0.433	7.87	1.183	21.89	1.933	7.63	2.68	5.06
0.450	7.87	1.200	21.89	1.950	7.63	2.70	5.06
0.467	7.87	1.217	21.89	1.967	7.63	2.72	5.06
0.483	7.87	1.233	21.89	1.983	7.63	2.73	5.06
0.500	7.87	1.250	21.89	2.000	7.63	2.75	5.06
0.517	9.08	1.267	17.51	2.017	7.19	2.77	4.90
0.533	9.08	1.283	17.51	2.033	7.19	2.78	4.90
0.550	9.08	1.300	17.51	2.050	7.19	2.80	4.90
0.567	9.08	1.317	17.51	2.067	7.19	2.82	4.90
0.583	9.08	1.333	17.51	2.083	7.19	2.83	4.90
0.600	10.85	1.350	14.74	2.100	6.81	2.85	4.74
0.617	10.85	1.367	14.74	2.117	6.81	2.87	4.74
0.633	10.85	1.383	14.74	2.133	6.81	2.88	4.74
0.650	10.85	1.400	14.74	2.150	6.81	2.90	4.74
0.667	10.85	1.417	14.74	2.167	6.81	2.92	4.74
0.683	13.77	1.433	12.83	2.183	6.47	2.93	4.60
0.700	13.77	1.450	12.83	2.200	6.47	2.95	4.60
0.717	13.77	1.467	12.83	2.217	6.47	2.97	4.60
0.733	13.77	1.483	12.83	2.233	6.47	2.98	4.60
0.750	13.77	1.500	12.83	2.250	6.47	3.00	4.60

Max.Eff.Inten.(mm/hr)=	135.08	21.15	
over (min)	5.00	7.00	
Storage Coeff. (min)=	0.86 (ii)	6.57 (ii)	
Unit Hyd. Tpeak (min)=	5.00	7.00	
Unit Hyd. peak (cms)=	0.49	0.17	
			TOTALS
PEAK FLOW (cms)=	0.05	0.01	0.057 (iii)
TIME TO PEAK (hrs)=	1.02	1.10	1.02
RUNOFF VOLUME (mm)=	42.90	6.67	13.91

```
     TOTAL RAINFALL   (mm)=      44.90        44.90          44.90
     RUNOFF COEFFICIENT   =       0.96         0.15           0.31

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  39.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0999)|   Area    (ha)=   1.60   Curve Number   (CN)= 30.0
|ID= 1 DT= 1.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.017    4.98 | 0.767   19.68 | 1.517   11.41 |  2.27    6.17
               0.033    4.98 | 0.783   19.68 | 1.533   11.41 |  2.28    6.17
               0.050    4.98 | 0.800   19.68 | 1.550   11.41 |  2.30    6.17
               0.067    4.98 | 0.817   19.68 | 1.567   11.41 |  2.32    6.17
               0.083    4.98 | 0.833   19.68 | 1.583   11.41 |  2.33    6.17
               0.100    5.34 | 0.850   40.72 | 1.600   10.32 |  2.35    5.91
               0.117    5.34 | 0.867   40.72 | 1.617   10.32 |  2.37    5.91
               0.133    5.34 | 0.883   40.72 | 1.633   10.32 |  2.38    5.91
               0.150    5.34 | 0.900   40.72 | 1.650   10.32 |  2.40    5.91
               0.167    5.34 | 0.917   40.72 | 1.667   10.32 |  2.42    5.91
               0.183    5.78 | 0.933  135.08 | 1.683    9.45 |  2.43    5.67
               0.200    5.78 | 0.950  135.08 | 1.700    9.45 |  2.45    5.67
               0.217    5.78 | 0.967  135.08 | 1.717    9.45 |  2.47    5.67
               0.233    5.78 | 0.983  135.08 | 1.733    9.45 |  2.48    5.67
               0.250    5.78 | 1.000  135.08 | 1.750    9.45 |  2.50    5.67
               0.267    6.32 | 1.017   51.42 | 1.767    8.73 |  2.52    5.45
               0.283    6.32 | 1.033   51.41 | 1.783    8.73 |  2.53    5.45
               0.300    6.32 | 1.050   51.41 | 1.800    8.73 |  2.55    5.45
               0.317    6.32 | 1.067   51.41 | 1.817    8.73 |  2.57    5.45
               0.333    6.32 | 1.083   51.41 | 1.833    8.73 |  2.58    5.45
               0.350    6.99 | 1.100   30.07 | 1.850    8.14 |  2.60    5.25
               0.367    6.99 | 1.117   30.07 | 1.867    8.14 |  2.62    5.25
               0.383    6.99 | 1.133   30.07 | 1.883    8.14 |  2.63    5.25
               0.400    6.99 | 1.150   30.07 | 1.900    8.14 |  2.65    5.25
```

```
                0.417    6.99 | 1.167   30.07 | 1.917    8.14 |  2.67    5.25
                0.433    7.87 | 1.183   21.89 | 1.933    7.63 |  2.68    5.06
                0.450    7.87 | 1.200   21.89 | 1.950    7.63 |  2.70    5.06
                0.467    7.87 | 1.217   21.89 | 1.967    7.63 |  2.72    5.06
                0.483    7.87 | 1.233   21.89 | 1.983    7.63 |  2.73    5.06
                0.500    7.87 | 1.250   21.89 | 2.000    7.63 |  2.75    5.06
                0.517    9.08 | 1.267   17.51 | 2.017    7.19 |  2.77    4.90
                0.533    9.08 | 1.283   17.51 | 2.033    7.19 |  2.78    4.90
                0.550    9.08 | 1.300   17.51 | 2.050    7.19 |  2.80    4.90
                0.567    9.08 | 1.317   17.51 | 2.067    7.19 |  2.82    4.90
                0.583    9.08 | 1.333   17.51 | 2.083    7.19 |  2.83    4.90
                0.600   10.85 | 1.350   14.74 | 2.100    6.81 |  2.85    4.74
                0.617   10.85 | 1.367   14.74 | 2.117    6.81 |  2.87    4.74
                0.633   10.85 | 1.383   14.74 | 2.133    6.81 |  2.88    4.74
                0.650   10.85 | 1.400   14.74 | 2.150    6.81 |  2.90    4.74
                0.667   10.85 | 1.417   14.74 | 2.167    6.81 |  2.92    4.74
                0.683   13.77 | 1.433   12.83 | 2.183    6.47 |  2.93    4.60
                0.700   13.77 | 1.450   12.83 | 2.200    6.47 |  2.95    4.60
                0.717   13.77 | 1.467   12.83 | 2.217    6.47 |  2.97    4.60
                0.733   13.77 | 1.483   12.83 | 2.233    6.47 |  2.98    4.60
                0.750   13.77 | 1.500   12.83 | 2.250    6.47 |  3.00    4.60

     Unit Hyd Qpeak  (cms)=   0.306

     PEAK FLOW       (cms)=   0.007 (i)
     TIME TO PEAK    (hrs)=   1.333
     RUNOFF VOLUME    (mm)=   1.941
     TOTAL RAINFALL   (mm)=  44.901
     RUNOFF COEFFICIENT   =   0.043

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0801)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0200):     0.70   0.057     1.02    13.91
      + ID2= 2 (  0800):     1.20   0.270     1.12    22.11
        ==================================================
        ID = 3 (  0801):     1.90   0.303     1.12    19.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0801)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
        ID1= 3 (  0801):     1.90   0.303     1.12    19.09
      + ID2= 2 (  0999):     1.60   0.007     1.33     1.94
        ====================================================
        ID = 1 (  0801):     3.50   0.307     1.12    11.24

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0803)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  1.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0280      0.0240
                          0.0010     0.0000   |   0.0300      0.0280
                          0.0010     0.0020   |   0.0320      0.0330
                          0.0010     0.0040   |   0.0420      0.0390
                          0.0080     0.0060   |   0.0550      0.0450
                          0.0150     0.0090   |   0.0630      0.0510
                          0.0190     0.0120   |   0.0700      0.0580
                          0.0220     0.0160   |   0.0760      0.0660
                          0.0250     0.0190   |   0.0820      0.0740

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0801)      3.498      0.307      1.12      11.24
   OUTFLOW: ID= 1 (  0803)      3.498      0.027      2.33      11.24

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.82
                  TIME SHIFT OF PEAK FLOW         (min)= 73.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0224

--------------------------------------------------------------------------------
================================================================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


                  *****  D E T A I L E D   O U T P U T *****
```

```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\2c6cd101-82e9-4b8a-bf10-
358ef87b2faf\scenari
  Summary filename: C:\Users\10NE\AppData\Local\Civica\VH5\41883446-0764-4217-9edb-05a05c75f793\2c6cd101-82e9-4b8a-bf10-
358ef87b2faf\scenari


DATE: 11-06-2023                          TIME: 03:25:22

USER:


COMMENTS: _____________________________________________________

-------------------------------------------------------------------------------------------------------------------
  ********************************************
  ** SIMULATION : 50 YR 3-HR Chicago - County o **
  ********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 766.038
| Ptotal= 75.22 mm |                          B=   1.898
--------------------                          C=   0.657
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00   10.16 |  0.83  150.54 |  1.67   15.55 |  2.50    9.82
                0.17   11.90 |  1.00   46.46 |  1.83   13.78 |  2.67    9.22
                0.33   14.65 |  1.17   28.76 |  2.00   12.44 |  2.83    8.70
                0.50   19.94 |  1.33   21.88 |  2.17   11.38 |
                0.67   37.59 |  1.50   18.04 |  2.33   10.53 |


-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   2.50
|ID= 1 DT= 1.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  45.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.38         1.12
```

Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	130.00	35.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	10.16	0.767	37.59	1.517	18.04	2.27	11.38
0.033	10.16	0.783	37.59	1.533	18.04	2.28	11.38
0.050	10.16	0.800	37.59	1.550	18.04	2.30	11.38
0.067	10.16	0.817	37.59	1.567	18.04	2.32	11.38
0.083	10.16	0.833	37.59	1.583	18.04	2.33	11.38
0.100	10.16	0.850	150.54	1.600	18.04	2.35	10.53
0.117	10.16	0.867	150.54	1.617	18.04	2.37	10.53
0.133	10.16	0.883	150.54	1.633	18.04	2.38	10.53
0.150	10.16	0.900	150.54	1.650	18.04	2.40	10.53
0.167	10.16	0.917	150.54	1.667	18.04	2.42	10.53
0.183	11.90	0.933	150.54	1.683	15.55	2.43	10.53
0.200	11.90	0.950	150.54	1.700	15.55	2.45	10.53
0.217	11.90	0.967	150.54	1.717	15.55	2.47	10.53
0.233	11.90	0.983	150.54	1.733	15.55	2.48	10.53
0.250	11.90	1.000	150.54	1.750	15.55	2.50	10.53
0.267	11.90	1.017	46.46	1.767	15.55	2.52	9.82
0.283	11.90	1.033	46.46	1.783	15.55	2.53	9.82
0.300	11.90	1.050	46.46	1.800	15.55	2.55	9.82
0.317	11.90	1.067	46.46	1.817	15.55	2.57	9.82
0.333	11.90	1.083	46.46	1.833	15.55	2.58	9.82
0.350	14.65	1.100	46.46	1.850	13.78	2.60	9.82
0.367	14.65	1.117	46.46	1.867	13.78	2.62	9.82
0.383	14.65	1.133	46.46	1.883	13.78	2.63	9.82
0.400	14.65	1.150	46.46	1.900	13.78	2.65	9.82
0.417	14.65	1.167	46.46	1.917	13.78	2.67	9.82
0.433	14.65	1.183	28.76	1.933	13.78	2.68	9.22
0.450	14.65	1.200	28.76	1.950	13.78	2.70	9.22
0.467	14.65	1.217	28.76	1.967	13.78	2.72	9.22
0.483	14.65	1.233	28.76	1.983	13.78	2.73	9.22
0.500	14.65	1.250	28.76	2.000	13.78	2.75	9.22
0.517	19.94	1.267	28.76	2.017	12.44	2.77	9.22
0.533	19.94	1.283	28.76	2.033	12.44	2.78	9.22
0.550	19.94	1.300	28.76	2.050	12.44	2.80	9.22
0.567	19.94	1.317	28.76	2.067	12.44	2.82	9.22
0.583	19.94	1.333	28.76	2.083	12.44	2.83	9.22
0.600	19.94	1.350	21.88	2.100	12.44	2.85	8.70
0.617	19.94	1.367	21.88	2.117	12.44	2.87	8.70
0.633	19.94	1.383	21.88	2.133	12.44	2.88	8.70
0.650	19.94	1.400	21.88	2.150	12.44	2.90	8.70

```
               0.667   19.94 | 1.417   21.88 | 2.167   12.44 |  2.92    8.70
               0.683   37.59 | 1.433   21.88 | 2.183   11.38 |  2.93    8.70
               0.700   37.59 | 1.450   21.88 | 2.200   11.38 |  2.95    8.70
               0.717   37.59 | 1.467   21.88 | 2.217   11.38 |  2.97    8.70
               0.733   37.59 | 1.483   21.88 | 2.233   11.38 |  2.98    8.70
               0.750   37.59 | 1.500   21.88 | 2.250   11.38 |  3.00    8.70

     Max.Eff.Inten.(mm/hr)=     150.54        24.37
               over (min)         5.00         9.00
     Storage Coeff.  (min)=       2.54 (ii)    8.07 (ii)
     Unit Hyd. Tpeak (min)=       5.00         9.00
     Unit Hyd. peak  (cms)=       0.34         0.14
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.45         0.05          0.484 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.12           1.00
     RUNOFF VOLUME    (mm)=      73.22        12.77          39.97
     TOTAL RAINFALL   (mm)=      75.22        75.22          75.22
     RUNOFF COEFFICIENT   =       0.97         0.17           0.53


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  39.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0800)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  1.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0060     0.0230
                          0.0060     0.0010   |   0.0000     0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      2.500      0.484      1.00      39.97
   OUTFLOW: ID= 1 (  0800)      0.731      0.006      0.37      40.29
   OVERFLOW:ID= 3 (  0003)      1.769      0.506      0.97      40.29

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =   134
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  2.23
                  PERCENTAGE OF TIME OVERFLOWING   (%) = 14.91

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.24
                  TIME SHIFT OF PEAK FLOW         (min)=-38.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0230

--------------------------------------------------------------------------------
```

```
  --------------------------
  | Junction Command(0017) |
  --------------------------

                           AREA     QPEAK   TPEAK     R.V.
                           (ha)     (cms)    (hrs)    (mm)
  INFLOW : ID= 1(  0800)    0.73     0.01    0.37    40.29
  OUTFLOW: ID= 2(  0017)    0.73     0.01    0.37    40.29

  ------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0200)|   Area    (ha)=   0.70
|ID= 1 DT= 1.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  20.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.39         0.31
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      20.00        20.00
     Mannings n             =    0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.


                        ---- TRANSFORMED HYETOGRAPH ----
      TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
       hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
     0.017   10.16 | 0.767   37.59 | 1.517   18.04 |  2.27   11.38
     0.033   10.16 | 0.783   37.59 | 1.533   18.04 |  2.28   11.38
     0.050   10.16 | 0.800   37.59 | 1.550   18.04 |  2.30   11.38
     0.067   10.16 | 0.817   37.59 | 1.567   18.04 |  2.32   11.38
     0.083   10.16 | 0.833   37.59 | 1.583   18.04 |  2.33   11.38
     0.100   10.16 | 0.850  150.54 | 1.600   18.04 |  2.35   10.53
     0.117   10.16 | 0.867  150.54 | 1.617   18.04 |  2.37   10.53
     0.133   10.16 | 0.883  150.54 | 1.633   18.04 |  2.38   10.53
     0.150   10.16 | 0.900  150.54 | 1.650   18.04 |  2.40   10.53
     0.167   10.16 | 0.917  150.54 | 1.667   18.04 |  2.42   10.53
     0.183   11.90 | 0.933  150.54 | 1.683   15.55 |  2.43   10.53
     0.200   11.90 | 0.950  150.54 | 1.700   15.55 |  2.45   10.53
     0.217   11.90 | 0.967  150.54 | 1.717   15.55 |  2.47   10.53
     0.233   11.90 | 0.983  150.54 | 1.733   15.55 |  2.48   10.53
     0.250   11.90 | 1.000  150.54 | 1.750   15.55 |  2.50   10.53
     0.267   11.90 | 1.017   46.46 | 1.767   15.55 |  2.52    9.82
     0.283   11.90 | 1.033   46.46 | 1.783   15.55 |  2.53    9.82
     0.300   11.90 | 1.050   46.46 | 1.800   15.55 |  2.55    9.82
     0.317   11.90 | 1.067   46.46 | 1.817   15.55 |  2.57    9.82
     0.333   11.90 | 1.083   46.46 | 1.833   15.55 |  2.58    9.82
     0.350   14.65 | 1.100   46.46 | 1.850   13.78 |  2.60    9.82
```

```
                0.367   14.65 | 1.117   46.46 | 1.867   13.78 |  2.62    9.82
                0.383   14.65 | 1.133   46.46 | 1.883   13.78 |  2.63    9.82
                0.400   14.65 | 1.150   46.46 | 1.900   13.78 |  2.65    9.82
                0.417   14.65 | 1.167   46.46 | 1.917   13.78 |  2.67    9.82
                0.433   14.65 | 1.183   28.76 | 1.933   13.78 |  2.68    9.22
                0.450   14.65 | 1.200   28.76 | 1.950   13.78 |  2.70    9.22
                0.467   14.65 | 1.217   28.76 | 1.967   13.78 |  2.72    9.22
                0.483   14.65 | 1.233   28.76 | 1.983   13.78 |  2.73    9.22
                0.500   14.65 | 1.250   28.76 | 2.000   13.78 |  2.75    9.22
                0.517   19.94 | 1.267   28.76 | 2.017   12.44 |  2.77    9.22
                0.533   19.94 | 1.283   28.76 | 2.033   12.44 |  2.78    9.22
                0.550   19.94 | 1.300   28.76 | 2.050   12.44 |  2.80    9.22
                0.567   19.94 | 1.317   28.76 | 2.067   12.44 |  2.82    9.22
                0.583   19.94 | 1.333   28.76 | 2.083   12.44 |  2.83    9.22
                0.600   19.94 | 1.350   21.88 | 2.100   12.44 |  2.85    8.70
                0.617   19.94 | 1.367   21.88 | 2.117   12.44 |  2.87    8.70
                0.633   19.94 | 1.383   21.88 | 2.133   12.44 |  2.88    8.70
                0.650   19.94 | 1.400   21.88 | 2.150   12.44 |  2.90    8.70
                0.667   19.94 | 1.417   21.88 | 2.167   12.44 |  2.92    8.70
                0.683   37.59 | 1.433   21.88 | 2.183   11.38 |  2.93    8.70
                0.700   37.59 | 1.450   21.88 | 2.200   11.38 |  2.95    8.70
                0.717   37.59 | 1.467   21.88 | 2.217   11.38 |  2.97    8.70
                0.733   37.59 | 1.483   21.88 | 2.233   11.38 |  2.98    8.70
                0.750   37.59 | 1.500   21.88 | 2.250   11.38 |  3.00    8.70

     Max.Eff.Inten.(mm/hr)=     150.54        51.36
               over (min)         5.00         7.00
     Storage Coeff.  (min)=       0.83 (ii)    6.29 (ii)
     Unit Hyd. Tpeak (min)=       5.00         7.00
     Unit Hyd. peak  (cms)=       0.50         0.17
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.06         0.04          0.087 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.07           1.02
     RUNOFF VOLUME    (mm)=      73.22        17.72          28.82
     TOTAL RAINFALL   (mm)=      75.22        75.22          75.22
     RUNOFF COEFFICIENT   =       0.97         0.24           0.38

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  39.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
```

```
| NASHYD   (  0999)|   Area     (ha)=   1.60   Curve Number    (CN)= 30.0
|ID= 1 DT= 1.0 min |   Ia       (mm)=  10.00   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=   0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	10.16	0.767	37.59	1.517	18.04	2.27	11.38
0.033	10.16	0.783	37.59	1.533	18.04	2.28	11.38
0.050	10.16	0.800	37.59	1.550	18.04	2.30	11.38
0.067	10.16	0.817	37.59	1.567	18.04	2.32	11.38
0.083	10.16	0.833	37.59	1.583	18.04	2.33	11.38
0.100	10.16	0.850	150.54	1.600	18.04	2.35	10.53
0.117	10.16	0.867	150.54	1.617	18.04	2.37	10.53
0.133	10.16	0.883	150.54	1.633	18.04	2.38	10.53
0.150	10.16	0.900	150.54	1.650	18.04	2.40	10.53
0.167	10.16	0.917	150.54	1.667	18.04	2.42	10.53
0.183	11.90	0.933	150.54	1.683	15.55	2.43	10.53
0.200	11.90	0.950	150.54	1.700	15.55	2.45	10.53
0.217	11.90	0.967	150.54	1.717	15.55	2.47	10.53
0.233	11.90	0.983	150.54	1.733	15.55	2.48	10.53
0.250	11.90	1.000	150.54	1.750	15.55	2.50	10.53
0.267	11.90	1.017	46.46	1.767	15.55	2.52	9.82
0.283	11.90	1.033	46.46	1.783	15.55	2.53	9.82
0.300	11.90	1.050	46.46	1.800	15.55	2.55	9.82
0.317	11.90	1.067	46.46	1.817	15.55	2.57	9.82
0.333	11.90	1.083	46.46	1.833	15.55	2.58	9.82
0.350	14.65	1.100	46.46	1.850	13.78	2.60	9.82
0.367	14.65	1.117	46.46	1.867	13.78	2.62	9.82
0.383	14.65	1.133	46.46	1.883	13.78	2.63	9.82
0.400	14.65	1.150	46.46	1.900	13.78	2.65	9.82
0.417	14.65	1.167	46.46	1.917	13.78	2.67	9.82
0.433	14.65	1.183	28.76	1.933	13.78	2.68	9.22
0.450	14.65	1.200	28.76	1.950	13.78	2.70	9.22
0.467	14.65	1.217	28.76	1.967	13.78	2.72	9.22
0.483	14.65	1.233	28.76	1.983	13.78	2.73	9.22
0.500	14.65	1.250	28.76	2.000	13.78	2.75	9.22
0.517	19.94	1.267	28.76	2.017	12.44	2.77	9.22
0.533	19.94	1.283	28.76	2.033	12.44	2.78	9.22
0.550	19.94	1.300	28.76	2.050	12.44	2.80	9.22
0.567	19.94	1.317	28.76	2.067	12.44	2.82	9.22
0.583	19.94	1.333	28.76	2.083	12.44	2.83	9.22
0.600	19.94	1.350	21.88	2.100	12.44	2.85	8.70
0.617	19.94	1.367	21.88	2.117	12.44	2.87	8.70
0.633	19.94	1.383	21.88	2.133	12.44	2.88	8.70
0.650	19.94	1.400	21.88	2.150	12.44	2.90	8.70
0.667	19.94	1.417	21.88	2.167	12.44	2.92	8.70

```
               0.683   37.59 | 1.433   21.88 | 2.183   11.38 |  2.93    8.70
               0.700   37.59 | 1.450   21.88 | 2.200   11.38 |  2.95    8.70
               0.717   37.59 | 1.467   21.88 | 2.217   11.38 |  2.97    8.70
               0.733   37.59 | 1.483   21.88 | 2.233   11.38 |  2.98    8.70
               0.750   37.59 | 1.500   21.88 | 2.250   11.38 |  3.00    8.70

     Unit Hyd Qpeak  (cms)=   0.306

     PEAK FLOW       (cms)=   0.024 (i)
     TIME TO PEAK    (hrs)=   1.250
     RUNOFF VOLUME    (mm)=   6.466
     TOTAL RAINFALL   (mm)=  75.222
     RUNOFF COEFFICIENT   =   0.086

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0801)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)      (mm)
        ID1= 1 (  0200):     0.70   0.087     1.02    28.82
      + ID2= 2 (  0800):     1.77   0.506     0.97    40.29
        ================================================
        ID = 3 (  0801):     2.47   0.585     0.97    37.03

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0801)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)      (mm)
        ID1= 3 (  0801):     2.47   0.585     0.97    37.03
      + ID2= 2 (  0999):     1.60   0.024     1.25     6.47
        ================================================
        ID = 1 (  0801):     4.07   0.590     0.97    25.01

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0803)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  1.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0280      0.0240
                          0.0010     0.0000   |   0.0300      0.0280
                          0.0010     0.0020   |   0.0320      0.0330
                          0.0010     0.0040   |   0.0420      0.0390
```

```
                          0.0080     0.0060   |   0.0550      0.0450
                          0.0150     0.0090   |   0.0630      0.0510
                          0.0190     0.0120   |   0.0700      0.0580
                          0.0220     0.0160   |   0.0760      0.0660
                          0.0250     0.0190   |   0.0820      0.0740

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0801)      4.069      0.590      0.97      25.01
   OUTFLOW: ID= 1 (  0803)      4.069      0.069      2.22      25.01

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.75
                    TIME SHIFT OF PEAK FLOW         (min)= 75.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0573

--------------------------------------------------------------------------------
```

Appendix C

Calculations

Subject: Dry Pond Stage Storage Discharge Curve
Project: Waverly Street, Delhi
Project No: 22-5115
Client: Landmark Homes Inc.
Date: November 1, 2022

			Outlet 1	Outlet 2		Overflow
Pond Side Slopes (__H:1V):	5	**Orifice Diameter (mm):**	130	160	**Weir Sill Elev. (m):**	241.2
Buffer (m):	5	**Orifice Invert (m):**	239.8	240.6	**Weir Width (m):**	5
Design Infiltration Rate (mm/h):	30	**Discharge Coefficient:**	0.6	0.6	**Side Slope (__H:1V):**	3
Design Infiltration Rate (m^3/s):	0.001	**Area (m^2):**	0.013	0.020	**Discharge Coefficient:**	1.7

Elevation (m)	Area (m^2)	Average Area (m^2)	Incremental Volume (m^3)	Cumulative Volume (m^3)	Infiltration Discharge (m^3/s)	Outlet 1 Head (m)	Outlet 1 Discharge (m^3/s)	Outlet 2 Head (m)	Outlet 2 Discharge (m^3/s)	Overflow Head (m)	Overflow Discharge (m^3/s)	Total Discharge (m^3/s)	Incremental Drawdown Time (hours)	Cumulative Drawdown Time (hours)
239.6	168	168	0	0	0.001	0.00	0.000	0.00	0.000			0.001	0.0	0.0
239.7	195	182	18	18	0.001	0.00	0.000	0.00	0.000			0.001	3.6	3.6
239.8	224	210	21	39	0.001	0.00	0.000	0.00	0.000			0.001	4.2	7.8
239.9	255	240	24	63	0.001	0.04	0.007	0.00	0.000			0.008	1.4	9.2
240.0	288	272	27	90	0.001	0.14	0.013	0.00	0.000			0.015	0.7	9.8
240.1	323	306	31	121	0.001	0.24	0.017	0.00	0.000			0.019	0.5	10.4
240.2	360	342	34	155	0.001	0.34	0.021	0.00	0.000			0.022	0.5	10.8
240.3	399	380	38	193	0.001	0.44	0.024	0.00	0.000			0.025	0.4	11.3
240.4	440	420	42	235	0.001	0.54	0.026	0.00	0.000			0.028	0.4	11.7
240.5	483	462	46	281	0.001	0.64	0.029	0.00	0.000			0.030	0.4	12.1
240.6	528	506	51	332	0.001	0.74	0.031	0.00	0.000			0.032	0.5	12.6
240.7	575	552	55	387	0.001	0.84	0.033	0.02	0.008			0.042	0.4	13.0
240.8	624	600	60	447	0.001	0.94	0.035	0.12	0.019			0.055	0.3	13.4
240.9	675	650	65	512	0.001	1.04	0.036	0.22	0.025			0.063	0.3	13.7
241.0	728	702	70	582	0.001	1.14	0.038	0.32	0.031			0.070	0.3	14.0
241.1	783	756	76	657	0.001	1.24	0.040	0.42	0.035			0.076	0.3	14.2
241.2	840	812	81	738	0.001	1.34	0.041	0.52	0.039	0.00	0.00	0.082	0.3	14.5
241.3	899	870	87	825	0.001	1.44	0.043	0.62	0.043	0.10	0.28	0.372	0.1	14.6
241.4	960	930	93	918	0.001	1.53	0.044	0.72	0.046	0.20	0.85	0.943	0.0	14.7
241.5	1,023	992	99	1,017	0.001	1.63	0.046	0.82	0.049	0.30	1.65	1.745	0.0	14.7
	1,763													

Subject: **Catchment 201 Preliminary LID Sizing**
Project: **Waverly Street, Delhi**
Project No: **22-5115**
Client: **Landmark Homes Inc.**
Date: **November 1, 2022**

LID Design Volume

Catchment Area (ha):	2.5	
Total Required Design Volume (m^3):	222	(calculated using Visual OTTHYMO)

Preliminary Infiltration Gallery Design

Assumed In-Situ Soil Porosity:	0.35
Total Available Gallery Length (m):	300
Average Gallery Depth (m):	1
Average Gallery Width (m):	2.2
Total Gallery Footprint (m):	660
Total Provided Design Volume (m^3):	231
Design Infiltration Rate (mm/hr):	30
Design Infiltration Rate (m^3/s):	0.006

DILLON CONSULTING

LANDMARK HOMES INC.

Transportation Impact Study

Proposed Waverly Street Subdivision, Delhi

October 2023 — 22-5115

Table of Contents

1.0 Introduction 1

1.1 Purpose 1
1.2 Proposed Subdivision 1
1.3 Scope of Analysis 3

2.0 Existing Conditions 4

2.1 Existing (2023) Traffic Volumes 5

3.0 Future Background Conditions 7

3.1 Background Developments 7
3.2 Background Growth 7
3.3 Future Background (2025) Traffic Volumes 8
3.4 Future Background (2030) Traffic Volumes 9
3.5 Future Background (2035) Traffic Volumes 10

4.0 Total Future Conditions 11

4.1 Proposed Development 11
4.2 Trip Generation 11
4.3 Trip Distribution and Assignment 12
4.4 Site-Generated Traffic Volumes 13
4.5 Total Future Traffic Volumes 14
4.5.1 *Total Future (2025) Traffic Volumes 14*
4.5.2 *Total Future (2030) Traffic Volumes 15*
4.5.3 *Total Future (2035) Traffic Volumes 16*

5.0 Intersection Operations 17

5.1 Highway 3 (James Street) at Waverly Street 17
5.2 Highway 3 (James Street) at Brock Avenue 18

6.0 Summary 19

Figures

Figure 1: Proposed Subdivision Plan 2
Figure 2: Existing (2023) Laning and Traffic Control 4
Figure 3: Existing (2023) Traffic Volumes 6
Figure 4: Future Background (2025) Traffic Volumes 8
Figure 5: Future Background (2030) Traffic Volumes 9
Figure 6: Future Background (2035) Traffic Volumes 10
Figure 7: Site-Generated Trips 13
Figure 8: Total Future (2025) Traffic Volumes 14
Figure 9: Total Future (2030) Traffic Volumes 15
Figure 10: Total Future (2035) Traffic Volumes 16

Tables

Table 1: Spring and Fall (2022) Peak Hour Traffic Volumes on Highway 3 (James Street) 5
Table 2: Trip Generation 11
Table 3: Trip Distribution and Assignment 12
Table 4: Intersection Operations, Highway 3 (James Street) at Waverly Street 17
Table 5: Intersection Operations, Highway 3 (James Street) at Brock Avenue 18

Appendices

A Proposed Site Plan
B Traffic Survey Data
C Level of Service Definitions
D Synchro Analysis Worksheets

1.0 Introduction

1.1 Purpose

Dillon Consulting Limited (Dillon) has been retained by Landmark Homes Inc. to prepare a Transportation Impact Study (TIS) to support a proposed residential subdivision located along Waverly Street east of Highway 3 (James Street) in Delhi, Ontario and within Norfolk County. The proposed subdivision includes 45 single-detached homes.

This TIS documents the traffic operations at two existing intersections in close proximity to the proposed subdivision. This study also assessed the future traffic volumes both with and without the proposed development.

Traffic projections and intersection analyses were completed for the AM and PM peak hours of a typical weekday. Based on guidelines found within Norfolk County's Traffic Impact Study Guidelines, the following analysis horizon years were identified and assessed:

- 2025 (build-out);
- 2030 (build-out plus five years); and,
- 2035 (build-out plus ten years).

The objective of this study is to determine the transportation impact of the proposed subdivision and whether or not any transportation infrastructure modifications are required to accommodate the future traffic volumes generated by the proposed subdivision.

1.2 Proposed Subdivision

This residential subdivision with 45 single-detached homes is proposed on vacant lands east of the Highway 3 (James Street) and Waverly Street intersection. With the subject subdivision in place, both Waverly Street and Brock Avenue will be extended east into the subdivision lands. No new road connections to Highway 3 are proposed.

Figure 1 outlines the proposed subdivision plan. This plan is also included in **Appendix A**.

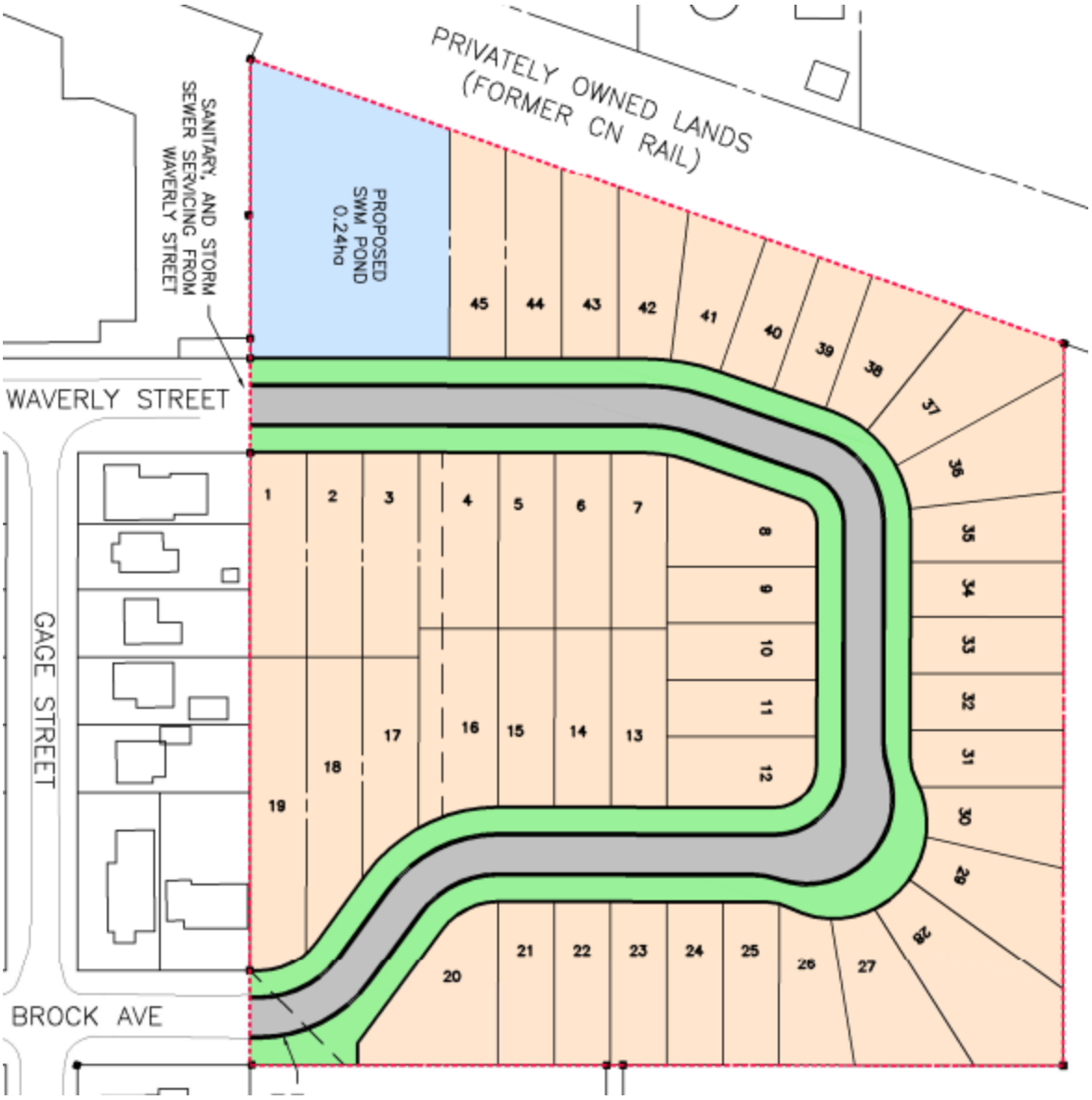


Figure 1: Proposed Subdivision Plan

1.3 Scope of Analysis

The study scope includes the following:

- Identification of existing traffic volumes and preparation of traffic projections for the Study Area intersections under future background conditions and with the development of the subdivision (total future conditions);
- Analysis of intersection operations under existing conditions, future background conditions, and total future conditions; and,
- Identification of any potential transportation infrastructure modifications (roads, intersection traffic control or geometry) that may be required.

As directed by staff at Norfolk County, the study analysed operations at the following two intersections:

- Highway 3 (James Street) at Waverly Street intersection – unsignalized; and,
- Highway 3 (James Street) at Brock Avenue intersection – unsignalized.

2.0 Existing Conditions

Currently, Highway 3 (James Street) within the Study Area is a four-lane corridor with two lanes per direction. No left-turn lanes are provided. In 2023, this portion of Highway 3 (James Street) was reconstructed. However, no changes to laning or traffic control at the Study Area intersections were implemented.

Figure 2 shows the current laning and traffic control at the two Study Area intersections.

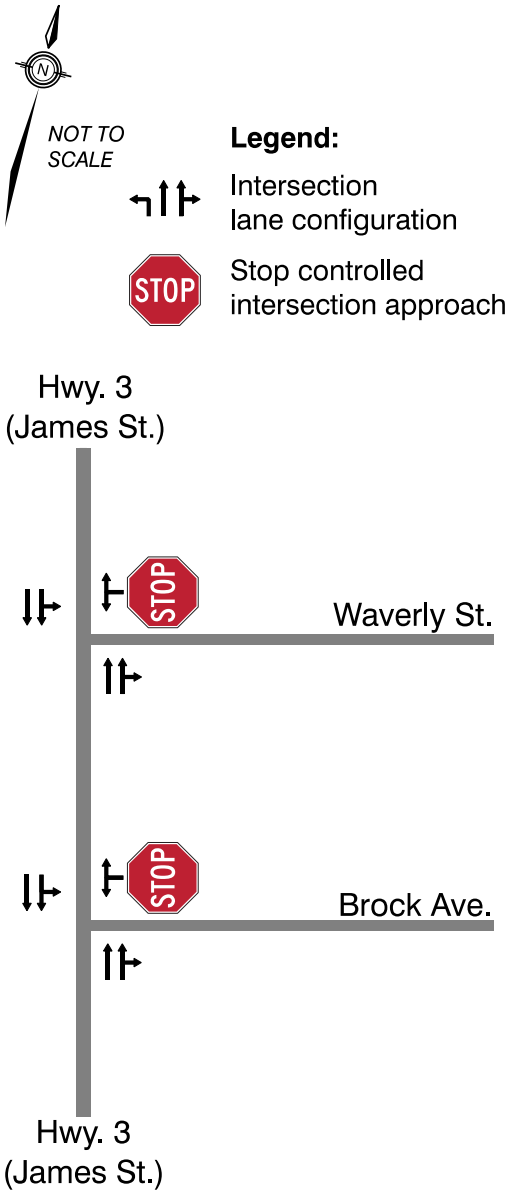


Figure 2: Existing (2023) Laning and Traffic Control

2.1 Existing (2023) Traffic Volumes

Spring and Fall (2022) average daily traffic (ADT) data was collected on Highway 3 (James Street) on Thursday, May 19, 2022, and Tuesday, November 1, 2022, by Norfolk County. The ADT counts were conducted on Highway 3 between Crosier Street and Ewell Street over a 24-hour period. **Table 1** summarizes the peak hour volumes for both seasons. The highest northbound and southbound peak hour volumes are in bold.

Table 1: Spring and Fall (2022) Peak Hour Traffic Volumes on Highway 3 (James Street)

Direction	Data Collection Period	AM Peak Hour Volumes	PM Peak Hour Volumes
Northbound	Spring 2022	322	**494**
	Fall 2022	**358**	444
Southbound	Spring 2022	**421**	**488**
	Fall 2022	372	450

Within the subsequent analysis, it was assumed that the highest collected northbound and southbound traffic would continue along Highway 3 (James Street), in front of both Waverly Street and Brock Avenue. This 2022 traffic data was inflated in order to better project 2023 traffic volumes. This was done by applying a 1.0% per annum compounded growth rate to the northbound and southbound volumes along Highway 3 (James Street). This growth rate was determined based on historical traffic volumes on this section of Highway 3. Further information is included in **Section 3.2**.

On Thursday, September 19, 2023, additional traffic data was collected by Dillon at the two Study Area intersections in order to confirm the number of vehicles entering and exiting both Waverly Street and Brock Avenue. This traffic data was collected between 8:00 AM and 9:00 AM and from 4:00 PM to 5:00 PM as these hours were identified as the peak hours within the Highway 3 ADT data. The collected traffic volumes were then added to the grown ADT volumes. This collected traffic data is found in **Appendix B**.

Figure 3 illustrates the existing (2023) traffic volumes utilized at the two existing Study Area intersections during the weekday AM and PM peak hours.

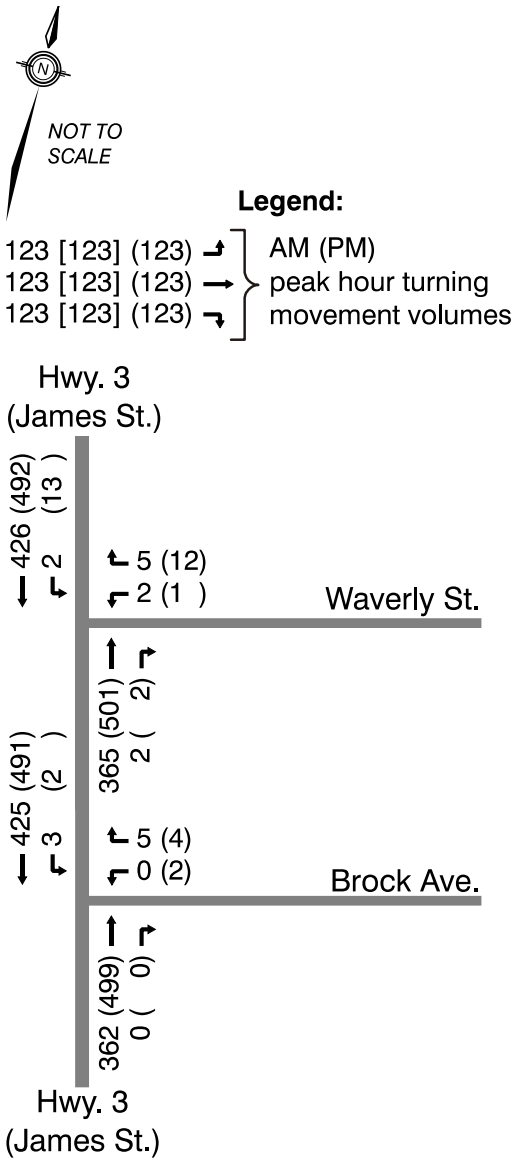


Figure 3: Existing (2023) Traffic Volumes

3.0 Future Background Conditions

The future background traffic volumes reflect the volume of traffic that is anticipated to be on the road network during the horizon years without the subject development in place. This is typically comprised of two components:

- The application of a growth rate to reflect general background traffic growth on the road network; and,
- The application of any site-specific traffic volumes for any background developments near the site.

For the future background analyses, three horizon periods were assessed; 2025 (build-out), 2030 (build-out plus five years), and 2035 (build-out plus ten years).

3.1 Background Developments

When scoping out this study with staff at Norfolk County, it was confirmed that there were no other developments that would significant impact traffic volumes within the Study Area.

3.2 Background Growth

General background traffic growth was estimated by reviewing historical Annual Average Daily Traffic (AADT) volume data published by MTO along Highway 3. There is no AADT volume data for Highway 3 (James Street) within Delhi, so the AADT volume data south of Delhi was reviewed.

Between 1988 and 2019, the daily traffic volumes along this part of Highway 3 were found to remain generally the same, with negligible growth in place. However, a 1.0% per annum compounded growth rate was applied to account for some potential traffic growth along Highway 3 (James Street). The growth rate was applied to only the through movements at the two existing Study Area intersections.

As both Waverly Street and Brock Avenue extend into neighbourhoods that are generally built-out (outside of the subject residential subdivision), no growth rates were applied to the traffic that would be entering and exiting these local streets to/from Highway 3 (James Street).

3.3 Future Background (2025) Traffic Volumes

The future background (2025) traffic volumes are illustrated in **Figure 4**.

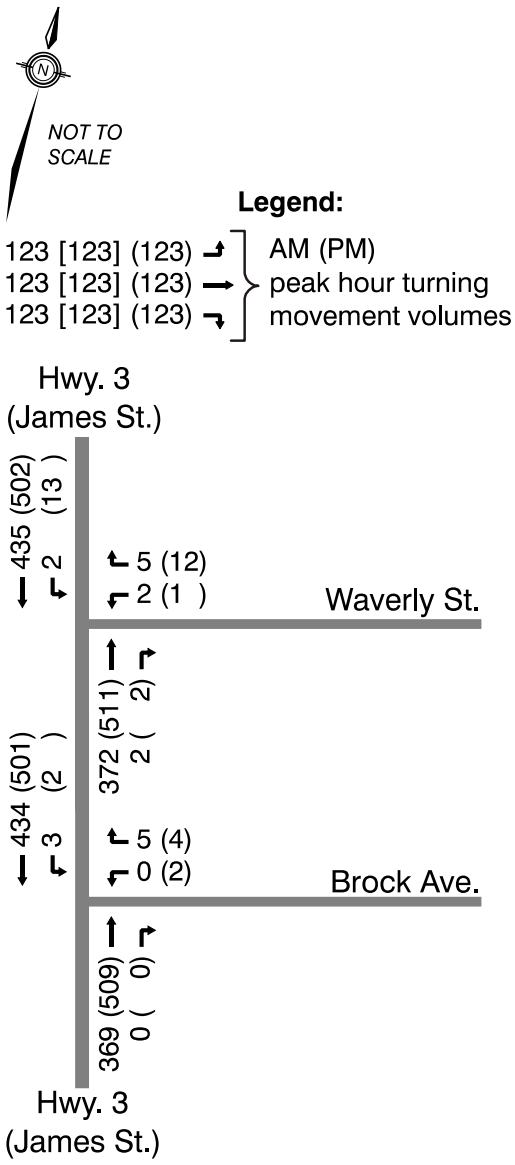


Figure 4: Future Background (2025) Traffic Volumes

3.4 Future Background (2030) Traffic Volumes

The future background (2030) traffic volumes are illustrated in **Figure 5**.

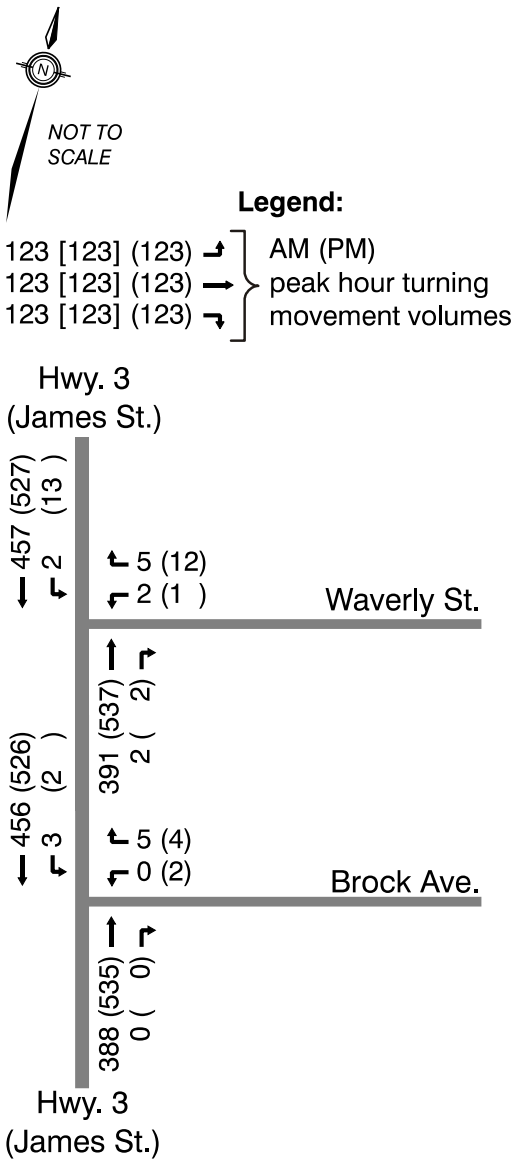


Figure 5: Future Background (2030) Traffic Volumes

3.5 Future Background (2035) Traffic Volumes

The future background (2035) traffic volumes are illustrated in **Figure 6**.

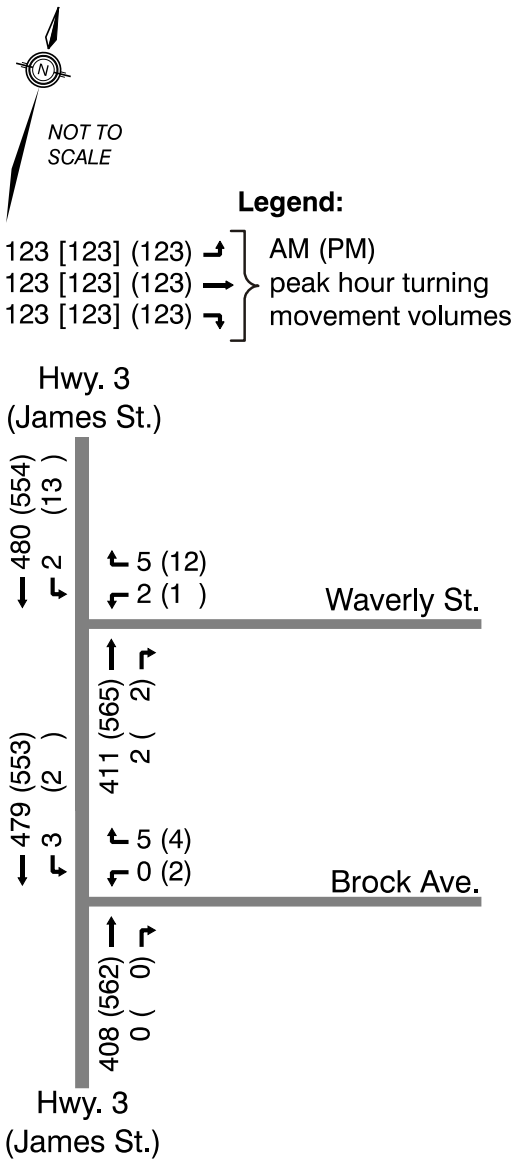


Figure 6: Future Background (2035) Traffic Volumes

4.0 Total Future Conditions

4.1 Proposed Development

This residential subdivision with 45 single-family dwelling units is proposed on vacant lands east of Highway 3 (James Street), noting both Waverly Street and Brock Avenue would be extended into the subdivision lands.

4.2 Trip Generation

The number of vehicle trips that are expected to be generated by the proposed residential subdivision was estimated based on trip generation rates published within the Institute of Transportation Engineers' Document *Trip Generation Manual* (11th edition).

Table 2 summarizes the number of vehicle trips anticipated to be generated by this subject subdivision during the weekday AM and PM peak hours. Given the nature of the proposed subdivision, ITE Land Use code 210 – Single-Family Detached Housing was used.

Table 2: Trip Generation

	Weekday AM peak hour			Weekday PM peak hour		
	In	Out	Total	In	Out	Total
Single-Family Detached Housing (45 dwelling units) – ITE Land Use Code 210						
In/Out/Rate	25%	75%	0.70	63%	37%	0.94
Total Trips	8	24	32	26	16	42

This proposed residential subdivision is forecast to generate 32 vehicle trips (eight inbound, 24 outbound) in the weekday AM peak hour and 42 vehicle trips (26 inbound, 16 outbound) in the weekday PM peak hour.

4.3 Trip Distribution and Assignment

The vehicle trips generated by the site were distributed and assigned through the Study Area intersections. The distribution generally considered the existing traffic volumes and patterns on Waverly Street and Brock Avenue at Highway 3 (James Street), and also considered the location of the residential subdivision within Delhi.

When considering the internal road network of the subdivision, it has been assumed that the site-generated trips travelling to/from the north would generally use Waverly Street, and the trips travelling to/from the south would use both Brock Avenue and Waverly Street in a more balanced manner.

Table 3 summarizes how the site vehicle trips were distributed and assigned throughout the Study Area intersections, noting all vehicles were distributed along Highway 3 (James Street).

Table 3: Trip Distribution and Assignment

Direction	To/From	Trip Distribution %	Via	Trip Assignment %
North	Highway 3 (James Street)	80%	Waverly Street	90%
			Brock Avenue	10%
South		20%	Waverly Street	50%
			Brock Avenue	50%
TOTAL	-	**100%**	-	-

4.4 Site-Generated Traffic Volumes

Figure 7 illustrates how the vehicle trips generated by the proposed residential subdivision were distributed and assigned through the two Study Area intersections.

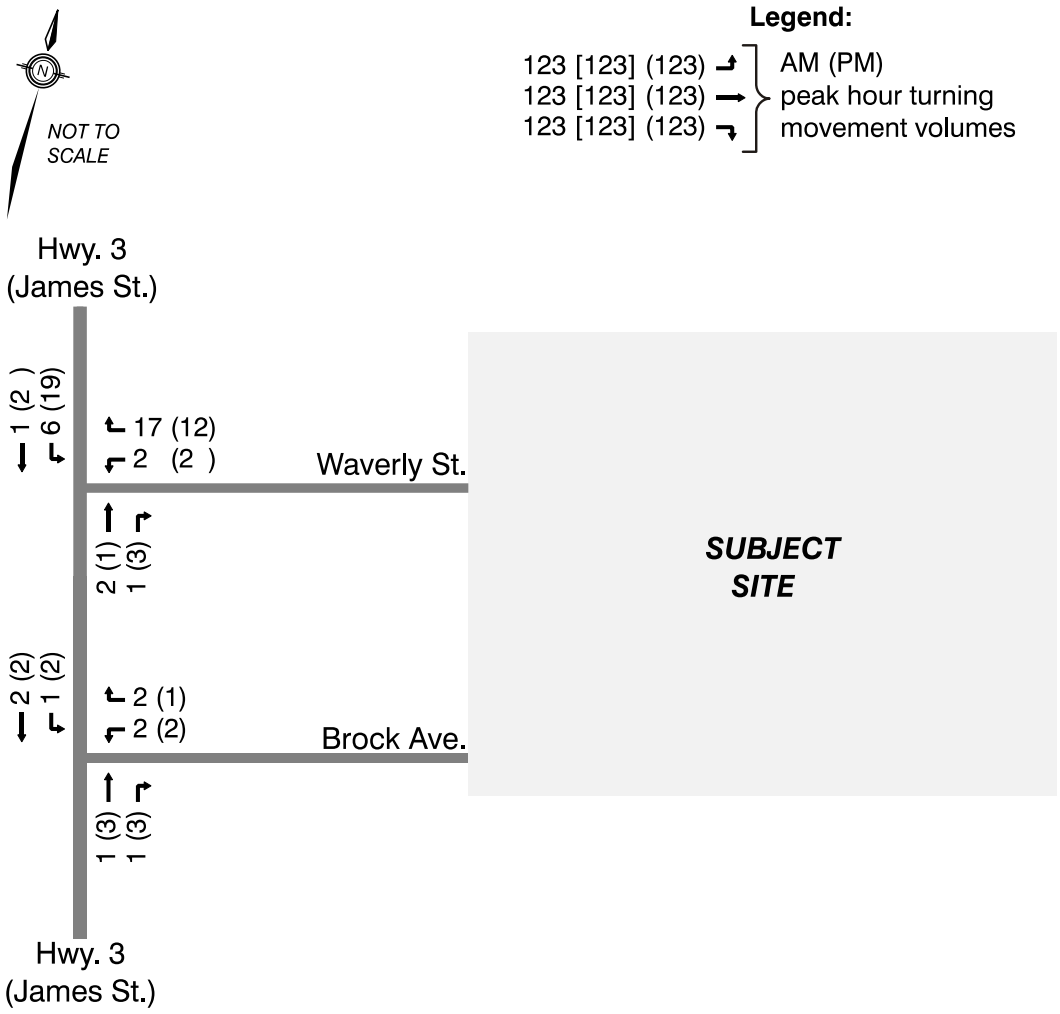


Figure 7: Site-Generated Trips

4.5 Total Future Traffic Volumes

The total future traffic volumes were calculated by adding the projected site-generated trips to the future background traffic volumes.

4.5.1 Total Future (2025) Traffic Volumes

The total future (2025) traffic volumes are illustrated in **Figure 8**.

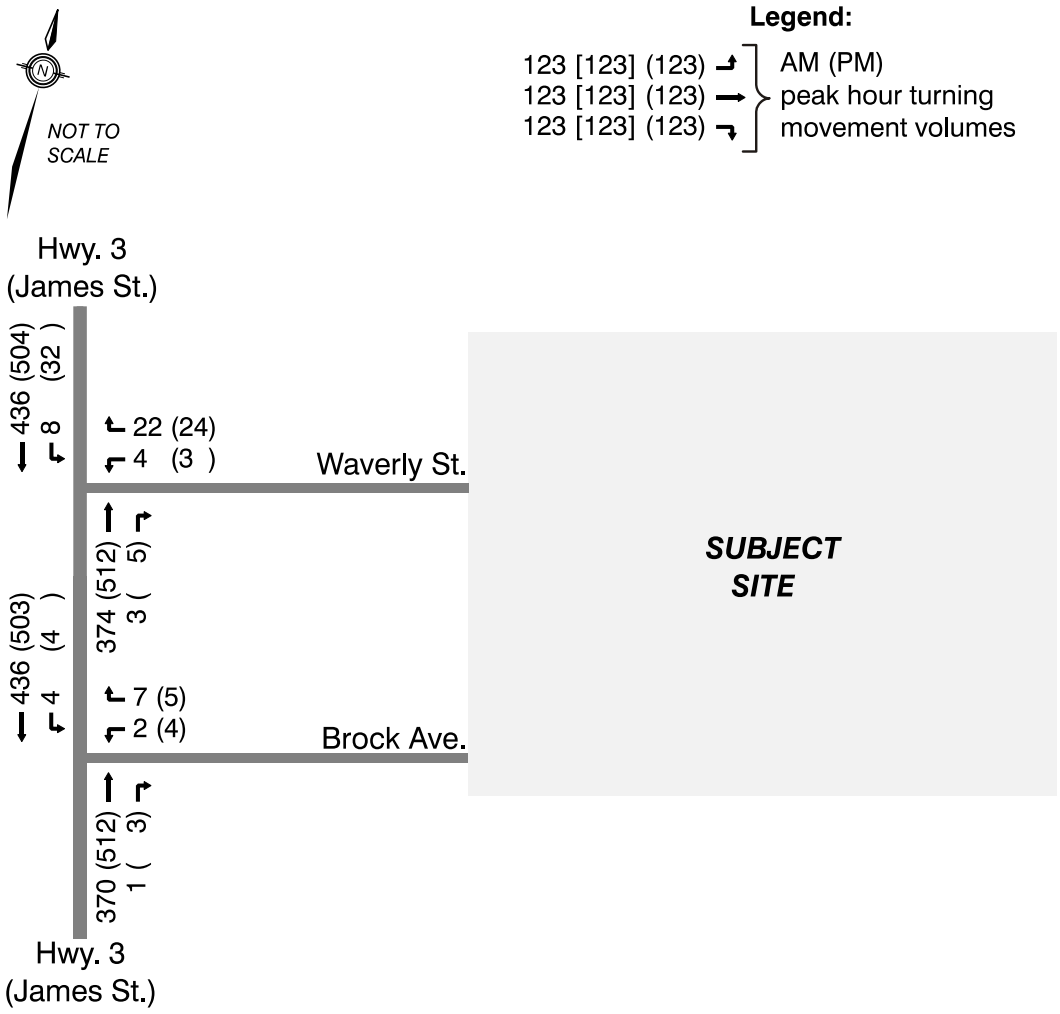


Figure 8: Total Future (2025) Traffic Volumes

4.5.2 Total Future (2030) Traffic Volumes

The total future (2030) traffic volumes are illustrated in **Figure 9**.

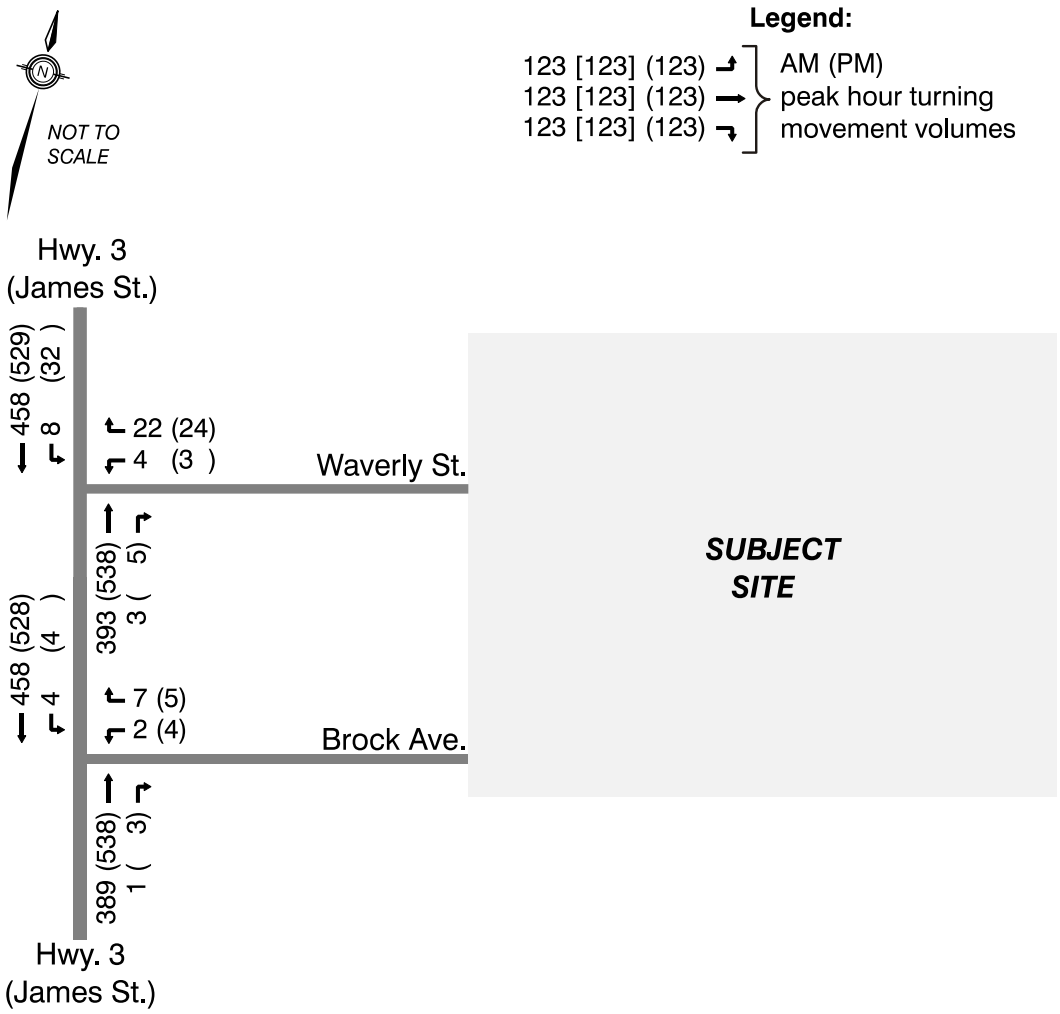


Figure 9: Total Future (2030) Traffic Volumes

4.5.3 Total Future (2035) Traffic Volumes

The total future (2035) traffic volumes are illustrated in **Figure 10**.

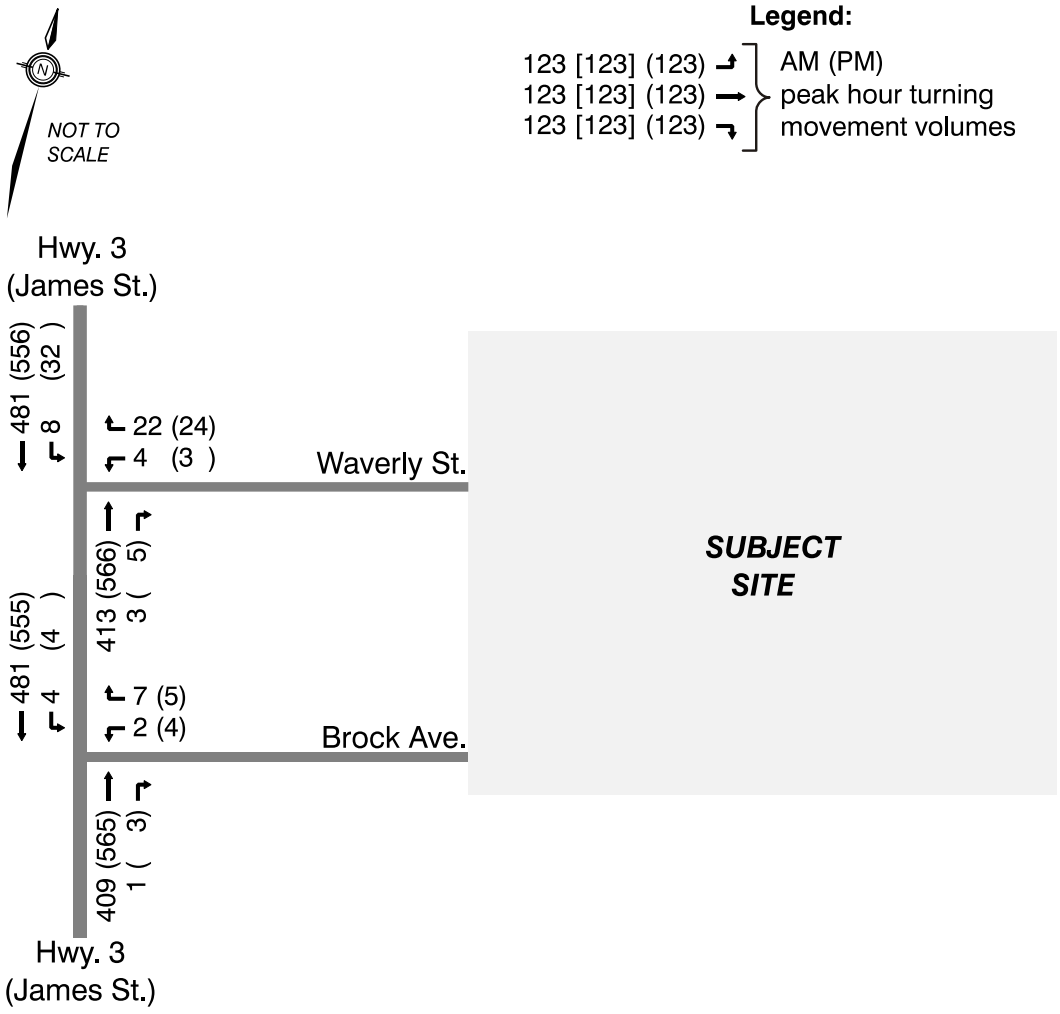


Figure 10: Total Future (2035) Traffic Volumes

5.0 Intersection Operations

Intersection operational analyses were completed at two Study Area intersections using the methodology outlined in the Highway Capacity Manual (HCM) and were facilitated through Trafficware's Synchro software (version 10). The analyses reflect the existing lane configurations at each intersection.

At the two unsignalized (stop-controlled) intersections, the v/c ratio, delay, level of service and 95th percentile queue are noted for the westbound STOP-controlled movements. Level of service definitions are provided in **Appendix C**. Synchro analysis worksheets reports are provided in **Appendix D**.

The results were reviewed to identify any critical movements, defined by Norfolk County's TIS Guidelines as follows:

- Any movement with a v/c ratio of 0.85 or higher.

5.1 Highway 3 (James Street) at Waverly Street

Table 4 summarizes the operations for the westbound STOP-controlled approach on Waverly Street at Highway 3 (James Street).

Table 4: Intersection Operations, Highway 3 (James Street) at Waverly Street

Movement	AM peak hour				PM peak hour			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
2023 Existing								
WB left/right	0.01	B	10.8	0	0.02	B	10.6	1
2025 Future Background								
WB left/right	0.01	B	10.9	0	0.02	B	10.7	1
2025 Total Future								
WB left/right	0.04	B	10.4	1	0.05	B	11.2	1
2030 Future Background								
WB left/right	0.01	B	11.1	0	0.02	B	10.8	1
2030 Total Future								
WB left/right	0.04	B	10.6	1	0.05	B	11.4	1
2035 Future Background								
WB left/right	0.01	B	11.2	0	0.02	B	11.0	1
2035 Total Future								
WB left/right	0.04	B	10.7	1	0.05	B	11.7	1

During the weekday AM and PM peak hours, the westbound STOP-controlled approach on Waverly Street at Highway 3 (James Street) is projected to continue operating at LOS B with essentially no queues and minimal delay through to the 2035 horizon year.

5.2 Highway 3 (James Street) at Brock Avenue

Table 5 summarizes the operations for the westbound STOP-controlled approach on Brock Avenue at Highway 3 (James Street).

Table 5: Intersection Operations, Highway 3 (James Street) at Brock Avenue

Movement	AM peak hour				PM peak hour			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
2023 Existing								
WB left/right	0.01	A	9.5	0	0.01	B	12.3	0
2025 Future Background								
WB left/right	0.01	A	9.5	0	0.01	B	12.4	0
2025 Total Future								
WB left/right	0.02	B	10.5	0	0.02	B	13.3	1
2030 Future Background								
WB left/right	0.01	A	9.6	0	0.01	B	12.7	0
2030 Total Future								
WB left/right	0.02	B	10.7	0	0.02	B	13.7	1
2035 Future Background								
WB left/right	0.01	B	9.7	0	0.01	B	13.1	0
2035 Total Future								
WB left/right	0.02	B	10.8	0	0.02	B	14.2	1

During the weekday AM and PM peak hours, the westbound STOP-controlled approach on Brock Avenue at Highway 3 (James Street) is projected to continue operating at LOS A or LOS B with essentially no queues and minimal delay through to the 2035 horizon year.

6.0 Summary

Dillon Consulting Limited (Dillon) has been retained by Landmark Homes Inc. to prepare a TIS to support a proposed residential subdivision located on Waverly Street east of Highway 3 (James Street) in Delhi, Ontario, in the municipality of Norfolk County. The proposed subdivision includes 45 single-detached homes along a future extension of Waverly Street.

With the residential subdivision in place, Waverly Street and Brock Avenue will be extended east into the subdivision lands. These single-family homes are forecast to generate 32 vehicle trips (eight inbound, 24 outbound) in the weekday AM peak hour and 42 vehicle trips (26 inbound, 16 outbound) in the weekday PM peak hour.

The STOP-control approaches on both Waverly Street and Brock Avenue at Highway 3 (James Street) currently operate at LOS A or LOS B during both the weekday AM and PM peak hours with essentially no queuing and minimal delay. The intersections are expected to continue operating in essentially the same manner through to the 2035 horizon year, both with and without the subject residential subdivision in place.

As a result, from a traffic and transportation perspective, there are no identified issues associated with this proposed residential subdivision that require remediation.

DILLON CONSULTING LIMITED

Prepared by:

Tim Kooistra, C.E.T.
Traffic and Transportation Technologist

Reviewed by:

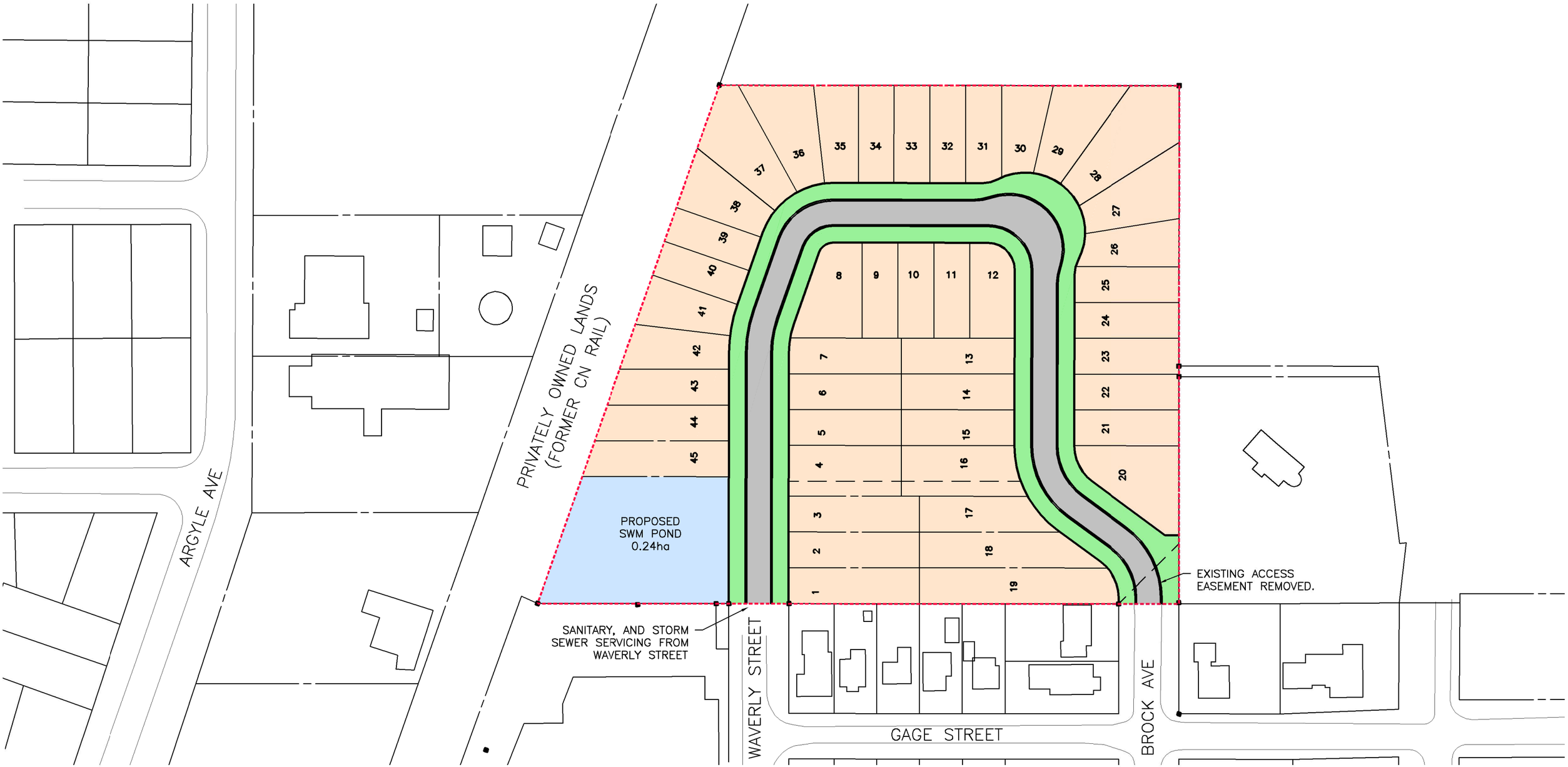
LICENSED PROFESSIONAL ENGINEER
M.D. WALTERS
OCT 30/23
PROVINCE OF ONTARIO

Mike Walters, P.Eng.
Transportation Engineer

Appendix A

Proposed Site Plan

DILLON CONSULTING



LANDMARK HOMES INC.
WAVERLY STREET, DELHI

CONCEPT PLAN
SINGLE FAMILY LOTS
45 UNITS

SUBJECT SITE
3.2 ha

SINGLE DETACHED

PROPOSED ROAD AND SIDEWALK

PROPOSED SWM POND

PROPOSED BOULEVARD

R1-B ZONING PROVISIONS

MIN. INTERIOR LOT AREA	360 sq.m.
MIN. CORNER LOT AREA	450 sq.m.
MIN. INTERIOR LOT FRONTAGE	12m
MIN. CORNER LOT FRONTAGE	15m

File Location:
c:\pw working directory\projects 2022\dillon_10cd\dms62516\concept oct 2023.dwg
October, 24, 2023 8:25 AM

MAP/DRAWING INFORMATION
THIS DRAWING IS FOR INFORMATION PURPOSES ONLY. ALL DIMENSIONS AND BOUNDARY INFORMATION SHOULD BE VERIFIED BY AN O.L.S PRIOR TO CONSTRUCTION.
CREATED BY: CD
CHECKED BY: MTP
DESIGNED BY: CD

SCALE: 1:1250

DILLON CONSULTING

PROJECT: 22-5115
STATUS: DRAFT
DATE: 10/23/2023

Appendix B

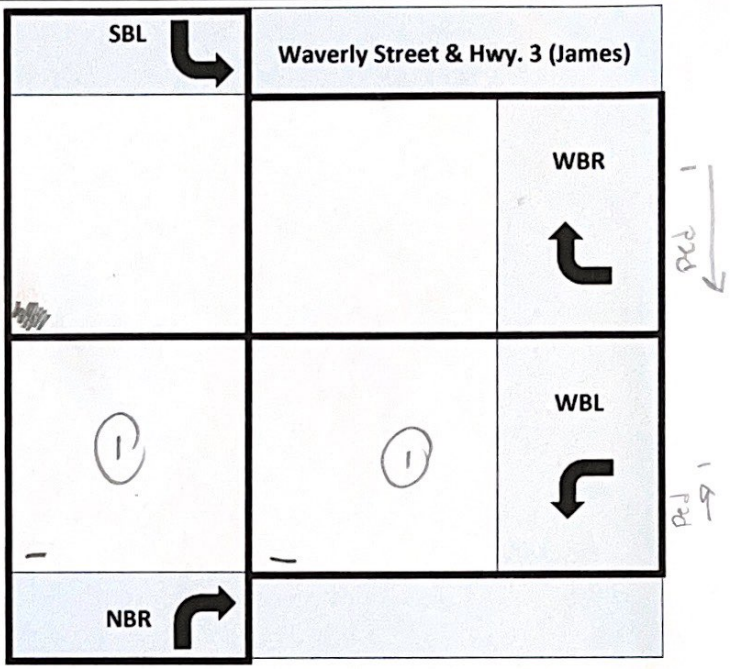
Traffic Survey Data

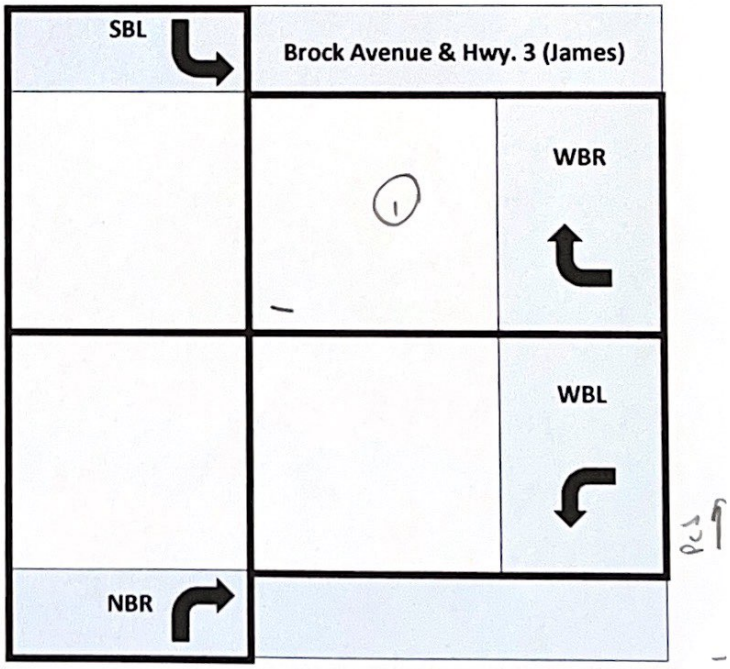
DILLON CONSULTING

↑ 9°
N Clear

Tuesday, September 19, 2023

Time Period: 8:00 AM - ~~8:15~~ **to** 8:15 AM





Collected data (parked) @ SE corner of James St. & Waverly St.
Counts conducted by Caylah Groskurth

Tuesday, September 19, 2023

Time Period: 8:15 AM **to** 8:30 AM

SBL	Waverly Street & Hwy. 3 (James)	
	HBT (4T)	WBR
	(1)	WBL
NBR		

Ped → 11

SBL	Brock Avenue & Hwy. 3 (James)	
	(1)	WBR
		WBL
NBR		

Ped → 11

B: School Bus

Tuesday, September 19, 2023

Time Period: 8:30 AM **to** 8:45 AM

SBL	Waverly Street & Hwy. 3 (James)	
1		WBR
		WBL
NBR		

SBL	Brock Avenue & Hwy. 3 (James)	
1	2	WBR
		WBL
NBR		

Tuesday, September 19, 2023

Time Period: 8:45 AM **to** 9:00 AM

SBL	Waverly Street & Hwy. 3 (James)	
1	1	WBR
1		WBL
NBR		

SBL	Brock Avenue & Hwy. 3 (James)	
2	1	WBR
		WBL
NBR		

Pg 1

Sunny 20°

Tuesday, September 19, 2023

Time Period: 4:00 PM **to** 4:15PM

SBL	Waverly Street & Hwy. 3 (James)	
5	3	WBR
1		WBL
NBR		

SBL	Brock Avenue & Hwy. 3 (James)	
1	1	WBR
		WBL
NBR		

Counts Conducted by Cayiah Groskurth

Parked in same area as AM counts

Tuesday, September 19, 2023

Time Period: 4:15PM to 4:30PM

SBL	Waverly Street & Hwy. 3 (James)	
4	4	WBR
		WBL
NBR		

SBL	Brock Avenue & Hwy. 3 (James)	
1	2	WBR
	1	WBL
NBR		

Tuesday, September 19, 2023

Time Period: 4:30 PM **to** 4:45PM

SBL	Waverly Street & Hwy. 3 (James)	
2	4	WBR
	1	WBL
NBR		

1 Ped →
1 Ped ←

SBL	Brock Avenue & Hwy. 3 (James)	
		WBR
	1	WBL
NBR		

1 Ped →
1 Ped ←

Tuesday, September 19, 2023

Time Period: 4:45 PM **to** 5:00 PM

SBL	Waverly Street & Hwy. 3 (James)	
2	1	WBR
1		WBL
NBR		

SBL	Brock Avenue & Hwy. 3 (James)	
	1	WBR
		WBL
NBR		

Appendix C

Level of Service Definitions

DILLON CONSULTING

LEVEL OF SERVICE[1]

Level of Service (LOS) is defined as a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. This concept was introduced in the 1965 *Highway Capacity Manual* as a criteria for interrupted flow conditions. The 2000 *Highway Capacity Manual* changed the basis for measuring Level of Service at intersections to control delay[2].

Six Levels of Service are defined with LOS A representing the best operating conditions, and LOS F the worst (briefly described below). It should be noted that there is often significant variability in the amount of delay experienced by individual drivers.

LOS A: This Level of Service describes the highest quality of traffic flow and is referred to as free flow. The approach appears open, turning movements are easily made and drivers have freedom of operation. Control delay is less than 10 seconds/vehicle.

LOS B: This Level of Service is referred to as a stable flow. Drivers feel somewhat restricted and occasionally may have to wait to complete the minor movement. Control delay is 10-15 seconds/vehicle for unsignalized intersections and 10-20 seconds/vehicle for signalized intersections.

LOS C: At this level, the operation is stable. Drivers feel more restricted and may have to wait, with queues developing for short periods. Control delay is 15-25 seconds/vehicle at unsignalized intersections and 20-35 seconds/vehicle at signalized intersections.

LOS D: At this level, traffic is approaching unstable flow. The motorist experiences increasing restriction and instability of flow. There are substantial delays to approaching vehicles during short peaks within the peak period, but there are enough gaps to lower demand to permit occasional clearance of developing queues and prevent excessive back-ups. Control delay is 25-35 seconds/vehicle at unsignalized intersections and 35-55 seconds/vehicle at signalized intersections.

LOS E: At this level capacity occurs. Long queues of vehicles exist and delays to vehicles may extend. Control delay is 35-50 seconds/vehicle at unsignalized intersections and 55-80 seconds/vehicle at signalized intersections.

LOS F: At this Level of Service, the intersection has failed. Capacity of the intersection has been exceeded. Control delay exceeds 50 seconds/vehicle at unsignalized intersections and exceeds 80 seconds/vehicle at signalized intersections.

---

[1] *Transportation Research Board: Highway Capacity Manual 1965, 2000*

[2] *Control delay is defined as the component of delay that results when a control signal causes a lane group to reduce speed or to stop; it is measured by comparison with the uncontrolled condition.*

Appendix D

Synchro Analysis Worksheets

DILLON CONSULTING

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	5	365	2	2	426
Future Volume (Veh/h)	2	5	365	2	2	426
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	5	397	2	2	463
Pedestrians	4					
Lane Width (m)	4.3					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	638	204			403	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	638	204			403	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	99			100	
cM capacity (veh/h)	407	800			1148	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	7	265	134	156	309
Volume Left	2	0	0	2	0
Volume Right	5	0	2	0	0
cSH	627	1700	1700	1148	1700
Volume to Capacity	0.01	0.16	0.08	0.00	0.18
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0
Control Delay (s)	10.8	0.0	0.0	0.1	0.0
Lane LOS	B			A	
Approach Delay (s)	10.8	0.0		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	23.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	5	362	0	3	425
Future Volume (Veh/h)	0	5	362	0	3	425
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	5	393	0	3	462
Pedestrians	4					
Lane Width (m)	4.4					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	634	200			397	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	634	200			397	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	99			100	
cM capacity (veh/h)	409	804			1153	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	5	262	131	157	308
Volume Left	0	0	0	3	0
Volume Right	5	0	0	0	0
cSH	804	1700	1700	1153	1700
Volume to Capacity	0.01	0.15	0.08	0.00	0.18
Queue Length 95th (m)	0.2	0.0	0.0	0.1	0.0
Control Delay (s)	9.5	0.0	0.0	0.2	0.0
Lane LOS	A			A	
Approach Delay (s)	9.5	0.0		0.1	
Approach LOS	A				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	23.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	12	501	2	13	492
Future Volume (Veh/h)	1	12	501	2	13	492
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	13	545	2	14	535
Pedestrians	2					
Lane Width (m)	4.3					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	844	276			549	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	844	276			549	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	98			99	
cM capacity (veh/h)	298	721			1015	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	14	363	184	192	357
Volume Left	1	0	0	14	0
Volume Right	13	0	2	0	0
cSH	654	1700	1700	1015	1700
Volume to Capacity	0.02	0.21	0.11	0.01	0.21
Queue Length 95th (m)	0.5	0.0	0.0	0.3	0.0
Control Delay (s)	10.6	0.0	0.0	0.7	0.0
Lane LOS	B			A	
Approach Delay (s)	10.6	0.0		0.3	
Approach LOS	B				

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	32.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	4	499	0	2	491
Future Volume (Veh/h)	2	4	499	0	2	491
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	4	542	0	2	534
Pedestrians	3		1			
Lane Width (m)	4.4		3.3			
Walking Speed (m/s)	1.2		1.2			
Percent Blockage	0		0			
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	817	274			545	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	817	274			545	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	313	721			1017	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	6	361	181	180	356
Volume Left	2	0	0	2	0
Volume Right	4	0	0	0	0
cSH	502	1700	1700	1017	1700
Volume to Capacity	0.01	0.21	0.11	0.00	0.21
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0
Control Delay (s)	12.3	0.0	0.0	0.1	0.0
Lane LOS	B			A	
Approach Delay (s)	12.3	0.0		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	25.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	5	372	2	2	435
Future Volume (Veh/h)	2	5	372	2	2	435
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	5	404	2	2	473
Pedestrians	4					
Lane Width (m)	4.3					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	650	207			410	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	650	207			410	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	400	796			1141	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	7	269	137	160	315
Volume Left	2	0	0	2	0
Volume Right	5	0	2	0	0
cSH	620	1700	1700	1141	1700
Volume to Capacity	0.01	0.16	0.08	0.00	0.19
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0
Control Delay (s)	10.9	0.0	0.0	0.1	0.0
Lane LOS	B			A	
Approach Delay (s)	10.9	0.0		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	23.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	5	369	0	3	434
Future Volume (Veh/h)	0	5	369	0	3	434
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	5	401	0	3	472
Pedestrians	4					
Lane Width (m)	4.4					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	647	204			405	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	647	204			405	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	99			100	
cM capacity (veh/h)	401	799			1146	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	5	267	134	160	315
Volume Left	0	0	0	3	0
Volume Right	5	0	0	0	0
cSH	799	1700	1700	1146	1700
Volume to Capacity	0.01	0.16	0.08	0.00	0.19
Queue Length 95th (m)	0.2	0.0	0.0	0.1	0.0
Control Delay (s)	9.5	0.0	0.0	0.2	0.0
Lane LOS	A			A	
Approach Delay (s)	9.5	0.0		0.1	
Approach LOS	A				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	24.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	12	511	2	13	502
Future Volume (Veh/h)	1	12	511	2	13	502
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	13	555	2	14	546
Pedestrians	2					
Lane Width (m)	4.3					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	859	280			559	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	859	280			559	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	98			99	
cM capacity (veh/h)	291	715			1006	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	14	370	187	196	364
Volume Left	1	0	0	14	0
Volume Right	13	0	2	0	0
cSH	648	1700	1700	1006	1700
Volume to Capacity	0.02	0.22	0.11	0.01	0.21
Queue Length 95th (m)	0.5	0.0	0.0	0.3	0.0
Control Delay (s)	10.7	0.0	0.0	0.7	0.0
Lane LOS	B			A	
Approach Delay (s)	10.7	0.0		0.3	
Approach LOS	B				

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	33.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	4	509	0	2	501
Future Volume (Veh/h)	2	4	509	0	2	501
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	4	553	0	2	545
Pedestrians	3		1			
Lane Width (m)	4.4		3.3			
Walking Speed (m/s)	1.2		1.2			
Percent Blockage	0		0			
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	834	280			556	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	834	280			556	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	305	715			1008	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	6	369	184	184	363
Volume Left	2	0	0	2	0
Volume Right	4	0	0	0	0
cSH	494	1700	1700	1008	1700
Volume to Capacity	0.01	0.22	0.11	0.00	0.21
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0
Control Delay (s)	12.4	0.0	0.0	0.1	0.0
Lane LOS	B			A	
Approach Delay (s)	12.4	0.0		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	25.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	4	22	374	3	8	436
Future Volume (Veh/h)	4	22	374	3	8	436
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	24	407	3	9	474
Pedestrians	4					
Lane Width (m)	4.3					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	668	209			414	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	668	209			414	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	97			99	
cM capacity (veh/h)	387	794			1137	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	28	271	139	167	316
Volume Left	4	0	0	9	0
Volume Right	24	0	3	0	0
cSH	690	1700	1700	1137	1700
Volume to Capacity	0.04	0.16	0.08	0.01	0.19
Queue Length 95th (m)	1.0	0.0	0.0	0.2	0.0
Control Delay (s)	10.4	0.0	0.0	0.5	0.0
Lane LOS	B			A	
Approach Delay (s)	10.4	0.0		0.2	
Approach LOS	B				

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	27.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	7	370	1	4	436
Future Volume (Veh/h)	2	7	370	1	4	436
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	8	402	1	4	474
Pedestrians	4					
Lane Width (m)	4.4					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	652	206			407	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	652	206			407	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	398	798			1144	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	10	268	135	162	316
Volume Left	2	0	0	4	0
Volume Right	8	0	1	0	0
cSH	664	1700	1700	1144	1700
Volume to Capacity	0.02	0.16	0.08	0.00	0.19
Queue Length 95th (m)	0.4	0.0	0.0	0.1	0.0
Control Delay (s)	10.5	0.0	0.0	0.2	0.0
Lane LOS	B			A	
Approach Delay (s)	10.5	0.0		0.1	
Approach LOS	B				

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	24.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	3	24	512	5	32	504
Future Volume (Veh/h)	3	24	512	5	32	504
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	26	557	5	35	548
Pedestrians	2					
Lane Width (m)	4.3					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	906	283			564	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	906	283			564	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	96			97	
cM capacity (veh/h)	266	713			1002	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	29	371	191	218	365
Volume Left	3	0	0	35	0
Volume Right	26	0	5	0	0
cSH	607	1700	1700	1002	1700
Volume to Capacity	0.05	0.22	0.11	0.03	0.21
Queue Length 95th (m)	1.2	0.0	0.0	0.9	0.0
Control Delay (s)	11.2	0.0	0.0	1.7	0.0
Lane LOS	B			A	
Approach Delay (s)	11.2	0.0		0.6	
Approach LOS	B				

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	42.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	4	5	512	3	4	503
Future Volume (Veh/h)	4	5	512	3	4	503
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	5	557	3	4	547
Pedestrians	3		1			
Lane Width (m)	4.4		3.3			
Walking Speed (m/s)	1.2		1.2			
Percent Blockage	0		0			
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	844	283			563	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	844	283			563	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	300	712			1001	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	9	371	189	186	365
Volume Left	4	0	0	4	0
Volume Right	5	0	3	0	0
cSH	442	1700	1700	1001	1700
Volume to Capacity	0.02	0.22	0.11	0.00	0.21
Queue Length 95th (m)	0.5	0.0	0.0	0.1	0.0
Control Delay (s)	13.3	0.0	0.0	0.2	0.0
Lane LOS	B			A	
Approach Delay (s)	13.3	0.0		0.1	
Approach LOS	B				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	26.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	5	391	2	2	457
Future Volume (Veh/h)	2	5	391	2	2	457
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	5	425	2	2	497
Pedestrians	4					
Lane Width (m)	4.3					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	682	218			431	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	682	218			431	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	381	784			1120	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	7	283	144	168	331
Volume Left	2	0	0	2	0
Volume Right	5	0	2	0	0
cSH	602	1700	1700	1120	1700
Volume to Capacity	0.01	0.17	0.08	0.00	0.19
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0
Control Delay (s)	11.1	0.0	0.0	0.1	0.0
Lane LOS	B			A	
Approach Delay (s)	11.1	0.0		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	24.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	5	388	0	3	456
Future Volume (Veh/h)	0	5	388	0	3	456
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	5	422	0	3	496
Pedestrians	4					
Lane Width (m)	4.4					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	680	215			426	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	680	215			426	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	99			100	
cM capacity (veh/h)	382	787			1125	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	5	281	141	168	331
Volume Left	0	0	0	3	0
Volume Right	5	0	0	0	0
cSH	787	1700	1700	1125	1700
Volume to Capacity	0.01	0.17	0.08	0.00	0.19
Queue Length 95th (m)	0.2	0.0	0.0	0.1	0.0
Control Delay (s)	9.6	0.0	0.0	0.2	0.0
Lane LOS	A			A	
Approach Delay (s)	9.6	0.0		0.1	
Approach LOS	A				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	24.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	12	537	2	13	527
Future Volume (Veh/h)	1	12	537	2	13	527
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	13	584	2	14	573
Pedestrians	2					
Lane Width (m)	4.3					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	902	295			588	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	902	295			588	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	98			99	
cM capacity (veh/h)	273	700			981	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	14	389	197	205	382
Volume Left	1	0	0	14	0
Volume Right	13	0	2	0	0
cSH	630	1700	1700	981	1700
Volume to Capacity	0.02	0.23	0.12	0.01	0.22
Queue Length 95th (m)	0.5	0.0	0.0	0.3	0.0
Control Delay (s)	10.8	0.0	0.0	0.7	0.0
Lane LOS	B			A	
Approach Delay (s)	10.8	0.0		0.3	
Approach LOS	B				

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	33.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	4	535	0	2	526
Future Volume (Veh/h)	2	4	535	0	2	526
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	4	582	0	2	572
Pedestrians	3		1			
Lane Width (m)	4.4		3.3			
Walking Speed (m/s)	1.2		1.2			
Percent Blockage	0		0			
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	876	294			585	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	876	294			585	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	287	700			983	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	6	388	194	193	381
Volume Left	2	0	0	2	0
Volume Right	4	0	0	0	0
cSH	473	1700	1700	983	1700
Volume to Capacity	0.01	0.23	0.11	0.00	0.22
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0
Control Delay (s)	12.7	0.0	0.0	0.1	0.0
Lane LOS	B			A	
Approach Delay (s)	12.7	0.0		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	25.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	4	22	393	3	8	458
Future Volume (Veh/h)	4	22	393	3	8	458
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	24	427	3	9	498
Pedestrians	4					
Lane Width (m)	4.3					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	700	219			434	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	700	219			434	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	97			99	
cM capacity (veh/h)	369	782			1118	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	28	285	145	175	332
Volume Left	4	0	0	9	0
Volume Right	24	0	3	0	0
cSH	674	1700	1700	1118	1700
Volume to Capacity	0.04	0.17	0.09	0.01	0.20
Queue Length 95th (m)	1.0	0.0	0.0	0.2	0.0
Control Delay (s)	10.6	0.0	0.0	0.5	0.0
Lane LOS	B			A	
Approach Delay (s)	10.6	0.0		0.2	
Approach LOS	B				

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	28.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	7	389	1	4	458
Future Volume (Veh/h)	2	7	389	1	4	458
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	8	423	1	4	498
Pedestrians	4					
Lane Width (m)	4.4					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	684	216			428	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	684	216			428	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	379	785			1123	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	10	282	142	170	332
Volume Left	2	0	0	4	0
Volume Right	8	0	1	0	0
cSH	647	1700	1700	1123	1700
Volume to Capacity	0.02	0.17	0.08	0.00	0.20
Queue Length 95th (m)	0.4	0.0	0.0	0.1	0.0
Control Delay (s)	10.7	0.0	0.0	0.2	0.0
Lane LOS	B			A	
Approach Delay (s)	10.7	0.0		0.1	
Approach LOS	B				

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	25.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	3	24	538	5	32	529
Future Volume (Veh/h)	3	24	538	5	32	529
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	26	585	5	35	575
Pedestrians	2					
Lane Width (m)	4.3					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	947	297			592	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	947	297			592	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	96			96	
cM capacity (veh/h)	250	698			978	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	29	390	200	227	383
Volume Left	3	0	0	35	0
Volume Right	26	0	5	0	0
cSH	589	1700	1700	978	1700
Volume to Capacity	0.05	0.23	0.12	0.04	0.23
Queue Length 95th (m)	1.2	0.0	0.0	0.9	0.0
Control Delay (s)	11.4	0.0	0.0	1.7	0.0
Lane LOS	B			A	
Approach Delay (s)	11.4	0.0		0.6	
Approach LOS	B				

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	4	5	538	3	4	528
Future Volume (Veh/h)	4	5	538	3	4	528
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	5	585	3	4	574
Pedestrians	3		1			
Lane Width (m)	4.4		3.3			
Walking Speed (m/s)	1.2		1.2			
Percent Blockage	0		0			
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	886	297			591	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	886	297			591	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	282	697			978	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	9	390	198	195	383
Volume Left	4	0	0	4	0
Volume Right	5	0	3	0	0
cSH	421	1700	1700	978	1700
Volume to Capacity	0.02	0.23	0.12	0.00	0.23
Queue Length 95th (m)	0.5	0.0	0.0	0.1	0.0
Control Delay (s)	13.7	0.0	0.0	0.2	0.0
Lane LOS	B			A	
Approach Delay (s)	13.7	0.0		0.1	
Approach LOS	B				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	27.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	5	411	2	2	480
Future Volume (Veh/h)	2	5	411	2	2	480
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	5	447	2	2	522
Pedestrians	4					
Lane Width (m)	4.3					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	717	228			453	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	717	228			453	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	362	771			1100	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	7	298	151	176	348
Volume Left	2	0	0	2	0
Volume Right	5	0	2	0	0
cSH	583	1700	1700	1100	1700
Volume to Capacity	0.01	0.18	0.09	0.00	0.20
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0
Control Delay (s)	11.2	0.0	0.0	0.1	0.0
Lane LOS	B			A	
Approach Delay (s)	11.2	0.0		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	24.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	5	408	0	3	479
Future Volume (Veh/h)	0	5	408	0	3	479
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	5	443	0	3	521
Pedestrians	4					
Lane Width (m)	4.4					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	714	226			447	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	714	226			447	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	99			100	
cM capacity (veh/h)	364	774			1105	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	5	295	148	177	347
Volume Left	0	0	0	3	0
Volume Right	5	0	0	0	0
cSH	774	1700	1700	1105	1700
Volume to Capacity	0.01	0.17	0.09	0.00	0.20
Queue Length 95th (m)	0.2	0.0	0.0	0.1	0.0
Control Delay (s)	9.7	0.0	0.0	0.2	0.0
Lane LOS	A			A	
Approach Delay (s)	9.7	0.0		0.1	
Approach LOS	A				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	25.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	12	565	2	13	554
Future Volume (Veh/h)	1	12	565	2	13	554
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	13	614	2	14	602
Pedestrians	2					
Lane Width (m)	4.3					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	946	310			618	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	946	310			618	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	98			99	
cM capacity (veh/h)	255	684			956	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	14	409	207	215	401
Volume Left	1	0	0	14	0
Volume Right	13	0	2	0	0
cSH	611	1700	1700	956	1700
Volume to Capacity	0.02	0.24	0.12	0.01	0.24
Queue Length 95th (m)	0.6	0.0	0.0	0.4	0.0
Control Delay (s)	11.0	0.0	0.0	0.7	0.0
Lane LOS	B			A	
Approach Delay (s)	11.0	0.0		0.2	
Approach LOS	B				

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	34.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	4	562	0	2	553
Future Volume (Veh/h)	2	4	562	0	2	553
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	4	611	0	2	601
Pedestrians	3		1			
Lane Width (m)	4.4		3.3			
Walking Speed (m/s)	1.2		1.2			
Percent Blockage	0		0			
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	920	308			614	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	920	308			614	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	269	685			959	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	6	407	204	202	401
Volume Left	2	0	0	2	0
Volume Right	4	0	0	0	0
cSH	452	1700	1700	959	1700
Volume to Capacity	0.01	0.24	0.12	0.00	0.24
Queue Length 95th (m)	0.3	0.0	0.0	0.1	0.0
Control Delay (s)	13.1	0.0	0.0	0.1	0.0
Lane LOS	B			A	
Approach Delay (s)	13.1	0.0		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	26.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	4	22	413	3	8	481
Future Volume (Veh/h)	4	22	413	3	8	481
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	24	449	3	9	523
Pedestrians	4					
Lane Width (m)	4.3					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	734	230			456	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	734	230			456	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	97			99	
cM capacity (veh/h)	351	769			1097	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	28	299	153	183	349
Volume Left	4	0	0	9	0
Volume Right	24	0	3	0	0
cSH	657	1700	1700	1097	1700
Volume to Capacity	0.04	0.18	0.09	0.01	0.21
Queue Length 95th (m)	1.1	0.0	0.0	0.2	0.0
Control Delay (s)	10.7	0.0	0.0	0.5	0.0
Lane LOS	B			A	
Approach Delay (s)	10.7	0.0		0.2	
Approach LOS	B				

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	29.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	7	409	1	4	481
Future Volume (Veh/h)	2	7	409	1	4	481
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	8	445	1	4	523
Pedestrians	4					
Lane Width (m)	4.4					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	719	227			450	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	719	227			450	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	360	773			1102	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	10	297	149	178	349
Volume Left	2	0	0	4	0
Volume Right	8	0	1	0	0
cSH	629	1700	1700	1102	1700
Volume to Capacity	0.02	0.17	0.09	0.00	0.21
Queue Length 95th (m)	0.4	0.0	0.0	0.1	0.0
Control Delay (s)	10.8	0.0	0.0	0.2	0.0
Lane LOS	B			A	
Approach Delay (s)	10.8	0.0		0.1	
Approach LOS	B				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	26.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	3	24	566	5	32	556
Future Volume (Veh/h)	3	24	566	5	32	556
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	26	615	5	35	604
Pedestrians	2					
Lane Width (m)	4.3					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	992	312			622	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	992	312			622	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	96			96	
cM capacity (veh/h)	233	682			953	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	29	410	210	236	403
Volume Left	3	0	0	35	0
Volume Right	26	0	5	0	0
cSH	569	1700	1700	953	1700
Volume to Capacity	0.05	0.24	0.12	0.04	0.24
Queue Length 95th (m)	1.3	0.0	0.0	0.9	0.0
Control Delay (s)	11.7	0.0	0.0	1.6	0.0
Lane LOS	B			A	
Approach Delay (s)	11.7	0.0		0.6	
Approach LOS	B				

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	45.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	4	5	565	3	4	555
Future Volume (Veh/h)	4	5	565	3	4	555
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	5	614	3	4	603
Pedestrians	3		1			
Lane Width (m)	4.4		3.3			
Walking Speed (m/s)	1.2		1.2			
Percent Blockage	0		0			
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	929	312			620	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	929	312			620	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	99			100	
cM capacity (veh/h)	264	682			954	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	9	409	208	205	402
Volume Left	4	0	0	4	0
Volume Right	5	0	3	0	0
cSH	401	1700	1700	954	1700
Volume to Capacity	0.02	0.24	0.12	0.00	0.24
Queue Length 95th (m)	0.6	0.0	0.0	0.1	0.0
Control Delay (s)	14.2	0.0	0.0	0.2	0.0
Lane LOS	B			A	
Approach Delay (s)	14.2	0.0		0.1	
Approach LOS	B				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	28.1%	ICU Level of Service	A
Analysis Period (min)	15		

Geotechnical Investigation

Landmark Homes Inc.

Project Name:
Proposed Residential Development
Waverley Street, Delhi, Ontario

Project Number:
LON-23003150-A0

Prepared By:
EXP Services Inc.
15701 Robin's Hill Road
London, Ontario, N5V 0A5
t: +1.519.963.3000
f: +1.519.963.1152

Date Submitted:
May 1, 2023

Geotechnical Investigation

Landmark Homes Inc.

Type of Document:

Geotechnical Report

Project Name:

Proposed Residential Development
Waverly Street, Delhi, Ontario

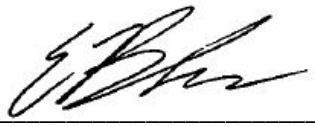
Project Number:

LON-23003150-A0

Prepared and Reviewed By:

EXP Services Inc.
15701 Robins Hill Road
London, ON, N5V 0A5
Canada
t: +1.519.963.3000
f: +1.519.963.1152

Arif Kidwai, P.Eng.
Geotechnical Services



Eric Buchanan, P.Eng.
Geotechnical Services

Date Submitted:

May 1, 2023

Table of Contents

1. INTRODUCTION AND BACKGROUND 1

1.1 Introduction 1

1.2 Terms of Reference 1

2. METHODOLOGY 2

3. SITE AND SUBSURFACE CONDITIONS 3

3.1 Site Description 3

3.2 Soil Stratigraphy 3

3.2.1 Topsoil 3
3.2.2 Asphalt 3
3.2.3 Fill 3
3.2.4 Sand 4
3.2.5 Sand and Gravel 4
3.2.6 Sandy Silt Till 4

3.3 Groundwater Conditions 4

3.4 Methane Gas 5

4. DISCUSSION AND RECOMMENDATIONS 6

4.1 Site Preparation 6

4.2 Excavation and Groundwater Control 7

4.2.1 Excess Soil Management 7
4.2.2 General 9
4.2.3 Excavation Support 9
4.2.4 Construction Dewatering 10

4.3 Building Foundations 11

4.3.1 Conventional Strip and Spread Footings 11
4.3.2 Foundations - General 11

4.4 Basements 12

4.5 Slab-on-Grade Construction 13

4.6 Foundation Backfill 13

4.7 Site Servicing 14

4.8 Seismic Considerations 14

4.9 Low Impact Development (LID) 15

4.10 Site Pavement Design 16

4.11 Curbs and Sidewalks 17

4.12 Methane Gas Testing 18

4.13 Inspection and Testing Requirements 18

5. GENERAL COMMENTS 19

Appendices

Drawings
Appendix A – Borehole Logs
Appendix B – Grain Size Analyses
Appendix C – Inspection and Testing Schedule
Appendix D – Limitations and Use of Report
Legal Notification

1. Introduction and Background

1.1 Introduction

EXP Services Inc. (EXP) was retained by **Landmark Homes Inc.** (Client) to carry out a geotechnical investigation and prepare a geotechnical report relating to the proposed residential development located at Waverly Street in Delhi, Ontario, hereinafter referred to as the 'Site'.

Based on information and a concept plan provided by Dillon Consulting Ltd., it is understood that the proposed development will include 47 single detached residential buildings. Other associated features of the development include full municipal servicing, a stormwater management pond, paved local roads and landscaped areas.

Based on an interpretation of the factual test hole data and a review of soil and groundwater information from test holes advanced at the Site, EXP has provided geotechnical engineering guidelines to support the proposed Site development.

1.2 Terms of Reference

The investigation and preparation of this report were carried out in general accordance with EXP's Proposal P23-032, dated March 1st, 2023. Authorization to proceed with this investigation was received from Mr. Peter Braun of **Landmark Homes Inc.** through a signed work authorization form on Mach 6th, 2023.

The purpose of the investigation was to examine the subsoil and groundwater conditions at the Site by advancing a series of boreholes at the locations chosen by EXP and shown on the attached Borehole Location Plan (**Drawing 1**).

Based on an interpretation of the factual borehole data, and a review of soil and groundwater information from test holes advanced at the site, EXP Services Inc. has provided engineering guidelines for the geotechnical design and construction of the proposed development. More specifically, this report provides comments on site preparation, excavations, dewatering, foundation design, slab-on-grade and basement construction, site servicing, seismic considerations, low impact development, pavement recommendations, and curbs and sidewalks.

This report is provided on the basis of the terms of reference presented above, and on the assumption that the design will be in accordance with applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design.

The information in this report in no way reflects on the environmental aspects of the soil. Should specific information in this regard be needed, additional testing may be required.

Reference is made to **Appendix D** of this report, which contains further information necessary for the proper interpretation and use of this report.

2. Methodology

The fieldwork was carried out on March 27th and 29th, 2023. In general, the geotechnical investigation consisted of the advancement of eight (8) boreholes at the locations shown on **Drawing 1** as BH1 to BH8. The boreholes were drilled to varying depths of about 3.5 to 12.2 m below the existing grade. The suffix "/MW" was appended to the borehole labels where monitoring wells were installed.

Prior to the drilling, buried service clearances were obtained for the test hole locations by EXP.

The boreholes and monitoring well installations were completed by a specialist drilling subcontractor under the full-time supervision of EXP geotechnical staff. The boreholes were advanced utilizing a track-mounted drill rig equipped with continuous flight solid and hollow stem augers, soil sampling and soil testing equipment. In each borehole, disturbed soil samples were recovered at depth intervals of 0.75 m and 1.5 m using conventional split spoon sampling equipment and Standard Penetration Test (SPT) methods or auger samples.

During the drilling, the stratigraphy in the boreholes was examined and logged in the field by EXP geotechnical personnel.

Short-term groundwater levels within the open boreholes were observed. These observations pertaining to groundwater conditions and stabilized groundwater levels at the test hole locations are recorded in the borehole logs found in **Appendix A**. Following the drilling, the remaining boreholes were backfilled with the excavated materials and bentonite, to satisfy the requirements of O.Reg. 903.

Representative samples of the various soil strata encountered at the test locations were taken to our laboratory in London for further examination by a Geotechnical Engineer and laboratory classification testing. Laboratory testing for this investigation comprised four (4) grain size analyses presented in **Appendix B** and routine moisture content determinations, presented on the borehole logs in **Appendix A**.

Samples remaining after the classification testing will be stored for a period of three months following the issuance of the report (i.e., until August 2023). After this time, they will be discarded unless prior arrangements have been made for longer storage.

The location of each test hole was established in the field in conjunction with a concept plan prepared by Dillon Consulting Limited. Ground surface elevations at the borehole locations were surveyed to the top of spindle of fire hydrant located in the north boulevard of Waverly Street, just west of Site. A geodetic elevation of 242.714 m was established for the benchmark by EXP using a SOKKIA GCX3 Receiver.

3. Site and Subsurface Conditions

3.1 Site Description

The subject area is currently grass covered with a parking lot on the west side, at the limit of Waverly Street. The Site is bounded by an abandoned railway to the north, woodlots to the east and south and a residential property to the south, and residential and industrial development to the west.

The following sections provide a summary of the soil and groundwater conditions.

3.2 Soil Stratigraphy

The detailed stratigraphy encountered in each test hole is shown on the borehole logs found in **Appendix A** and summarized in the following paragraphs. It must be noted that the boundaries of the soil indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect transition zones for geotechnical design and should not be interpreted as exact planes of geological change.

3.2.1 Topsoil

Except for Boreholes BH4 and BH5, each borehole was surfaced with a layer of topsoil. The topsoil thickness ranged between about 150 mm and 300 mm.

It should be noted that topsoil quantities should not be established from the information provided at the test hole locations only. If required, a more detailed analysis (involving additional shallow test pits) is recommended to accurately quantify the amount of topsoil to be removed for construction purposes.

3.2.2 Asphalt

Approximately 25 to 30 mm thick asphalt was encountered at the surface of Boreholes BH4 and BH5.

3.2.3 Fill

Beneath the asphalt at Boreholes BH4 and BH5, approximately 150 mm of granular fill was encountered.

Below the granular or topsoil in Boreholes BH4 to BH6 a layer of fill, which extended to a depth about 1.4 to 3.2 m below ground surface (bgs) (Elevation 240.9 to 239.3 m), was encountered. The fill varied in composition, compactness and moisture condition. In general, it was noted to be brown, sand and gravel some silt to sandy silt, trace to some clay.

In Boreholes BH4 and BH5, the fill was loose to very dense (based on Standard Penetration Test (SPT) N Values of 8 to 53 blows per 300 mm split spoon sampler penetration) and moist to very moist (based on tactile examination and *in situ* moisture contents of 2 to 11 percent). Very loose (SPT N Values of 0 to 3) sandy silt fill was observed in Borehole BH6, generally in a moist to very moist condition (*in situ* moisture contents of 11 to 19 percent).

A 100 mm thick organic layer was observed near 0.4 m bgs in Borehole BH5, while trace to some organics were noted below 2.5 m bgs in Borehole BH6.

3.2.4 Sand

Except for Boreholes BH4 and BH6, all boreholes encountered sand. Boreholes BH1/MW, BH2/MW, BH3, BH7 and BH8 were terminated in sand deposits. There were typically upper and lower sand layers, with the upper layer typically extending to between 2.1 m and 4.0 m bgs and the deeper layer extending to the base of the deeper boreholes. In general, the sand was noted to be brown, typically fine to medium grained, contained trace to some silt, was occasionally silty, and trace to some gravel. The sand was loose to very dense, based on SPT N Values of 5 blows per 300 mm to greater than 50 blows per 150 mm split spoon sampler penetration. Laboratory testing of the sand yielded *in situ* moisture contents of 2 to 22 percent, indicating damp to wet conditions.

3.2.5 Sand and Gravel

Below the sand, fill or topsoil, Boreholes BH3, BH4, BH5, BH7 and BH8 contacted sand and gravel that extended to a depth of about 1.4 to 2.2 m bgs (Elevations 241.0 to 239.9 m). In general, the sand and gravel was noted to be brown, with trace to some silt with occasional cobbles. It was compact (SPT N Values of 17 to 27) and damp to moist (based on *in situ* moisture contents of 2 to 7 percent).

3.2.6 Sandy Silt Till

With the exption of Borehole BH7, each borehole contacted a stratum of sandy silt till. The till was encountered below the upper sand/sand and gravel layers, and extended to depth of about 5.5 to 5.6 m bgs, Elevations 237.7 to 236.8 m, in the deeper boreholes. Boreholes BH4, BH5 and BH6 were terminated in till deposits. The sandy silt till was generally described as brown with trace clay, trace to some gravel with dilatant layering at depth. The till was compact to dense in relative density (based on SPT N values of 16 to 45). Laboratory testing of the till yielded *in situ* moisture contents of 6 to 18 percent, indicative of moist to very moist conditions. Below 4.0 m bgs in Borehole BH2/MW, the till became wet (tactile examination).

3.3 Groundwater Conditions

Two (2) monitoring wells were installed during the drilling on March 27th, 2023. The wells were installed to depths of approximately 12.2 m bgs. The summary of monitoring well construction details and water levels are presented in the tables below.

Table 1 – Summary of Monitoring Well Construction Details

Borehole/Well ID	Approximate Ground Surface Elevation (m)	Completion Depth (m bgs)	Screen Length (m)
BH1/MW	241.76	12.19	1.52
BH2/MW	243.24	12.19	1.52

Table 2 – Groundwater Level Monitoring

Borehole/Well ID	Approximate Ground Surface Elevation (m)	Depth to Groundwater, m bgs (Groundwater Elevation, m)	
		April 3, 2023	April 13, 2023
BH1/MW	241.76	10.14 (231.62)	10.14 (231.62)
BH2/MW	243.24	10.84 (232.40)	10.90 (232.34)

The monitoring well has been registered with the Ministry of Environment, Conservation and Parks (MECP), in accordance with Ontario Regulation 903, and remains intact for the purposes of ongoing monitoring of stabilized groundwater conditions, as needed. Groundwater was measured between 10.14 and 10.90 m bgs, with groundwater elevations ranging from 231.62 to 232.40 m, over the monitored period.

Details of the groundwater conditions observed within the boreholes are provided on the attached Borehole Logs. Upon completion of drilling, the open boreholes were examined for the presence of groundwater and groundwater seepage. Water was measured near 2.7 m bgs in Borehole BH6 upon completion of drilling. All other boreholes without monitoring wells installed were open and dry at completion.

It is noted that the depth to the groundwater table may vary in response to climatic or seasonal conditions, and, as such, may differ at the time of construction, with higher levels in wet seasons. Capillary rise effects should also be anticipated in fine-grained soil deposits..

3.4 Methane Gas

No methane gas producing materials or significant organic matter was encountered at the borehole locations, except a thin veneer of topsoil.

An RKI Gx-2003 Gas Detector was used in the upper levels of the open boreholes. The unit measures LEL combustibles, methane gas, oxygen content, carbon monoxide and hydrogen sulfide in standard confined space gases. No significant methane gas concentration was detected in the boreholes.

4. Discussion and Recommendations

Based on information and a concept plan provided by Dillon Consulting Ltd., it is understood that the proposed development will include 47 single detached residential buildings. Other associated features of the development include full municipal servicing, a stormwater management pond, paved local roads and landscaped areas.

The following sections of this report provide geotechnical comments and recommendations regarding site preparation, excavations, dewatering, foundation design, slab-on-grade and basement construction, site servicing, seismic considerations, low impact development, pavement recommendations, and curbs and sidewalks.

4.1 Site Preparation

Prior to placement of foundations and/or engineered fill, all fill, surficial topsoil, vegetation and/or otherwise deleterious materials should be stripped. Thicker areas of topsoil may be anticipated in areas with trees and/or heavy vegetative cover. It is anticipated that the surficial topsoil may be stockpiled on site for possible reuse as landscaping fill.

Following the removal of the topsoil and unsuitable materials described above and prior to fill placement, the exposed subgrade should be inspected by a Geotechnical Engineer. Any loose or soft zones noted in the inspection should be over-excavated and replaced with approved fill.

It is recommended that construction traffic be minimized on the finished subgrade and that the subgrade be sloped to promote surface drainage and runoff.

In the building areas where the grade will be raised, the fill material should consist of imported granular or approved onsite (excavated) material. The fill material should be inspected and approved by a Geotechnical Engineer and should be placed in a maximum 300 mm (12 inch) thick loose lifts and uniformly compacted to 100 percent Standard Proctor Maximum Dry Density (SPMDD) within 3 percent of optimum moisture content. The geometric requirements for engineered fill are provided on **Drawing 2**.

The natural and inorganic fill materials on site would be suitable for reuse as engineered fill. The material should be examined and approved by a Geotechnical Engineer prior to reuse.

In areas along the proposed roadways, fill material used to raise grades may comprise onsite excavated soils or imported granular fill approved by an Engineer. The fill should be placed in a maximum 300 mm (12 inch) thick loose lifts and uniformly compacted to 95/98 percent SPMDD, depending on depth, within 3 percent of optimum moisture content to provide adequate stability for the new pavements.

In situ density testing should be carried out during the fill placement to ensure that the specified compaction is being achieved.

If imported fill material is used at the Site, verification of the suitability of the fill may be required from an environmental standpoint. Conventional geotechnical testing will not determine the suitability of the material in this regard. Analytical testing and environmental site assessment may be required at the source. This will best be assessed prior to the selection of the material source. A quality assurance program should be implemented to ensure that the fill material will comply with the current MECP standards for placement and transportation. The disposal of

excavated materials must also conform to the MECP Guidelines and requirements. EXP can be of assistance if an assessment of the materials is required.

4.2 Excavation and Groundwater Control

4.2.1 Excess Soil Management

It should be noted that the Geotechnical Investigation does not include any testing for off-site disposal according to the new Regulation O. Reg. 406/19.

Ontario Regulation 406/19 made under the Environmental Protection Act (November 28, 2019) was implemented on January 1, 2021. The new regulation dictates the testing protocol that is required for the management and disposal of Excess Soils. As set forth in the Regulation, specific analytical testing protocols will need to be implemented and followed based on the quality and quantity of soil to be managed.

The quality of soils is assessed through an Assessment of Past Uses (APU) including the provision of an Ecolog ERIS data base report to determine if there are any Areas of Potential Environmental Concern (APEC). The parameters to be tested will be determined by the APU results.

The testing protocols are specific as to whether the soils are stockpiled or in situ. In either scenario, the testing protocols are far more onerous than have been historically carried out as part of standard industry practices. These decisions should be factored in and accounted for prior to the initiation of the project-defined scope of work. EXP would be pleased to assist with the implementation of a soil management and testing program that would satisfy the requirements of Ontario Regulation 406/19.

Soil sampling requirements for Areas of Potential Environmental Concern (APEC) related to the new standard effective January 1, 2022 are provided below.

Table 3 – Ex-Situ (e.g., Stockpiles)

Soil Volume	Sampling Frequency
< 130 m^3	Minimum of 3
> 130 - 220 m^3	4
> 220 – 5,000 m^3	5-32*
> 5,000 m^3	N = 32 + (Volume – 5,000) / 300

*refer to stockpile sampling frequency in O.Reg. 153/04 for specifics. Essentially, one sample for every 150 m^3 after 800 m^3

Table 4 – In Situ

Soil Volume	Sampling Frequency
< 600 m^3	Minimum of 3
> 600 m^3 - 10,000 m^3	1 sample per every additional 200 m^3
> 10,000 m^3 – 40,000 m^3	1 sample per every additional 450 m^3
> 40,000 m^3	1 sample per every additional 2,000 m^3

In areas where no APECs have been identified, the sampling frequency in the tables noted above does not need to be followed and can be determined at the discretion of the QP.

In addition to the above tables, one field duplicate should be submitted for approximately every 10 samples taken for quality control/quality assurance purposes.

Soil Analytical Testing Requirements:

- Samples to be tested for a minimum of Petroleum Hydrocarbons (PHCs) – Fractions F1-F4, Benzene, Toluene, Ethylbenzene & Xylenes (BTEX), Metals & Inorganics, including Electrical Conductivity (EC) and Sodium Absorption Ration (SAR);
- Any additional potential Contaminant of Concern identified in past uses report (comes into effect January 1st, 2022); and,
- mSPLP Leachate testing (metals and VOCs) (not required for volumes under 350 m^3: between 350 m^3 and 600 m^3 (minimum of 3); greater than 600 m^3 (10 % of samples).

Other components of the new regulation include:

- The Sampling and Analysis Plan (SAP) which follows the APU;
- The Soil Characterization Report (SCR) which follows the sampling program;
- The Excess Soil Destination Assessment Report (ESDAR) which follows the SCR;
- Notice of Project on the Resouce Productivity and Recovery Authority (RPRA) which is usually the responsibility of the Project Lead, the Project Lead's Contract Administrator or Contractor during the construction phase; and,
- Tracking Requirements on the RPRA, again, usually the responsibility of the Contractor during the construction phase.

In general, it is most economical to provide a site grading plan that keeps all excess soils on site so that O. Reg 406/19 is not invoked.

4.2.2 General

All work associated with design and construction relative to excavations must be carried out in accordance with Part III of Ontario Regulation 213/91 under the Occupational Health and Safety Act. Based on the results of the geotechnical investigation and in accordance with Section 226 of Ontario Regulation 213/91, the fill and natural Site soils are classified as Type 3 soils.

For reference, temporary excavation sidewalls which extend through and terminate within Type 2 soils may be cut vertically in the bottom 1.2 m (4 ft.) and cut back at an inclination of 1 horizontal to 1 vertical above that level. Where excavations extend into or through Type 3 soils, excavation side slopes must be cut back at a maximum inclination of about 1H:1V from the base of the excavation. Should groundwater egress loosen the side slopes, slopes of 3H:1V or flatter will be required.

Geotechnical inspection at the time of excavation can confirm the soil type present.

It should be noted that the presence of cobbles and boulders in natural glacial deposits may influence the progress of excavation and construction.

4.2.3 Excavation Support

The recommendations for side slopes given in the above section would apply to most of the conventional excavations expected for the proposed development. However, in areas adjacent to buried services that are located above the base of the excavations, side slopes may require support to prevent possible disturbance or distress to these structures. This concept also applies to connections to existing services. In granular soils above the groundwater and in cohesive natural soils, bracing will not normally be required if the structures are behind a 45-degree line drawn up from the toe of the excavation. In wet sandy or silty soils, the setback should be about 3H to 1V if bracing is to be avoided.

For support of excavations such as for any deep manholes or to minimize disturbance to surrounding lands, shoring such as sheeting or soldier piles and lagging can be considered. Alternatively, the option of a prefabricated trench box system may be available depending on the required depths. The prefabricated trench box system, if utilized, must be designed by a professional engineer to withstand the soil and hydrostatic loading. The design and use of the support system should conform to the requirements set out in the most recent version of the Occupational Health and Safety Act for Construction Projects and approved by the Ministry of Labour. Excavations should conform to the guidelines set out in the proceeding section and the Safety Act.

The shoring should also be designed in accordance with the guidelines set out in the Canadian Foundation Engineering Manual, 4th Edition. Soil-related parameters considered appropriate for a soldier pile and lagging system are shown below.

Where applicable, the lateral earth pressure acting on the excavation shoring walls may be calculated from the following equation:

$$P = K (\gamma h + q)$$

where, P = lateral earth pressure in kPa acting at depth h;

γ = natural unit weight, a value of 20.4 kN/m^3 may be assumed;

h = depth of point of interest in m; and,

q = equivalent value of any surcharge on the ground surface in kPa.

The earth pressure coefficient (K) may be taken as 0.25 where small movements are acceptable and adjacent footing or movement-sensitive services are not above a line extending at 45 degrees from the bottom edge of the excavation; 0.35 where utilities, roads, and sidewalks must be protected from significant movement; and 0.45 where adjacent building footings or movement sensitive services (gas and water mains) are above a line of 60 degrees from the horizontal extending from the bottom edge of the excavation.

For long-term design, a K at rest (K_o) of a minimum of 0.5 should be considered.

The above expression assumes that no hydrostatic pressure will be applied against the shoring system. It should be recognized that the final shoring design will be prepared by the shoring contractor. It is not possible to comment further on specific design details until this design is completed.

If the shoring is exposed to freezing temperatures, appropriate insulation may be provided to prevent outward movement.

The performance of the shoring must be checked through monitoring for lateral movement of the walls of the excavation to ensure that the shoring movements remain within design limits. The most effective method for monitoring the shoring movements can best be devised by this office when the shoring plans become available. The shoring designer should however assess the specific site requirements and submit the shoring plans to the engineer for review and comment.

4.2.4 Construction Dewatering

Based on the groundwater conditions encountered during the investigation, significant groundwater infiltration is not anticipated within service trench and foundation excavations at conventional depths (approximately 2 to 3 m below the existing grade). Any minor groundwater infiltration can likely be accommodated using conventional sump pumping techniques; however, if groundwater infiltration persists, more extensive dewatering measures may be required. EXP would be pleased to provide further information in this regard, upon request.

The collected water should be discharged a sufficient distance away from the excavated area to prevent the discharged water from returning to the excavation. Sediment control measures should be provided at the discharge point of the dewatering system. Caution should also be taken to avoid any adverse impacts to the environment.

Although not anticipated for this Site, it is important to mention that for any projects requiring positive groundwater control with a removal rate of 50,000 liters to less than 400,000 liters per day, an Environmental Activity and Sector Registry (EASR) will be required. Permit to Take Water (PTTW) applications are required for removal rates of more than 400,000 L per day and will need to be approved by the MECP per Sections 34 and 98 of the Ontario Water Resources Act R.S.O. 1990 and the Water Taking and Transfer Regulation O. Reg. 387/04. It is noted that a standard geotechnical investigation will not determine all the groundwater parameters which may be required to support the application.

4.3 Building Foundations

4.3.1 Conventional Strip and Spread Footings

The proposed structures can be supported on the conventional spread and strip footings founded below the topsoil or unsuitable soils on the competent subgrade soils or on engineered fill.

The following allowable bearing pressures (net stress increase) can be used on the natural, undisturbed soils below a typical depth of approximately 1.2 m below the existing grade throughout the Site:

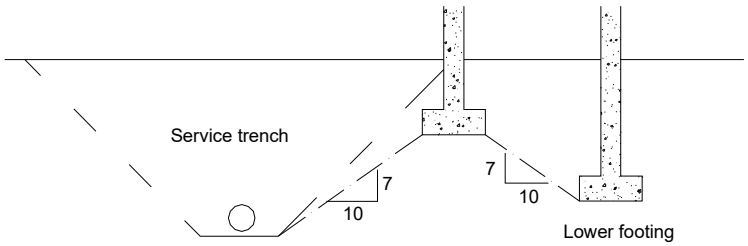
Bearing Resistance at Serviceability Limit States (SLS)	170 kPa (3,550 psf)
Factored Bearing Resistance at Ultimate Limit States (ULS)	250 kPa (5,220 psf)

Fill was encountered in Boreholes BH4 to BH6 and extended to depths of 1.4 m to 3.2 m below ground surface (bgs). In the area of these boreholes, the footings must be placed at greater depth to found on the natural undisturbed soils. Geotechnical inspection is imperative to confirm the exposed subgrade condition before placing footings.

If the grades are to be raised or restored, the engineered fill can be used for foundation support. The geometric requirements for the fill placement are shown on **Drawing 2**, appended. The available SLS and ULS bearing capacities for the engineered fill is 145 kPa (3,000 psf) and 215 kPa (4,500 psf) respectively. For footings placed on engineered fill, it is recommended that the strip footings be widened to 500 mm (20 inches) and contain nominal concrete reinforcing steel. Verification of the soil conditions and the extent of reinforcement are best determined by the Geotechnical Engineer at the time of excavation.

4.3.2 Foundations - General

Footings at different elevations should be located such that the higher footings are set below a line drawn up at 10 horizontal to 7 vertical from the near edge of the lower footing. This concept should also be applied to service excavation, etc. to ensure that undermining is not a problem.



FOOTINGS NEAR SERVICE TRENCHES OR AT DIFFERENT ELEVATIONS

Provided that the footing bases are not disturbed due to construction activity, precipitation, freezing and thawing action, etc., and the aforementioned bearing pressures are not exceeded, the total and differential settlements of footings designed in accordance with the recommendations of this report and with careful attention to construction detail are expected to be less than 25 mm and 20 mm (1 and ¾ inch) respectively.

All footings exposed to seasonal freezing conditions should be protected from frost action by at least 1.2 m (4 ft) of soil cover or equivalent insulation.

It should be noted that the recommended bearing capacities have been calculated by EXP from the borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of underground conditions becomes available. For example, if more specific information becomes available with respect to conditions between boreholes when foundation construction is underway. The interpretation between the boreholes and the recommendations of this report must therefore be checked through field inspections provided by EXP to validate the information for use during the construction stage.

4.4 Basements

If the development includes buildings with basements, the basement floors can be constructed using cast slab-on-grade techniques provided the subgrade is stripped of all topsoil and other obviously objectionable material. The subgrade should then be proof-rolled thoroughly. Any soft zones detected should be dug out and replaced with compactable excavated material placed in accordance with the requirements outlined in the previous Section 4.1.

A granular base, consisting of a 200 mm (8 in.) thick, compacted layer of 19 mm (3/4 in.) clear stone, should be then placed between the prepared subgrade and the floor slab. Alternatively, 300 mm of OPSS Granular 'A' material compacted to 100 percent SPMDD may be considered.

The installation and requirement of a vapour barrier under the floor slab, where applicable, should conform to the flooring manufacturer's and designer's requirements. Moisture emission testing is recommended to determine the concrete condition prior to flooring installation.

All basement walls should be damp-proofed and must be designed to resist a horizontal earth pressure 'P' at any depth 'h' below the surface as given by the following expression:

$$P = K (\gamma h + q)$$

where, P = lateral earth pressure in kPa acting at depth h;

K = earth pressure coefficient, assumed to be 0.4;

γ = unit weight of bcakfill, a value of 20.4 kN/m^3 may be assumed;

h = depth of point of interest in m; and,

q = equivalent value of any surcharge on the ground surface in kPa.

If basements are planned, installation of perimeter drains is required. The above expression assumes that the perimeter drainage system prevents the build-up of any hydrostatic pressure behind the wall. Suggestions for permanent perimeter drainage are given on **Drawing 3**.

4.5 Slab-on-Grade Construction

Preparation of the subgrade should include the removal of all topsoil and/or deleterious material from the proposed building area. The entire floor slab area should then be thoroughly proof-rolled with a heavy roller and examined by a Geotechnical Engineer. Any excessively soft or loose areas should be sub-excavated and replaced with suitable compacted fill. Where the exposed subgrade requires reconstruction to achieve the design elevations, the structural fill should be used. It is recommended that structural fill be comprised of granular material, such as OPSS Granular 'B', or approved alternative material. The fill should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98 percent Standard Proctor Maximum Dry Density (SPMDD). For best compaction results, the *in situ* moisture content of the fill should be within about three percent of the optimum, as determined by Standard Proctor density testing.

No special underfloor drains are required provided that the exterior grades are lower than the floor slab and positively sloped away from the slab. It is recommended that an impermeable soil seal such as clay, asphalt or concrete be provided on the surface to minimize water infiltration from the exterior of the building. See **Drawing 4** for Drainage and Backfill recommendations for slab-on-grade construction.

A granular base, consisting of a 200 mm (8 in.) thick, compacted layer of 19 mm (3/4 in.) clear stone, should be then placed between the prepared subgrade and the floor slab. Alternatively, 300 mm of OPSS Granular 'A' material compacted to 100 percent SPMDD may be considered.

The installation and requirement of a vapour barrier under a concrete slab should conform to the flooring manufacturer's and designer's requirements. Moisture emission testing will be required to determine the concrete condition prior to flooring installation. In order to minimize the potential for excess moisture in the floor slab at the time of the flooring installation, a concrete mixture with a low water-to-cement ratio (i.e., 0.45 to 0.55) should be used. Chemical additives may be required at the time of placement to make the concrete workable and should be used in place of additional water at the point of placement. Ongoing liaison from this office will be required.

For slab-on-grade design, the modulus of subgrade reaction (k) can be taken as 25 MPa/m for the compacted stone layer over the compacted granular subbase.

4.6 Foundation Backfill

In general, the existing natural soils excavated from the foundation area should be suitable for re-use as the foundation wall backfill beyond the free-draining zone if the work is carried out during relatively dry weather. The materials to be re-used should be within three percent of optimum moisture for best compaction results. Any excavated soils proposed for re-use as backfill should be examined by a Geotechnical Engineer. If the weather conditions are very wet during construction, then consideration should be given to the use of imported granular material such as OPSS Granular 'B' as backfill material. Materials should be stockpiled per their composition (i.e. sandy soils should not be mixed with clayey soils).

The backfill must be brought up evenly on both sides of walls not designed to resist lateral earth pressures. The backfill materials should be compacted to 95 to 98 percent SPMDD.

The fill surface around the perimeter of structures should be sloped in such a way that the surface runoff water does not accumulate around the structure.

4.7 Site Servicing

Based on the results of the investigation, it is anticipated that services will be set into the natural sand, sand and gravel or sandy silt till. For services constructed on natural soils or engineered fill, the bedding should conform to OPS standards. The bedding course may be thickened if portions of the subgrade become wet during excavation. Bedding aggregate should be placed around the pipe to at least 300 mm (12 inch) above the pipe, and be compacted to a minimum 95 percent SPMDD.

Water and sewer lines installed outside of heated areas should be provided with a minimum 1.2 m (4 ft.) of soil cover for frost protection.

The bases of excavations which cut into and terminate in competent natural soils are expected to remain stable for the short construction period. For bases terminated in wet silty layers, localized improvement will be required. Base improvement may also be required if work is carried out in wet weather seasons. The extent of base improvement or stabilization is best determined in the field during construction, with consultation from a Geotechnical Engineer.

To minimize disturbance to the base, pipe laying should be carried out in short sections, with backfilling following closely after laying and no section of the trench should be left open overnight.

The trenches above the specified pipe bedding should be backfilled with inorganic on-site soils placed in 300 mm thick lifts and uniformly compacted to at least 95% SPMDD. For trench backfill within 1 metre below the roadway subbase, the fill should be uniformly compacted to at least 98% SPMDD. A program of *in situ* density testing should be set up to ensure that satisfactory levels of compaction are achieved.

A summary of the general recommendations for trench backfill is presented on **Drawings 5** and **6**. A program of *in-situ* density testing should be set up to ensure that satisfactory levels of compaction are achieved.

Based on the results of this investigation, the majority of the excavated natural material may be used for construction backfill provided that reasonable care is exercised in handling. In this regard, the material should be within 3 percent of the optimum moisture as determined in the Standard Proctor density test, and stockpiling of material for prolonged periods of time should be avoided. This is particularly important if construction is carried out in wet or otherwise adverse weather.

Soils excavated from below the stabilized groundwater table may be too wet for reuse as backfill unless adequate time is allowed for drying, or if the material is blended with approved dry fill; otherwise, it may be stockpiled onsite for reuse as landscape fill.

As noted previously, disposal of excavated materials off site should conform to current MECP guidelines.

4.8 Seismic Considerations

The recommendations for the geotechnical aspects to determine the earthquake loading for a design using the OBC 2012 are presented below.

The subsoil and groundwater information at this Site have been examined in relation to Section 4.1.8.4 of the OBC 2012. The subsoils at the Site generally consist of topsoil and fill over sand, sand and gravel and sandy silt till deposits. It is anticipated that the proposed structures will be founded on the natural deposits, below any loose or soft zones.

Table 4.1.8.4.A. Site Classification for Seismic Site Response in OBC 2012 indicates that to determine the site classification, the average properties in the top 30 m (below the lowest basement level) are to be used. The boreholes advanced at this Site were excavated to a maximum depth of 12.2 m below the existing grade. Therefore, the Site Classification recommendation would be based on the available information as well as our interpretation of conditions below the boreholes based on our knowledge of the soil conditions in the area.

Based on the above assumptions, interpretations in combination with the known local geological conditions, the Site Class for the proposed development is "D" as per Table 4.1.8.4.A, Site Classification for Seismic Site Response, OBC 2012. Additional depth drilling or geophysical methods may be advised to determine if the soil conditions below the current depth of exploration can support a higher Site Classification.

4.9 Low Impact Development (LID)

It is understood that LID stormwater management design requires the practical availability of unsaturated, sufficiently pervious soil with depth and aerial extent to accommodate the infiltration of stormwater run-off created by land development.

It is understood that the Stormwater Management (SWM) Block, proposed to be in the northwest corner of the Site in the area of Borheoles BH1/MW and BH5, may incorporate an LID system. Based on the information collected at the borehole locations, and the above cited criteria, the materials encountered at the test hole locations have potential for use in LID stormwater management design. The following table summarizes the elevations where the upper surface of the sand/sand and gravel (LID soil) was encountered, and the elevation of low permeability strata (till).

Table 5 – Low Impact Development

Borehole No.	Approximate Ground Surface Elevation (m)	Elevation of Top of LID Soil (m)	Elevation of Low Permeability Strata (m)	Comments
BH1/MW	241.76	241.61	237.72	3.89 m of sand soils available.
BH5	242.06	240.69	238.86	1.83 m of sand/silty sand/sand and gravel soils available.

Four (4) grain size distribution analyses were carried out on recovered samples of the sand/sand and gravel soils from Boreholes BH1/MW and BH5, with results are provided in **Appendix B**. The gradations are generally representative of the LID soils available at the Site. Based on the grain size distributions, the estimated hydraulic conductivity (K) of the sand/sand and gravel was approximately 5.1 x 10^{-4} cm/s to 4.5 x 10^{-3} cm/s. These K values correspond with estimated infiltration rates of approximately 60 mm/hour to 115 mm/hour, based on information provided in Appendix C of the Credit Valley Conservation Authority's (CVC) 2010 Low Impact Development Stormwater Management Planning and Design Guide.

It is understood that recommended factors of safety will be applied to the estimated parameters cited above for use in design.

4.10 Site Pavement Design

Areas to be paved should be stripped of all topsoil, organics and other obviously unsuitable material. The exposed subgrade must then be thoroughly proof-rolled. Any soft areas revealed by this or any other observations must be over-excavated and backfilled with an approved material. All fill required to backfill service trenches or to raise the subgrade to design levels must conform to the requirements outlined previously. Preferably, the natural inorganic excavated soils should be used to maintain uniform subgrade conditions, provided adequate compaction can be achieved.

Provided that the preceding recommendations are followed, the pavement thickness design requirements given in the following table are recommended for the anticipated specified classification (local roads internal to the Site) and anticipated subgrade conditions.

Table 6 – Recommended Pavement Structure Thicknesses

Pavement Layer	Compaction Requirements	Local Road (Waverly Street)
Asphaltic Concrete	92% MRD[1] or 97% BRD[1]	40 mm HL-3 50 mm HL-8
Granular 'A' (Base)	100% SPMDD[1]	150 mm
Granular 'B' (Sub-Base)	100% SPMDD[1]	300 mm
*Notes: 1) SPMDD denotes Standard Proctor Maximum Dry Density, MRD denotes Maximum Relative Density, BRD denotes Bulk Relative Density. 2) The subgrade must be compacted to 98% SPMDD. 3) The above recommendations are minimum requirements.		

The recommended pavement structure provided in the above table is based on the existing subgrade soil properties determined from visual examination and textural classification of the soil samples. Consequently, the recommended pavement structures should be considered for preliminary design purposes only. Other granular configurations may also be possible provided the granular base equivalency (GBE) thickness is maintained. These recommendations on thickness design are not intended to support heavy and concentrated construction traffic, particularly where only a portion of the pavement section is installed.

If construction is undertaken under adverse weather conditions (i.e., wet or freezing conditions) subgrade preparation and granular sub-base requirements should be reviewed by the Geotechnical Engineer. If the sub-base is set on wet or dilatant silty soils, a geotextile will be required. A woven type geotextile such as Terrafix 200W or equivalent would be suitable for this application.

If only a section of the pavement will be in place during construction, the granular sub-base may have to be thickened, and/or the subgrade improved with a geotextile separator or geogrid stabilizing layer. This is best determined in the field during the site servicing stage of construction, prior to road construction.

If a geogrid stabilizing layer is recommended at the time of construction, the source of the granular material should be reviewed to verify its compatibility with the geogrid. For example, where Tensar BX1100 (or equivalent) is utilized, the Granular B material should have a nominal size of 26.5 mm, with a maximum of 25 percent (by mass) passing the

4.75 mm sieve size. EXP would be pleased to review the project specifications and proposed source of imported materials to verify compatibility.

Samples of both the Granular 'A' and Granular 'B' aggregate should be checked for conformance to OPSS 1010 requirements prior to use on Site and during construction. The Granular 'B' sub-base and the Granular 'A' base courses must be compacted to 100 percent SPMDD.

The asphaltic concrete paving materials should conform to the requirements of OPSS MUNI 1150. The asphalt should be placed in accordance with OPSS 310 and compacted to at least 97 percent of the Marshall mix design bulk relative density or 92% of maximum relative density. A tack coat should be applied between the surface and binder asphalt courses.

Good drainage provisions will optimize pavement performance. The finished pavement surface should be free of depressions and should be sloped (preferably at a minimum grade of two percent) to provide effective surface drainage toward catch basins. Surface water should not be allowed to pond adjacent to the outside edges of pavement areas. In low areas, sub-drains should be installed to intercept excess subsurface moisture and prevent subgrade softening, as shown on **Drawing 7**. This is particularly important in heavier traffic areas at the site entrances. The locations and extent of sub-drainage required within the paved areas should be reviewed by this office in conjunction with the proposed grading.

A program of *in situ* density testing must be carried out to verify that satisfactory levels of compaction are being achieved.

To minimize the effects of differential settlements of service trench fill, it is recommended that wherever practical, the placement of binder asphalt be delayed for approximately six months after the granular sub-base is put down. The surface course asphalt should be delayed for a further one year. Prior to the surface asphalt being placed, it is recommended that a pavement evaluation be carried out on the base asphalt to identify repair areas or areas requiring remedial works prior to surface asphalt being placed.

4.11 Curbs and Sidewalks

It is recommended that the concrete for curb and gutter and sidewalks should be proportioned, mixed, placed, and cured in accordance with the requirements of OPSS 353 and OPSS 1350.

During cold weather, the freshly placed concrete must be covered with insulating blankets to protect against freezing. Three cylinders from each day's pour should be taken for compressive strength testing. Air entrainment, temperature, and slump tests should be made from the same batch of concrete from which test cylinders are made.

The subgrade for the sidewalks should comprise undisturbed natural competent soil of well-compacted fill. A minimum 150 mm thick layer of compacted Granular 'A' type aggregate should be placed beneath the sidewalk slabs. It is recommended that the Granular 'A' be compacted to a minimum 100 percent SPMDD, to provide adequate support for the concrete sidewalk. Construction traffic should be kept off the placed curbs and sidewalks as they are not designed to withstand heavy traffic load.

4.12 Methane Gas Testing

No methane gas producing materials or significant organic matter was encountered at the borehole locations, except a thin veneer of topsoil.

An RKI Gx-2003 Gas Detector was used in the upper levels of the open boreholes. The unit measures LEL combustibles, methane gas, oxygen content, carbon monoxide and hydrogen sulfide in standard confined space gases. No significant methane gas was detected in any of the boreholes. Based on the present information, no special methane gas abatement measures are indicated at this Site.

4.13 Inspection and Testing Requirements

An effective inspection and testing program is an essential part of construction monitoring. The Inspection and Testing Program typically includes the following items:

- Subgrade examination following removal of existing (if any), fill and organics, prior to foundation installation and engineered fill placement (if required);
- Inspection and Materials testing during engineered fill placement (full-time supervision is recommended) and site servicing works, including soil sampling, laboratory testing (moisture contents and Standard Proctor density test on the pipe bedding, trench backfill and engineered fill material), monitoring of fill placement, and *in situ* density testing;
- Footing base examinations to confirm suitability to support the design bearing pressures;
- Inspection of the concrete reinforcing steel placement in footings placed on engineered fill;
- Materials testing for concrete curbs and sidewalks;
- Inspection and Materials testing during paved area construction, including subgrade examination of the paved area subgrade soils following site servicing, laboratory testing (grain size analyses and Standard Proctor density tests on the Granular 'A' and 'B' material placed on site roadways), and *in situ* density testing; and,
- Inspection and Materials testing for base and surface asphalt, including laboratory testing on asphalt sampling to confirm conformance to project specifications and standards.

EXP would be pleased to prepare an inspection and testing work program prior to construction, incorporating the above items.

5. General Comments

The information presented in this report is based on a limited investigation designed to provide information to support an assessment of the current geotechnical conditions within the subject property. The conclusions and recommendations presented in this report reflect site conditions existing at the time of the investigation. Consequently, during the future development of the property, conditions not observed during this investigation may become apparent. Should this occur, EXP Services Inc. should be contacted to assess the situation, and the need for additional testing and reporting. EXP has qualified personnel to provide assistance in regards to any future geotechnical and environmental issues related to this property.

Our undertaking at EXP, therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the engineering profession.

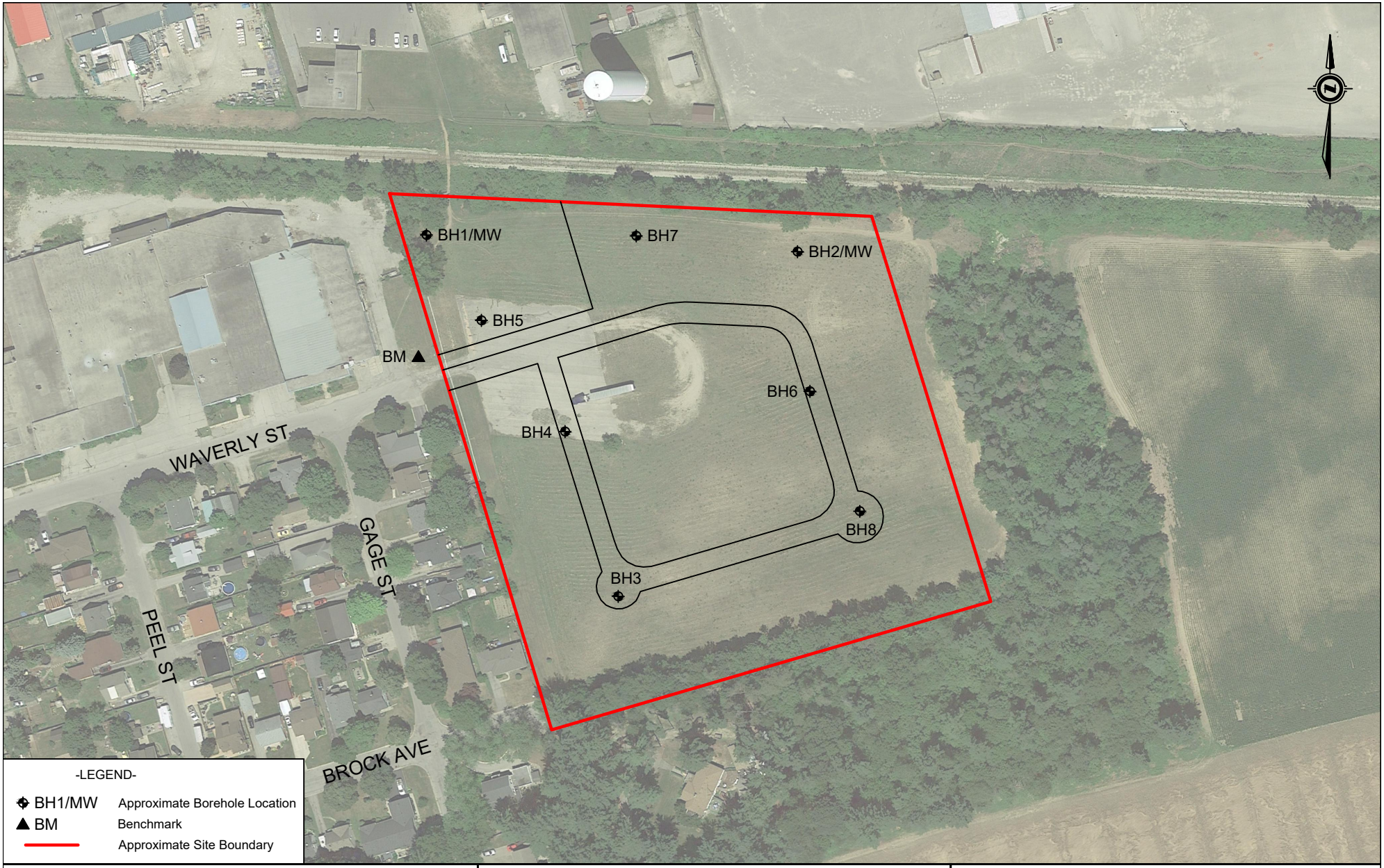
The comments given in this report are intended only for the guidance of design engineers. The number of test holes required to determine the localized underground conditions between test holes affecting construction costs, techniques, sequencing, equipment, scheduling, etc. would be much greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

EXP Services Inc. should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not afforded the privilege of making this review, EXP Services Inc. will assume no responsibility for interpretation of the recommendations in this report.

This report was prepared for the exclusive use of **Landmark Homes Inc.** and may not be reproduced in whole or in part, without the prior written consent of EXP, or used or relied upon in whole or in part by other parties for any purposes whatsoever. Any use which a third party makes of this report, or any part thereof, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We trust that this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Drawings



-LEGEND-

BH1/MW	Approximate Borehole Location
BM	Benchmark
	Approximate Site Boundary

-NOTES-

1. The boundaries and soil types have been established only at test hole locations. Between test holes they are assumed and may be subject to considerable error.
2. Soil samples will be retained in storage for 3 months and then destroyed unless client advises that an extended time period is required.
3. Topsoil quantities should not be established from the information provided at the test hole locations.
4. The site plan was reproduced from Google Earth Pro and should be read in conjunction with EXP Geotechnical Report LON-23003150-A0.
5. Benchmark taken as top of spindle of fire hydrant in north boulevard of Waverly Street, just west of Site (Geodetic Elevation 242.714 m).

Geotechnical Investigation

Waverly Street Development

Delhi, Ontario

CLIENT: Landmark Homes Inc.

TITLE: Borehole Location Plan

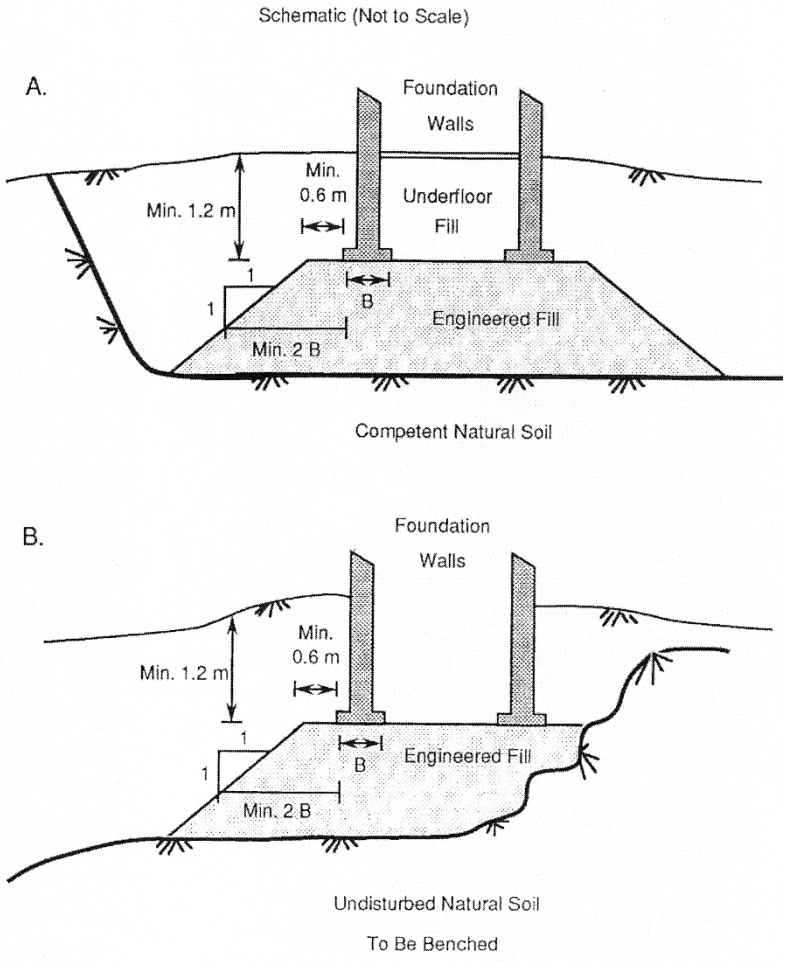
Prepared By: E.B.

Reviewed By: A.K.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	APPROXIMATE SCALE	PROJECT NO.	DWG.
APRIL 2023	1:2,000	LON-23003150-A0	1

DRAWING 2 – GEOMETRIC REQUIREMENTS FOR FOUNDATIONS ON ENGINEERED FILL

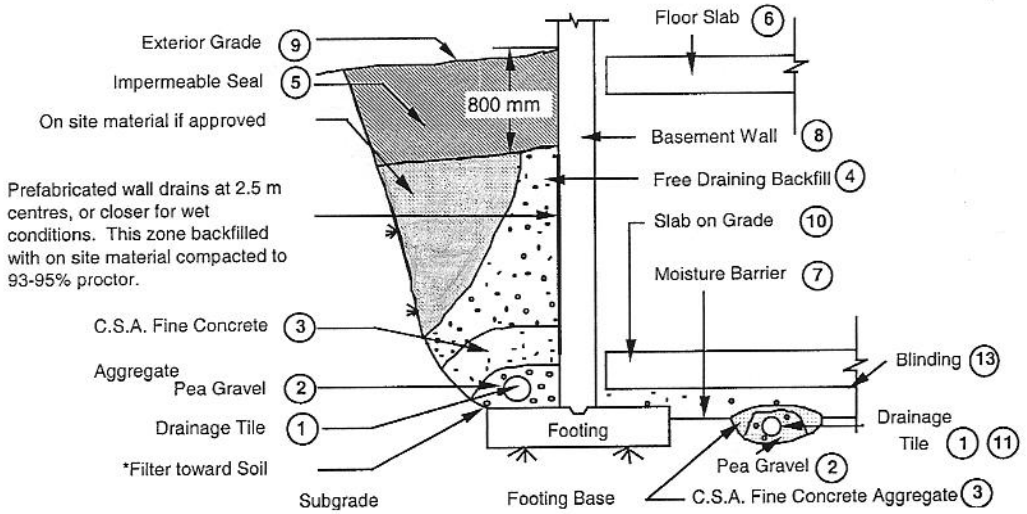


- SECTION VIEW

NOTES:

1. The area must be stripped of all topsoil contaminated fill material and proof rolled. Soft areas must be dug out. The stripped native subgrade must be examined and approved by an EXP engineer prior to placement of fill.
2. The approved engineered fill must be compacted to 100% Standard Proctor dry density throughout. Granular fill is required.
3. Fulltime geotechnical inspection by EXP is required during placement of the engineered fill.
4. The fill must be placed such that the specified geometry is achieved. Refer to sketches for minimum requirements.
5. An allowable SLS bearing pressure of 145 kPa (3,000 psf) may be used provided that all conditions outlined above, are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and as a precautionary measure, footings should be provided with nominal steel reinforcement.
6. All excavations must be done in accordance with the Occupational Health and Safety Regulation of Ontario (Construction Projects - O.Reg. 213.91)
7. These guidelines are to be read in conjunction with the attached EXP Report for Project Number LON-23003150-A0.

DRAWING 3 – BACKFILL AND BASEMENT DRAINAGE DETAIL (NOT TO SCALE)

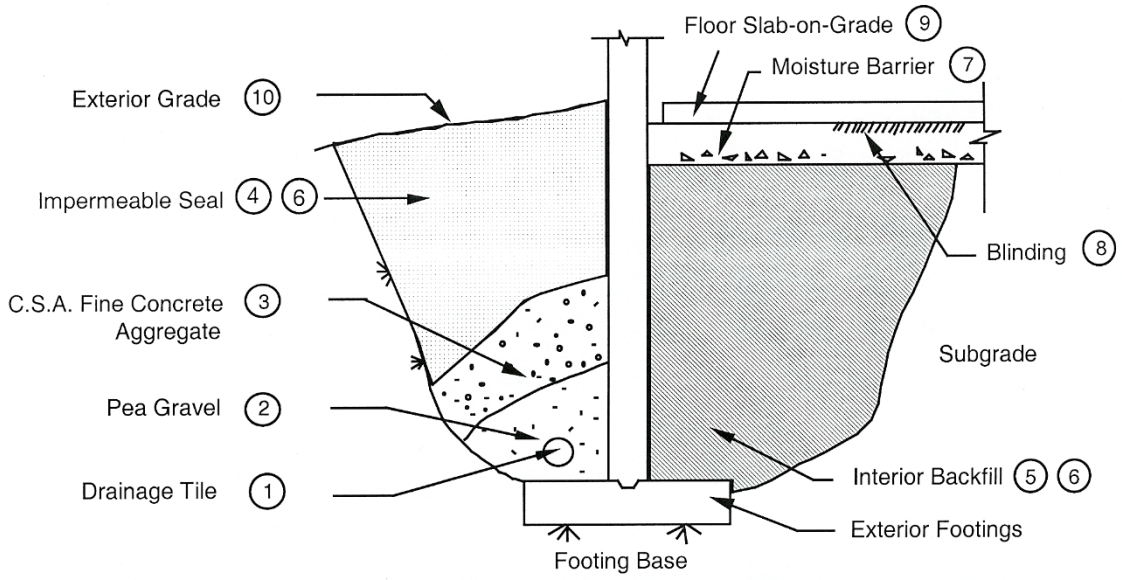


NOTES:

1. Drainage tile to consist of 100 mm (4 in.) diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet. Invert to be minimum of 150 mm (6 in.) below underside of floor slab.
2. Pea gravel 150 mm (6 in.) top and sides of drain. If drain is not on footing, place 100 mm (4 in.) of pea gravel below drain. 20 mm (3/4 in.) clear stone may be used provided if it is covered by an approved porous geotextile fabric membrane (Terrafix 270R or equivalent).
3. C.S.A. fine concrete aggregate to act as filter material. Minimum 300 mm (12 in.) top and side of drain. This may be replaced by an approved porous geotextile membrane (Terrafix 270R or equivalent).
4. Free-draining backfill - OPSS Granular B or equivalent compacted to 93 to 95 (maximum) percent Standard Proctor density. Do not compact closer than l.8 m (6 ft) from wall with heavy equipment. Use hand controlled light compaction equipment within 1.8 m (6 ft) of wall.
5. Impermeable backfill seal of compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted.
6. Do not backfill until wall is supported by basement and floor slabs or adequate bracing.
7. Moisture barrier to consist of compacted 20 mm (3/4 in.) clear, crushed stone or equivalent free-draining material. Layer to be 200 mm (8 in.) minimum thickness.
8. Basement walls to be damp-proofed.
9. Exterior grade to slope away from wall.
10. Slab on grade should not be structurally connected to wall or footing.
11. Underfloor drain invert to be at least 300 mm (12 in.) below underside of floor slab. Drainage tile placed in parallel rows 6 to 8 m (20 to 25 ft.) centres one way. Place drain on 100 mm (4 in.) of pea gravel with 150 mm (6 in.) of pea gravel top and sides. CSA fine concrete aggregate to be provided as filter material or an approved porous geotextile membrane (as in 2 above) may be used.
12. Do not connect the underfloor drains to perimeter drains.
13. If the 20 mm (3/4 in.) clear stone requires surface binding, use 6 mm (1/4 in.) clear stone chips.

Note: a) Underfloor drainage can be deleted where not required (see report).
b) Free draining backfill, item 4 may be replaced by wall drains, as indicated, if more economical.

DRAWING 4 – DRAINAGE AND BACKFILL RECOMMENDATIONS (NOT TO SCALE)

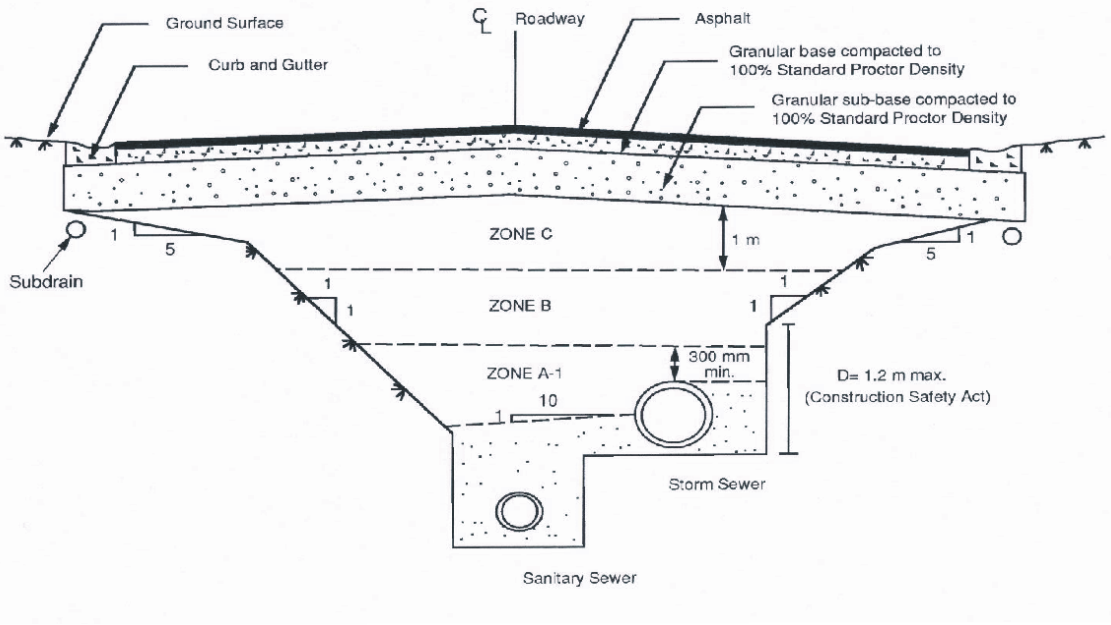


NOTES:

1. Drainage tile to consist of 100 mm (4 in.) diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet. Invert to be minimum of 150 mm (6 in.) below underside of interior floor slab.
2. Pea gravel 150 mm (6 in.) top and sides of drain. If drain is not on footing, place 100 mm (4 in.) of pea gravel below drain. 20 mm (3/4 in.) clear stone may be used provided if it is covered by an approved porous geotextile fabric membrane (Terrafix 270R or equivalent).
3. C.S.A. fine concrete aggregate to act as filter material. Minimum 300 mm (12 in.) top and side of drain. This may be replaced by an approved porous geotextile membrane (Terrafix 270R or equivalent).
4. Impermeable backfill seal of compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted. Compact backfill to 95 percent Standard Proctor Maximum Dry Density.
5. The interior fill may be any clean, inorganic soil which may be compacted to at least 95 percent Standard Proctor density in this confined space.
6. Do not use heavy compaction equipment within 450 mm (18 in.) of the wall. Do not fill or compact within 1.8 m (6 ft) of wall unless fill is placed on both sides simultaneously.
7. Moisture barrier to be at least 200 mm (8 in.) of compacted 20 mm (3/4 in.) clear, crushed stone or equivalent free-draining material.
8. If the 20 mm (3/4 in.) clear stone requires surface binding, use 60 mm (1/4 in.) clear stone chips.
9. Slab on grade should not be structurally connected to wall or footing.
10. Exterior grade to slope away from building.

This system is not normally required if the floor is at least 300 mm (1 ft.) above exterior grade.

DRAWING 5 – TYPICAL BACKFILL DETAIL
STORM AND SANITARY SEWER (COMMON TRENCH)



SECTION VIEW

NOTES:

ZONE A
Granular bedding satisfying current OPS Standards compacted to 95% Standard Proctor maximum dry density.

ZONE A-l
To be compacted to 95% Standard Proctor maximum dry density.

ZONE B
To be compacted to 95% Standard Proctor maximum dry density.

ZONE C
To be compacted to 98% Standard Proctor maximum dry density.

The excavations shown above are for Type 1 or 2 soils. Where excavations extend through Type 3 soils, the side walls should be sloped back at a maximum inclination of 1 horizontal to 1 vertical from the base (Reference O.Reg 219/31).

DRAWING 6 – TRENCH BACKFILL REQUIREMENTS

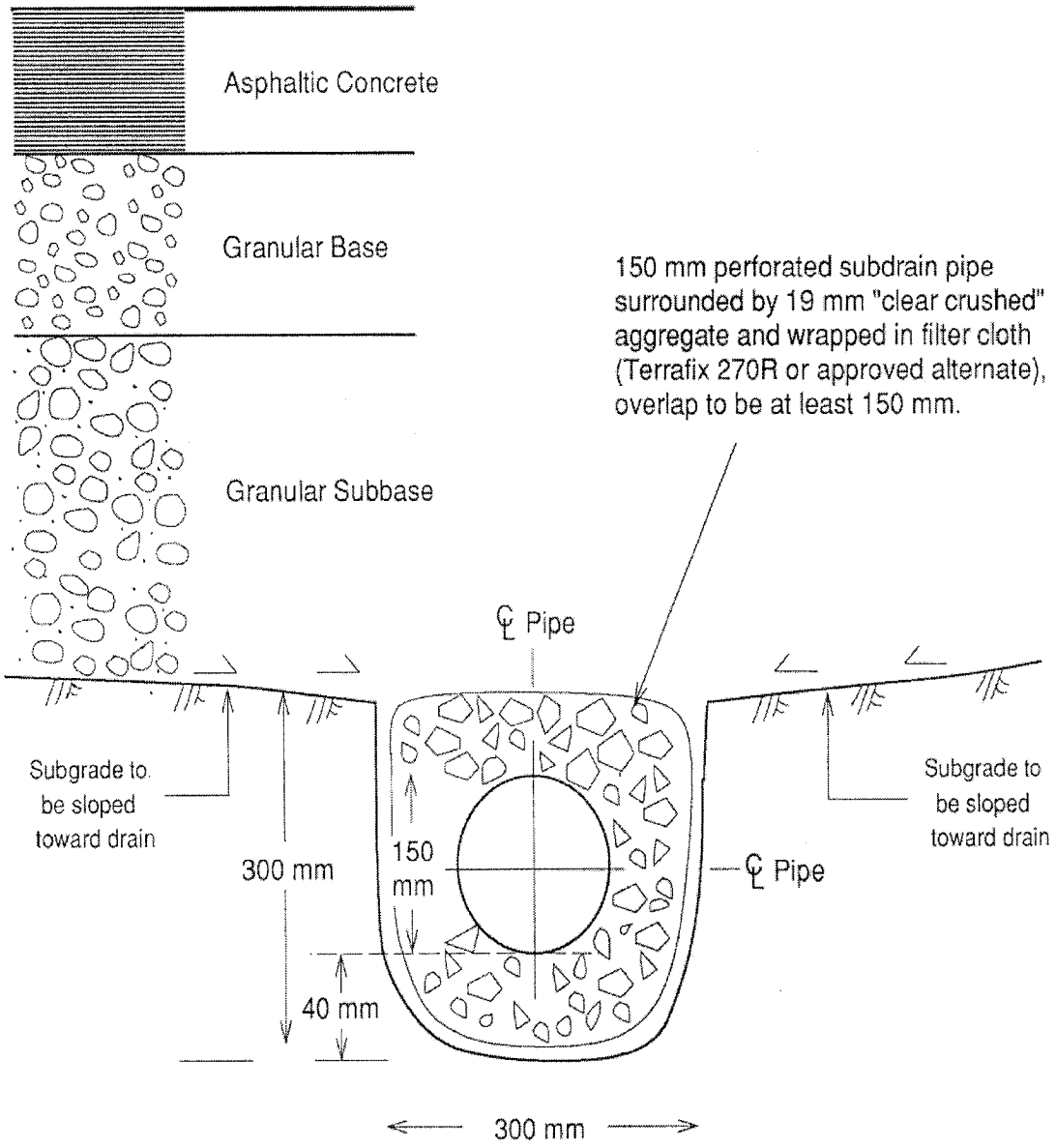
Requirements for backfill in service trenches, etc. should conform to the current OPSS requirements. A summary of the general recommendations for trench backfill is presented on **Drawing 5**.

The bedding materials for the services designated as Zone A on the attached drawings should consist of approved granular material satisfying the current OPSS minimum standards and specifications. (Class B bedding should provide adequate support for the pipes). These materials should be uniformly compacted to 95 percent of standard Proctor dry density. Some problems may be encountered in maintaining alignment when bedding pipes in wet sandy soil. If Granular 'A' or other sandy material is used for bedding, they may become 'spongy' when saturated. If significant amounts of clear stone are used to stabilize the base, a geotextile should be incorporated to avoid problems with the migration of fine-grained materials and differential settlement under the pipes as the groundwater rises after backfilling. For minor local use of crushed stone without a geotextile filter, a graded HL3 stone is preferable.

The backfill in Zone B will consist of the native material. This material should be placed in loose lifts not exceeding 300 mm (12 inches) and be uniformly compacted to 95 percent of the standard Proctor maximum dry density. Material wetter than 5 percent above optimum must be allowed to dry sufficiently or should be discarded or used in landscaped areas.

The upper 1 metre of the general backfill (i.e. Zone C) should be placed in loose lifts not exceeding 300 mm (12 inches) and be uniformly compacted to at least 98 percent of the standard Proctor maximum dry density. To achieve satisfactory compaction, the fill material should be within 3 percent of standard Proctor optimum moisture content at placement.

DRAWING 7 – PAVEMENT SUBDRAIN DETAIL



NOTES:

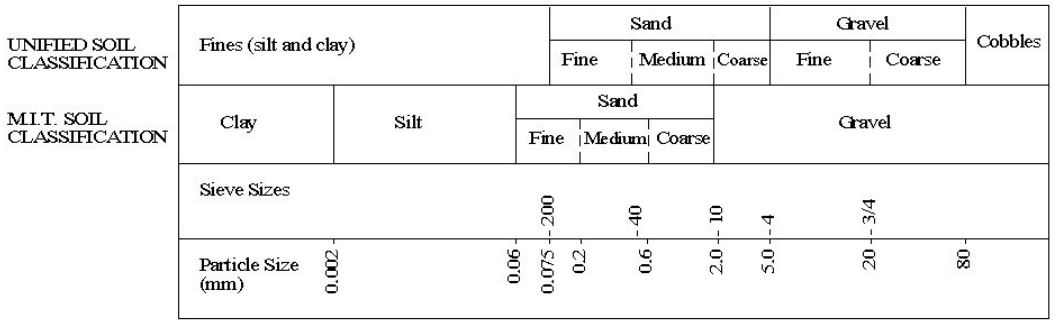
1. All dimensions in millimetres.
2. All sub drains to be set on at least 1% grade draining to a positive outlet.
3. Subgrade soil conditions should be verified onsite, during subgrade preparation works, following site servicing installations.

Scale: NTS

Appendix A – Borehole Logs

NOTES ON SAMPLE DESCRIPTIONS

1. All descriptions included in this report follow the 'modified' Massachusetts Institute of Technology (M.I.T.) soil classification system. The laboratory grain-size analysis also follows this classification system. Others may designate the Unified Classification System as their source; a comparison of the two is shown for your information. Please note that, with the exception of those samples where the grain size analysis has been carried out, all samples are classified visually and the accuracy of the visual examination is not sufficient to differentiate between the classification systems or exact grain sizing. The M.I.T. system has been modified and the EXP classification includes a designation for cobbles above the 75 mm size and boulders above the 200 mm size.



2. **Fill**: Where fill is designated on the borehole log, it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description therefore, may not be applicable as a general description of the site fill material. All fills should be expected to contain obstructions such as large concrete pieces or subsurface basements, floors, tanks, even though none of these obstructions may have been encountered in the borehole. Despite the use of borehole, the heterogeneous nature of fill will leave some ambiguity as to the exact and correct composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. The fill at this site has been monitored for the presence of methane gas and the results are recorded on the borehole logs. The monitoring process neither indicates the volume of gas that can be potentially generated or pinpoints the source of the gas. These readings are to advise of a potential or existing problem (if they exist) and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic waste that renders the material unacceptable for deposition in any but designated land fill sites; unless specifically stated, the fill on the site has not been tested for contaminants that may be considered hazardous. This testing and a potential hazard study can be carried out if you so request. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common, but not detectable using conventional geotechnical procedures.

3. **Glacial Till**: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process, the till must be considered heterogeneous in composition and as such, may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (75 to 200 mm in diameter) or boulders (greater than 200 mm diameter) and therefore, contractors may encounter them during excavation, even if they are not indicated on the borehole logs. It should be appreciated that normal sampling equipment can not differentiate the size or type of obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited area; therefore, caution is essential when dealing with sensitive excavations or dewatering programs in till material.

BOREHOLE LOG

BH1/MW
Sheet 1 of 1

CLIENT **Landmark Homes Inc.** PROJECT NO. **LON-23003150-A0**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **Waverly Street, Delhi, ON** DATES: Boring **March 27, 2023** Water Level **Apr 13/23**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
	241.8						
0	241.6	**TOPSOIL**: 150 mm					
		SAND: brown, fine to medium grained, some to trace silt, some to trace gravel, compact, moist	SS	S1	300	23	
1			SS	S2	350	20	7
2			SS	S3	400	18	4
		- becoming medium to coarse grained near 2.7 m bgs	SS	S4	400	18	3
3							
4	237.7						
		SANDY SILT TILL: brown, trace clay, trace gravel, dilatant, compact, very moist	SS	S5	450	22	13
5	236.2						
		SAND: brown, fine to medium grained, trace silt, dense, moist	SS	S6	450	34	6
6							
7							
		- silty near 7.6 m bgs	SS	S7	450	33	18
8							
9			SS	S8	450	19	7
		- becoming wet near 10.1 m bgs					
10							
11			SS	S9	450	21	20
12	229.6						
		End of Borehole at 12.2 m bgs.					
13							

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

Atterberg Limits and Moisture
W_P W W_L
SPT N Value Dynamic Cone
10 20 30 40

NOTES

1) Borehole interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP report LON-23003150-A0. For definition of terms used on logs, see sheets prior to logs.
2) bgs denotes below ground surface.
3) No significant methane gas concentration was detected upon completion.
4) Water Level Readings:
April 3, 2023 - 10.14 m bgs, Elevation 231.62 m
April 13, 2023 - 10.14 m bgs, Elevation 231.62 m

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

BH2/MW
Sheet 1 of 1

CLIENT **Landmark Homes Inc.** PROJECT NO. **LON-23003150-A0**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **Waverly Street, Delhi, ON** DATES: Boring **March 27, 2023** Water Level **Apr 13/23**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
	243.2						
0	243.0	**TOPSOIL**: 250 mm					
		SAND: brown, fine to medium grained, trace silt, trace gravel, loose, moist	SS	S1	600	5	7
1		- becoming gravelly and dense to compact near 0.8 m bgs	SS	S2	150	31	3
		- trace gravel below 1.4 m bgs	SS	S3	300	29	5
2	241.1						
		SANDY SILT TILL: brown, trace clay, trace gravel, dense, very moist	SS	S4	400	45	13
3			SS	S5	450	32	14
4		- becoming dilatant, wet near 4.0 m bgs					
5			SS	S6	300	34	17
	237.7						
6		**SAND**: brown, fine to medium grained, trace to some silt, compact, moist	SS	S7	400	25	8
7							
8			SS	S8	300	27	11
9			SS	S9	400	23	2
10		- becoming wet near 10.1 m bgs					
11			SS	S10	400	14	22
12	231.1						
		End of Borehole at 12.2 m bgs.					
13							

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

Atterberg Limits and Moisture
W_P W W_L
SPT N Value Dynamic Cone
10 20 30 40

NOTES

1) Borehole interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP report LON-23003150-A0. For definition of terms used on logs, see sheets prior to logs.
2) bgs denotes below ground surface.
3) No significant methane gas concentration was detected upon completion.
4) Water Level Readings:
April 3, 2023 - 10.84 m bgs, Elevation 232.40 m
April 13, 2023 - 10.90 m bgs, Elevation 232.34 m

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

BH3
Sheet 1 of 1

CLIENT **Landmark Homes Inc.** PROJECT NO. **LON-23003150-A0**

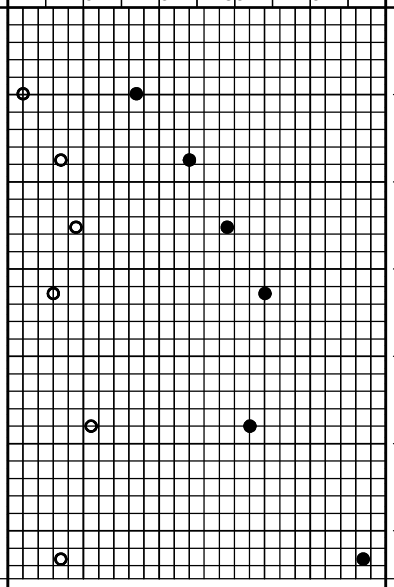
PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **Waverly Street, Delhi, ON** DATES: Boring **March 27, 2023** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	243.0								
	242.7	**TOPSOIL**: 280 mm							
	242.4	**SILTY SAND**: brown, weathered							
1		**SAND & GRAVEL**: brown, trace silt, compact, moist			SS	S1	300	17	2
					SS	S2	400	24	7
2	241.0	**SANDY SILT TILL**: brown, trace clay, trace to some gravel, compact to dense, moist			SS	S3	450	29	9
3		- becoming grey near 2.9 m bgs			SS	S4	450	34	6
4		- becoming brown with dilatant silt layering and very moist below 4.0 m bgs							
5					SS	S5	450	32	11
	237.4								
6		**SAND**: brown, fine to medium grained, trace silt, dense, moist							
	236.4				SS	S6	300	47	7
7		**End of Borehole at 6.6 m bgs.**							
8									
9									
10									
11									
12									
13									

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

Atterberg Limits and Moisture
W_P W W_L
SPT N Value Dynamic Cone
10 20 30 40



NOTES

1) Borehole interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP report LON-23003150-A0. For definition of terms used on logs, see sheets prior to logs.
2) bgs denotes below ground surface.
3) Borehole open and dry upon completion of drilling.
4) No significant methane gas concentration was detected upon completion.

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

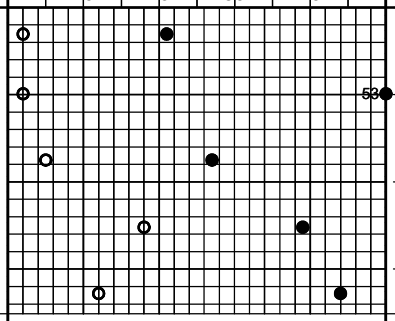
BH4
Sheet 1 of 1

CLIENT **Landmark Homes Inc.** PROJECT NO. **LON-23003150-A0**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **Waverly Street, Delhi, ON** DATES: Boring **March 29, 2023** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	242.3								
	242.2	**ASPHALT**: 30 mm			SS	S1	250	21	2
	242.1	**GRANULAR**: 150 mm							
1		**FILL**: sand and gravel, brown, some silt, compact to very dense, moist			SS	S2	300	53	2
	240.9								
2	240.1	**SAND & GRAVEL**: brown, trace to some silt, compact, moist			SS	S3	300	27	5
		SANDY SILT TILL - brown, trace clay, trace gravel, dilatant, dense, moist to very moist			SS	S4	400	39	18
3	238.7				SS	S5	450	44	12
4		**End of Borehole at 3.5 m bgs.**							
5									
6									
7									
8									
9									
10									
11									
12									
13									

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

Atterberg Limits and Moisture
W_P W W_L
SPT N Value × Dynamic Cone
10 20 30 40



NOTES

1) Borehole interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP report LON-23003150-A0. For definition of terms used on logs, see sheets prior to logs.
2) bgs denotes below ground surface.
3) Borehole open and dry upon completion of drilling.
4) No significant methane gas concentration was detected upon completion.

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

BH5
Sheet 1 of 1

CLIENT **Landmark Homes Inc.** PROJECT NO. **LON-23003150-A0**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **Waverly Street, Delhi, ON** DATES: Boring **March 29, 2023** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	242.1								
	242.0	**ASPHALT**: 25 mm			SS	S1	500	8	9
	241.9	**GRANULAR**: 150 mm							
1		**FILL**: sand and gravel to sandy silt, trace to some clay, loose to compact, moist to very moist			SS	S2	300	16	11
	240.7	- 100 mm organic layer encountered near 0.4 m bgs			SS	S3	300	27	3
2	239.9	**SAND & GRAVEL**: brown, trace silt, compact, moist							
		SAND: brown, fine to medium grained, some silt to silty, compact, moist			SS	S4	300	27	6
3	238.9								
	238.6	**SANDY SILT TILL**: brown, trace clay, trace gravel, compact, moist			SS	S5	380	24	9
4		**End of Borehole at 3.5 m bgs.**							
5									
6									
7									
8									
9									
10									
11									
12									
13									

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa
Atterberg Limits and Moisture
W_P W W_L
SPT N Value Dynamic Cone
10 20 30 40

NOTES

1) Borehole interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP report LON-23003150-A0. For definition of terms used on logs, see sheets prior to logs.
2) bgs denotes below ground surface.
3) Borehole open and dry upon completion of drilling.
4) No significant methane gas concentration was detected upon completion.

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

BH6
Sheet 1 of 1

CLIENT **Landmark Homes Inc.** PROJECT NO. **LON-23003150-A0**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **Waverly Street, Delhi, ON** DATES: Boring **March 29, 2023** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	**242.5**								
	242.2	**TOPSOIL**: 300 mm			SS	S1	400	3	11
		FILL: sandy silt, brown, trace clay, trace gravel, very loose, moist to very moist			SS	S2	0	1	15
1					SS	S3	0	0	16
2					SS	S4	0	0	19
		- trace to some organics encountered near 2.5 m bgs							
3	239.3				SS	S5	450	16	15
	239.0	**SANDY SILT TILL**: brown, trace clay, trace gravel, dilatant, compact, very moist							
4		**End of Borehole at 3.5 m bgs.**							
5									
6									
7									
8									
9									
10									
11									
12									
13									

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa
Atterberg Limits and Moisture
W_P W W_L
SPT N Value Dynamic Cone
10 20 30 40

NOTES

1) Borehole interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP report LON-23003150-A0. For definition of terms used on logs, see sheets prior to logs.
2) bgs denotes below ground surface.
3) Borehole open to 2.7 m bgs and water measured near 2.7 m bgs upon completion of drilling.
4) No significant methane gas concentration was detected upon completion.

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS
G Specific Gravity C Consolidation
H Hydrometer CD Consolidated Drained Triaxial
S Sieve Analysis CU Consolidated Undrained Triaxial
γ Unit Weight UU Unconsolidated Undrained Triaxial
P Field Permeability UC Unconfined Compression
K Lab Permeability DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

BH7
Sheet 1 of 1

CLIENT **Landmark Homes Inc.** PROJECT NO. **LON-23003150-A0**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **Waverly Street, Delhi, ON** DATES: Boring **March 27, 2023** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
	242.4								
0	242.1	**TOPSOIL**: 300 mm			SS	S1	600	7	9
	241.8	**SILTY SAND**: brown, weathered, loose, moist							
1		**SAND & GRAVEL**: brown, occasional cobbles, compact, moist			SS	S2	300	27	2
	240.8								
2		**SAND**: brown, fine to medium grained, trace to some silt, very dense to compact, moist			SS	S3	300	67	4
					SS	S4	400	33	3
3	238.9				SS	S5	350	29	2
4		**End of Borehole at 3.5 m bgs.**							
5									
6									
7									
8									
9									
10									
11									
12									
13									

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

Atterberg Limits and Moisture
W_P W W_L
SPT N Value × Dynamic Cone
10 20 30 40

67

NOTES

1) Borehole interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP report LON-23003150-A0. For definition of terms used on logs, see sheets prior to logs.
2) bgs denotes below ground surface.
3) Borehole open and dry upon completion of drilling.
4) No significant methane gas concentration was detected upon completion.

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

BH8
Sheet 1 of 1

CLIENT **Landmark Homes Inc.** PROJECT NO. **LON-23003150-A0**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **Waverly Street, Delhi, ON** DATES: Boring **March 27, 2023** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	242.4								
	242.1	**TOPSOIL**: 250 mm							
		SAND & GRAVEL: brown, trace silt, compact, moist							
1	241.0				SS	S1	300	19	
		SAND: brown, fine to medium grained, trace silt, compact, moist			SS	S2	400	25	9
2	240.2								
		SANDY SILT TILL: brown, trace clay, trace gravel, dense, moist to very moist			SS	S3	450	36	10
3					SS	S4	450	36	11
4									
5					SS	S5	400	34	16
	236.8								
6		**SAND**: brown, fine to medium grained, trace silt, very dense, moist			SS	S6	150	50 *	6
	235.8								
7		**End of Borehole at 6.6 m bgs.**							
8									
9									
10									
11									
12									
13									

SHEAR STRENGTH
✤ S Field Vane Test (#=Sensitivity)
▲ Penetrometer ■ Torvane
100 200 kPa

Atterberg Limits and Moisture
W_P W W_L
● SPT N Value × Dynamic Cone
10 20 30 40

NOTES

1) Borehole interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP report LON-23003150-A0. For definition of terms used on logs, see sheets prior to logs.
2) bgs denotes below ground surface.
3) Borehole open and dry upon completion of drilling.
4) No significant methane gas concentration was detected upon completion.
5) * denotes N = 50 blows per less than 150 mm split spoon sampler penetration.

SAMPLE LEGEND
☒ AS Auger Sample ▨ SS Split Spoon ■ ST Shelby Tube
▯ Rock Core (eg. BQ, NQ, etc.) ▯ VN Vane Sample

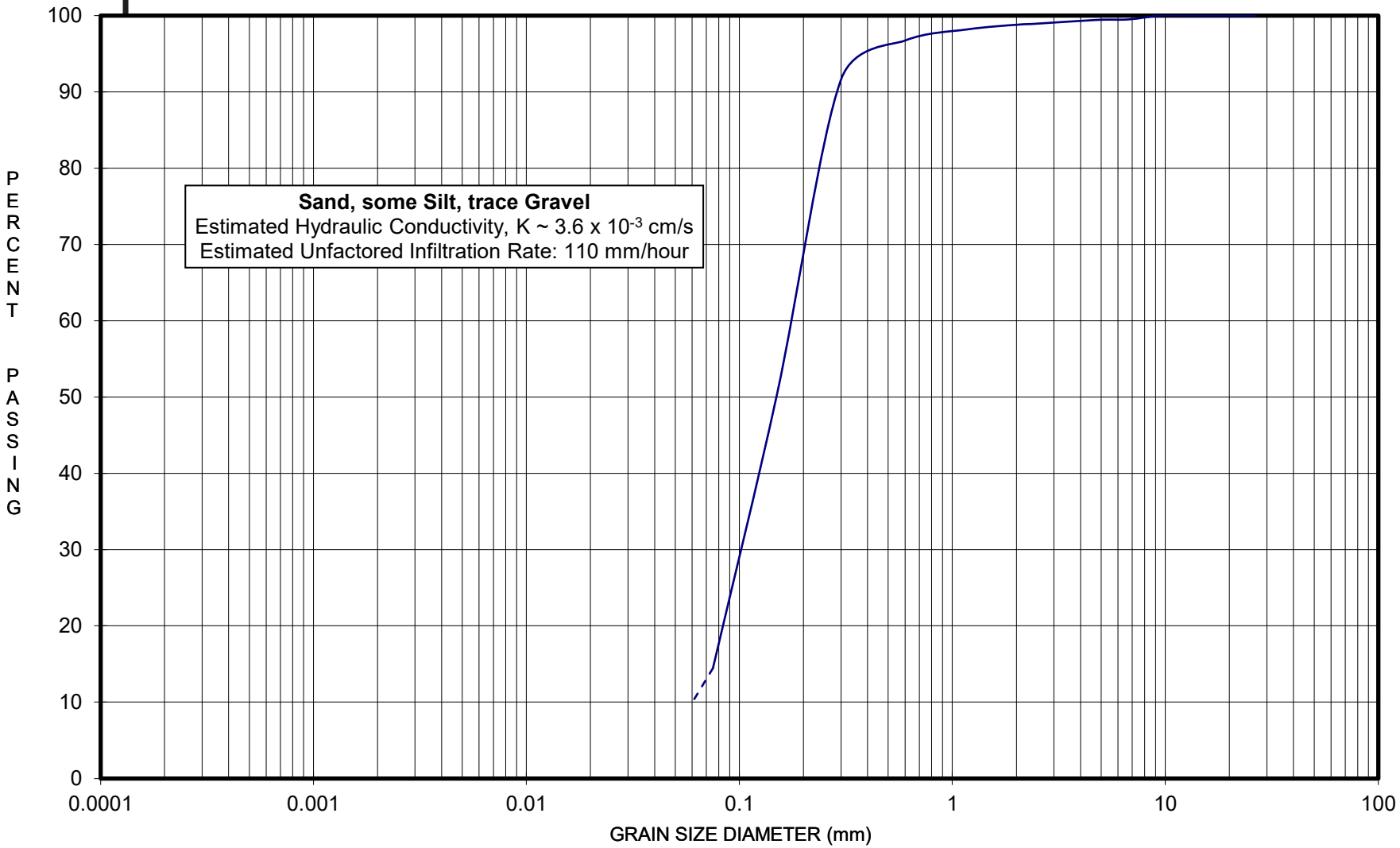
OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
▽ Apparent ▼ Measured ▲ Artesian (see Notes)

Appendix B – Grain Size Analyses

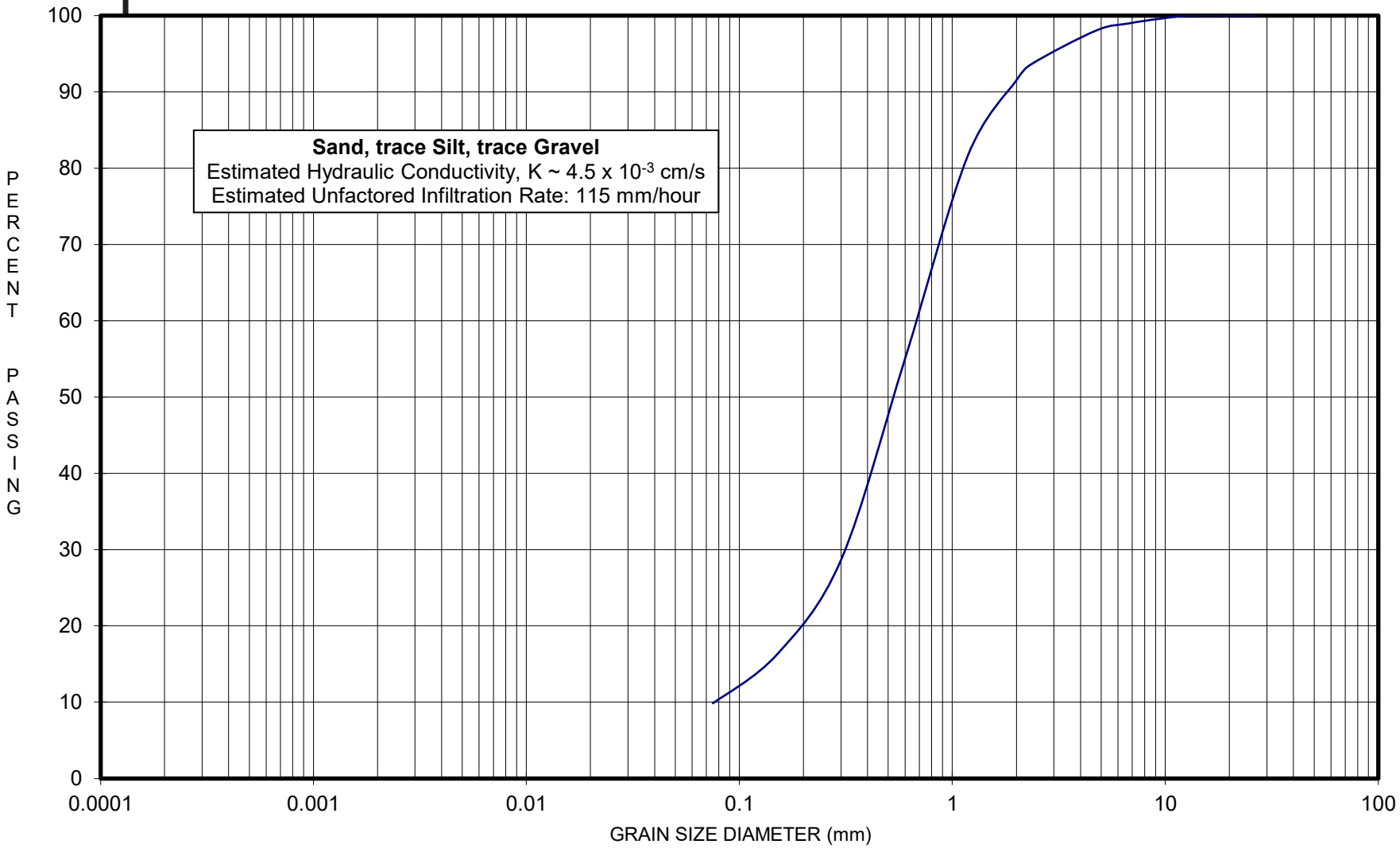
MECHANICAL GRAIN SIZE ANALYSIS



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	
	SILT			SAND			GRAVEL			

MODIFIED M.I.T. CLASSIFICATION	**Sample Description:** **Sand (BH1 S2, 1.5 to 2.0 m depth)**	**Waverly Street Development** **Project: LON-23003150-A0**	**Figure 1**

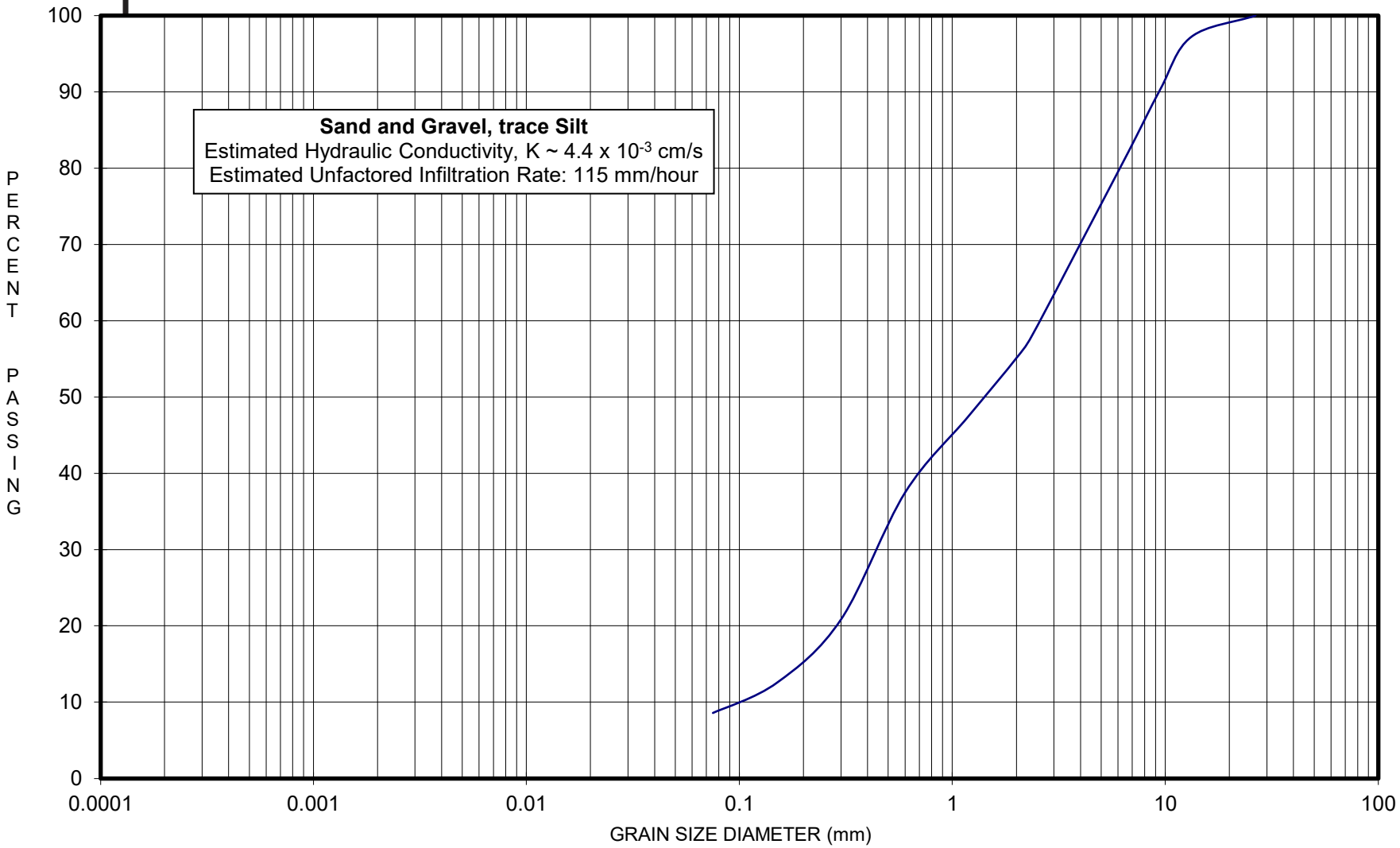
MECHANICAL GRAIN SIZE ANALYSIS



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	
	SILT			SAND			GRAVEL			

MODIFIED M.I.T. CLASSIFICATION	**Sample Description:** **Sand (BH1 S4, 3.0 to 3.5 m depth)**	**Waverly Street Development** **Project: LON-23003150-A0**	**Figure 2**

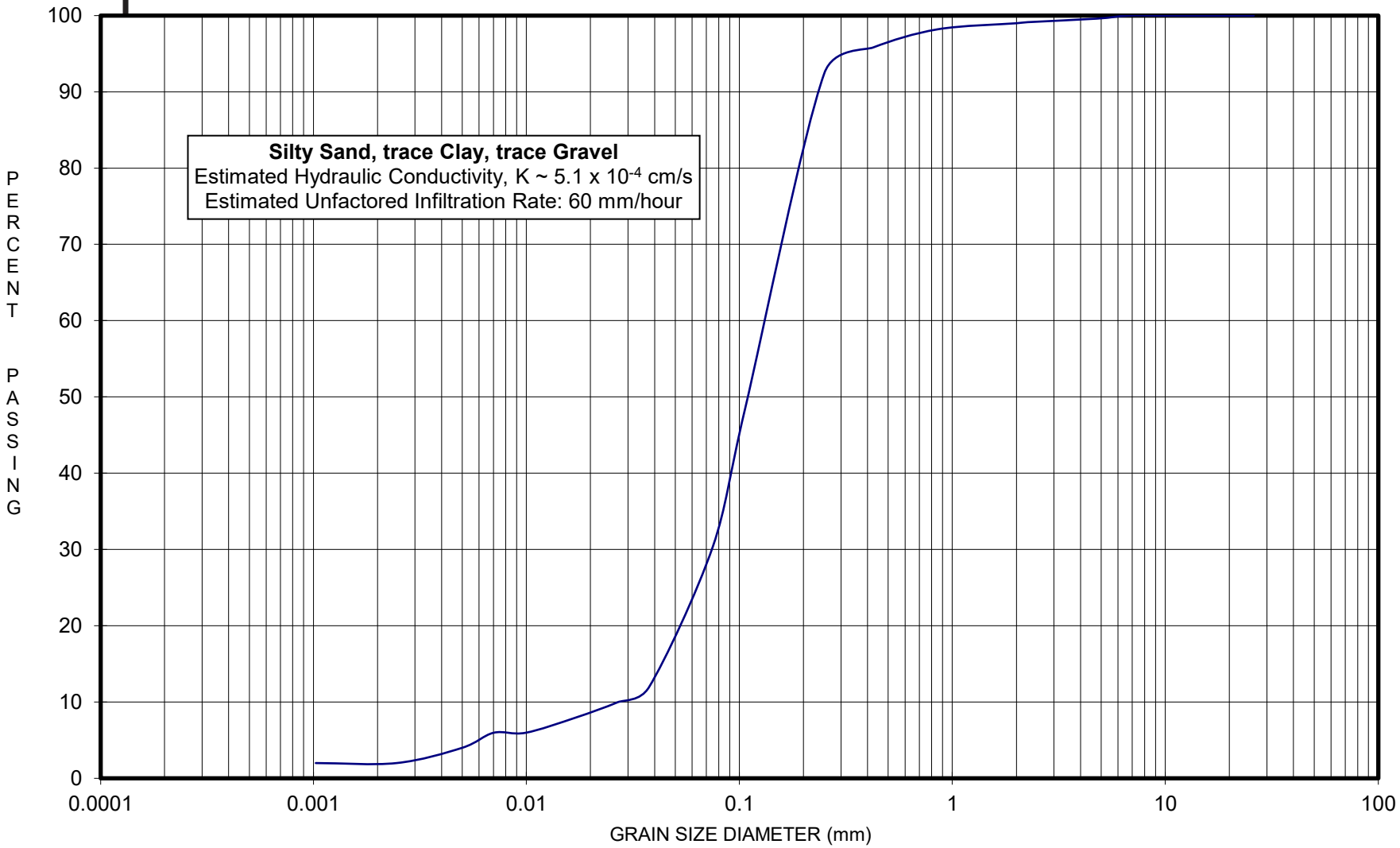
MECHANICAL GRAIN SIZE ANALYSIS



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	
	SILT			SAND			GRAVEL			

MODIFIED M.I.T. CLASSIFICATION	**Sample Description:** **Sand and Gravel (BH5 S3, 1.5 to 2.0 m depth)**	**Waverly Street Development** **Project: LON-23003150-A0**	**Figure 3**

MECHANICAL GRAIN SIZE ANALYSIS



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	
	SILT			SAND			GRAVEL			

MODIFIED M.I.T. CLASSIFICATION	**Sample Description:** **Silty Sand (BH5 S4, 2.3 to 2.7 m depth)**	**Waverly Street Development** **Project: LON-23003150-A0**	**Figure 4**

Appendix C – Inspection and Testing Schedule

INSPECTION & TESTING SCHEDULE

The following program outlines suggested minimum testing requirements during backfilling of service trenches and construction of pavements. In adverse weather conditions (wet/freezing), increased testing will be required. The testing frequencies are general requirements and may be adjusted at the discretion of the engineer based on test results and prevailing construction conditions.

I TRENCH BACKFILL

ZONE A	- one *in situ* density test per 100 cubic meters or 50 linear metres of trench whichever is less - one laboratory grain size and Proctor density test per 50 density tests or 4000 cubic metres or on change of material (source, visual)
ZONE A1	- one *in situ* density test per 75 cubic metres of material or 25 linear metres of each lift of fill - one laboratory grain size and Proctor density test per each 50 density tests or 4000 cubic metres of material placed or as directed by the engineer
ZONES B & C	- one *in situ* density test per 150 cubic metres of material or 50 linear metres or each lift whichever is less - one laboratory grain size and Proctor density test per 50 density tests or 4000 cubic metres of material placed or as directed by the engineer

II PAVEMENT MATERIALS

GRANULAR SUBBASE	- one *in situ* density test per 50 linear metres of road - one laboratory grain size and standard Proctor test per 50 density tests or 4000 cubic metres or each change of material (visual, source), as determined by the engineer
GRANULAR BASE	- one *in situ* density test per 50 linear metres of road - one laboratory grain size and Proctor per 50 density tests or 8000 cubic metres or change in material (visual, source), as determined by the engineer - Benkelman beam testing at 10 metre intervals per lane, after final grading and compaction. Asphaltic concrete should not be placed until rebound criteria have been satisfied.
ASPHALTIC CONCRETE	- one *in situ* density test per 25 linear metres of roadway - one complete Marshall Compliance test including stability flow, etc. for each mix type to check mix acceptability. One extraction and gradation test per each day of paving to be compared to job mix formula

NOTES: Where testing indicates inadequate compaction, additional fill should not be placed until the area is recompacted and retested at the discretion of the engineer.

Appendix D – Limitations and Use of Report

LIMITATIONS AND USE OF REPORT

BASIS OF REPORT

This report ("Report") is based on site conditions known or inferred by the geotechnical investigation undertaken as of the date of the Report. Should changes occur which potentially impact the geotechnical condition of the site, or if construction is implemented more than one year following the date of the Report, the recommendations of EXP may require re-evaluation.

The Report is provided solely for the guidance of design engineers and on the assumption that the design will be in accordance with applicable codes and standards. Any changes in the design features which potentially impact the geotechnical analyses or issues concerning the geotechnical aspects of applicable codes and standards will necessitate a review of the design by EXP. Additional field work and reporting may also be required.

Where applicable, recommended field services are the minimum necessary to ascertain that construction is being carried out in general conformity with building code guidelines, generally accepted practices and EXP's recommendations. Any reduction in the level of services recommended will result in EXP providing qualified opinions regarding the adequacy of the work. EXP can assist design professionals or contractors retained by the Client to review applicable plans, drawings, and specifications as they relate to the Report or to conduct field reviews during construction.

Contractors contemplating work on the site are responsible for conducting an independent investigation and interpretation of the test pit results contained in the Report. The number of test pits necessary to determine the localized underground conditions as they impact construction costs, techniques, sequencing, equipment and scheduling may be greater than those carried out for the purpose of the Report.

Classification and identification of soils, rocks, geological units, contaminant materials, building envelopment assessments, and engineering estimates are based on investigations performed in accordance with the standard of care set out below and require the exercise of judgment. As a result, even comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations or building envelope descriptions involve an inherent risk that some conditions will not be detected. All documents or records summarizing investigations are based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated. Some conditions are subject to change over time. The Report presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, these should be disclosed to EXP to allow for additional or special investigations to be undertaken not otherwise within the scope of investigation conducted for the purpose of the Report.

RELIANCE ON INFORMATION PROVIDED

The evaluation and conclusions contained in the Report are based on conditions in evidence at the time of site inspections and information provided to EXP by the Client and others. The Report has been prepared for the specific site, development, building, design or building assessment objectives and purpose as communicated by the Client. EXP has relied in good faith upon such representations, information and instructions and accepts no responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of any misstatements, omissions, misrepresentation or fraudulent acts of persons providing information. Unless specifically stated otherwise, the applicability and reliability of the findings, recommendations, suggestions or opinions expressed in the Report are only valid to the extent that there has been no material alteration to or variation from any of the information provided to EXP.

STANDARD OF CARE

The Report has been prepared in a manner consistent with the degree of care and skill exercised by engineering consultants currently practicing under similar circumstances and locale. No other warranty, expressed or implied, is made. Unless specifically stated otherwise, the Report does not contain environmental consulting advice.

COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment form part of the Report. This material includes, but is not limited to, the terms of reference given to EXP by its client ("Client"), communications between EXP and the Client, other reports, proposals or documents prepared by EXP for the Client in connection with the site described in the Report. In order to properly understand the suggestions, recommendations and opinions expressed in the Report, reference must be made to the Report in its entirety. EXP is not responsible for use by any party of portions of the Report.

USE OF REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. No other party may use or rely upon the Report in whole or in part without the written consent of EXP. Any use of the Report, or any portion of the Report, by a third party are the sole responsibility of such third party. EXP is not responsible for damages suffered by any third party resulting from unauthorized use of the Report.

REPORT FORMAT

Where EXP has submitted both electronic file and a hard copy of the Report, or any document forming part of the Report, only the signed and sealed hard copy shall be the original documents for record and working purposes. In the event of a dispute or discrepancy, the hard copy shall govern. Electronic files transmitted by EXP have utilize specific software and hardware systems. EXP makes no representation about the compatibility of these files with the Client's current or future software and hardware systems. Regardless of format, the documents described herein are EXP's instruments of professional service and shall not be altered without the written consent of EXP.

Legal Notification

This report was prepared by EXP Services Inc. for the exclusive use of **Landmark Homes Inc.** and may not be reproduced in whole or in part, or used or relied upon in whole or in part by any party other than **Landmark Homes Inc.** for any purpose whatsoever without the express permission of the EXP in writing.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

MAP A

CONTEXT MAP

Geographic Township of WINDHAM

28TPL2023390
ZNPL2023392

Legend

Subject Lands

2020 Air Photo

12/18/2023

N

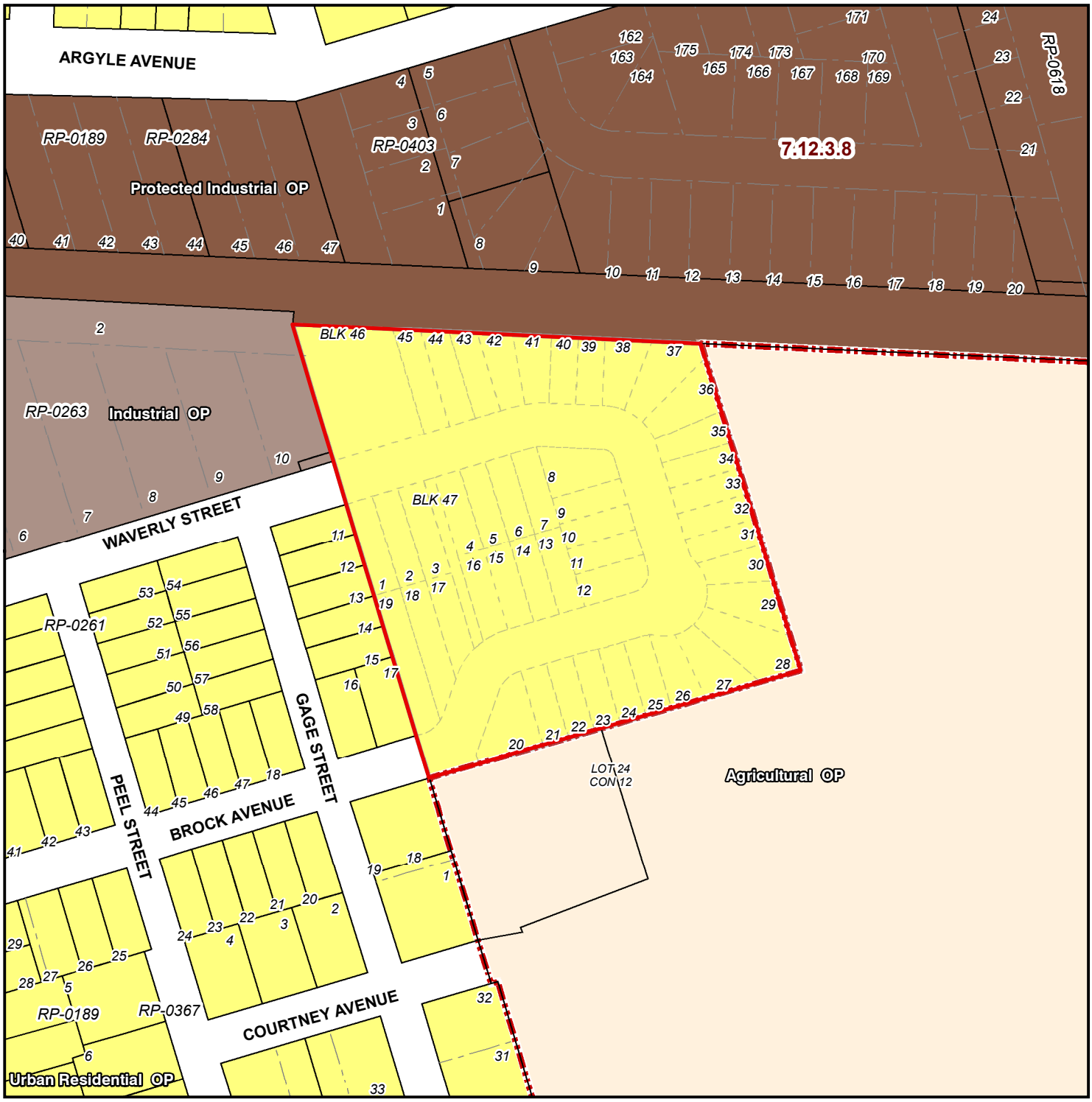
40 20 0 40 80 120 160 Meters

MAP B

OFFICIAL PLAN MAP

Geographic Township of WINDHAM

28TPL2023390
ZNPL2023392



Legend

Subject Lands

Official Plan Designations

- Agricultural
- Urban Residential
- Commercial
- Protected Industrial
- Industrial
- Urban Area Boundary

12/18/2023

N

20 10 0 20 40 60 80 Meters

MAP C

ZONING BY-LAW MAP

Geographic Township of WINDHAM

28TPL2023390
ZNPL2023392

LEGEND

Subject Lands

ZONING BY-LAW 1-Z-2014

(H) - Holding

A - Agricultural Zone

CS - Service Commercial Zone

MG - General Industrial Zone

R1-A - Residential R1-A Zone

R2 - Residential R2 Zone

12/18/2023

N

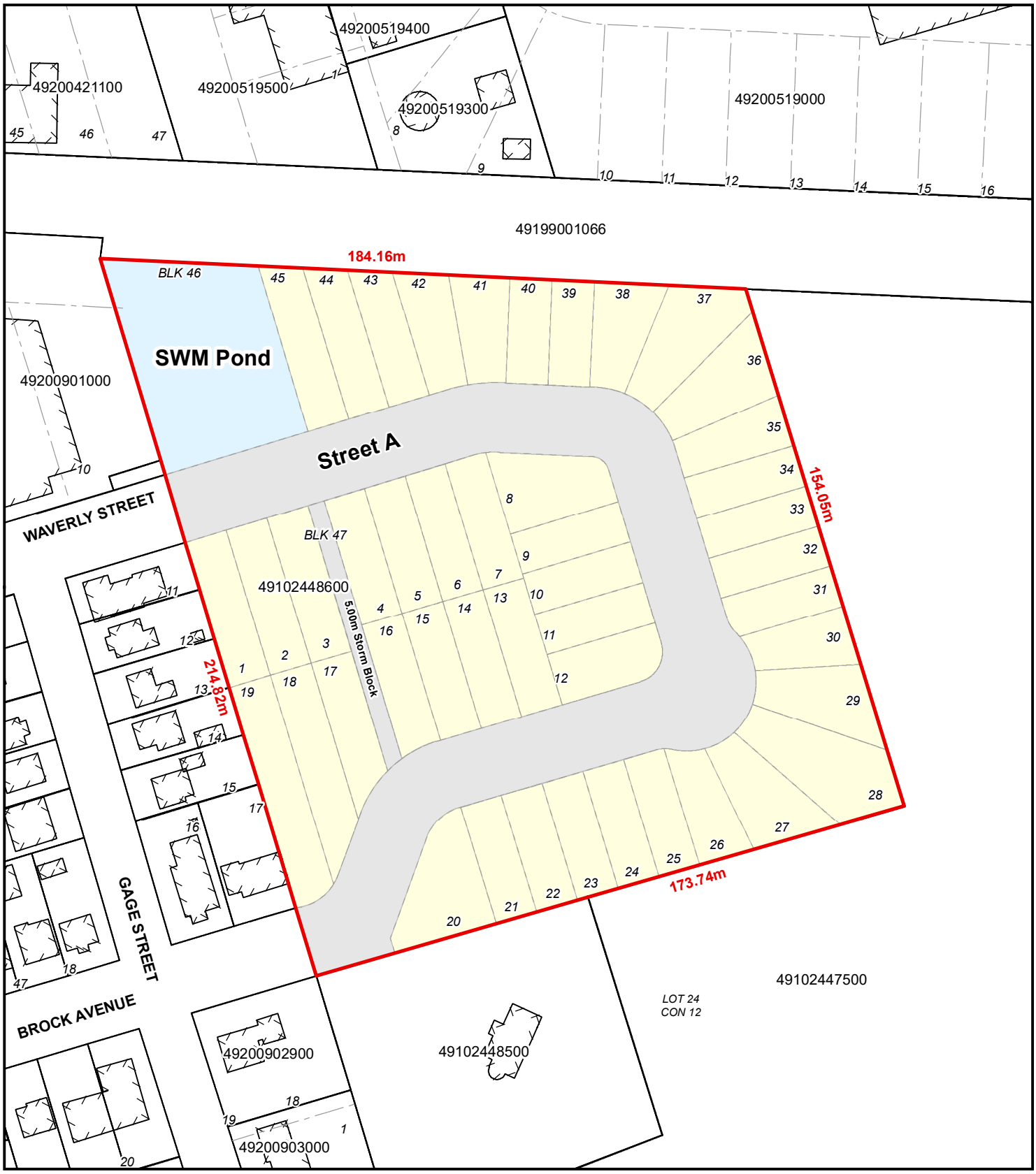
20 10 0 20 40 60 80 Meters

MAP D

CONCEPTUAL PLAN

Geographic Township of WINDHAM

28TPL2023390
ZNPL2023392



Legend

Subject Lands

12/18/2023

N

10 5 0 10 20 30 40 Meters