FUNCTIONAL SERVICING REPORT

PROPOSED MIXED USE DEVELOPMENT

MN 78 King Street
Delhi, Ontario
Norfolk County

Prepared By:

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Job: 16025 **March 2024**

INTRODUCTION

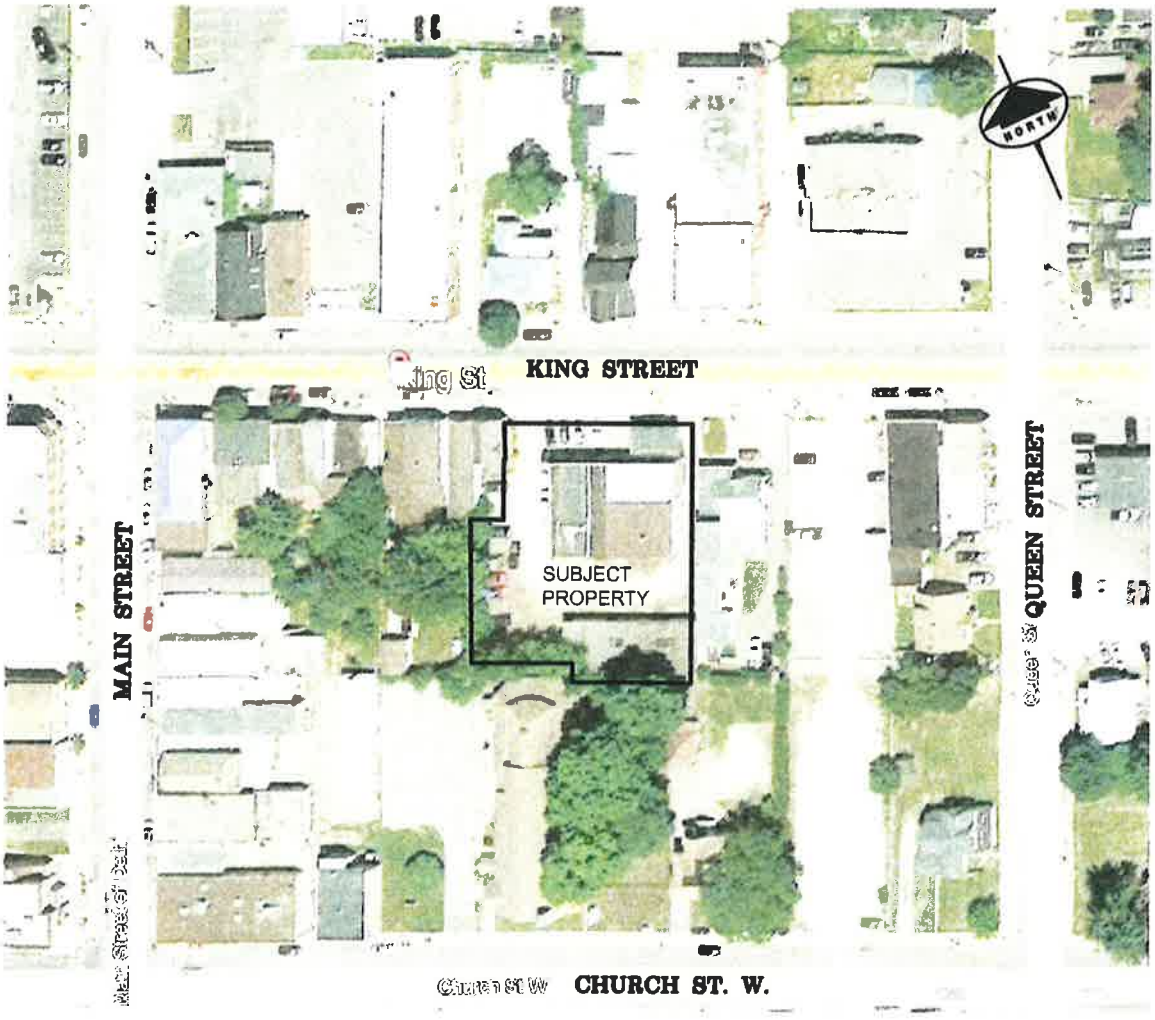
The following Functional Servicing Report was prepared by J.H. Cohoon Engineering Limited for Mr. D. Knill of Sentry Property Group (Brantford, Ontario) in support of a proposed mixed-use commercial \ residential development of the site on the southwest side of King Street in the Town of Delhi, in Norfolk County. The site is located at MN 78 King Street in Delhi, Ontario. The proposal is to construct a 527 +/- sq.m., five (5) storey development consisting of 527 sq.m. of commercial space (broken into two units) on the main level of the building and four (4) storeys of residential apartments consisting of twenty-three (23) units. (Note: one barrier free unit is located at the rear of the building on the main floor). The proposal includes the provision of some off-street parking on the property to be located at the rear of the building. The entire property is some 0.195 ha. in size. The preliminary layout of the development is illustrated within Appendix 'A' of this report on drawings prepared by J H Cohoon Engineering Limited being drawing 16025-1 (which illustrates the proposed grading and servicing of this site).

The objective of this report is to document the servicing strategy to be utilized for the site. The property is currently serviced with all municipal services including sanitary and water services. The owner will assume full responsibility for the installation and maintenance of the services on the property and any associated upgrades.

PROPOSED DEVELOPMENT CONCEPT

As noted above, the proposed development is to be constructed on the on the subject lands which is located on the southwest side of King Street h side of Wellington Avenue in downtown Delhi, Ontario in Norfolk County. The site is located east of Main Street and west of Queen Street in the downtown core. The site proposed for the development as a mixed-use development (commercial / residential) development is 0.195 hectares in size. A key map illustrating the site location is provided in Figure 1.

The development is intended to construct a five (5) story – twenty-three (23) unit 18-unit residential apartment style building with two (2) commercial units on the main floor including the associated servicing, and improvements to the presently developed site. The overall development is illustrated on the plans prepared by the J H Cohoon Engineering Limited being drawing 16025-1 which has been included within Appendix 'A' of this report



Site Location – Key Plan
Figure No. 1

SANITARY SEWERS & APPURTENANCES

3.1 Design Flows

This site is proposed to be fully connected to the municipal sanitary sewer system located on King Street adjacent to the site. The proposed development is illustrated on the attached site plan being drawing that is located within Appendix 'A' of this report (being J H Cohoon Engineering Limited 16025-1) which indicates the location of the proposed sanitary servicing into this site.

In accordance with the current Norfolk County design criteria, the design flows are being submitted to the County for the review of the conveyance systems within the Town of Delhi, Norfolk County. The following information is being provided to the Norfolk County for their use and consideration.

Sanitary Design Flows

Residential Component

23 Residential Apartment Units
2.75 people per unit
As per the requirements of the Norfolk County, the average daily flow is based upon 450 litres per person per day
2.75 x 23 x 450 = 28,462.5 liters per day
= 0.329 liters per second

Total Average Design Residential Flow
= 0.329 liters per second.

Commercial Component

Two (2) units – Total Area = Approximately 527 sq.m. x 50% of the Mian Floor = 263.5 sq.m. +/-

As per the requirements of the Norfolk County, the average daily flow is based upon 90 persons per hectare or in this case
90 * 263.5 sq.m. / 10,000 = 2.37 persons. We have estimated that the occupant load may be in the order of 5 to 7 persons

Again, utilizing the Norfolk County standards, the associated sanitary discharge is based upon 40 cu.m. / hectare / day
40 x 263.5 / 10,000 = 1.054 cu.m. per day
= 1054 litres per day
= 0.012 litres per second.

Total Average Design Commercial Flow
= 0.013 liters per second.

Total Sanitary Effluent Flow from the development
= 0.341 litres per second

Therefore, the total sanitary effluent from this site results in the following estimation of the sanitary flows:

Summary of Results

Average Flow Rate
Residential Component = 0.329 liters per sec

Commercial Component	=	0.012 liters per sec
Total	=	0.341 litres per sec

Infiltration Allowance

Site Area = 0.195 hectares
Infiltration Rate = 0.28 liters per second per hectare
Infiltration Allowance
= 0.043 liters per second

Total Average Flow Rate
= 0.384 liters per sec

On the basis of the Modified Harmon Peaking Factor, and a total population for this site being 63.25 (residential) and 2.37 (commercial), the peaking factor of 4.135 (Max 4) was applied resulting in a peak design flow for this building being 1.364 liters per second. (See peaking factor calculation below)

The peak flow was calculated as follow:

AR	=	Residential Area = 2,371.5 sq.m. (50% residential area on main floor)
AI	=	Industrial Area = 0.0
AC	=	Commercial Area = 263.5 sq.m.

Mav = Kav * (1 + (14 / (4 + (P + Pe) ** 0.5)))

Where
Kav = (AR + (0.80 * ((AI + AC)) / (AR + AI + AC)))

In this case, the Modified Harmon Peaking Factor is

Kav =
(2371.5 + (0.80 * ((0.0 + 263.5))) / (2371.5 + 0.0 + 263.5))
= 0.964
Mav = Kav * (1 + (14 / (4 + (P + Pe) ** 0.5)))
= 0.964* (1 + (14 / (4 + ((63.25 + 2.37) / 1000) ** 0.5
= 4.135 (Max 4)

Therefore, the resulting flows from this development are as follows:

Average Day Flow Route (including infiltration)	=	0.384 lps
Peak Flow Rate (including infiltration)	=	1.420 lps

The proposed sanitary connection is proposed to be located into the existing sanitary main on King Street adjacent to the property.

Sanitary Outlet

The sanitary sewer system for the subject development will be connected into the existing sanitary sewer that are located on King Street in the Town of Delhi, Norfolk County. The analysis relating to the overall impact of this development on the receiving sanitary sewer system will be reviewed by the Norfolk County as part of this submission.

WATERMAINS & APPURTENANCES

Design Flows

The peak design flow rate from the proposed development using current Norfolk County Standards. As with the wastewater, the estimated average flows have been detailed with the Sanitary Sewer Section of this report. (Section 3.1 above). However, in this case the peaking factor of 2 has been utilized and a demand of 450 liters per person per day.

The summary of the water system demands can be summarized as follows:

	Average Daily Flow Rate (Liters per second)	Peak Daily Flow Rate* (Litres per second)
Residential Component	0.341	0.682

The proposed fire protection to this development will be handled by the existing fire hydrants located adjacent to the property.

Utilizing the requirements of the Fire Underwriters Survey 2020, the following outlines the water demand for the overall building area:

This building is approximately 527.0 +/- sq. m. in size (multi - storey residential building with commercial on the ground floor). In accordance with the requirements of the Fire Underwriters Survey, the area is to include 25% of the floor areas above and below the main level. In this case, the area of 790.5 sq.m. was utilized. Utilizing the Fire Underwriters Survey Document, our estimation of the required fire demand is as follows:

Estimate of Fire Flow Required = 220 * C * SQRT (A)
Where C = Coefficient related to type of

Construction
In this case, ordinary construction is proposed.
Ordinary Construction = 1.0

A = Total Area of the Building (As outlined above)
790.5 sq. m.

= 220 x 1.0 x SQRT (790.5)
= 6,185.5 litres per min
Rounded
= 6,000 litres per min

Modifications
Occupancy = Low Hazard Occupancy = -15%
Reduction = 900 litres per min

Net Fire Demand = 5,100 litres per min

Further Modifications Automatic Sprinkler System = 50%
Reduction = 2,550 litres per min

Spatial Exposure (Estimated)

North	Street	+ 0 %
East	3.24m +/-	+ 20 %
West	10.6 +/-	+ 15 %
South	25.6m +/-	+ 10 %
Total		+ 45 %

Increase = 2,295 litres per min

Total Fire Demand
4,845.0 litres per min
5,000 litres per min (Rounded)
83.3 litres per sec.

STORM SEWERS & APPURTENANCES

Storm Sewers

The site is intended to be serviced with municipal storm sewers which are to be designed to handle the 5-year storm event where possible. The overall stormwater management system is to be consistent with the current policies of the County of Norfolk which require reduction in the post development flows to below the pre-development rates for all storm events up to and including the 100-year event. In this case, no municipally owned storm sewer exists on the King Street right-of-

way adjacent to the site. In fact, the stie presently drains in a southerly direction towards the abutting property to the south. The site is presently developed with a commercial building and its associated parking facilities. The proposal is to collect the runoff to reduce the runoff that is being directed to the rear lot line and the abutting land / property. In this case, an infiltration gallery is proposed to direct the runoff into the soils in the area which are suitable for infiltration. The soils report prepared by "Soil Mat Engineers and Consultants Ltd." Dated June 29, 2023, indicates that the native soils have an infiltration capacity of between 75 and 90 mm per hour. For the purposes of our design, we have utilized an initial infiltration rate of 50 mm per hour with a degradation of that rate to 10 mm hour per hour. (These assumptions would be considered conservative and reflect the potential for variety in the soils to be encountered).

The soils report prepared by Soil-Mat Engineers is included within Appendix 'B' of this report.

The proposed development is a slightly larger impervious areas and as such, conventional stormwater management techniques are required to be implemented.

Pre-Development Hydrologic Modeling Parameters

MIDUSS modeling software was used to establish pre-development runoff rates for the site. The site is approximately 0.195 hectares in size with the flow direction being extremely flat but is directed towards the Wellington Avenue right-of-way. The existing topography slope is approximately 1.5+/-% and directs the runoff to the rear of the site.

Post Development Conditions

The proposed concept plan includes the following:

- A proposed 527.0 +/- sq.m. mixed use building consisting of two (2) commercial units and one (1) residential unit on the main floor and an additional twenty-two (22) unit residential units on the upper floors of a total of a five (5) storey building, with the required parking, resulting in an overall % impervious on the site being increased from the 97.3% impervious surfaces in the pre-development condition to a 85.5% impervious condition.

  For the purposes of this report, 85.5% has been utilized in the hydrologic modeling for the overall development to represent the proposed development. Actual reduction of the runoff is not required to meet the Norfolk County design standards, however, as the site drains into an abutting neighbour's property, a reduction is being proposed for this site.

Modelling Results – Quantity Control

Stormwater flows were calculated using MIDUSS modeling software. Norfolk County IDF parameters were used to generate rainfall for sizing of the SWM facilities in accordance with Norfolk County Development Engineering Standards.

Peak flow reduction will be achieved through on-site detention in an effort minimize the potential for downstream flooding and erosion. Post development surface water runoff will be controlled to existing pre-development levels for the 2, 5, 10, 25, 50- and 100-year storm events (as possible). The results of the Miduss modeling have been included within Appendix 'D' of this report and can be summarized as follows:

Table 1 – Peak Flow Rates

Storm Event	Pre-Development Peak Flow (m^3/sec)	Post Development Peak Flow No SWM (m^3/sec)	Post Development Peak Flow with SWM
2 Year	0.037	0.032	0.005
5 Year	0.048	0.044	0.013
10 Year	0.057	0.052	0.019
25 Year	0.068	0.065	0.028
50 Year	0.076	0.074	0.037
100 Year	0.083	0.082	0.047

Peak flow reduction will be achieved by designing the proposed infiltration gallery to be located in the rear parking area of the site, whereas the infiltration gallery has a storage capacity of 21.6 cu.m. which is based on the following infiltration gallery.

Proposed Infiltration Galley = 12.0 x 4.5m x 1.0m
Capacity = 54 cu.m.
Void Ratio = 0.40
Storage Capacity within the gallery (assuming no infiltration)
= 21.6 cu.m.

Table 2 – Post Development Storage Volumes

Storm Event	Infiltration Galley Storage (cms)	Required Storage (cms)
2 Year	21.6	20.863
5 Year	21.6	21.153
10 Year	21.6	20.698
25 Year	21.6	21.437
50 Year	21.6	21.566
100 Year	21.6	21.617

Peak flow reduction will be achieved by designing an outlet structure that restricts the runoff into the neighboring property that is the pre-development flow direction.

The pre-development runoff computer simulations results have been included within Appendix 'C' of this report. The post-development runoff computer simulations results have been included within Appendix 'D' of this report.

The storage that is being proposed will be surface storage within the site with an overland flow towards Wellington Avenue. We have illustrated on the enclosed preliminary grading and servicing plan. (Included within Appendix 'A' of this report).

In addition, we have included a stormceptor within the parking area prior to discharge into the infiltration gallery to treat the discharge prior to infiltration. In this case, we are proposing

The proposed stormwater management system includes the provision for a minor system designed to accommodate the 5-year storm event. The storm sewer design calculations are included in Appendix 'E' of this report

GRADING

Preliminary site grades are illustrated on the attached grading plan prepared by J H Cohoon Engineering Limited being drawing 16025-1 included with this report.

UTILITIES

Gas, hydro, Bell, and cable utilities are available to service the proposed development. Coordination of these services will be required with Union Gas, Hydro One, Bell, and Rogers.

CONCLUSIONS

The preceding sections of this report outline the preliminary servicing and grading requirements for the proposed residential development on this site. Based on the work completed to date, it may be concluded that the proposed development may be developed with full municipal services.

Report Prepared By:

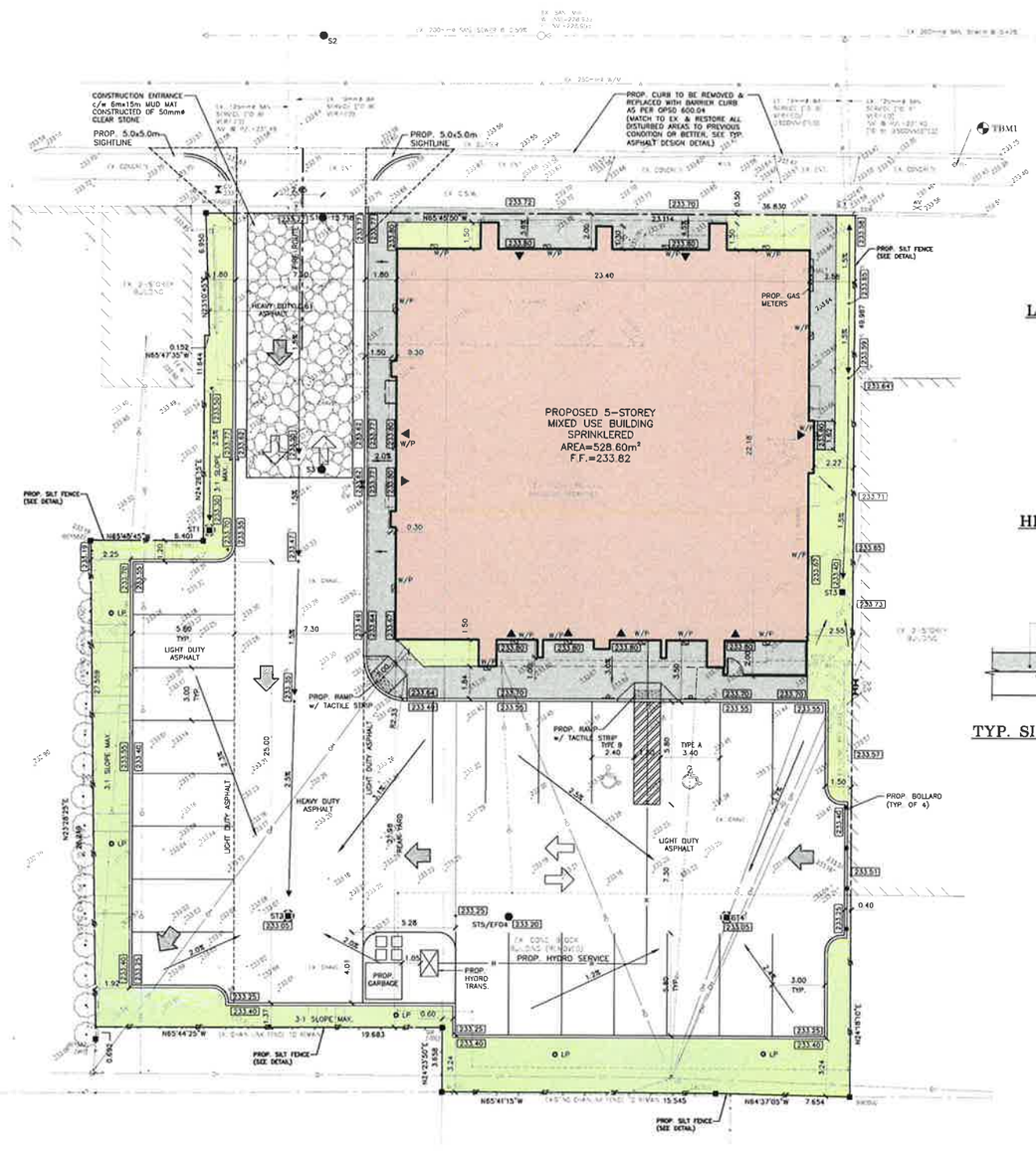
J.H. COHOON ENGINEERING LIMITED

R. W. Phillips, P.Eng.

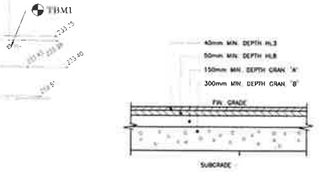
Appendix 'A'
Development Proposal as prepared by
J H Cohoon Engineering Drawing 16025-1

KING STREET
(THE KING'S HIGHWAY No. 3)

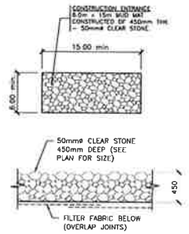
ROAD RESTORATION TO NORFOLK COUNTY STANDARDS



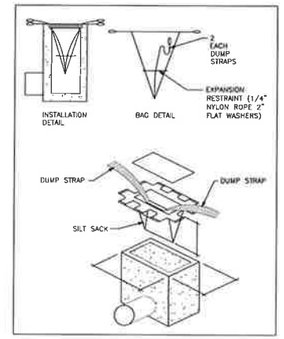
KEY PLAN



LIGHT DUTY ASPHALT DESIGN



MUD MAT DETAIL



SILT SACK DETAIL

HEAVY DUTY ASPHALT DESIGN

TYP. SIDEWALK DETAIL

HEAVY DUTY SILT FENCE DETAIL OPSD 219.130

GENERAL NOTES:

1. CONSTRUCTION OF SEWERS, WATERMAINS AND RELATED APPURTENANCES SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE CURRENT STANDARD DRAWINGS OF THE COUNTY OF NORFOLK, AND THE ONTARIO PROVINCIAL STANDARDS DRAWINGS (OPSD). THE COUNTY OF NORFOLK DRAWINGS SHALL TAKE PRECEDENCE OVER THE OPSD DRAWINGS
2. INFORMATION REGARDING ANY EXISTING SERVICES AND/OR UTILITIES SHOWN ON THE APPROVED SET OF CONSTRUCTION DRAWINGS IS FURNISHED AS THE BEST AVAILABLE INFORMATION. THE CONTRACTOR SHALL INTERPRET THIS INFORMATION AS THEY SEE FIT WITH THE UNDERSTANDING THAT THE OWNER AND HIS AGENTS DISCLAIM ALL RESPONSIBILITY FOR ITS ACCURACY AND/OR SUFFICIENCY.
3. ALL DIMENSIONS SHALL BE CHECKED AND VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO ANY CONSTRUCTION AND HE SHALL REPORT ANY DISCREPANCIES IMMEDIATELY TO THE ENGINEER.
4. RELOCATION OF EXISTING SERVICES AND/OR UTILITIES SHALL BE CONSTRUCTED AS SHOWN ON THE DRAWINGS OR AS DIRECTED BY THE ENGINEER.
5. THE CONTRACTOR SHALL OBTAIN ALL PERMITS FOR CONSTRUCTION.
6. FOR ALL SEWERS AND WATERMAIN IN FILL SECTIONS, THE COMPACTION SHALL BE VERIFIED PRIOR TO LAYING OF PIPE.
7. NO SUBSTITUTIONS WILL BE ALLOWED WITHOUT WRITTEN APPROVAL FROM THE COUNTY OF NORFOLK OR THE ENGINEER.
8. NO BLASTING WILL BE PERMITTED.
9. ALL EXCAVATIONS TO BE BACKFILLED WITH SELECT NATIVE MATERIAL, APPROVED BY THE ENGINEER, TO 95% S.P.D.
10. THE DEVELOPER AND/OR CONTRACTOR IS RESPONSIBLE FOR INSTALLING AND MAINTAINING (UNTIL ROAD CONSTRUCTION IS FINISHED) SILT CONTROL DEVICES AS SHOWN ON THE DRAWINGS AND AS DIRECTED BY THE ENGINEER.
11. TREE PROTECTION PROCEDURES TO BE IMPLEMENTED IN ACCORDANCE WITH COUNTY OF NORFOLK STANDARDS
12. ALL WORKS SHALL BE DESIGNED AND CONSTRUCTED SO AS TO COMPLY WITH APPLICABLE LAW, TO BE CONSISTENT WITH THE COUNTY OF NORFOLK DEVELOPMENT & ENGINEERING STANDARDS AND IN ACCORDANCE WITH CURRENT GUIDELINES, CODES, REGULATIONS AND STANDARDS PRESCRIBED BY THE COUNTY
13. ALL BOULEVARD AREAS TO BE RESTORED WITH #1 NURSERY SOD ON A MINIMUM 100mm OF SELECT TOPSOIL.
14. ALL TRENCH BACKFILL UNDER EXISTING ROADWAYS SHALL BE COMPACTED IN MINIMUM 230mm LIFTS TO 98% STANDARD PROCTOR DENSITY. A GEOTECHNICAL ENGINEER'S REPRESENTATIVE SHALL BE ON SITE DURING THE WORK TO VERIFY THE COMPACTION OF EACH LIFT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS OF RE-TESTING.
15. AN ENGINEER IS REQUIRED TO BE ONSITE FOR INSPECTION OF ALL UNDERGROUND SERVICES.
16. DRIVEWAYS MUST HAVE MINIMUM 1.0m CLEARANCE FROM CATCHBASINS, VALVES, HYDRANTS STREETLIGHT POLES, TRANSFORMERS, CANADA POST COMMUNITY MAILBOX LOCATIONS ETC.
17. ALL EXISTING OVERHEAD HYDRO SERVICES WILL BE REMOVED AND RELOCATED TO A UNDERGROUND SERVICES
18. ROAD RESTORATION WITHIN THE R.O.W. TO BE 40mmHL3, 100HLB, 150mm GRANULAR 'A', 450mm GRANULAR 'B'.
19. CONCRETE SIDEWALK RESTORATION SHALL BE 125mm CLASS C2 CONCRETE ON 150mm GRANULAR 'A'.

ROADWORKS:

1. ROADWAYS & RELATED WORKS SHALL BE DESIGNED AND CONSTRUCTED SO AS TO COMPLY WITH APPLICABLE LAW, TO BE CONSISTENT WITH THE COUNTY OF NORFOLK DEVELOPMENT AND ENGINEERING STANDARDS AND IN ACCORDANCE WITH CURRENT GUIDELINES, CODES, REGULATIONS, BEST PRACTICES AND STANDARDS PRESCRIBED BY THE COUNTY.
2. CATCH BASIN CONNECTIONS TO BE PVC PIPE CSA B182.4, SDR 35 OR 'ULTRA RIB' SINGLE CATCH BASIN LEADS TO BE MIN. 250mm DIA. DOUBLE CATCH BASIN LEADS TO BE MIN. 300mm DIA. REAR LOT CATCHBASIN LEADS AND DITCH INLET LEADS TO BE CSA A257.1 EXTRA STRENGTH CL.3 CONC. 300mm DIA. AT 1.0% MIN
3. SINGLE CATCH BASINS AS PER OPSD 705.010 FRAME AND COVER AS PER OPSD 400.110.
4. FINAL ROADWAY CROSSFALL TO BE 2.0%
5. VALVES, MANHOLES AND CATCH BASINS SHALL BE PLACED AT ASPHALT BINDER COURSE (HL4) ELEVATION AS DIRECTED BY THE ENGINEER.
6. AT SAG POINTS, CATCH BASIN ADJUSTMENT AND PAVING TO BE PLACED IN SUCH MANNER THAT WILL NOT OBSTRUCT DRAINAGE
7. FINAL ASPHALT COURSE (HL3) SHALL BE PLACED IN ACCORDANCE WITH APPROVED COUNTY OF NORFOLK STANDARDS FOR TIMING, AS DIRECTED BY THE ENGINEER AND AS PER THE REQUIREMENTS STIPULATED IN THE DEVELOPMENT AGREEMENT.
8. FOR MANHOLE AND CATCH BASIN TOP ADJUSTMENTS, ALL PERMANENT ADJUSTMENTS ARE TO BE POURED IN PLACE OR APPROVED EQUIVALENT (e.g. MODULOC)
9. ALL BEDDING AND BACKFILL MATERIAL, ROAD SUB-GRADES AND GRANULAR ROAD BASES SHALL BE COMPACTED TO MIN 100% SPD UNLESS OTHERWISE SPECIFIED.
10. SILTATION CONTROL BARRIERS SHALL BE PLACED AS DETAILED ON THE SILTATION AND EROSION CONTROL PLAN.
11. ADDITIONAL SILT CONTROL LOCATIONS MAY BE REQUIRED AS DETERMINED BY THE COUNTY AND/OR THE ENGINEER.
12. ANY ROADWORK OR RESTORATION SPECIFICATION REQUIRED BY DS DEPARTMENT ENGINEERING APPROVAL.

LEGEND:

- EXISTING ELEVATIONS
- 200.00 PROPOSED ELEVATIONS
- 200.00^S PROPOSED SWALE ELEVATIONS
- PROPOSED SWALE
- GENERAL DRAINAGE
- SILTATION FENCE
- CB SILT SOCK AS SHOWN
- CONSTRUCTION ENTRANCE c/w 6mx15m MUD MAT CONSTRUCTED OF 50mm¢ CLEAR STONE
- OVERLAND FLOW ROUTE
- EXISTING CATCHBASIN
- EXISTING DOUBLE CATCHBASIN
- EXISTING DITCH INLET CATCHBASIN
- EXISTING FIRE HYDRANT
- EXISTING VALVE & BOX
- EXISTING WATER BOX
- EXISTING LIGHT STANDARD
- W/P PROPOSED WALL PACK LIGHTING
- LP PROPOSED LIGHT POLE

NOTES:

1. ALL ELEVATIONS SHOWN ARE METRIC.
2. BUILDER/OWNER TO VERIFY COMPLIANCE WITH ZONING BYLAWS (ie. SIDEYARDS, SETBACKS, REARYARDS ETC.)
3. BOUNDARY AND TOPOGRAPHIC SURVEY PROVIDED BY JEWITT AND DIXON SURVEYING (PROJECT 22-3383 DATED MAY 26, 2022)
4. THE SILTATION & EROSION CONTROL (SEC) MEASURES ILLUSTRATED ON THIS PLAN ARE CONSIDERED TO BE THE MINIMUM REQUIREMENT. SITE CONDITIONS MAY REQUIRE ADDITIONAL MEASURES WHICH WILL BE IDENTIFIED BY THE ENGINEER DURING CONSTRUCTION.
5. ALL SEC MEASURES ARE TO BE IN PLACE PRIOR TO COMMENCEMENT OF CONSTRUCTION.
6. OWNER/CONTRACTOR TO MAINTAIN EROSION CONTROL MEASURES THROUGHOUT SITE UNTIL A COMPLETE GRASS/VEGETATION COVER IS ACHIEVED.
7. ONLY AT THE DIRECTION OF THE ENGINEER ARE THE SEC MEASURES TO BE REMOVED.
8. ALL EXPOSED AREAS NOT SUBJECT TO ACTIVE CONSTRUCTION WITHIN 30 DAYS ARE TO BE REVEGETATED AS PER O.P.S.S. 572 IMMEDIATELY UPON COMPLETION OF AREA GRADING.
9. ALL RAINWATER LEADERS FROM EACH HOUSE ARE TO BE DIRECTED TOWARDS THE RIGHT-OF-WAY. UNLESS NOTED OTHERWISE.
10. CONTRACTOR TO PROVIDE SILT FENCE AROUND PERIMETER OF ALL ON SITE STOCKPILES
11. CONTRACTOR TO PROVIDE SILT SACKS ON TOP OF ALL EXISTING AND PROPOSED STORM STRUCTURES WITHIN THE INFLUENCE OF RUNOFF DURING CONSTRUCTION UNTIL ADEQUATE VEGETATIVE COVER IS ACHIEVED.
12. SEC CONSULTANT TO VISIT DEVELOPMENT, AT A MINIMUM, ON A WEEKLY BASIS AND ALSO DURING AND AFTER EACH STORM EVENT TO ENSURE SEC MEASURES ARE FUNCTIONING PROPERLY.
13. SEC CONSULTANT SHALL PROVIDE THE CITY WITHIN 48 HRS. OF A STORM EVENT A LIST OF DEFICIENCIES AND TIMETRAME FOR THE COMPLETION OF NECESSARY CORRECTIVE MEASURES.

T.B.M. No. 1 ELEV. = 234.25m (GEO)
TOP OF VAN GUYLET OF FIRE HYDRANT AS SHOWN (TO BE VERIFIED)

NO	REVISION	DATE (MM/DD/YY)	BY
4	STORMCEPTOR/ASPHALT DESIGN	03/06/24	S.L.M.
3	HYDRO SERVICE	02/16/24	S.L.M.
2	WATER & SANITARY SERVICING	02/06/24	K.P.B.
1	AS PER COUNTY COMMENTS	01/19/24	S.L.M.

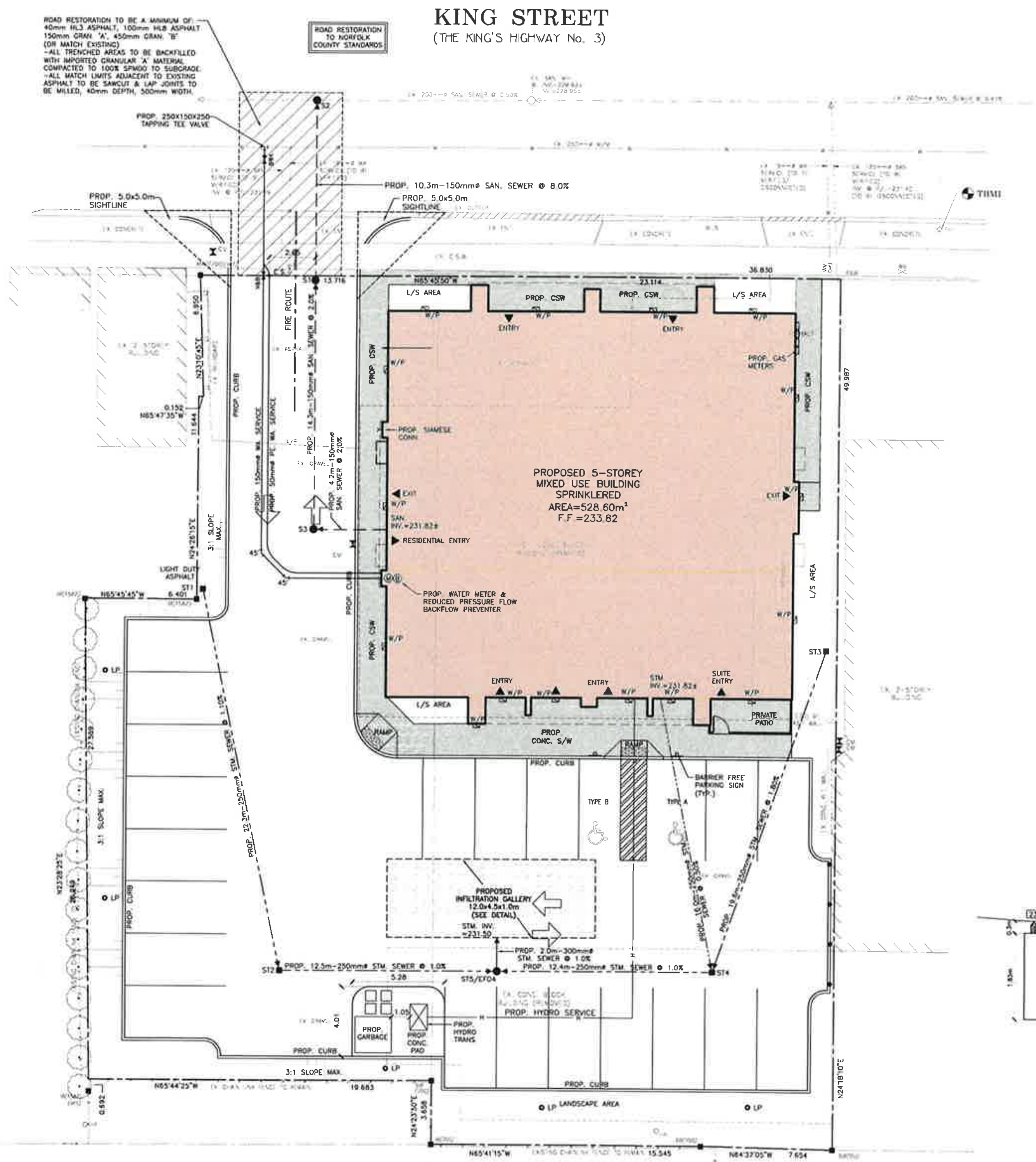
J.H. COHOON ENGINEERING LIMITED
CONSULTING ENGINEERS
440 HARDY ROAD, UNIT #1, BRANTFORD - ONTARIO, N3T 5L8
TEL. (519) 753-2656 FAX. (519) 753-4263 www.cohooneng.com

PROJECT:
PROPOSED MIXED USE BUILDING
LOTS 2 & 3, BLOCK 16
R-PLAN 189
78 KING STREET, DELHI
NORFOLK COUNTY

CLIENT:
SENTRY GROUP

GRADING & SILTATION CONTROL PLAN

DESIGN	R.W.P.	SCALE	1:150
DRAWN	S.L.M./K.P.B.	JOB No.	16025
CHECKED	R.W.P.	DWG No.	16025-1
SHEET	1 of 2		
DATE	APR. 20/23		



KEY PLAN

WATERMAINS:

1. WATERMAINS AND RELATED APPURTENANCES SHALL BE DESIGNED AND CONSTRUCTED SO AS TO COMPLY WITH APPLICABLE LAW, TO BE CONSISTENT WITH THE COUNTY OF NORFOLK DEVELOPMENT AND ENGINEERING STANDARDS AND IN ACCORDANCE WITH CURRENT GUIDELINES, CODES, REGULATIONS, BEST PRACTICES AND STANDARDS PRESCRIBED BY THE COUNTY.
2. WATERMAINS TO BE INSTALLED WITH A MINIMUM DEPTH OF COVER OF 1.70m BELOW FINISHED GRADE.
3. WATERMAINS TO BE INSTALLED IN ACCORDANCE WITH OPSD 802.010 TYPE 2 TRENCH BEDDING TO BE GRANULAR 'A' UNLESS OTHERWISE NOTED.
4. WATERMAINS TO BE PVC DR-18 IN ACCORDANCE WITH AWWA C900 & CSA B137.3 THE PIPE SHALL BE SHIPPED TO THE SITE WITH THE ENDS FACTORY CAPPED
5. FOR PVC WATERMAIN DEFLECTION:
   - MAXIMUM ALLOWABLE DEFLECTION OF 1 DEGREE PER JOINT SHALL NOT BE EXCEEDED.
   - EACH JOINT SHALL BE DEFLECTED AN EQUAL AMOUNT.
6. ALL WATER MAINS TO BE SWABBED, TESTED, DISINFECTED AND FLUSHED UNDER THE SUPERVISION OF THE ENGINEER TO THE SATISFACTION OF THE COUNTY OF NORFOLK PRIOR TO CONNECTION TO THE EXISTING MUNICIPAL SYSTEM. REFER TO OPSS 701.07.25, AWWA C651 & COUNTY OF NORFOLK GENERAL WATERMAIN DISINFECTION PROCEDURES.
7. A REDUCED PRESSURE FLOW BACKFLOW PREVENTER IS REQUIRED ON THE TEMPORARY SUPPLY LINES USED FOR FILLING AND FLUSHING/SWABBING OF WATERMAINS AND TO BE TESTED AND CERTIFIED ON SITE.
8. UPON COMPLETION OF INSTALLATION, THE CONTRACTOR SHALL PERFORM A PRESSURE TEST ON THE WATERMAINS AS PER OPSS 701.07.24 AND COUNTY OF NORFOLK SPECIFICATIONS. WATERMAIN IS TO BE TESTED UNDER THE SUPERVISION OF THE ENGINEER PRIOR TO CONNECTION TO EXISTING WATERMAINS USING TEMPORARY CAPS OR PLUGS.
9. PIPE CLOSURES WHERE REQUIRED, ARE TO BE SUPPLIED BY THE CONTRACTOR. THE CONTRACTOR SHALL ALSO SUPPLY AND INSTALL ALL ADAPTOR PIECES IN ORDER TO CONNECT EXISTING WATERMAINS.
10. ALL WATER SERVICE CONNECTIONS 19mm DIA. ASTM B88 TYPE 'K' SOFT COPPER AS PER OPSD 1104.01 & COUNTY OF NORFOLK ENGINEERING STANDARDS, WITH SAND BEDDING
11. WATER SERVICES TO BE LOCATED AS PER TYPICAL SERVICING DETAIL ON THIS SHEET AND CURB STOPS TO BE MUELLER A-726 OR EQUIVALENT APPROVED BY THE COUNTY OF NORFOLK.
12. 3-WAY HYDRANTS TO BE INSTALLED AS PER OPSD 1105.01 (SHALL OPEN LEFT – COUNTER CLOCKWISE) & PAINTED RED. HYDRANTS TO BE CANADA VALVE CENTURY HYDRANT OR EQUIVALENT APPROVED BY THE COUNTY OF NORFOLK.
13. ALL WATERMAIN VALVES, BENDS AND FITTINGS TO HAVE MECHANICAL JOINTS
14. CATHODIC PROTECTION TO BE PROVIDED AT ALL VALVES, BENDS AND FITTINGS WITH 11.0 KG ZINC ANODES AND ON ALL WATER SERVICE CONNECTIONS WITH 5.5 KG ZINC ANODES
15. SHOULD AIR IN THE WATERMAIN BE DEMONSTRATED TO BE A PROBLEM, THE CONTRACTOR WILL BE REQUIRED TO INSTALL AN AIR RELIEF VALVE(s) TO THE SATISFACTION OF THE COUNTY OF NORFOLK.
16. THE APPLICANT AND/OR CONTRACTOR MUST SUBMIT A DETAILED DISINFECTION AND COMMISSIONING PLAN TO THE COUNTY OF NORFOLK PUBLIC WORKS PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.
17. NO WORK ON WATER SERVICES CAN TAKE PLACE WITHOUT SUPERVISION OF A LICENSED NORFOLK COUNTY WATER OPERATOR ON-SITE.
18. EXISTING WATER SERVICE LOCATED ON THE EAST SIDE OF THE PROPERTY IS TO BE DECOMMISSIONED.
19. TRACER WIRE TO BE INSTALLED AND NOTED PER NORFOLK COUNTY DESIGN CRITERIA SECTION 10.6.0
20. DOMESTIC WATER SERVICE WILL REQUIRE REDUCED PRESSURE FLOW ASSEMBLY AFTER WATER METER. NO BYPASS WILL BE ALLOWED WITHOUT THE APPROVAL OF THE DIRECTOR OF ENVIRONMENTAL SERVICES. IF THE BYPASS IS ALLOWED THEN ADDITIONAL WATER METER WILL BE REQUIRED WITH A RPZ ASSEMBLY AND THE OWNER WILL BE BILLED MONTHLY FOR THE METER CONSUMPTION.

SANITARY & STORM SEWERS:

1. SANITARY & STORM SEWERS & RELATED APPURTENANCES SHALL BE DESIGNED AND CONSTRUCTED SO AS TO COMPLY WITH APPLICABLE LAW, TO BE CONSISTENT WITH THE COUNTY OF NORFOLK DEVELOPMENT AND ENGINEERING STANDARDS AND IN ACCORDANCE WITH CURRENT GUIDELINES, CODES, REGULATIONS, BEST PRACTICES AND STANDARDS PRESCRIBED BY THE COUNTY.
2. COVER AND BEDDING MATERIAL FOR CONCRETE PIPE AS PER OPSD 802.030 CLASS 'B' BEDDING SHALL BE GRANULAR 'A' MATERIAL UNLESS OTHERWISE INDICATED.
3. COVER AND BEDDING MATERIAL FOR PVC PIPE AS PER OPSD 802.010 TYPE 2 TRENCH BEDDING SHALL BE GRANULAR 'A' MATERIAL UNLESS OTHERWISE INDICATED.
4. PVC PIPE WILL REQUIRE SPECIAL CONSTRUCTION PROCEDURES FOR LEAKAGE AND TESTING, PIPE DEFLECTION, ETC.
5. ALL SEWERS TO BE FLUSHED & VIDEOED PRIOR TO THE SUBMISSION OF THE FIRST INTERIM COMPLETION CERTIFICATE AND PRIOR TO THE FINAL COMPLETION CERTIFICATE
6. ALTERNATE MATERIALS MAY BE ACCEPTABLE, PROVIDED APPROVAL HAS FIRST BEEN OBTAINED FROM THE COUNTY OF NORFOLK AND ENGINEER IN WRITING.
9. ALL STORM MANHOLES AND CATCHBASINS TO BE PRECAST CONCRETE STRUCTURES MANUFACTURED IN PRE QUALIFIED PLANTS IN ACCORDANCE WITH THE LATEST APPLICABLE ONTARIO PROVINCIAL STANDARD (OPS) DRAWINGS AND SPECIFICATIONS.
10. ALL SEWER INSTALLATIONS TO CONFORM WITH OPSD 802.031 TYPE 3 SOIL
11. ALL MANHOLE FRAMES AND COVERS TO CONFORM WITH OPSD 401.010 TYPE 'A' CLOSED COVER.
12. MANHOLES SHALL BE SUPPLIED TO THE SITE PRE-BENCHED UNLESS OTHERWISE NOTED
13. PRIVATE SANITARY & STORM DRAINS TO BE LOCATED AS PER THE TYPICAL LOT SERVICING DETAIL THIS SHEET.
14. PRIVATE SANITARY DRAINS TO 150mmø PVC DR28 PIPE
15. A 38x89mm x 2.0m LONG MARKER IS TO BE PLACED FROM THE CAPPED LATERAL AND EXTEND 1.0m ABOVE GROUND AND PAINTED GREEN FOR SANITARY AND WHITE FOR STORM
16. BEDDING FOR PRIVATE SANITARY & STORM DRAINS AS PER OPSD 1006.02 TYPE 2 TRENCH WITH GRANULAR 'A' BEDDING AND COVER MATERIAL.
17. MINIMUM FALL FOR PRIVATE SANITARY & STORM DRAINS TO BE 2.0%
18. INFILTRATION GALLERIES/PROPOSED DRYWELLS ARE NOT THE RESPONSIBILITY OF NORFOLK COUNTY.
19. ALL APPLICABLE PERMITS ARE TO BE APPLIED FOR PRIOR TO THE INSTALLATION OF ANY SERVICES.
20. ALL ON-SITE STORM SEWERS TO BE REMOVED OR FILLED WITH GROUT.
21. ALL SANITARY SEWER LATERAL CONNECTIONS SHALL BE INSTALLED USING PREFABRICATED TEES. THE USE OF SERVICE SADDLES MUST BE APPROVED BY NORFOLK COUNTY ENVIRONMENTAL SERVICES DIVISION. ALL CONNECTIONS SHALL CONFORM TO CURRENT OPSD 1006.010 AND OPSS 410.
22. NO DEFLECTIONS OF SANITARY LATERALS ALLOWED FROM MAIN TO PROPERTY LINE. NEW CONNECTIONS MUST BE 3.0m FROM PROPERTY LINE BARS OR AS APPROVED BY THE MANAGER OF ENVIRONMENTAL SERVICES. AFTER THE PROPERTY LINE ONLY 22.5' & 45' 1.2m SWEEPS ARE ALLOWED. CLEANOUTS ARE REQUIRED EVERY 30.5m AND PRIVATE MANHOLES EVERY 91.3m
23. SPATIAL SEPARATION FROM WATER SERVICE CONNECTIONS OF NOT LESS THAN 2.50m MEASURED HORIZONTALLY FROM UNDISTURBED OR COMPACTED EARTH OR AS APPROVED BY THE MANAGER OF ENVIRONMENTAL SERVICES.
24. EXISTING SANITARY SERVICE LOCATED ON THE EAST SIDE OF PROPERTY TO BE DECOMMISSIONED.
25. ALL SANITARY, STORM OR FORCE MAINS SHALL MEET THE NORFOLK COUNTY DESIGN CRITERIA OR DESIGN CRITERIA FOR SANITARY SEWER, STORM SEWER AND FORCE MAINS FOR ALTERATION AUTHORIZED UNDER AN ENVIRONMENTAL COMPLIANCE APPROVAL MINISTRY OF ENVIRONMENT, CONSERVATION AND PARKS. ALL WATER MAIN INFRASTRUCTURE SHALL MEET THE NORFOLK COUNTY DESIGN AND CRITERIA OR WATERMAIN DESIGN CRITERIA FOR ALTERATION AUTHORIZED UNDER A DRINKING WATER PERMIT ENVIRONMENTAL COMPLIANCE APPROVAL MINISTRY OF ENVIRONMENT, CONSERVATION AND PARKS.

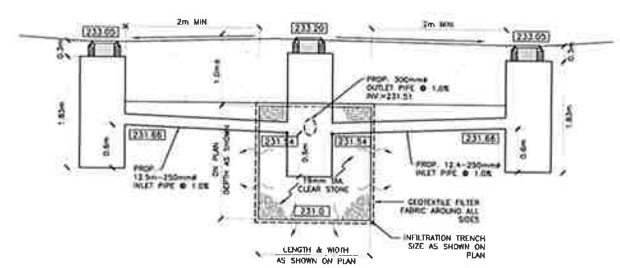
THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND ABOVEGROUND UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE COMMENCING WORK, THE CONTRACTOR SHALL FAMILIARIZE HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

LEGEND:

- EXISTING SANITARY MANHOLE
- EXISTING STORM MANHOLE
- EXISTING CATCHBASIN
- EXISTING DOUBLE CATCHBASIN
- EXISTING DITCH INLET CATCHBASIN
- EXISTING FIRE HYDRANT
- EXISTING VALVE & BOX
- EXISTING WATER BOX
- EXISTING LIGHT STANDARD
- S1 PROPOSED SANITARY MANHOLE
- PROPOSED SANITARY SERVICE
- PROPOSED STORM SERVICE
- ST1 PROPOSED STORM MANHOLE
- ST1 PROPOSED CATCHBASIN MANHOLE
- CB PROPOSED CATCHBASIN
- V&B PROPOSED VALVE & BOX
- CS PROPOSED WATER SERVICE & CURBSTOP
- W/P PROPOSED WALL PACK LIGHTING
- LP PROPOSED LIGHT POLE

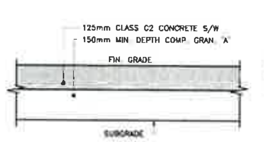
NOTES:

1. ALL ELEVATIONS SHOWN ARE METRIC.
2. BUILDER/OWNER TO VERIFY COMPLIANCE WITH ZONING BYLAWS (ie. SIDEYARDS, SETBACKS, REARYARDS ETC.)
3. BOUNDARY AND TOPOGRAPHIC SURVEY PROVIDED BY JEWITT AND DIXON SURVEYING (PROJECT 22-3363 DATED MAY 26, 2022)
4. A ROAD OCCUPANCY PERMIT WILL BE REQUIRED FOR EXCAVATION AND INSTALLATION OF SANITARY LATERAL AND INSPECTION MANHOLE, REMOVAL OF EXISTING WATER AND SANITARY SERVICES AND PLACEMENT OF THE NEW WATER SERVICE. THE PERMIT MUST BE OBTAINED PRIOR TO THE START OF ANY EXCITATION.



INFILTRATION GALLERY DETAIL

N.T.S.

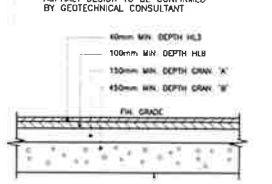


NOTES:
1. SIDEWALK GRADE TO BE 0.5 to 6.0%
2. SIDEWALK CROSSFALL TO BE 2.0 to 4.0%
3. SIDEWALK WIDTH TO BE 1.5m OR MATCH EXISTING

TYP. SIDEWALK DETAIL

N.T.S.

NOTE:
ASPHALT DESIGN TO BE CONFIRMED BY GEOTECHNICAL CONSULTANT



ASPHALT DESIGN FOR ROAD RESTORATION

N.T.S.

STORM SYSTEM

MH No.	DESCRIPTION	T/G	INVERTS
ST1	0.6x0.6x1.52m P/C CB	233.30	S 231.93
ST2	0.6x0.6x1.52m P/C CB	233.05	N 231.68 E 231.66
ST3	0.6x0.6x1.52m P/C CB	233.40	S 232.03
ST4	0.6x0.6x1.52m P/C CB	233.05	N 231.68 W 231.66 NW 231.74
ST5	STORMCEPTOR EFO4	233.20	N 231.52 W 231.54 E 231.54

SANITARY SYSTEM

MH No.	DESCRIPTION	T/G	INVERTS
S1	1.2mø P/C MH (INSPECTION MANHOLE)	233.75±	N 231.30 S 231.36
S2	1.2mø P/C MH c/w DROP STRUCTURE	233.75±	EX. 228.87 S 230.48
S3	1.2mø P/C MH	233.58	N 231.65 E 231.73

WATERMAIN SUMMARY – JOINT RESTRAINTS

LOCATION / DESCRIPTION	LENGTH TO BE RESTRAINED (L_r)
150mm 2A PVC [illegible]	[illegible]
250x250x150mm PVC [illegible]	[illegible]

INPUT PARAMETERS:
SOIL TYPE: ML. FACTOR OF SAFETY: 1.5:1. TRENCH TYPE: 5.
DEPTH OF BURY: 1.7m. TEST PRESSURE: 200 P.S.I.

LICENSED PROFESSIONAL ENGINEER 06/02/24 R. W. PHILLIPS PROVINCE OF ONTARIO

T.B.M. No. 1 ELEV. = 234.25m (GEO)

NO.	REVISION	DATE	BY
4	STORMCEPTOR/ASPHALT DESIGN	03/06/24	S.L.M.
3	HYDRO SERVICE	02/16/24	S.L.M.
2	WATER & SANITARY SERVICING	02/06/24	K.P.B.
1	AS PER COUNTY COMMENTS	01/19/24	S.L.M.

J.H. COHOON ENGINEERING LIMITED
CONSULTING ENGINEERS
440 HARDY ROAD, UNIT #1, BRANTFORD – ONTARIO, N3T 5L8
TEL. (519) 753-2656 FAX. (519) 753-4263 www.cohooneng.com

PROPOSED
MIXED USE BUILDING
LOTS 2 & 3, BLOCK 16
R-PLAN 189
78 KING STREET, DELHI
NORFOLK COUNTY

SENTRY GROUP

SERVICING PLAN

DESIGN	R.W.P.	SCALE	1:150
DRAWN	S.L.M./K.P.B.	JOB No.	16025
CHECKED	R.W.P.		
SHEET	2 of 2	DWG. No.	16025-2
DATE	APR. 20/23		

Appendix 'B'
Soil Mat Engineers & Consultants Ltd Report dated June 29, 2022

SOIL-MAT ENGINEERS & CONSULTANTS LTD.
www.soil-mat.ca info@soil-mat.ca TF: 800.243.1922
Hamilton: 130 Lancing Drive L8W 3A1 T: 905.318.7440 F: 905.318.7455
Milton: PO Box 40012 Derry Heights PO L9T 7W4 T: 800.243.1922

PROJECT NO.: SM 220178-G

June 29, 2022

SENTRY PROPERTY GROUP
224 Colborne Street West – Unit 4
Brantford, Ontario
N4T 1L8

Attention: Darrin Knill, P. Eng.

GEOTECHNICAL INVESTIGATION
PROPOSED MIXED-USE STRUCTURE
78 KING STREET
DELHI, ONTARIO

Dear Mr. Knill,

Further to your authorisation, SOIL-MAT ENGINEERS & CONSULTANTS LTD. has completed the fieldwork, laboratory testing, and report preparation in connection with the above noted project. The scope of work was completed in general accordance with our proposal P220178, dated March 11, 2022. Our comments and recommendations based on our findings at the five [5] borehole locations are presented in the following paragraphs.

1. INTRODUCTION

We understand that the project will involve the construction of a basementless, 3 to 4 storey mixed-use structure, upon demolition of the existing structure located at 78 King Street in Delhi, Ontario. It is understood that the development would also include the construction of an asphalt paved surface level parking lot. The purpose of this geotechnical investigation work is to assess the site subsurface soil conditions, and to provide our comments and recommendations with respect to the design and construction of the extension from a geotechnical point of view.

This report is based on the above summarised project description, and on the assumption that the design and construction will be performed in accordance with the applicable codes and standards. Any significant deviations from the proposed project design may void the recommendations given in this report. If significant changes are made to the proposed design, this office must be consulted to review the new design with respect to the results of this investigation.

2. PROCEDURE

A total of five [5] sampled boreholes were advanced at the locations illustrated in the attached Drawing No. 1, Borehole Location Plan. The boreholes were advanced using direct push equipment on April 11, 2022 under the direction and supervision of representatives of SOIL-MAT ENGINEERS & CONSULTANTS LTD. and PINCHIN LTD. to termination at depths of approximately 10.7 metres below the existing ground surface.

Upon completion of drilling, groundwater monitoring wells were installed at all borehole locations to allow for future measurements of the static groundwater level. The monitoring wells consist of 50-millimetre diameter PVC pipe, screened in the lower 3 metres. The wells were encased in well filter sand up to approximately 0.3 metres above the screened portion, then with bentonite 'hole plug' up to the surface and fitted with a protective "flush mount" casing.

Representative samples of the subsoils were recovered from the borings at selected depth intervals using direct push equipment with soil properties determined by dynamic cone penetration testing directly adjacent to the sampled borehole. After undergoing a general field examination, the soil samples were preserved and transported to the SOIL-MAT laboratory for visual, tactile, and olfactory classifications. Routine moisture content tests were performed on all soil samples recovered from the borings, with hand penetrometer testing conducted on cohesive samples. A selected sample of the native soils was submitted for grain size analysis.

The boreholes were located in the field by representatives of SOIL-MAT ENGINEERS based on accessibility over the site and clearance of underground utilities. The ground surface elevation at the borehole locations was referenced to a temporary benchmark, described as the top of manhole cover located on the centreline of King Street, east of the project area, as shown on Drawing No. 1, Borehole Location Plan. This benchmark has been assigned an elevation of 100.00 metres for convenience.

Details of the conditions encountered in the boreholes, together with the results of the field and laboratory tests, are presented in Log of Boreholes Nos. 1 to 5 inclusive, following the text of this report.

3. SITE DESCRIPTION AND SUBSURFACE CONDITIONS

The subject site is located at 78 King Street in Delhi, Ontario and consists of a used car dealership fronting onto King Street to the north. The property is bordered by commercial properties to the west, a church to the south and residential properties to the east. The subject site is relatively flat and even, roughly level with the adjacent roadways.

The subsurface conditions encountered at the borehole locations are summarised as follows:

Pavement Structure

All boreholes were advanced through the existing pavement structure, which was noted to consist of approximately 250 to 300 millimetres of compact granular base, with approximately 80 millimetres of asphaltic concrete overlying the granular base in Borehole No. 5.

Silty Sand Fill

Silty sand fill material was encountered beneath the pavement structure at all borehole locations. The fill was reddish brown in colour and contained trace gravel and clay with occasional construction debris in the upper levels. The granular fill soil encountered was generally very loose to compact in consistency and proven to depths of approximately 1.5 to 3.0 metres below the existing ground surface.

Sand

Native sand material was encountered beneath the silty sand fill material at all borehole locations. The native material was brown in colour containing trace to some gravel becoming coarser with depth and containing occasional silty sand seams. The granular soil encountered was generally very loose to dense in consistency and proven to depths of 9.4 to 10.7 metres below the existing ground surface.

As noted above, one [1] selected sample was subjected to grain size analysis including sieve and hydrometer tests. The result of this grain size analysis has been summarised as follows:

TABLE A: SUMMARY OF GRAIN SIZE ANALYSIS

Sample	Depth [m]	Clay [%]	Silt [%]	Sand [%]	Gravel [%]
BH1 SS3	1.5	3	8	89	0

Silty Clay/Clayey Silt

Native silty clay/clayey silt soils were encountered beneath the native sand material with the exception of Borehole No. 3. The native material was brown in colour, transitioning to grey with depth, containing trace sand and gravel. The cohesive soil was generally very stiff to hard in consistency and proven to termination at depths of approximately 10.7 metres below the existing ground surface.

Groundwater Observations

All boreholes were recorded as being open and 'wet' at depths ranging from 7.0 to 7.5 metres below the existing ground surface. It is noted that insufficient time would have passed for the static groundwater level to stabilise in the open boreholes. As noted above, monitoring wells were installed at all borehole locations to allow for future measurements of the static groundwater level. The details of the monitoring well installation, as well as the groundwater measurements taken by PINCHIN LTD., have been summarised as follows:

TABLE B: SUMMARY OF GROUNDWATER MEASUREMENTS

BH/MW #	Ground Surface Elevation	MW Depth (m)	Screened Interval (m)	Date	Water Depth	Water Elevation
1	100.46	10.67	7.62–10.67	29/04/22	7.42	93.04
2	100.21	10.67	7.62–10.67	29/04/22	7.05	93.16
3	100.21	10.67	7.62–10.67	29/04/22	6.97	93.24
4	100.27	10.67	7.62–10.67	29/04/22	7.09	93.18
5	100.44	10.67	7.62–10.67	29/04/22	7.30	93.14

It is noted that the elevations above are based on the reference of a temporary benchmark with an assumed elevation of 100.00 metres. These elevations should be corrected once a geodetic elevation of the benchmark utilised has be established.

4. FOUNDATION CONSIDERATIONS

Without underground levels, it is anticipated that the proposed structure would typically have a founding elevation on the order of approximately 1 to 2 metres below the existing grade. However, given the encountered depths of fill, it is recommended that the foundations extend to depths of 3 to 4 metres, where more competent native soils are encountered. The soil conditions encountered at these depths are generally considered to be suitable to support the proposed structure on conventional spread footings founded in the undisturbed native sand soils, below any fill or otherwise unsuitable material. Spread footings founded in the competent native sand 3 metres below the ground surface may be designed using a factored Ultimate Limit State [ULS] bearing capacity of 150 kPa [~3,000 psf]. The allowable bearing stress at Serviceability Limit State [ULS] should be limited to 100 kPa [~2,000 psf], based on the total and differential settlements not exceeding 25 and 20 millimetres respectively. These design bearing capacities are based on a minimum footing width of one metre wide, and would decrease linearly with footing width such that a width of zero would also have a bearing capacity of zero.

Alternatively, the proposed additions to the structure may be supported on helical piers installed into the compact sand soils below at a depth of approximately 4 metres or greater below the exterior grade of the structure. Helical piers may be a preferred option considering the relative ease of access, the speed of installation, limited vibration and disturbance of the neighbouring structures, as well as the lack of spoil and no need to place large volumes of concrete. As helical pier systems are proprietary in nature a specialty contractor should be consulted in the design process. On a preliminary basis, helical piers installed in the compact granular soils may be expected to develop approximate capacities of 200 kN [45 kips] SLS and 270 kN [60 kips] ULS.

It is noted that the SLS value represents the Serviceability Limit State, which is governed by the tolerable deflection [settlement] based on proposed building type, using unfactored load combinations. The ULS value represents the Ultimate Limit State and is intended to reflect an upper limit of the available bearing capacity of the founding soils in terms of geotechnical design, using factored load combinations. There is no direct relationship between ULS and SLS; rather they are a function of the soil type and the tolerable deflections for serviceability, respectively. Evidently, the bearing capacity would be lower for more settlement sensitive structures, and larger for more flexible buildings.

The support conditions afforded by the founding soils are usually not uniform across the site, neither are that loads on various foundation elements. It is therefore recommended that the footings and foundation walls be structurally reinforced to account for the potential variable support conditions.

In areas where it will be necessary to provide adjacent footings at different founding elevations, the lower footing should be constructed before the higher footing is constructed, if possible, and the higher footing should be set below and imaginary line drawn up from the lower footing at 10 horizontal to 7 vertical. This practice will stress transfer from the higher footings to the lower footings.

All footings exposed to the environment must be provided with a minimum of 1.2 metres of earth cover or equivalent insulation to protect against frost damage. This frost protection would also be required if construction were undertaken during the winter months. All footings and foundations should be designed and constructed in accordance with the current Ontario Building Code.

With foundations designed as outlined above and as required by the Ontario Building Code, and with careful attention paid to construction detail, total and differential settlement should be well within normally tolerated limits of 25 and 20 millimetres respectively, for the type of building and occupancy expected.

It is imperative that a soils engineer be retained from this office to provide geotechnical engineering services during the excavation and foundation construction phases of the project. This is to observe compliance with the design concepts and recommendations of this report and to allow changes to be made in the event that the subsurface conditions differ from the conditions identified at the borehole locations.

5. SEISMIC DESIGN CONDITIONS

The structure shall be designed according to Section 4.1.8 of the Ontario Building Code, Ontario Regulation 332/12. Based on the subsurface soil conditions encountered in this investigation the applicable Site Classification for the seismic design is Site Class D, stiff soil, based on the average soil characteristics for this site.

The seismic data from Supplementary Standard SB-1 of the Ontario Building Code for nearby Simcoe are as follows:

S_a (0.2)	S_a(0.5)	S_a(1.0)	S_a(2.0)	S_a(5.0)	S_a(10.0)	PGA	PGV
0.141	0.084	0.047	0.0230	0.0058	0.0024	0.087	0.064

6. FLOOR SLAB AND PERMANENT DRAINAGE

The floor slab may be constructed using conventional slab-on-grade techniques on a prepared subgrade. The exposed subgrade surface should be well compacted in the presence of a representative of SOIL-MAT ENGINEERS. Ant 'soft spots' delineated during this work should be sub-excavated and replaced with quality backfill material compacted to 100 per cent of its standard Proctor maximum dry density [SPMDD]. The subgrade level can then be raised to the design level with granular soils compacted to 100 per cent of its SPMDD. Granular fill such as Ontario Provincial Standard Specification [OPSS] Granular 'B', Type II (crushed limestone bedrock) product is preferred within the building footprint due to its relative insensitivity to weather conditions, ease in achieving the required degree of compaction, and its quick repose to applied stresses.

As with all concrete floors, there is a tendency for the floor slabs to crack. The slab thickness, concrete mix design, the amount of steel and/or fiber reinforcement and/or wire mesh placed into the concrete, if any, will therefore be a function of the owner's tolerance for cracks in and movements of, the slabs-on-grade, etc. The 'saw-cuts' in the concrete floors, for crack control, should extend to a minimum depth of 1/3 of the slab thickness.

A moisture barrier will be required under the floor slabs such as the placement of at least 200 millimetres of well compacted 20-millimetre clear crushed stone. At a minimum the moisture barrier material should contain no more then 10 per cent passing the No. 4 sieve. Where 'non-damp' floor slabs are required, as for instance under sheet vinyl floor coverings, etc., extra efforts will be required to damp proof the floor slab, as with the additional provisions of a heavy 'poly' sheet, damp proofing sprays/membranes, drainage board products, etc. Where 'poly' sheets are used care should be taken to prevent puncturing and tearing and/or sufficiently heavy gauge sheeting specified.

Curing of the slab-on-grade must be carefully specified to ensure that slab curl is minimised. This is especially critical during the hot summer months of the year when the surface of the slab tends to dry out quickly while high moisture conditions in; the moisture barrier or water trapped on any 'poly' sheet, at the sawcut joints and cracks, and at the edges of the slabs, maintains the underside of the slab in a moist condition.

It is important that the concrete mix design provide a limiting water/cement ratio and total cement content, which will mitigate moisture related problems with low permeance floor coverings, such as debonding of vinyl and ceramic tile. It is equally important that free excess water not be added to the concrete during its placement as this could increase the potential for shrinkage cracking and curling of the slab.

Where the finished floor elevation is less then 300 millimetres above the finished exterior grade consideration should be given to the provision of a perimeter weeping tile system to prevent the buildup of water against foundations. Where provided, the perimeter drainage system should consist of 100 millimetre perforated pipe, encased in a geofabric sock and covered with a minimum of 200 millimetres of a 20 millimetres clear crushed stone product, in turn encased in a heavy geotextile product. The suppliers of the filter geotextile should be consulted as to the best type suited to this project. This office should examine the installation of the drains. Even a small break in the filtering materials could result in a loss of fines into the drains with attendant performance difficulties, including settlements of the ground surface. The perimeter drains should outlet to a gravity sewer connection, nearby catch basin, or a sump pit a minimum of 150 millimetres below the underside of finished floor. The exterior grade around the structure should be sloped away from the structure to prevent the ponding of water against the foundation walls. The enclosed Drawing No. 2 shows the schematics of the typical requirements for slab-on-grade construction without a basement level.

7. EXCAVATIONS

Excavations for the installations of the foundations and underground services are generally expected to extend to depths of up to about 2 to 3 metres below the existing grade. Excavations through the native sand and silty sand fill materials may be expected to remain stable for the short excavation period at inclinations up to 45 degrees to the horizontal. Where encountered, the presence of old foundations, underground structures, debris, etc., would be expected to slow the rate of construction. Nevertheless, all excavations must comply with the current Occupation Health and Safety Act and Regulations for Construction Projects. In regards to the Safety Act, the encountered silty sand fill and native sand soils would be considered a Type 3 Soil. Excavation slopes steeper than those required in the Safety Act must be supported or a trench box must be provided, and a senior engineer from this office should monitor the work.

As noted above the static groundwater level is estimated at a depth of approximately 7 to 8 metres below the existing ground surface, generally well below the anticipated depths of construction. Regardless, some minor infiltration of perched water through permeable seams, as well as runoff into open excavations, should be anticipated. Although the infiltration rate in high permeable sand is anticipated to be high, any perched water infiltration for the short construction period would be relatively limited such that using conventional construction dewatering methods are anticipated to suffice, such as pumping from sumps in the base of excavations. More groundwater control should be anticipated when making connection to existing services, and excavations through the areas of existing structures and service trenches. Surface water should be directed aways from the excavations.

The base of the excavations on the native sand encountered in the boreholes should generally remain compact and stable. Therefore, standard pipe bedding, as typically specified by the Ontario Provincial Standard Specification will be satisfactory, compacted to 95 per cent of its standard Proctor maximum dry density [SPMDD], should suffice.

8. BACKFILL CONSIDERATIONS

The excavated materials will primarily consist of the native sand and silty sand fill soils encountered in the boreholes, as described above. These soils are generally considered suitable for use as engineered fill, trench backfill, etc., provided they are free of organics, debris, or other deleterious material, and that their moisture contents can be controlled to within 3 per cent of their standard Proctor optimum moisture content.

While the silty sand/sand soils are moderately permeable, they would not strictly be considered 'free draining' and should not be used where this characteristic is necessary. The fine to medium grained soils encountered are generally considered to be near to 'dry' of their standard Proctor optimum moisture content, depending on depth. Some moisture conditioning may be required depending upon the weather conditions at the time of construction.

The use of a free draining, well-graded granular material, such as an Ontario Provincial Standard Specification [OPSS] Granular 'B', Type II (crushed limestone bedrock), is recommended for backfill against foundation walls or to raise the interior grade to the design subgrade level. This material is more readily compacted in restricted access areas, and generally presents a more positive support condition for interior floor slabs and exterior concrete sidewalks.

After a period of heavy precipitation, any near-surface softened material should be allowed to dry or be removed from the fill surface and discarded. The on-site soils encountered are generally considered to be near to 'dry' of their standard Proctor optimum moisture content. Some moisture conditioning may be required depending on the weather conditions at the time of construction.

We note that where backfill material is placed near or slightly above its optimum moisture content, the potential for long term settlements due to the ingress of groundwater and collapse of the fill structure is reduced. Correspondingly, the shear strength of the 'wet' backfill material is also lowered, thereby reducing its ability to support construction traffic. If the soil is well dry of its optimum value, it will appear to be very strong when compacted, but will tend to settle with time as the moisture content in the fill increases to equilibrium condition. Any imported fill required in the service trenches or to raise the subgrade elevation should have its moisture content within 3 per cent of its optimum moisture content and meet the necessary environmental guidelines.

A representative of SOIL-MAT should be present on-site during the backfilling and compaction operations to confirm the uniform compaction of the backfill material to project specification requirements. Close supervision is prudent in areas that are not readily accessibly to compaction equipment, for instance near the end of compaction 'runs'. All structural fill should be compacted to 100 per cent of its SPMDD. Backfill within service trenches, areas to be paved, etc., should be compacted to a minimum of 95 per cent of its SPMDD, and to 100 per cent of its SPMDD in the upper 1 metre below the design subgrade level. The appropriate compaction equipment should be employed based on soil type, i.e. pad-toe for cohesive soils and smooth drum/vibratory plate for granular soils. A method should be developed to assess compaction efficiency employing the on-site compaction equipment and backfill materials during construction.

9. PAVEMENT DESIGN CONSIDERATIONS

All areas to be paved should be stripped of all organic or otherwise unsuitable materials. The exposed subgrade should be proof rolled with 3 to 4 passes of a loaded tandem truck in the presence of a representative of SOIL-MAT ENGINEERS & CONSULTANTS LTD., immediately prior to the placement of the sub-base material. Any areas of distress revealed by this or other means must be sub-excavated and replaced with suitable backfill material. Alternatively, the soft areas may be stabilised by placing coarse crushed stone and 'punching' it into the soft areas. Where the subgrade condition is poorer it may be necessary to implement more aggressive stabilisation methods, such as the use of coarse aggregate [50-millimetre clear stone, 'rip-rap', etc.] 'punched' into the soft areas. The need for the treatment of softened subgrade will be reduced if construction is undertaken during the dry summer months and careful attention is paid to the compaction operations. The fill over shallow utilities cut into or across paved areas such as telephone, hydro, gas, etc. must also be compacted to 100 per cent if its standard Proctor dry density.

Good drainage provisions will optimise the long-term performance of the pavement structure. The subgrade must be properly crowned and shaped to promote drainage to the subdrain system. Subdrains should be installed to intercept excess subsurface water and mitigate softening of the subgrade material. Surface water should not be allowed to pond adjacent to the outer limits of the paved areas.

The most severe loading conditions on the subgrade typically occur during the course of construction, therefore precautionary measures may have to be taken to ensure that the subgrade is not unduly disturbed by construction traffic. SOIL-MAT should be given the opportunity to review the final pavement structure design and subdrain scheme prior to construction to ensure that they are consistent with the recommendations of this report.

If construction is conducted under adverse weather conditions, additional subgrade preparation may be required. During wet weather conditions, such as during the Fall and Spring months, or during colder winter weather, it should be anticipated that additional subgrade preparation will be required, such as additional depth of Ontario Provincial Standard Specification [OPSS] Granular 'B', Tyle II (crushed limestone bedrock) sub-base material. It is also important that the sub-base and base granular layers of the pavement structure be placed as soon as possible after exposure, preparation, and approval of the exposed subgrade.

The suggested pavement structures outlined in Table C below are based on subgrade parameters estimated on the basis of visual and tactile examinations of the on-site soils and past experience. The outlined pavement structure may be expected to have an approximate ten to fifteen-year life, assuming that regular maintenance is performed. Should a more detailed pavement structure design be required, site specific traffic information would be needed, together with detailed laboratory testing of the subgrade soils.

TABLE C – RECOMMENDED PAVEMENT STRUCTURES

LAYER DESCRIPTION	COMPACTION REQUIREMENTS	LIGHT DUTY SECTIONS	HEAVY DUTY [TRUCK ROUTE]
Asphaltic Concrete Wearing course OPSS HL 3 or HL 3A	Min. 92 % Marshall MRD	40 millimetres	40 millimetres
Binder Course OPSS HL 8	Min. 92 % Marshall	50 millimetres	80 millimetres
Base Course OPSS Granular A	100% SPMDD	150 millimetres	150 millimetres
Sub-base Course OPSS Granular B Type II	100% SPMDD	300 millimetres	450 millimetres

* Marshall MRD denotes Maximum Relative Density.
* SPMDD denotes Standard Proctor Maximum Dry Density, ASTM-D698.

Depending on the anticipated traffic, a reduced light duty asphalt structure consisting of 65 millimetres of HL3 surface course may also perform sufficiently. This would be reasonable in areas subjected only to light vehicles such as cars for parking. Such a structure may have a reduced lifespan if subjected to heavier vehicles, and would also not allow for 'mill and pave' type operations for future rehabilitation.

To minimise segregation of the finished asphalt mat, the asphalt temperature must be maintained uniform throughout the mat during the placement and compaction. All to often, significant temperature gradients exist in the delivered and placed asphalt with the cooler portions of the mat resisting compaction and presenting a honeycomb surface. As the spreader moves forward, a responsible member of the paving crew should monitor the pavement surface, to ensure a smooth uniform surface. The contractor can mitigate the surface segregation by 'back-casting' or scattering shovels of the full mix material over the segregated areas and racking out the coarse particles during compaction operations. Of course, the above assumes that the asphalt mix is sufficiently hot to allow the 'back-casting' to be performed.

10. GENERAL COMMENTS

The comments provided in this document are intended only for the guidance of the design team. The material in it reflects SOIL-MAT ENGINEERS' best judgement in light of the information available at the time of preparation. The subsurface descriptions and borehole information are intended to describe conditions at the borehole locations only. It is the contractors' responsibility to determine how these conditions will affect the scheduling and methods of construction for the project. 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. SOIL-MAT ENGINEERS 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 geotechnical report is sufficient for your present requirements. Should you require any additional information or clarification as to the contents of this document, please do not hesitate to contact the undersigned.

Yours very truly,
SOIL-MAT ENGINEERS & CONSULTANTS LTD.

Kevin Reid, B.Eng., EIT.

Adam Roemmele, P. Eng.
Project Engineer

LICENSED PROFESSIONAL ENGINEER
June 29/22
A.D. ROEMMELE
100212893
PROVINCE OF ONTARIO

Stephen R. Sears, B. Eng. Mgmt., P. Eng., QP_{ESA}
Review Engineer

Enclosures: Drawing No.1, Borehole Location Plan
Log of Borehole Nos. 1 to 5, inclusive
Drawing No. 2, Typical Design Requirements – Slab-on-Grade with Perimeter Drainage

Distribution: Sentry Property Group [1, plus pdf]

LEGEND

Borehole Location
BH#

Temporary Benchmark
Top of Manhole Cover
Assigned Elevation : 100 m
TBM

NOTES

1. This drawing should be read in conjunction with SOIL-MAT ENGINEERS & CONSULTANTS LTD. Report No. SM 220178-G.

2. Borehole locations are approximate.

SOIL-MAT

ENGINEERS & CONSULTANTS LTD.

Geotechnical Investigation
Proposed Mixed-Use Structure
78 King Street
Delhi, Ontario

Borehole Location Plan

Project No. SM 220178-G

Date: April 2022

Drawn: CL | Checked: AR

SM 220178-G Borehole Location Plan

Drawing No. 1

Log of Borehole No. 1

Project No: SM 220178-G
Project: Proposed Mixed-Use Structure
Location: 78 King Street, Delhi
Client: Sentry Property Group

Project Manager: Adam Roemmele, P.Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 541094
E: 4744854

Depth (ft)	Depth (m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		100.46	Ground Surface							
		100.16	**Pavement Structure** Approximately 300 millimetres of compact granular base.							
			Silty Sand Fill Reddish brown, trace to some gravel, trace clay, occasional construction debris in the upper levels, very loose to compact.	DC	1	4,4,3,2	7			
				DC	2	1,2,1,1	3			
				DC	3	2,2,3,2	5			
				DC	4	3,3,3,3	6			
				DC	5	4,5,8,8	13			
		97.40	**Sand** Brown, trace to some gravel, becoming coarser with depth, occasional sandy silt seams in the upper levels, compact to dense.	DC	6	11,11,17,18	28			
				DC	7	19,19,12,12	31			
				DC	8	14,15,22,21	37			
				DC	9	21,22,12,12	34			
				DC	10	7,7,9,10	16			
				DC	11	16,17,18,17	35			
				DC	12	11,11,21,21	32			
				DC	13	26,25,21,21	46			
				DC	14	10,10,14,13	24			
				DC	15	10,12,11,10	23			
		91.00	**Silty Clay/Clayey Silt** Brown, trace sand and gravel, very stiff.	DC	16	9,8,9,8	17			
		89.90		DC	17	7,12,15,22	27		3.5	
			Transition to grey in color	DC	18	24,7	31			
			End of Borehole							

NOTES:
1. Borehole was advanced using direct push and dynamic cone equipment on April 11, 2022 to termination at a depth of 10.67 metres.
2. Borehole was recorded as open and 'wet' at a depth of 7.5 metres upon completion and backfilled as per Ontario Regulation 903.
3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)

Drill Method: Direct Push/Dynamic Cone
Drill Date: April 11, 2022
Hole Size: 200 millimetres
Drilling Contractor: Strata Drilling Group

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130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Temporary Benchmark
Field Logged by: CL
Checked by: AR
Sheet: 1 of 1

Log of Borehole No. 2

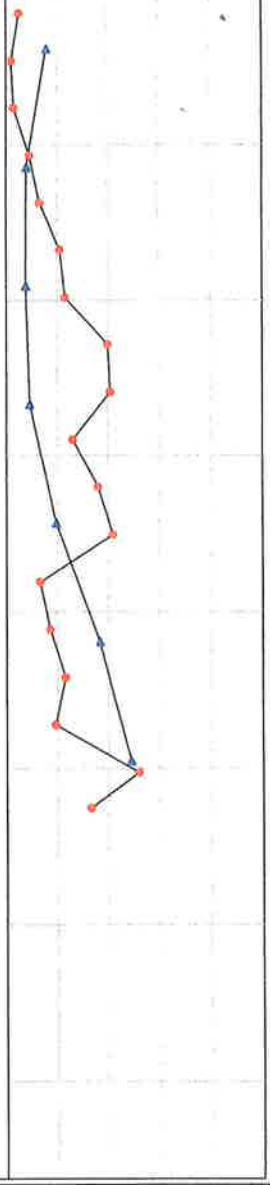
Project No: SM 220178-G
Project: Proposed Mixed-Use Structure
Location: 78 King Street, Delhi
Client: Sentry Property Group

Project Manager: Adam Roemmele, P.Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 541090
E: 4744846

Depth (ft)	Depth (m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		100.21	Ground Surface							
		99.91	**Pavement Structure** Approximately 300 millimetres of compact granular base.							
		98.70	**Silty Sand Fill** Reddish brown, trace gravel and clay, occasional construction debris in the upper levels, loose to very loose.							
			Sand Brown, trace to some gravel, becoming coarser with depth, occasional sandy silt seams in the lower levels, very loose to dense.	DC	1	4,4,1,2	5			
				DC	2	1,1,1,1	2			
				DC	3	0,1,2,1	3			
				DC	4	2,4,5,8	9			
				DC	5	7,6,7,8	13			
				DC	6	9,10,11,14	21			
				DC	7	13,12,11,15	23			
				DC	8	18,21,19,20	40			
				DC	9	20,17,24,21	41			
				DC	10	13,12,14,15	26			
				DC	11	15,16,20,22	36			
				DC	12	22,23,19,17	42			
				DC	13	8,8,5,5	13			
				DC	14	8,8,9,6	17			
				DC	15	11,12,11,10	23			
		90.60		DC	16	10,9,10,12	19			
			Silty Clay/Clayey Silt Brown, trace sand and gravel, hard.	DC	17	15,24,28,17	52		3.0	
		89.80								
		89.50	Transition to grey in color	DC	18	17,16	33			
			End of Borehole							

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:
1. Borehole was advanced using direct push and dynamic cone equipment on April 11, 2022 to termination at a depth of 10.7 metres.

2. Borehole was recorded as open and 'wet' at a depth of 7.0 metres upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Direct Push/Dynamic Cone
Drill Date: April 11, 2022
Hole Size: 200 millimetres
Drilling Contractor: Strata Drilling Group

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Datum: Temporary Benchmark
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Checked by: AR
Sheet: 1 of 1

Log of Borehole No. 3

Project No: SM 220178-G
Project: Proposed Mixed-Use Structure
Location: 78 King Street, Delhi
Client: Sentry Property Group

Project Manager: Adam Roemmele, P.Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 541087
E: 4744837

Ground Surface — Elevation 100.21 m

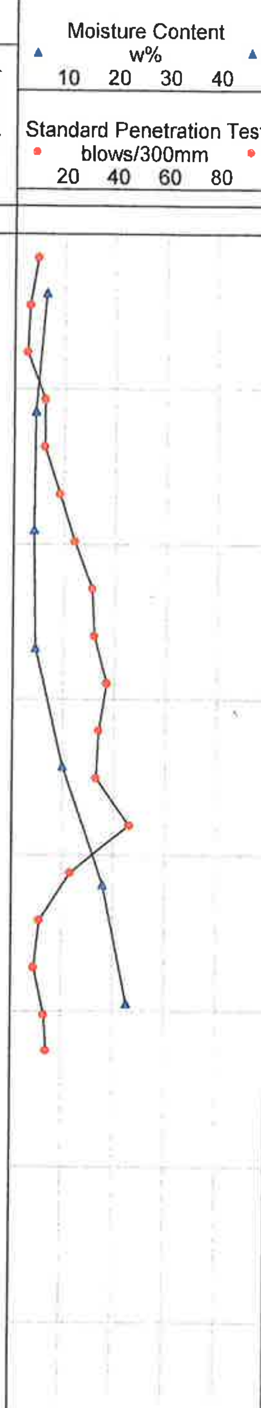
Pavement Structure (0 – approx. 0.25 m)
Approximately 250 millimetres of compact granular base.

Silty Sand Fill (to 98.70 m elevation)
Reddish brown, trace gravel and clay, occasional construction debris in the upper levels, loose.

Sand (to 89.50 m elevation)
Brown, trace to some gravel, becoming coarser with depth, occasional sandy silt seams in the lower levels, loose to dense.

End of Borehole

Type	Number	Blow Counts	Blows/300mm
DC	1	8,6,3,4	9
DC	2	1,2,4,2	6
DC	3	3,2,3,8	5
DC	4	5,6,6,6	12
DC	5	8,6,6,7	12
DC	6	7,8,10,9	18
DC	7	9,10,14,12	24
DC	8	14,16,15,16	31
DC	9	16,16,16,16	32
DC	10	18,18,19,16	37
DC	11	16,17,17,16	34
DC	12	15,16,17,19	33
DC	13	24,22,24,23	46
DC	14	17,13,10,6	23
DC	15	6,6,5,7	11
DC	16	7,4,5,6	9
DC	17	8,7,6,6	13
DC	18	7,7	14



NOTES:
1. Borehole was advanced using direct push and dynamic cone equipment on April 11, 2022 to termination at a depth of 10.7 metres.

2. Borehole was recorded as open and 'wet' at a depth of 7.0 metres upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Direct Push/Dynamic Cone
Drill Date: April 12, 2022
Hole Size: 200 millimetres
Drilling Contractor: Strata Drilling Group

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E: info@soil-mat.ca

Datum: Temporary Benchmark
Field Logged by: CL
Checked by: AR
Sheet: 1 of 1

Log of Borehole No. 4

Project No: SM 220178-G
Project: Proposed Mixed-Use Structure
Location: 78 King Street, Delhi
Client: Sentry Property Group

Project Manager: Adam Roemmele, P.Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 541112
E: 4744827

Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	100.27	Ground Surface							
		Pavement Structure Approximately 250 millimetres of compact granular base.	DC	1	9,9,10,7	19			
		Silty Sand Fill Reddish brown, trace gravel and clay, occasional construction debris and in the upper levels, compact to very loose.	DC	2	7,4,2,2	6			
			DC	3	1,1,2,2	3			
			DC	4	4,2,2,2	4			
	97.50		DC	5	3,2,1,2	3			
		Sand Brown, trace to some gravel, becoming coarser with depth, occasional sandy silt seams in the lower levels, very loose to compact.	DC	6	2,3,2,4	5			
			DC	7	4,4,6,9	10			
			DC	8	12,14,15,14	29			
			DC	9	14,14,13,14	27			
			DC	10	11,10,9,9	19			
			DC	11	11,8,6,5	14			
			DC	12	4,7,8,13	15			
			DC	13	18,16,13,11	19			
			DC	14	14,10,8,10	18			
			DC	15	8,8,9,5	17			
			DC	16	6,7,7,7	14			
	90.40								
		Silty Clay/Clayey Silt Brown, trace sand and gravel, very stiff.	DC	17	7,7,9,10	16		3.0	
	89.60		DC	18	9,8	17			
		End of Borehole							

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)

NOTES:
1. Borehole was advanced using direct push and dynamic cone equipment on April 12, 2022 to termination at a depth of 10.7 metres.

2. Borehole was recorded as open and 'wet' at a depth of 7.6 metres upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Direct Push/Dynamic Cone
Drill Date: April 12, 2022
Hole Size: 200 millimetres
Drilling Contractor: Strata Drilling Group

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Sheet: 1 of 1

Log of Borehole No. 5

Project No: SM 220178-G
Project: Proposed Mixed-Use Structure
Location: 78 King Street, Delhi
Client: Sentry Property Group

Project Manager: Adam Roemmele, P.Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 541117
E: 4744835

Depth (ft)	Depth (m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0	0	100.44	Ground Surface							
		100.06	**Pavement Structure** Approximately 80 millimetres of asphaltic concrete overlying 300 millimetres of compact granular base.	DC	1	6,4,5,12	9			
1				DC	2	2,0,0,0	0			
2				DC	3	2,1,2,2	3			
3	1		**Silty Sand Fill** Reddish brown, trace gravel and clay, occasional construction debris and in the upper levels, very loose to loose.	DC	4	1,4,4,3	8			
4		97.70		DC	5	3,1,2,0	3			
5			**Sand** Brown, trace to some gravel, becoming coarser with depth, occasional sandy silt seams in the lower levels, very loose to compact.	DC	6	0,1,2,1	3			
6	2			DC	7	1,2,3,4	5			
7				DC	8	2,5,6,18	11			
8				DC	9	8,12,10,9	22			
9	3			DC	10	6,4,2,3	6			
10				DC	11	2,3,3,3	6			
11				DC	12	1,2,2,4	4			
12	4			DC	13	4,3,5,4	8			
13				DC	14	6,6,6,6	12			
14				DC	15	7,8,7,15	15			
15	5			DC	16	17,12,10,12	22			
16				DC	17	9,8,23,31	31		3.5	
17				DC	18	44,49	93			
18	6									
19										
20										
21	7									
22										
23										
24										
25	8									
26										
27										
28										
29	9									
30										
31										
32		90.60								
33	10		**Silty Clay/Clayey Silt** Brown, trace sand and gravel, hard.							
34		89.80								
35			End of Borehole							
36	11									
37										
38										
39	12									
40										
41										
42										
43	13									
44										
45										
46	14									
47										
48										
49										

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)

NOTES:
1. Borehole was advanced using direct push and dynamic cone equipment on April 12, 2022 to termination at a depth of 10.7 metres.

2. Borehole was recorded as open and 'wet' at a depth of 7.3 metres upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Direct Push/Dynamic Cone
Drill Date: April 12, 2022
Hole Size: 200 millimetres
Drilling Contractor: Strata Drilling Group

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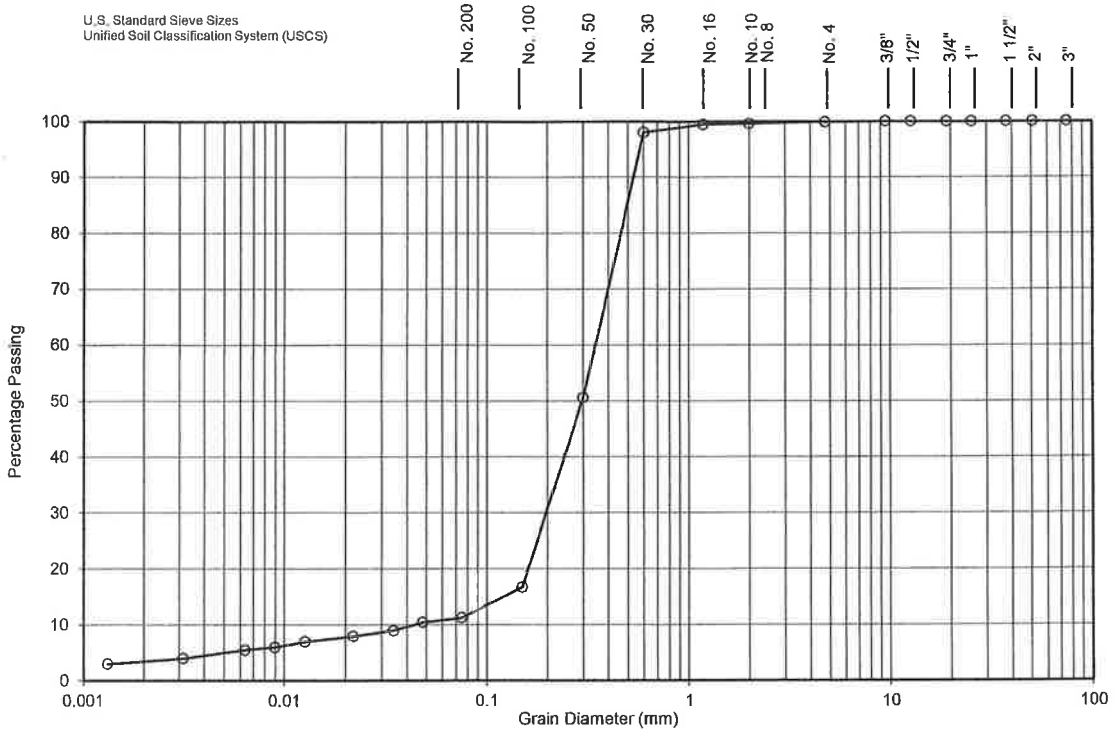
Mechanical & Hydrometer Analyses



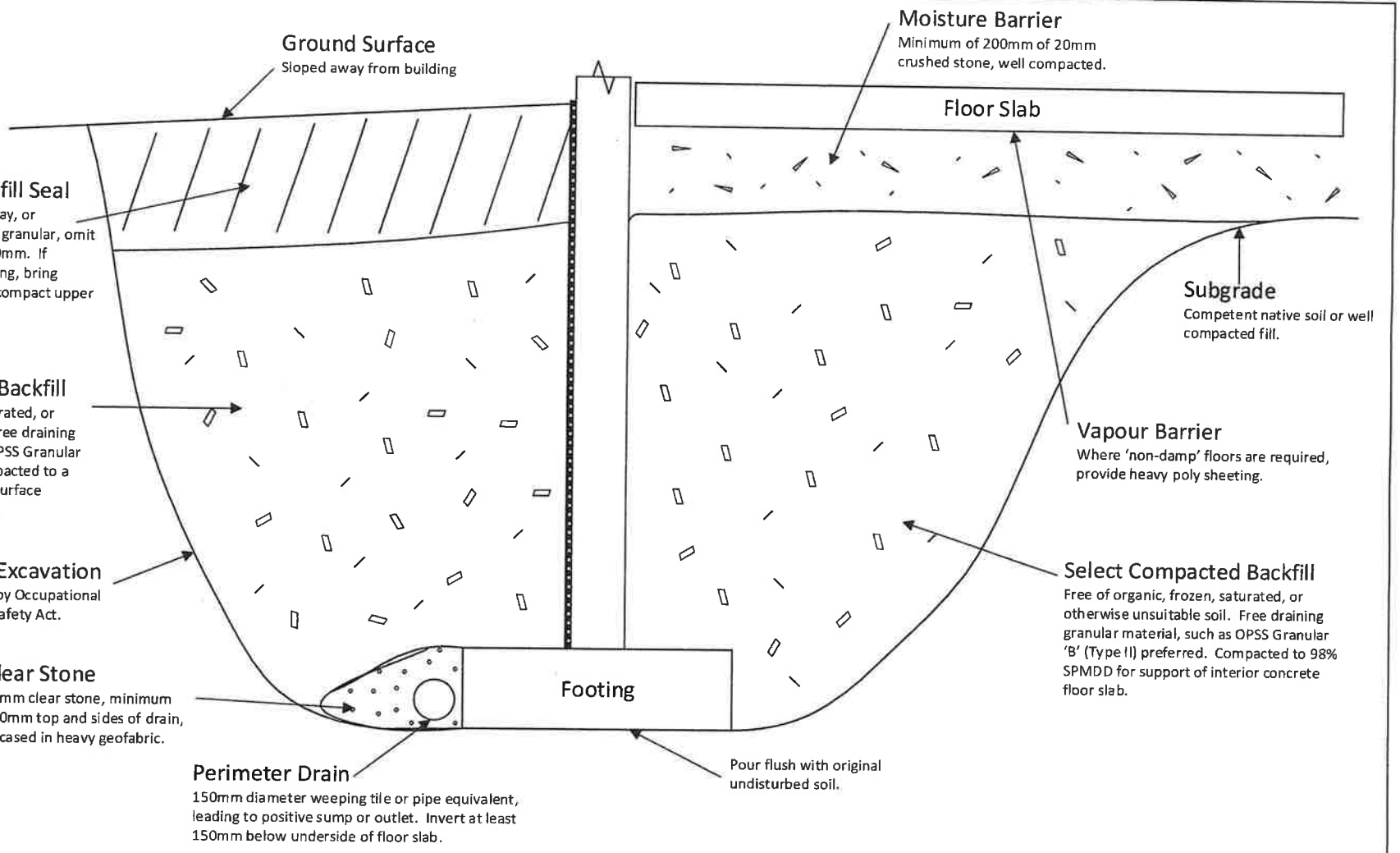
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	COARSE
		SAND			GRAVEL	

Lab No.:	22-203	Notes: 5 - 10'			
Borehole No.:	1				
Sample No.:	2				
CLAY [%]:	3	Soil Description:	**Brown Sand w/ traces of Silt and Clay**		
SILT [%]:	8		**S.W. - Well graded sands to S.M. - Sand-silt mixtures**		
SAND [%]:	89				
GRAVEL [%]:	0	Estimated Infiltration Rate [mm/hr]:	**70 to 95**	Estimated Permeability, k [cm/s]	**10^{-3}**
D_{10} (Effective Diam. in mm):	0.041	Coefficient of Uniformity C_U:	**8.5**	Coefficient of Curvature C_C:	**2.8**

SOIL-MAT ENGINEERS & CONSULTANTS LTD.

78 King Street, Delhi ON

May 2022	Grain Size Analysis No. 1	Project No.: SM 220178-T



NOT TO SCALE

Soil-Mat

Soil-Mat Engineers & Consultants Ltd.

Project No.:	SM 220178-G
Date:	June, 2022

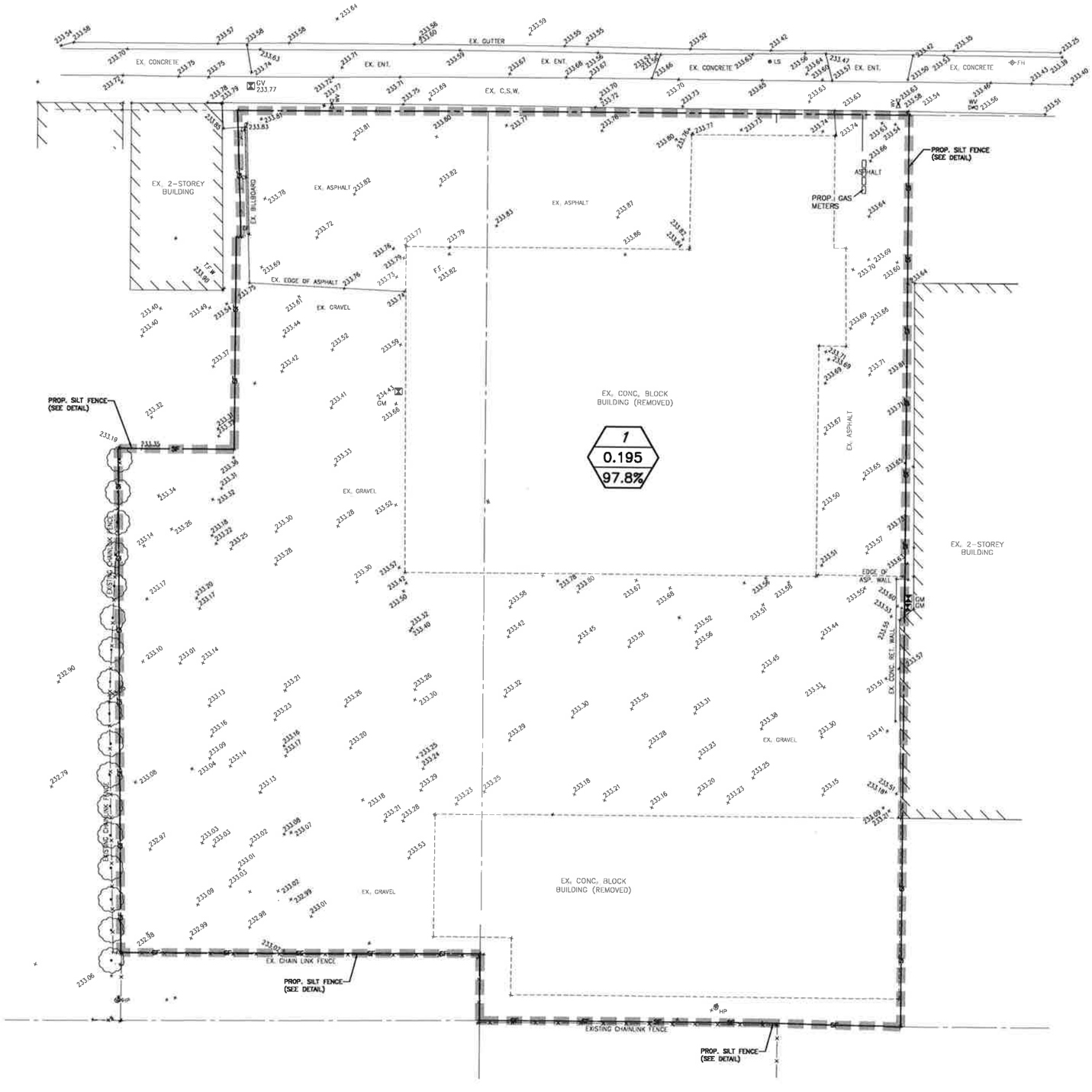
Typical Design Requirements
Slab-on-Grade with Perimeter Drainage

Drawing No. 2

Appendix 'C'
MIDUSS Stormwater Management Simulation Results
Pre-development Conditions

Appendix 'D'
MIDUSS Stormwater Management Simulation Results
Post-development Conditions

KING STREET



LEGEND

STORM DRAINAGE BOUNDARY

1
0.53
35.0

- STORM DRAINAGE NUMBER
- STORM AREA IN HECTARES
- % IMPERVIOUS

PRE DEVELOPMENT STORM DRAINAGE AREAS

PROPOSED MIXED USE BUILDING
78 KING STREET – NORFOLK COUNTY

J.H. COHOON ENGINEERING LIMITED
CONSULTING ENGINEERS
BRANTFORD

CLIENT: SENTRY GROUP
SCALE: 1:250

JOB: 16025

```
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"                MIDUSS created                                        February-07-10"
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"                Licensee name:                                                 Bob"
"                Company                                                          "
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"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      529.711   Coefficient A"
"        4.501   Constant B"
"        0.745   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity            69.337    mm/hr"
"             Total depth                  32.583    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          101   No description"
"       97.800   % Impervious"
"        0.195   Total Area"
"       45.252   Flow length"
"        1.400   Overland Slope"
"        0.004   Pervious Area"
"       45.252   Pervious length"
"        1.400   Pervious slope"
"        0.191   Impervious Area"
"       45.252   Impervious length"
"        1.400   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        2.000   Impervious Depression storage"
"                    0.037     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.191      0.195      hectare"
"             Time of concentration      ---    3.658      3.658      minutes"
"             Time to Centroid       0.000      89.997     89.997     minutes"
"             Rainfall depth         32.583     32.583     32.583     mm"
"             Rainfall volume        1.40       62.14      63.54      c.m"
"             Rainfall losses        32.583     2.000      2.673      mm"
"             Runoff depth           0.000      30.583     29.910     mm"
"             Runoff volume          0.00       58.32      58.32      c.m"
"             Runoff coefficient     0.000      0.939      0.918      "
```

```
"              Maximum flow           0.000      0.037      0.037      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.037     0.037     0.000     0.000"
" 38           START/RE-START TOTALS 101"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                        0.195    hectare"
"              Total Impervious area                       0.191    hectare"
"              Total % impervious                         97.800"
" 19           EXIT"
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"                MIDUSS created                                  February-07-10"
"           10   Units used:                                          ie METRIC"
"                Job folder:                              C:\swm\MIDUSS\16025"
"                Output filename:                                      Pre5.out"
"                Licensee name:                                             Bob"
"                Company                                                      "
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" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      583.017   Coefficient A"
"        3.007   Constant B"
"        0.703   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity            92.454    mm/hr"
"             Total depth                  44.904    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          101   No description"
"       97.800   % Impervious"
"        0.195   Total Area"
"       45.252   Flow length"
"        1.400   Overland Slope"
"        0.004   Pervious Area"
"       45.252   Pervious length"
"        1.400   Pervious slope"
"        0.191   Impervious Area"
"       45.252   Impervious length"
"        1.400   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        2.000   Impervious Depression storage"
"                    0.049     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.191      0.195      hectare"
"             Time of concentration  32.251     3.260      3.317      minutes"
"             Time to Centroid       94.595     89.505     89.515     minutes"
"             Rainfall depth         44.904     44.904     44.904     mm"
"             Rainfall volume        1.93       85.64      87.56      c.m"
"             Rainfall losses        41.133     2.000      2.861      mm"
"             Runoff depth           3.771      42.904     42.043     mm"
"             Runoff volume          0.16       81.82      81.98      c.m"
"             Runoff coefficient     0.084      0.955      0.936      "
```

```
"              Maximum flow            0.000      0.049      0.049      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.049     0.049     0.000     0.000"
" 38           START/RE-START TOTALS 101"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                        0.195    hectare"
"              Total Impervious area                       0.191    hectare"
"              Total % impervious                         97.800"
" 19           EXIT"
```

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"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
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"                Job folder:                                 C:\swm\MIDUSS\16025"
"                Output filename:                                        Pre10.out"
"                Licensee name:                                                Bob"
"                Company                                                         "
"                Date & Time last used:                 31/07/2022 at 9:10:19 AM"
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      670.324   Coefficient A"
"        3.007   Constant B"
"        0.698   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          107.682    mm/hr"
"             Total depth                 52.991    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          101   No description"
"       97.800   % Impervious"
"        0.195   Total Area"
"       45.252   Flow length"
"        1.400   Overland Slope"
"        0.004   Pervious Area"
"       45.252   Pervious length"
"        1.400   Pervious slope"
"        0.191   Impervious Area"
"       45.252   Impervious length"
"        1.400   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        2.000   Impervious Depression storage"
"                    0.057     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.191      0.195      hectare"
"             Time of concentration  23.695     3.067      3.146      minutes"
"             Time to Centroid       90.551     89.152     89.157     minutes"
"             Rainfall depth         52.991     52.991     52.991     mm"
"             Rainfall volume        2.27       101.06     103.33     c.m"
"             Rainfall losses        44.350     2.000      2.932      mm"
"             Runoff depth           8.641      50.991     50.059     mm"
"             Runoff volume          0.37       97.25      97.62      c.m"
"             Runoff coefficient     0.163      0.962      0.945      "
```

```
"              Maximum flow           0.000      0.057      0.057      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.057     0.057     0.000     0.000"
" 38           START/RE-START TOTALS 101"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                        0.195    hectare"
"              Total Impervious area                       0.191    hectare"
"              Total % impervious                         97.800"
" 19           EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
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"                MIDUSS created                                      February-07-10"
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"                Job folder:                                  C:\swm\MIDUSS\16025"
"                Output filename:                                        Pre25.out"
"                Licensee name:                                                Bob"
"                Company                                                         "
"                Date & Time last used:                 31/07/2022 at 9:09:09 AM"
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      721.533   Coefficient A"
"        2.253   Constant B"
"        0.679   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           127.011    mm/hr"
"             Total depth                  63.151    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          101   No description"
"       97.800   % Impervious"
"        0.195   Total Area"
"       45.252   Flow length"
"        1.400   Overland Slope"
"        0.004   Pervious Area"
"       45.252   Pervious length"
"        1.400   Pervious slope"
"        0.191   Impervious Area"
"       45.252   Impervious length"
"        1.400   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        2.000   Impervious Depression storage"
"                    0.068     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.191      0.195      hectare"
"             Time of concentration  19.336     2.871      2.964      minutes"
"             Time to Centroid       90.364     88.989     88.996     minutes"
"             Rainfall depth         63.151     63.151     63.151     mm"
"             Rainfall volume        2.71       120.44     123.14     c.m"
"             Rainfall losses        47.786     2.000      3.007      mm"
"             Runoff depth           15.365     61.151     60.144     mm"
"             Runoff volume          0.66       116.62     117.28     c.m"
"             Runoff coefficient     0.243      0.968      0.952      "
```

```
"              Maximum flow            0.000      0.067      0.068      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.068     0.068     0.000     0.000"
" 38           START/RE-START TOTALS 101"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                      0.195    hectare"
"              Total Impervious area                     0.191    hectare"
"              Total % impervious                       97.800"
" 19           EXIT"
```

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"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                      February-07-10"
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"                Output filename:                                        Pre50.out"
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"                Company                                                         "
"                Date & Time last used:                  31/07/2022 at 9:07:51 AM"
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      766.038   Coefficient A"
"        1.898   Constant B"
"        0.668   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           141.545    mm/hr"
"             Total depth                  71.090    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          101   No description"
"       97.800   % Impervious"
"        0.195   Total Area"
"       45.252   Flow length"
"        1.400   Overland Slope"
"        0.004   Pervious Area"
"       45.252   Pervious length"
"        1.400   Pervious slope"
"        0.191   Impervious Area"
"       45.252   Impervious length"
"        1.400   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        2.000   Impervious Depression storage"
"                    0.076     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.191      0.195      hectare"
"             Time of concentration  17.387     2.750      2.851      minutes"
"             Time to Centroid       92.128     88.885     88.907     minutes"
"             Rainfall depth         71.090     71.090     71.090     mm"
"             Rainfall volume        3.05       135.58     138.62     c.m"
"             Rainfall losses        49.748     2.000      3.050      mm"
"             Runoff depth           21.342     69.090     68.039     mm"
"             Runoff volume          0.92       131.76     132.68     c.m"
"             Runoff coefficient     0.300      0.972      0.957      "
```

```
"              Maximum flow            0.001      0.075      0.076      c.m/sec"
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"             4   Add Runoff "
"                    0.076     0.076     0.000     0.000"
" 38           START/RE-START TOTALS 101"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                        0.195    hectare"
"              Total Impervious area                       0.191    hectare"
"              Total % impervious                         97.800"
" 19           EXIT"
```

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"                MIDUSS Output ----------------------------------------------->"
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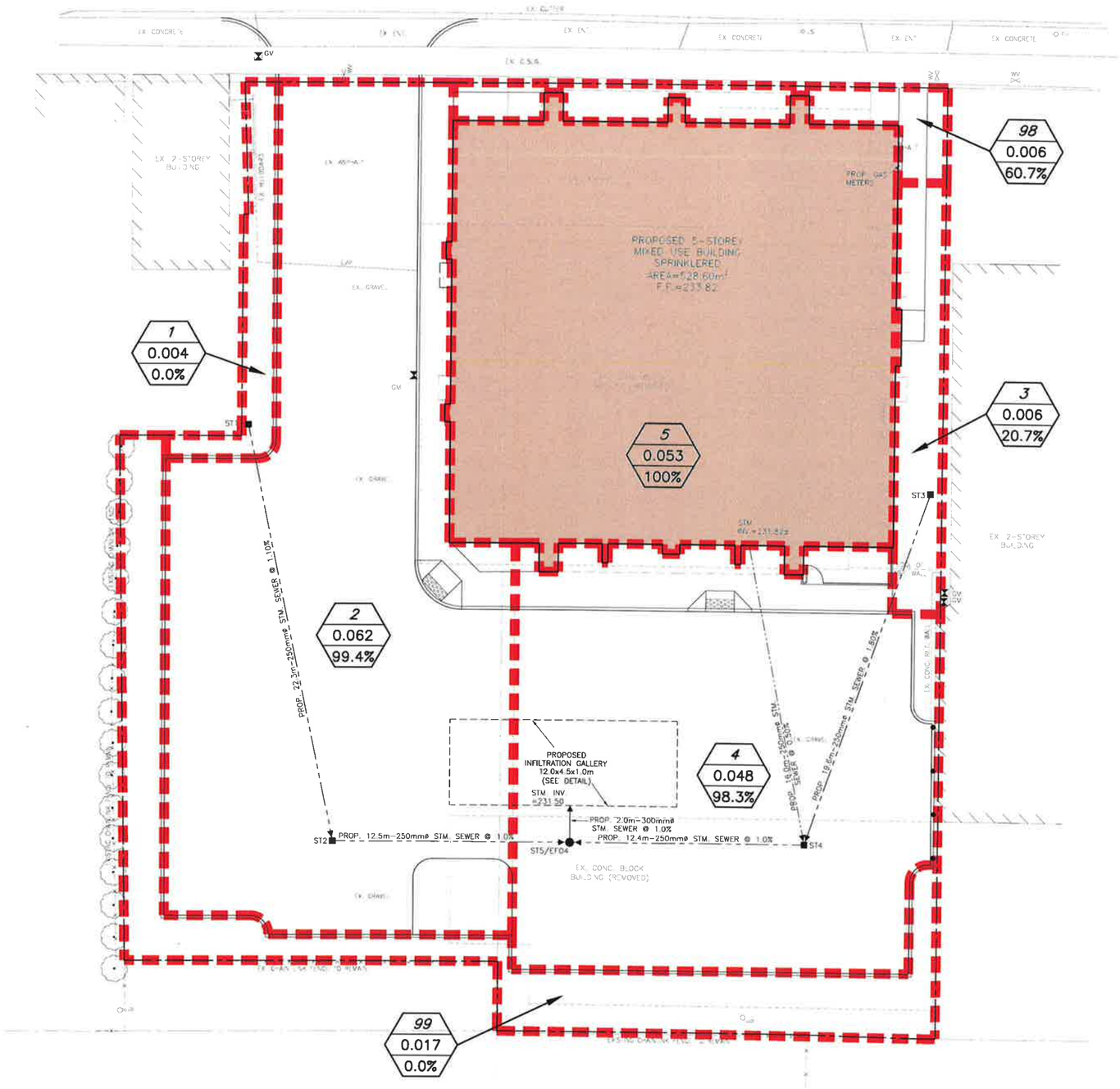
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      801.041   Coefficient A"
"        1.501   Constant B"
"        0.657   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          155.782    mm/hr"
"             Total depth                 78.830    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          101   No description"
"       97.800   % Impervious"
"        0.195   Total Area"
"       45.252   Flow length"
"        1.400   Overland Slope"
"        0.004   Pervious Area"
"       45.252   Pervious length"
"        1.400   Pervious slope"
"        0.191   Impervious Area"
"       45.252   Impervious length"
"        1.400   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        2.000   Impervious Depression storage"
"                    0.083     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.191      0.195      hectare"
"             Time of concentration  16.039     2.646      2.754      minutes"
"             Time to Centroid       94.485     88.849     88.894     minutes"
"             Rainfall depth         78.830     78.830     78.830     mm"
"             Rainfall volume        3.38       150.34     153.72     c.m"
"             Rainfall losses        51.075     2.000      3.080      mm"
"             Runoff depth           27.755     76.830     75.751     mm"
"             Runoff volume          1.19       146.52     147.71     c.m"
"             Runoff coefficient     0.352      0.975      0.961      "
```

```
"              Maximum flow            0.001       0.083       0.083       c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4    Add Runoff "
"                    0.083      0.083      0.000      0.000"
" 38           START/RE-START TOTALS 101"
"             3    Runoff Totals on EXIT"
"              Total Catchment area                          0.195    hectare"
"              Total Impervious area                         0.191    hectare"
"              Total % impervious                           97.800"
" 19           EXIT"
```

Appendix 'D'
MIDUSS Stormwater Management Simulation Results
Post-development Conditions

KING STREET



LEGEND

STORM DRAINAGE BOUNDARY

1
0.53
35.0

STORM DRAINAGE NUMBER
STORM AREA IN HECTARES
% IMPERVIOUS

POST DEVELOPMENT STORM DRAINAGE AREAS

PROPOSED MIXED USE BUILDING
78 KING STREET – NORFOLK COUNTY

J.H. COHOON ENGINEERING LIMITED
CONSULTING ENGINEERS
BRANTFORD

CLIENT: SENTRY GROUP
SCALE: 1:250

JOB: 16025

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                      February-07-10"
"           10   Units used:                                                ie METRIC"
"                Job folder:                                   C:\swm\MIDUSS\16025"
"                Output filename:                                          Pre2.out"
"                Licensee name:                                                 Bob"
"                Company                                                          "
"                Date & Time last used:                  31/07/2022 at 9:12:59 AM"
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      529.711   Coefficient A"
"        4.501   Constant B"
"        0.745   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity            69.337    mm/hr"
"             Total depth                  32.583    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          101   No description"
"       97.800   % Impervious"
"        0.195   Total Area"
"       45.252   Flow length"
"        1.400   Overland Slope"
"        0.004   Pervious Area"
"       45.252   Pervious length"
"        1.400   Pervious slope"
"        0.191   Impervious Area"
"       45.252   Impervious length"
"        1.400   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        2.000   Impervious Depression storage"
"                    0.037     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.191      0.195      hectare"
"             Time of concentration      ---    3.658      3.658      minutes"
"             Time to Centroid       0.000      89.997     89.997     minutes"
"             Rainfall depth         32.583     32.583     32.583     mm"
"             Rainfall volume        1.40       62.14      63.54      c.m"
"             Rainfall losses        32.583     2.000      2.673      mm"
"             Runoff depth           0.000      30.583     29.910     mm"
"             Runoff volume          0.00       58.32      58.32      c.m"
"             Runoff coefficient     0.000      0.939      0.918      "
```

```
"              Maximum flow           0.000      0.037      0.037      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                   0.037     0.037     0.000     0.000"
" 38           START/RE-START TOTALS 101"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                        0.195    hectare"
"              Total Impervious area                       0.191    hectare"
"              Total % impervious                         97.800"
" 19           EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                      February-07-10"
"           10   Units used:                                              ie METRIC"
"                Job folder:                                 C:\swm\MIDUSS\16025"
"                Output filename:                                         Pre5.out"
"                Licensee name:                                                Bob"
"                Company                                                         "
"                Date & Time last used:                  31/07/2022 at 9:11:43 AM"
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      583.017   Coefficient A"
"        3.007   Constant B"
"        0.703   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity            92.454    mm/hr"
"             Total depth                  44.904    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          101   No description"
"       97.800   % Impervious"
"        0.195   Total Area"
"       45.252   Flow length"
"        1.400   Overland Slope"
"        0.004   Pervious Area"
"       45.252   Pervious length"
"        1.400   Pervious slope"
"        0.191   Impervious Area"
"       45.252   Impervious length"
"        1.400   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        2.000   Impervious Depression storage"
"                    0.049     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.191      0.195      hectare"
"             Time of concentration  32.251     3.260      3.317      minutes"
"             Time to Centroid       94.595     89.505     89.515     minutes"
"             Rainfall depth         44.904     44.904     44.904     mm"
"             Rainfall volume        1.93       85.64      87.56      c.m"
"             Rainfall losses        41.133     2.000      2.861      mm"
"             Runoff depth           3.771      42.904     42.043     mm"
"             Runoff volume          0.16       81.82      81.98      c.m"
"             Runoff coefficient     0.084      0.955      0.936      "
```

```
"              Maximum flow           0.000      0.049      0.049      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                   0.049     0.049     0.000     0.000"
" 38           START/RE-START TOTALS 101"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                      0.195    hectare"
"              Total Impervious area                     0.191    hectare"
"              Total % impervious                       97.800"
" 19           EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                      February-07-10"
"           10   Units used:                                              ie METRIC"
"                Job folder:                                  C:\swm\MIDUSS\16025"
"                Output filename:                                        Pre10.out"
"                Licensee name:                                                Bob"
"                Company                                                         "
"                Date & Time last used:                  31/07/2022 at 9:10:19 AM"
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      670.324   Coefficient A"
"        3.007   Constant B"
"        0.698   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           107.682    mm/hr"
"             Total depth                  52.991    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          101   No description"
"       97.800   % Impervious"
"        0.195   Total Area"
"       45.252   Flow length"
"        1.400   Overland Slope"
"        0.004   Pervious Area"
"       45.252   Pervious length"
"        1.400   Pervious slope"
"        0.191   Impervious Area"
"       45.252   Impervious length"
"        1.400   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        2.000   Impervious Depression storage"
"                    0.057     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.191      0.195      hectare"
"             Time of concentration  23.695     3.067      3.146      minutes"
"             Time to Centroid       90.551     89.152     89.157     minutes"
"             Rainfall depth         52.991     52.991     52.991     mm"
"             Rainfall volume        2.27       101.06     103.33     c.m"
"             Rainfall losses        44.350     2.000      2.932      mm"
"             Runoff depth           8.641      50.991     50.059     mm"
"             Runoff volume          0.37       97.25      97.62      c.m"
"             Runoff coefficient     0.163      0.962      0.945      "
```

```
"              Maximum flow           0.000      0.057      0.057      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.057     0.057     0.000     0.000"
" 38           START/RE-START TOTALS 101"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                        0.195    hectare"
"              Total Impervious area                       0.191    hectare"
"              Total % impervious                         97.800"
" 19           EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                      February-07-10"
"           10   Units used:                                              ie METRIC"
"                Job folder:                                  C:\swm\MIDUSS\16025"
"                Output filename:                                        Pre25.out"
"                Licensee name:                                                Bob"
"                Company                                                         "
"                Date & Time last used:                  31/07/2022 at 9:09:09 AM"
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      721.533   Coefficient A"
"        2.253   Constant B"
"        0.679   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          127.011    mm/hr"
"             Total depth                 63.151    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          101   No description"
"       97.800   % Impervious"
"        0.195   Total Area"
"       45.252   Flow length"
"        1.400   Overland Slope"
"        0.004   Pervious Area"
"       45.252   Pervious length"
"        1.400   Pervious slope"
"        0.191   Impervious Area"
"       45.252   Impervious length"
"        1.400   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        2.000   Impervious Depression storage"
"                    0.068     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.191      0.195      hectare"
"             Time of concentration  19.336     2.871      2.964      minutes"
"             Time to Centroid       90.364     88.989     88.996     minutes"
"             Rainfall depth         63.151     63.151     63.151     mm"
"             Rainfall volume        2.71       120.44     123.14     c.m"
"             Rainfall losses        47.786     2.000      3.007      mm"
"             Runoff depth           15.365     61.151     60.144     mm"
"             Runoff volume          0.66       116.62     117.28     c.m"
"             Runoff coefficient     0.243      0.968      0.952      "
```

```
"              Maximum flow           0.000      0.067      0.068      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                   0.068     0.068     0.000     0.000"
" 38           START/RE-START TOTALS 101"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                        0.195    hectare"
"              Total Impervious area                       0.191    hectare"
"              Total % impervious                         97.800"
" 19           EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                      February-07-10"
"           10   Units used:                                              ie METRIC"
"                Job folder:                                  C:\swm\MIDUSS\16025"
"                Output filename:                                        Pre50.out"
"                Licensee name:                                                Bob"
"                Company                                                         "
"                Date & Time last used:                    31/07/2022 at 9:07:51 AM"
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      766.038   Coefficient A"
"        1.898   Constant B"
"        0.668   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"              Maximum intensity          141.545    mm/hr"
"              Total depth                 71.090    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          101   No description"
"       97.800   % Impervious"
"        0.195   Total Area"
"       45.252   Flow length"
"        1.400   Overland Slope"
"        0.004   Pervious Area"
"       45.252   Pervious length"
"        1.400   Pervious slope"
"        0.191   Impervious Area"
"       45.252   Impervious length"
"        1.400   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        2.000   Impervious Depression storage"
"                    0.076     0.000     0.000     0.000 c.m/sec"
"              Catchment 101          Pervious   Impervious Total Area "
"              Surface Area           0.004      0.191      0.195      hectare"
"              Time of concentration  17.387     2.750      2.851      minutes"
"              Time to Centroid       92.128     88.885     88.907     minutes"
"              Rainfall depth         71.090     71.090     71.090     mm"
"              Rainfall volume        3.05       135.58     138.62     c.m"
"              Rainfall losses        49.748     2.000      3.050      mm"
"              Runoff depth           21.342     69.090     68.039     mm"
"              Runoff volume          0.92       131.76     132.68     c.m"
"              Runoff coefficient     0.300      0.972      0.957      "
```

```
"              Maximum flow           0.001      0.075      0.076      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                   0.076     0.076     0.000     0.000"
" 38           START/RE-START TOTALS 101"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                        0.195    hectare"
"              Total Impervious area                       0.191    hectare"
"              Total % impervious                         97.800"
" 19           EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                      February-07-10"
"           10   Units used:                                                ie METRIC"
"                Job folder:                                  C:\swm\MIDUSS\16025"
"                Output filename:                                       Pre100.out"
"                Licensee name:                                                Bob"
"                Company                                                         "
"                Date & Time last used:                  31/07/2022 at 9:03:36 AM"
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      801.041   Coefficient A"
"        1.501   Constant B"
"        0.657   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          155.782    mm/hr"
"             Total depth                 78.830    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          101   No description"
"       97.800   % Impervious"
"        0.195   Total Area"
"       45.252   Flow length"
"        1.400   Overland Slope"
"        0.004   Pervious Area"
"       45.252   Pervious length"
"        1.400   Pervious slope"
"        0.191   Impervious Area"
"       45.252   Impervious length"
"        1.400   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        2.000   Impervious Depression storage"
"                    0.083     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.191      0.195      hectare"
"             Time of concentration  16.039     2.646      2.754      minutes"
"             Time to Centroid       94.485     88.849     88.894     minutes"
"             Rainfall depth         78.830     78.830     78.830     mm"
"             Rainfall volume        3.38       150.34     153.72     c.m"
"             Rainfall losses        51.075     2.000      3.080      mm"
"             Runoff depth           27.755     76.830     75.751     mm"
"             Runoff volume          1.19       146.52     147.71     c.m"
"             Runoff coefficient     0.352      0.975      0.961      "
```

```
"              Maximum flow           0.001      0.083      0.083      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.083     0.083     0.000     0.000"
" 38           START/RE-START TOTALS 101"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                      0.195    hectare"
"              Total Impervious area                     0.191    hectare"
"              Total % impervious                       97.800"
" 19           EXIT"
```

Appendix 'D'
MIDUSS Stormwater Management Simulation Results
Post-development Conditions

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                      February-07-10"
"           10   Units used:                                              ie METRIC"
"                Job folder:                                  C:\swm\MIDUSS\16025"
"                Output filename:                                         Pst2.out"
"                Licensee name:                                                Bob"
"                Company                                                         "
"                Date & Time last used:                  31/07/2022 at 9:49:19 AM"
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      529.711   Coefficient A"
"        4.501   Constant B"
"        0.745   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity            69.337    mm/hr"
"             Total depth                  32.583    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          101   No description"
"        0.000   % Impervious"
"        0.004   Total Area"
"       20.000   Flow length"
"        1.500   Overland Slope"
"        0.004   Pervious Area"
"       20.000   Pervious length"
"        1.500   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                    0.000     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.000      0.004      hectare"
"             Time of concentration     ---     2.195      2.195      minutes"
"             Time to Centroid       0.000      96.515     96.515     minutes"
"             Rainfall depth         32.583     32.583     32.583     mm"
"             Rainfall volume        1.30       0.00       1.30       c.m"
"             Rainfall losses        32.583     7.500      32.583     mm"
"             Runoff depth           0.000      25.083     0.000      mm"
"             Runoff volume          0.00       0.00       0.00       c.m"
"             Runoff coefficient     0.000      0.000      0.000      "
```

```
"              Maximum flow            0.000      0.000      0.000      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.000     0.000     0.000     0.000"
" 51           PIPE DESIGN"
"          0.000   Current peak flow    c.m/sec"
"          0.013   Manning 'n'"
"          0.250   Diameter    metre"
"          1.100   Gradient    %"
"               Depth of flow                 0.000    metre"
"               Velocity                      0.006    m/sec"
"               Pipe capacity                 0.062    c.m/sec"
"               Critical depth                0.000    metre"
" 53           ROUTE    Pipe Route 22"
"         22.30      Pipe Route 22 Reach length   ( metre)"
"          0.429   X-factor <= 0.5"
"        668.317   K-lag   ( seconds)"
"          0.000   Default(0) or user spec.(1) values used"
"          0.500   X-factor <= 0.5"
"         30.000   K-lag   ( seconds)"
"          0.500   Beta weighting factor"
"        600.000   Routing time step   ( seconds)"
"              4   No. of sub-reaches"
"               Peak outflow                  0.000    c.m/sec"
"                      0.000     0.000     0.000     0.000 c.m/sec"
" 40           HYDROGRAPH   Combine    2"
"             6   Combine "
"             2   Node #"
"                 "
"               Maximum flow                  0.000    c.m/sec"
"               Hydrograph volume             0.000    c.m"
"                      0.000     0.000     0.000     0.000"
" 40           HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                    0.000     0.000     0.000     0.000"
" 33           CATCHMENT 102"
"             2   Rectangular"
"             1   Equal length"
"             2   Horton equation"
"           102   No description"
"         99.400   % Impervious"
"          0.062   Total Area"
"         35.227   Flow length"
"          1.500   Overland Slope"
"          0.000   Pervious Area"
"         35.227   Pervious length"
"          1.500   Pervious slope"
"          0.062   Impervious Area"
"         35.227   Impervious length"
"          1.500   Impervious slope"
"          0.250   Pervious Manning 'n'"
"         50.000   Pervious Max.infiltration"
"         10.000   Pervious Min.infiltration"
"          0.500   Pervious Lag constant (hours)"
"          7.500   Pervious Depression storage"
"          0.015   Impervious Manning 'n'"
"          0.000   Impervious Max.infiltration"
"          0.000   Impervious Min.infiltration"
"          0.500   Impervious Lag constant (hours)"
"          7.500   Impervious Depression storage"
```

```
"                    0.012     0.000     0.000     0.000 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.062      0.062      hectare"
"             Time of concentration      ---    3.083      3.083      minutes"
"             Time to Centroid       0.000      96.537     96.537     minutes"
"             Rainfall depth         32.583     32.583     32.583     mm"
"             Rainfall volume        0.12       20.08      20.20      c.m"
"             Rainfall losses        32.583     7.500      7.650      mm"
"             Runoff depth           0.000      25.083     24.933     mm"
"             Runoff volume          0.00       15.46      15.46      c.m"
"             Runoff coefficient     0.000      0.770      0.765      "
"             Maximum flow           0.000      0.012      0.012      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.012     0.012     0.000     0.000"
" 51          PIPE DESIGN"
"         0.012   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         1.000   Diameter    metre"
"         1.000   Gradient    %"
"              Depth of flow                 0.051    metre"
"              Velocity                      0.792    m/sec"
"              Pipe capacity                 2.398    c.m/sec"
"              Critical depth                0.059    metre"
" 53          ROUTE Zero Route"
"          0.00   Zero Route Reach length   ( metre)"
"                    0.012     0.012     0.012     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                "
"              Maximum flow                  0.012    c.m/sec"
"              Hydrograph volume            15.458    c.m"
"                    0.012     0.012     0.012     0.012"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.012     0.000     0.012     0.012"
" 33          CATCHMENT 103"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          103   No description"
"       20.700   % Impervious"
"        0.006   Total Area"
"       20.690   Flow length"
"        1.500   Overland Slope"
"        0.005   Pervious Area"
"       20.690   Pervious length"
"        1.500   Pervious slope"
"        0.001   Impervious Area"
"       20.690   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
```

```
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                    0.000     0.000     0.012     0.012 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
"             Surface Area           0.005      0.001      0.006      hectare"
"             Time of concentration      ---    2.240      2.240      minutes"
"             Time to Centroid       0.000      96.515     96.515     minutes"
"             Rainfall depth         32.583     32.583     32.583     mm"
"             Rainfall volume        1.55       0.40       1.95       c.m"
"             Rainfall losses        32.583     7.500      27.391     mm"
"             Runoff depth           0.000      25.083     5.192      mm"
"             Runoff volume          0.00       0.31       0.31       c.m"
"             Runoff coefficient     0.000      0.770      0.159      "
"             Maximum flow           0.000      0.000      0.000      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.000     0.000     0.012     0.012"
" 51          PIPE DESIGN"
"        0.000   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        0.250   Diameter    metre"
"        1.800   Gradient   %"
"             Depth of flow                 0.010    metre"
"             Velocity                      0.362    m/sec"
"             Pipe capacity                 0.080    c.m/sec"
"             Critical depth                0.012    metre"
" 53          ROUTE    Pipe Route 20"
"        19.60      Pipe Route 20 Reach length   ( metre)"
"        0.487   X-factor <= 0.5"
"       40.646   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       40.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.000    c.m/sec"
"                    0.000     0.000     0.000     0.012 c.m/sec"
" 40          HYDROGRAPH   Combine    4"
"            6   Combine "
"            4   Node #"
"                "
"             Maximum flow                  0.000    c.m/sec"
"             Hydrograph volume             0.312    c.m"
"                    0.000     0.000     0.000     0.000"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.000     0.000     0.000     0.000"
" 33          CATCHMENT 104"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          104   No description"
"       98.300   % Impervious"
"        0.048   Total Area"
"       15.094   Flow length"
"        1.500   Overland Slope"
"        0.001   Pervious Area"
"       15.094   Pervious length"
"        1.500   Pervious slope"
```

```
"         0.047   Impervious Area"
"        15.094   Impervious length"
"         1.500   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        50.000   Pervious Max.infiltration"
"        10.000   Pervious Min.infiltration"
"         0.500   Pervious Lag constant (hours)"
"         7.500   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.500   Impervious Lag constant (hours)"
"         7.500   Impervious Depression storage"
"                     0.009     0.000     0.000     0.000 c.m/sec"
"              Catchment 104          Pervious   Impervious Total Area "
"              Surface Area           0.001      0.047      0.048      hectare"
"              Time of concentration      ---    1.854      1.854      minutes"
"              Time to Centroid       0.000      96.515     96.515     minutes"
"              Rainfall depth         32.583     32.583     32.583     mm"
"              Rainfall volume        0.27       15.37      15.64      c.m"
"              Rainfall losses        32.583     7.500      7.926      mm"
"              Runoff depth           0.000      25.083     24.657     mm"
"              Runoff volume          0.00       11.84      11.84      c.m"
"              Runoff coefficient     0.000      0.770      0.757      "
"              Maximum flow           0.000      0.009      0.009      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.009     0.009     0.000     0.000"
" 51           PIPE DESIGN"
"         0.009   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         1.000   Diameter    metre"
"         1.000   Gradient    %"
"              Depth of flow                 0.045    metre"
"              Velocity                      0.730    m/sec"
"              Pipe capacity                 2.398    c.m/sec"
"              Critical depth                0.052    metre"
" 53           ROUTE Zero Route"
"          0.00   Zero Route Reach length   ( metre)"
"                     0.009     0.009     0.009     0.000 c.m/sec"
" 40           HYDROGRAPH   Combine    4"
"             6   Combine "
"             4   Node #"
"                 "
"              Maximum flow                  0.009    c.m/sec"
"              Hydrograph volume            12.147    c.m"
"                     0.009     0.009     0.009     0.009"
" 40           HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                     0.009     0.000     0.009     0.009"
" 33           CATCHMENT 105"
"             2   Rectangular"
"             1   Equal length"
"             2   Horton equation"
"           105   No description"
"       100.000   % Impervious"
"         0.053   Total Area"
"        11.522   Flow length"
"         1.500   Overland Slope"
"         0.000   Pervious Area"
```

```
"       11.522   Pervious length"
"        1.500   Pervious slope"
"        0.053   Impervious Area"
"       11.522   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                    0.010     0.000     0.009     0.009 c.m/sec"
"            Catchment 105          Pervious   Impervious Total Area "
"            Surface Area           0.000      0.053      0.053      hectare"
"            Time of concentration      ---    1.577      1.577      minutes"
"            Time to Centroid       0.000      96.515     96.515     minutes"
"            Rainfall depth         32.583     32.583     32.583     mm"
"            Rainfall volume        0.00       17.27      17.27      c.m"
"            Rainfall losses        32.583     7.500      7.500      mm"
"            Runoff depth           0.000      25.083     25.083     mm"
"            Runoff volume          0.00       13.29      13.29      c.m"
"            Runoff coefficient     0.000      0.770      0.770      "
"            Maximum flow           0.000      0.010      0.010      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.010     0.010     0.009     0.009"
" 51         PIPE DESIGN"
"        0.010   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        0.200   Diameter    metre"
"        0.500   Gradient   %"
"            Depth of flow                0.093    metre"
"            Velocity                     0.715    m/sec"
"            Pipe capacity                0.023    c.m/sec"
"            Critical depth               0.085    metre"
" 53         ROUTE    Pipe Route 16"
"       16.00      Pipe Route 16 Reach length   ( metre)"
"        0.166   X-factor <= 0.5"
"       16.790   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       27.273   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"            Peak outflow                 0.010    c.m/sec"
"                    0.010     0.010     0.010     0.009 c.m/sec"
" 40         HYDROGRAPH   Combine    4"
"           6   Combine "
"           4   Node #"
"               "
"            Maximum flow                 0.019    c.m/sec"
"            Hydrograph volume           25.441    c.m"
"                    0.010     0.010     0.010     0.019"
" 40         HYDROGRAPH   Confluence    2"
"           7   Confluence "
```

```
"            2   Node #"
"                "
"             Maximum flow                    0.012    c.m/sec"
"             Hydrograph volume              15.458    c.m"
"                    0.010     0.012     0.010     0.000"
" 51          PIPE DESIGN"
"         0.012   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         0.250   Diameter    metre"
"         1.000   Gradient   %"
"              Depth of flow                  0.076    metre"
"              Velocity                       0.945    m/sec"
"              Pipe capacity                  0.059    c.m/sec"
"              Critical depth                 0.086    metre"
" 53          ROUTE    Pipe Route 5"
"          4.60      Pipe Route 5 Reach length   ( metre)"
"         0.056   X-factor <= 0.5"
"         3.649   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.500   Beta weighting factor"
"         6.818   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                   0.012    c.m/sec"
"                    0.010     0.012     0.012     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    100"
"             6   Combine "
"           100   Node #"
"                 "
"             Maximum flow                    0.012    c.m/sec"
"             Hydrograph volume              15.458    c.m"
"                    0.010     0.012     0.012     0.012"
" 40          HYDROGRAPH   Confluence    4"
"             7   Confluence "
"             4   Node #"
"                 "
"             Maximum flow                    0.019    c.m/sec"
"             Hydrograph volume              25.441    c.m"
"                    0.010     0.019     0.012     0.000"
" 51          PIPE DESIGN"
"         0.019   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         0.250   Diameter    metre"
"         1.000   Gradient   %"
"              Depth of flow                  0.098    metre"
"              Velocity                       1.082    m/sec"
"              Pipe capacity                  0.059    c.m/sec"
"              Critical depth                 0.111    metre"
" 53          ROUTE    Pipe Route 5"
"          5.10      Pipe Route 5 Reach length   ( metre)"
"         0.000   X-factor <= 0.5"
"         3.536   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.518   Beta weighting factor"
"         7.317   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                   0.019    c.m/sec"
```

```
"                    0.010     0.019     0.019     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    100"
"            6   Combine "
"          100   Node #"
"                "
"             Maximum flow                  0.031    c.m/sec"
"             Hydrograph volume            40.899    c.m"
"                    0.010     0.019     0.019     0.031"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.010     0.000     0.019     0.031"
" 33          CATCHMENT 98"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"           98   No description"
"       60.700   % Impervious"
"        0.006   Total Area"
"        2.353   Flow length"
"        1.500   Overland Slope"
"        0.002   Pervious Area"
"        2.353   Pervious length"
"        1.500   Pervious slope"
"        0.004   Impervious Area"
"        2.353   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                    0.001     0.000     0.019     0.031 c.m/sec"
"             Catchment 98           Pervious   Impervious Total Area "
"             Surface Area           0.002      0.004      0.006      hectare"
"             Time of concentration      ---    0.608      0.608      minutes"
"             Time to Centroid       0.000      96.515     96.515     minutes"
"             Rainfall depth         32.583     32.583     32.583     mm"
"             Rainfall volume        0.77       1.19       1.95       c.m"
"             Rainfall losses        32.583     7.500      17.358     mm"
"             Runoff depth           0.000      25.083     15.225     mm"
"             Runoff volume          0.00       0.91       0.91       c.m"
"             Runoff coefficient     0.000      0.770      0.467      "
"             Maximum flow           0.000      0.001      0.001      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.001     0.001     0.019     0.031"
" 51          PIPE DESIGN"
"        0.001   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        1.000   Diameter    metre"
"        1.000   Gradient    %"
"             Depth of flow                 0.014    metre"
"             Velocity                      0.333    m/sec"
"             Pipe capacity                 2.398    c.m/sec"
"             Critical depth                0.014    metre"
```

```
" 53          ROUTE Zero Route"
"          0.00   Zero Route Reach length   ( metre)"
"                      0.001     0.001     0.001     0.031 c.m/sec"
" 40          HYDROGRAPH   Combine    101"
"             6   Combine "
"           101   Node #"
"                 "
"             Maximum flow                   0.001    c.m/sec"
"             Hydrograph volume              0.914    c.m"
"                      0.001     0.001     0.001     0.001"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                      0.001     0.000     0.001     0.001"
" 33          CATCHMENT 99"
"             2   Rectangular"
"             1   Equal length"
"             2   Horton equation"
"            99   No description"
"         0.000   % Impervious"
"         0.017   Total Area"
"         4.048   Flow length"
"         1.500   Overland Slope"
"         0.017   Pervious Area"
"         4.048   Pervious length"
"         1.500   Pervious slope"
"         0.000   Impervious Area"
"         4.048   Impervious length"
"         1.500   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        50.000   Pervious Max.infiltration"
"        10.000   Pervious Min.infiltration"
"         0.500   Pervious Lag constant (hours)"
"         7.500   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.500   Impervious Lag constant (hours)"
"         7.500   Impervious Depression storage"
"                      0.000     0.000     0.001     0.001 c.m/sec"
"              Catchment 99           Pervious   Impervious Total Area "
"              Surface Area           0.017      0.000      0.017      hectare"
"              Time of concentration      ---    0.842      0.842      minutes"
"              Time to Centroid       0.000      96.515     96.515     minutes"
"              Rainfall depth         32.583     32.583     32.583     mm"
"              Rainfall volume        5.54       0.00       5.54       c.m"
"              Rainfall losses        32.583     7.500      32.583     mm"
"              Runoff depth           0.000      25.083     0.000      mm"
"              Runoff volume          0.00       0.00       0.00       c.m"
"              Runoff coefficient     0.000      0.000      0.000      "
"              Maximum flow           0.000      0.000      0.000      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.000     0.000     0.001     0.001"
" 51          PIPE DESIGN"
"         0.000   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         1.000   Diameter    metre"
"         1.000   Gradient   %"
"              Depth of flow                 0.000    metre"
"              Velocity                      0.008    m/sec"
```

```
"            Pipe capacity                  2.398    c.m/sec"
"            Critical depth                 0.000    metre"
" 53         ROUTE Zero Route"
"       0.00   Zero Route Reach length   ( metre)"
"                 0.000     0.000     0.000     0.001 c.m/sec"
" 40         HYDROGRAPH   Combine    101"
"          6   Combine "
"        101   Node #"
"              "
"            Maximum flow                   0.001    c.m/sec"
"            Hydrograph volume              0.914    c.m"
"                 0.000     0.000     0.000     0.001"
" 40         HYDROGRAPH   Confluence    100"
"          7   Confluence "
"        100   Node #"
"              "
"            Maximum flow                   0.031    c.m/sec"
"            Hydrograph volume             40.899    c.m"
"                 0.000     0.031     0.000     0.000"
" 56         DIVERSION"
"        100   Node number"
"      0.004   Overflow threshold"
"      1.000   Required diverted fraction"
"          0   Conduit type; 1=Pipe;2=Channel"
"            Peak of diverted flow          0.027    c.m/sec"
"            Volume of diverted flow       20.863    c.m"
"            DIV00100.005hyd"
"            Divert to Underground Storage 20.863 cu.m. (21.6 cu.m.)"
"                 0.000     0.031     0.004     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"          5   Next link "
"                 0.000     0.004     0.004     0.000"
" 51         PIPE DESIGN"
"      0.004   Current peak flow    c.m/sec"
"      0.013   Manning 'n'"
"      1.000   Diameter    metre"
"      1.000   Gradient   %"
"           Depth of flow                  0.031    metre"
"           Velocity                       0.568    m/sec"
"           Pipe capacity                  2.398    c.m/sec"
"           Critical depth                 0.034    metre"
" 53         ROUTE Zero Route"
"       0.00   Zero Route Reach length   ( metre)"
"                 0.000     0.004     0.004     0.000 c.m/sec"
" 40         HYDROGRAPH   Combine    101"
"          6   Combine "
"        101   Node #"
"              "
"            Maximum flow                   0.005    c.m/sec"
"            Hydrograph volume             20.950    c.m"
"                 0.000     0.004     0.004     0.005"
" 40         HYDROGRAPH   Confluence    101"
"          7   Confluence "
"        101   Node #"
"              "
"            Maximum flow                   0.005    c.m/sec"
"            Hydrograph volume             20.950    c.m"
"                 0.000     0.005     0.004     0.000"
" 38         START/RE-START TOTALS 101"
"            3   Runoff Totals on EXIT"
```

```
"              Total Catchment area                    0.196    hectare"
"              Total Impervious area                   0.167    hectare"
"              Total % impervious                     85.049"
" 19           EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                      February-07-10"
"           10   Units used:                                              ie METRIC"
"                Job folder:                                 C:\swm\MIDUSS\16025"
"                Output filename:                                         Pst5.out"
"                Licensee name:                                               Bob"
"                Company                                                        "
"                Date & Time last used:                  31/07/2022 at 9:46:43 AM"
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      583.017   Coefficient A"
"        3.007   Constant B"
"        0.703   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity            92.454    mm/hr"
"             Total depth                  44.904    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          101   No description"
"        0.000   % Impervious"
"        0.004   Total Area"
"       20.000   Flow length"
"        1.500   Overland Slope"
"        0.004   Pervious Area"
"       20.000   Pervious length"
"        1.500   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                    0.000     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.000      0.004      hectare"
"             Time of concentration  19.355     1.957      19.355     minutes"
"             Time to Centroid       87.157     95.540     87.157     minutes"
"             Rainfall depth         44.904     44.904     44.904     mm"
"             Rainfall volume        1.80       0.00       1.80       c.m"
"             Rainfall losses        41.133     7.500      41.133     mm"
"             Runoff depth           3.771      37.404     3.771      mm"
"             Runoff volume          0.15       0.00       0.15       c.m"
"             Runoff coefficient     0.084      0.000      0.084      "
```

```
"             Maximum flow          0.000      0.000      0.000      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.000     0.000     0.000     0.000"
" 51          PIPE DESIGN"
"         0.000   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         0.250   Diameter    metre"
"         1.100   Gradient   %"
"              Depth of flow                 0.008    metre"
"              Velocity                      0.245    m/sec"
"              Pipe capacity                 0.062    c.m/sec"
"              Critical depth                0.008    metre"
" 53          ROUTE    Pipe Route 22"
"        22.30      Pipe Route 22 Reach length   ( metre)"
"         0.481   X-factor <= 0.5"
"        68.212   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.500   Beta weighting factor"
"        66.667   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                  0.000    c.m/sec"
"                     0.000     0.000     0.000     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                "
"              Maximum flow                  0.000    c.m/sec"
"              Hydrograph volume             0.151    c.m"
"                     0.000     0.000     0.000     0.000"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.000     0.000     0.000     0.000"
" 33          CATCHMENT 102"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          102   No description"
"       99.400   % Impervious"
"        0.062   Total Area"
"       35.227   Flow length"
"        1.500   Overland Slope"
"        0.000   Pervious Area"
"       35.227   Pervious length"
"        1.500   Pervious slope"
"        0.062   Impervious Area"
"       35.227   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
```

```
"                    0.016     0.000     0.000     0.000 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.062      0.062      hectare"
"             Time of concentration  27.183     2.748      2.763      minutes"
"             Time to Centroid       91.809     95.551     95.549     minutes"
"             Rainfall depth         44.904     44.904     44.904     mm"
"             Rainfall volume        0.17       27.67      27.84      c.m"
"             Rainfall losses        41.133     7.500      7.702      mm"
"             Runoff depth           3.771      37.404     37.202     mm"
"             Runoff volume          0.01       23.05      23.07      c.m"
"             Runoff coefficient     0.084      0.833      0.828      "
"             Maximum flow           0.000      0.016      0.016      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.016     0.016     0.000     0.000"
" 51          PIPE DESIGN"
"         0.016   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         1.000   Diameter    metre"
"         1.000   Gradient   %"
"              Depth of flow                0.058    metre"
"              Velocity                     0.864    m/sec"
"              Pipe capacity                2.398    c.m/sec"
"              Critical depth               0.069    metre"
" 53          ROUTE Zero Route"
"          0.00   Zero Route Reach length   ( metre)"
"                    0.016     0.016     0.016     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                "
"             Maximum flow                  0.016    c.m/sec"
"             Hydrograph volume            23.216    c.m"
"                    0.016     0.016     0.016     0.016"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.016     0.000     0.016     0.016"
" 33          CATCHMENT 103"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          103   No description"
"       20.700   % Impervious"
"        0.006   Total Area"
"       20.690   Flow length"
"        1.500   Overland Slope"
"        0.005   Pervious Area"
"       20.690   Pervious length"
"        1.500   Pervious slope"
"        0.001   Impervious Area"
"       20.690   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
```

```
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                    0.000     0.000     0.016     0.016 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
"             Surface Area           0.005      0.001      0.006      hectare"
"             Time of concentration  19.753     1.997      6.944      minutes"
"             Time to Centroid       87.292     95.540     93.242     minutes"
"             Rainfall depth         44.904     44.904     44.904     mm"
"             Rainfall volume        2.14       0.56       2.69       c.m"
"             Rainfall losses        41.133     7.500      34.171     mm"
"             Runoff depth           3.771      37.404     10.733     mm"
"             Runoff volume          0.18       0.46       0.64       c.m"
"             Runoff coefficient     0.084      0.833      0.239      "
"             Maximum flow           0.000      0.000      0.000      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.000     0.000     0.016     0.016"
" 51          PIPE DESIGN"
"        0.000   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        0.250   Diameter    metre"
"        1.800   Gradient   %"
"             Depth of flow                 0.014    metre"
"             Velocity                      0.440    m/sec"
"             Pipe capacity                 0.080    c.m/sec"
"             Critical depth                0.016    metre"
" 53          ROUTE    Pipe Route 20"
"        19.60      Pipe Route 20 Reach length   ( metre)"
"        0.486   X-factor <= 0.5"
"       33.395   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       33.333   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.000    c.m/sec"
"                    0.000     0.000     0.000     0.016 c.m/sec"
" 40          HYDROGRAPH   Combine    4"
"            6   Combine "
"            4   Node #"
"                "
"             Maximum flow                  0.000    c.m/sec"
"             Hydrograph volume             0.644    c.m"
"                    0.000     0.000     0.000     0.000"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.000     0.000     0.000     0.000"
" 33          CATCHMENT 104"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          104   No description"
"       98.300   % Impervious"
"        0.048   Total Area"
"       15.094   Flow length"
"        1.500   Overland Slope"
"        0.001   Pervious Area"
"       15.094   Pervious length"
"        1.500   Pervious slope"
```

```
"        0.047   Impervious Area"
"       15.094   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                    0.012     0.000     0.000     0.000 c.m/sec"
"             Catchment 104          Pervious   Impervious Total Area "
"             Surface Area           0.001      0.047      0.048      hectare"
"             Time of concentration  16.348     1.653      1.678      minutes"
"             Time to Centroid       85.923     95.540     95.523     minutes"
"             Rainfall depth         44.904     44.904     44.904     mm"
"             Rainfall volume        0.37       21.19      21.55      c.m"
"             Rainfall losses        41.133     7.500      8.072      mm"
"             Runoff depth           3.771      37.404     36.833     mm"
"             Runoff volume          0.03       17.65      17.68      c.m"
"             Runoff coefficient     0.084      0.833      0.820      "
"             Maximum flow           0.000      0.012      0.012      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.012     0.012     0.000     0.000"
" 51          PIPE DESIGN"
"        0.012   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        1.000   Diameter    metre"
"        1.000   Gradient   %"
"             Depth of flow                0.051    metre"
"             Velocity                     0.797    m/sec"
"             Pipe capacity                2.398    c.m/sec"
"             Critical depth               0.060    metre"
" 53          ROUTE Zero Route"
"         0.00   Zero Route Reach length   ( metre)"
"                    0.012     0.012     0.012     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    4"
"            6   Combine "
"            4   Node #"
"                "
"             Maximum flow                 0.013    c.m/sec"
"             Hydrograph volume           18.324    c.m"
"                    0.012     0.012     0.012     0.013"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.012     0.000     0.012     0.013"
" 33          CATCHMENT 105"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          105   No description"
"      100.000   % Impervious"
"        0.053   Total Area"
"       11.522   Flow length"
"        1.500   Overland Slope"
"        0.000   Pervious Area"
```

```
"       11.522   Pervious length"
"        1.500   Pervious slope"
"        0.053   Impervious Area"
"       11.522   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                    0.014     0.000     0.012     0.013 c.m/sec"
"             Catchment 105          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.053      0.053      hectare"
"             Time of concentration  13.902     1.405      1.405      minutes"
"             Time to Centroid       84.696     95.540     95.540     minutes"
"             Rainfall depth         44.904     44.904     44.904     mm"
"             Rainfall volume        0.00       23.80      23.80      c.m"
"             Rainfall losses        41.133     7.500      7.500      mm"
"             Runoff depth           3.771      37.404     37.404     mm"
"             Runoff volume          0.00       19.82      19.82      c.m"
"             Runoff coefficient     0.000      0.833      0.833      "
"             Maximum flow           0.000      0.014      0.014      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.014     0.014     0.012     0.013"
" 51          PIPE DESIGN"
"        0.014   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        0.200   Diameter    metre"
"        0.500   Gradient   %"
"             Depth of flow                 0.110    metre"
"             Velocity                      0.768    m/sec"
"             Pipe capacity                 0.023    c.m/sec"
"             Critical depth                0.099    metre"
" 53          ROUTE    Pipe Route 16"
"       16.00      Pipe Route 16 Reach length   ( metre)"
"        0.077   X-factor <= 0.5"
"       15.633   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       28.571   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.013    c.m/sec"
"                    0.014     0.014     0.013     0.013 c.m/sec"
" 40          HYDROGRAPH   Combine    4"
"            6   Combine "
"            4   Node #"
"                "
"             Maximum flow                  0.026    c.m/sec"
"             Hydrograph volume            38.148    c.m"
"                    0.014     0.014     0.013     0.026"
" 40          HYDROGRAPH   Confluence    2"
"            7   Confluence "
```

```
"            2   Node #"
"                "
"             Maximum flow                    0.016    c.m/sec"
"             Hydrograph volume              23.216    c.m"
"                     0.014     0.016     0.013     0.000"
" 51          PIPE DESIGN"
"         0.016   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         0.250   Diameter    metre"
"         1.000   Gradient    %"
"              Depth of flow                  0.088    metre"
"              Velocity                       1.027    m/sec"
"              Pipe capacity                  0.059    c.m/sec"
"              Critical depth                 0.101    metre"
" 53          ROUTE    Pipe Route 5"
"          4.60       Pipe Route 5 Reach length   ( metre)"
"         0.000   X-factor <= 0.5"
"         3.360   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.515   Beta weighting factor"
"         6.897   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                   0.016    c.m/sec"
"                     0.014     0.016     0.016     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    100"
"            6   Combine "
"          100   Node #"
"                "
"             Maximum flow                    0.016    c.m/sec"
"             Hydrograph volume              23.216    c.m"
"                     0.014     0.016     0.016     0.016"
" 40          HYDROGRAPH   Confluence    4"
"            7   Confluence "
"            4   Node #"
"                "
"             Maximum flow                    0.026    c.m/sec"
"             Hydrograph volume              38.148    c.m"
"                     0.014     0.026     0.016     0.000"
" 51          PIPE DESIGN"
"         0.026   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         0.250   Diameter    metre"
"         1.000   Gradient    %"
"              Depth of flow                  0.116    metre"
"              Velocity                       1.170    m/sec"
"              Pipe capacity                  0.059    c.m/sec"
"              Critical depth                 0.130    metre"
" 53          ROUTE    Pipe Route 5"
"          5.10       Pipe Route 5 Reach length   ( metre)"
"         0.000   X-factor <= 0.5"
"         3.268   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.566   Beta weighting factor"
"         7.500   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                   0.026    c.m/sec"
```

```
"                    0.014     0.026     0.026     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    100"
"            6   Combine "
"          100   Node #"
"                "
"             Maximum flow                  0.042    c.m/sec"
"             Hydrograph volume            61.364    c.m"
"                    0.014     0.026     0.026     0.042"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.014     0.000     0.026     0.042"
" 33          CATCHMENT 98"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"           98   No description"
"       60.700   % Impervious"
"        0.006   Total Area"
"        2.353   Flow length"
"        1.500   Overland Slope"
"        0.002   Pervious Area"
"        2.353   Pervious length"
"        1.500   Pervious slope"
"        0.004   Impervious Area"
"        2.353   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                    0.001     0.000     0.026     0.042 c.m/sec"
"             Catchment 98           Pervious   Impervious Total Area "
"             Surface Area           0.002      0.004      0.006      hectare"
"             Time of concentration  5.360      0.542      0.837      minutes"
"             Time to Centroid       81.196     95.540     94.661     minutes"
"             Rainfall depth         44.904     44.904     44.904     mm"
"             Rainfall volume        1.06       1.64       2.69       c.m"
"             Rainfall losses        41.133     7.500      20.718     mm"
"             Runoff depth           3.771      37.404     24.186     mm"
"             Runoff volume          0.09       1.36       1.45       c.m"
"             Runoff coefficient     0.084      0.833      0.539      "
"             Maximum flow           0.000      0.001      0.001      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.001     0.001     0.026     0.042"
" 51          PIPE DESIGN"
"        0.001   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        1.000   Diameter    metre"
"        1.000   Gradient   %"
"             Depth of flow                 0.017    metre"
"             Velocity                      0.379    m/sec"
"             Pipe capacity                 2.398    c.m/sec"
"             Critical depth                0.018    metre"
```

```
" 53          ROUTE Zero Route"
"          0.00   Zero Route Reach length   ( metre)"
"                      0.001     0.001     0.001     0.042 c.m/sec"
" 40          HYDROGRAPH   Combine    101"
"             6   Combine "
"           101   Node #"
"                 "
"             Maximum flow                    0.001    c.m/sec"
"             Hydrograph volume               1.451    c.m"
"                      0.001     0.001     0.001     0.001"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                      0.001     0.000     0.001     0.001"
" 33          CATCHMENT 99"
"             2   Rectangular"
"             1   Equal length"
"             2   Horton equation"
"            99   No description"
"         0.000   % Impervious"
"         0.017   Total Area"
"         4.048   Flow length"
"         1.500   Overland Slope"
"         0.017   Pervious Area"
"         4.048   Pervious length"
"         1.500   Pervious slope"
"         0.000   Impervious Area"
"         4.048   Impervious length"
"         1.500   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        50.000   Pervious Max.infiltration"
"        10.000   Pervious Min.infiltration"
"         0.500   Pervious Lag constant (hours)"
"         7.500   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.500   Impervious Lag constant (hours)"
"         7.500   Impervious Depression storage"
"                      0.001     0.000     0.001     0.001 c.m/sec"
"              Catchment 99            Pervious   Impervious Total Area "
"              Surface Area            0.017      0.000      0.017      hectare"
"              Time of concentration   7.422      0.750      7.422      minutes"
"              Time to Centroid        81.401     95.540     81.401     minutes"
"              Rainfall depth          44.904     44.904     44.904     mm"
"              Rainfall volume         7.63       0.00       7.63       c.m"
"              Rainfall losses         41.133     7.500      41.133     mm"
"              Runoff depth            3.771      37.404     3.771      mm"
"              Runoff volume           0.64       0.00       0.64       c.m"
"              Runoff coefficient      0.084      0.000      0.084      "
"              Maximum flow            0.001      0.000      0.001      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.001     0.001     0.001     0.001"
" 51          PIPE DESIGN"
"         0.001   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         1.000   Diameter    metre"
"         1.000   Gradient   %"
"              Depth of flow                 0.016    metre"
"              Velocity                      0.367    m/sec"
```

```
"              Pipe capacity                    2.398    c.m/sec"
"              Critical depth                   0.017    metre"
" 53           ROUTE Zero Route"
"         0.00   Zero Route Reach length   ( metre)"
"                     0.001     0.001     0.001     0.001 c.m/sec"
" 40           HYDROGRAPH   Combine    101"
"            6   Combine "
"          101   Node #"
"                "
"              Maximum flow                     0.002    c.m/sec"
"              Hydrograph volume                2.092    c.m"
"                     0.001     0.001     0.001     0.002"
" 40           HYDROGRAPH   Confluence    100"
"            7   Confluence "
"          100   Node #"
"                "
"              Maximum flow                     0.042    c.m/sec"
"              Hydrograph volume               61.364    c.m"
"                     0.001     0.042     0.001     0.000"
" 56           DIVERSION"
"          100   Node number"
"        0.011   Overflow threshold"
"        1.000   Required diverted fraction"
"            0   Conduit type; 1=Pipe;2=Channel"
"              Peak of diverted flow           0.031    c.m/sec"
"              Volume of diverted flow        21.153    c.m"
"              DIV00100.005hyd"
"              Divert to Underground Storage 21.153 cu.m. (21.6 cu.m.)"
"                     0.001     0.042     0.011     0.000 c.m/sec"
" 40           HYDROGRAPH Next link "
"            5   Next link "
"                     0.001     0.011     0.011     0.000"
" 51           PIPE DESIGN"
"        0.011   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        1.000   Diameter    metre"
"        1.000   Gradient   %"
"             Depth of flow                    0.049    metre"
"             Velocity                         0.773    m/sec"
"             Pipe capacity                    2.398    c.m/sec"
"             Critical depth                   0.057    metre"
" 53          ROUTE Zero Route"
"         0.00   Zero Route Reach length   ( metre)"
"                     0.001     0.011     0.011     0.000 c.m/sec"
" 40           HYDROGRAPH   Combine    101"
"            6   Combine "
"          101   Node #"
"                "
"              Maximum flow                     0.013    c.m/sec"
"              Hydrograph volume               42.303    c.m"
"                     0.001     0.011     0.011     0.013"
" 40           HYDROGRAPH   Confluence    101"
"            7   Confluence "
"          101   Node #"
"                "
"              Maximum flow                     0.013    c.m/sec"
"              Hydrograph volume               42.303    c.m"
"                     0.001     0.013     0.011     0.000"
" 38           START/RE-START TOTALS 101"
"              3   Runoff Totals on EXIT"
```

```
"              Total Catchment area                    0.196    hectare"
"              Total Impervious area                   0.167    hectare"
"              Total % impervious                     85.049"
" 19           EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                      February-07-10"
"           10   Units used:                                             ie METRIC"
"                Job folder:                                 C:\swm\MIDUSS\16025"
"                Output filename:                                        Pst10.out"
"                Licensee name:                                                Bob"
"                Company                                                         "
"                Date & Time last used:                   31/07/2022 at 9:41:35 AM"
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      670.324   Coefficient A"
"        3.007   Constant B"
"        0.698   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          107.682    mm/hr"
"             Total depth                 52.991    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          101   No description"
"        0.000   % Impervious"
"        0.004   Total Area"
"       20.000   Flow length"
"        1.500   Overland Slope"
"        0.004   Pervious Area"
"       20.000   Pervious length"
"        1.500   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                    0.000     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.000      0.004      hectare"
"             Time of concentration  14.220     1.841      14.220     minutes"
"             Time to Centroid       85.418     94.639     85.418     minutes"
"             Rainfall depth         52.991     52.991     52.991     mm"
"             Rainfall volume        2.12       0.00       2.12       c.m"
"             Rainfall losses        44.350     7.500      44.350     mm"
"             Runoff depth           8.641      45.491     8.641      mm"
"             Runoff volume          0.35       0.00       0.35       c.m"
"             Runoff coefficient     0.163      0.000      0.163      "
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"            Maximum flow           0.000      0.000      0.000      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.000     0.000     0.000     0.000"
" 51         PIPE DESIGN"
"       0.000   Current peak flow    c.m/sec"
"       0.013   Manning 'n'"
"       0.250   Diameter    metre"
"       1.100   Gradient   %"
"            Depth of flow                 0.013    metre"
"            Velocity                      0.341    m/sec"
"            Pipe capacity                 0.062    c.m/sec"
"            Critical depth                0.014    metre"
" 53         ROUTE    Pipe Route 22"
"       22.30      Pipe Route 22 Reach length   ( metre)"
"       0.480   X-factor <= 0.5"
"      49.073   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      50.000   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                  0.000    c.m/sec"
"                  0.000     0.000     0.000     0.000 c.m/sec"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               "
"            Maximum flow                  0.000    c.m/sec"
"            Hydrograph volume             0.346    c.m"
"                  0.000     0.000     0.000     0.000"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                  0.000     0.000     0.000     0.000"
" 33         CATCHMENT 102"
"           2   Rectangular"
"           1   Equal length"
"           2   Horton equation"
"         102   No description"
"      99.400   % Impervious"
"       0.062   Total Area"
"      35.227   Flow length"
"       1.500   Overland Slope"
"       0.000   Pervious Area"
"      35.227   Pervious length"
"       1.500   Pervious slope"
"       0.062   Impervious Area"
"      35.227   Impervious length"
"       1.500   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      50.000   Pervious Max.infiltration"
"      10.000   Pervious Min.infiltration"
"       0.500   Pervious Lag constant (hours)"
"       7.500   Pervious Depression storage"
"       0.015   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
"       0.500   Impervious Lag constant (hours)"
"       7.500   Impervious Depression storage"
```

```
"                    0.018     0.000     0.000     0.000 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.062      0.062      hectare"
"             Time of concentration  19.971     2.585      2.605      minutes"
"             Time to Centroid       87.974     94.639     94.631     minutes"
"             Rainfall depth         52.991     52.991     52.991     mm"
"             Rainfall volume        0.20       32.66      32.85      c.m"
"             Rainfall losses        44.350     7.500      7.721      mm"
"             Runoff depth           8.641      45.491     45.270     mm"
"             Runoff volume          0.03       28.04      28.07      c.m"
"             Runoff coefficient     0.163      0.858      0.854      "
"             Maximum flow           0.000      0.018      0.018      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.018     0.018     0.000     0.000"
" 51          PIPE DESIGN"
"        0.018   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        1.000   Diameter    metre"
"        1.000   Gradient   %"
"             Depth of flow                0.062    metre"
"             Velocity                     0.905    m/sec"
"             Pipe capacity                2.398    c.m/sec"
"             Critical depth               0.074    metre"
" 53          ROUTE Zero Route"
"         0.00   Zero Route Reach length   ( metre)"
"                    0.018     0.018     0.018     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                "
"             Maximum flow                 0.019    c.m/sec"
"             Hydrograph volume           28.413    c.m"
"                    0.018     0.018     0.018     0.019"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.018     0.000     0.018     0.019"
" 33          CATCHMENT 103"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          103   No description"
"       20.700   % Impervious"
"        0.006   Total Area"
"       20.690   Flow length"
"        1.500   Overland Slope"
"        0.005   Pervious Area"
"       20.690   Pervious length"
"        1.500   Pervious slope"
"        0.001   Impervious Area"
"       20.690   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
```

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"         0.500   Impervious Lag constant (hours)"
"         7.500   Impervious Depression storage"
"                     0.001     0.000     0.018     0.019 c.m/sec"
"              Catchment 103          Pervious   Impervious Total Area "
"              Surface Area           0.005      0.001      0.006      hectare"
"              Time of concentration  14.512     1.879      7.200      minutes"
"              Time to Centroid       85.570     94.639     90.819     minutes"
"              Rainfall depth         52.991     52.991     52.991     mm"
"              Rainfall volume        2.52       0.66       3.18       c.m"
"              Rainfall losses        44.350     7.500      36.722     mm"
"              Runoff depth           8.641      45.491     16.269     mm"
"              Runoff volume          0.41       0.57       0.98       c.m"
"              Runoff coefficient     0.163      0.858      0.307      "
"              Maximum flow           0.000      0.000      0.001      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.001     0.001     0.018     0.019"
" 51           PIPE DESIGN"
"         0.001   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         0.250   Diameter    metre"
"         1.800   Gradient   %"
"              Depth of flow                 0.017    metre"
"              Velocity                      0.517    m/sec"
"              Pipe capacity                 0.080    c.m/sec"
"              Critical depth                0.021    metre"
" 53           ROUTE    Pipe Route 20"
"         19.60       Pipe Route 20 Reach length   ( metre)"
"         0.485   X-factor <= 0.5"
"        28.430   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.500   Beta weighting factor"
"        28.571   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                  0.001    c.m/sec"
"                     0.001     0.001     0.001     0.019 c.m/sec"
" 40           HYDROGRAPH   Combine    4"
"             6   Combine "
"             4   Node #"
"                 "
"              Maximum flow                  0.001    c.m/sec"
"              Hydrograph volume             0.976    c.m"
"                     0.001     0.001     0.001     0.001"
" 40           HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                     0.001     0.000     0.001     0.001"
" 33           CATCHMENT 104"
"             2   Rectangular"
"             1   Equal length"
"             2   Horton equation"
"           104   No description"
"        98.300   % Impervious"
"         0.048   Total Area"
"        15.094   Flow length"
"         1.500   Overland Slope"
"         0.001   Pervious Area"
"        15.094   Pervious length"
"         1.500   Pervious slope"
```

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"         0.047   Impervious Area"
"        15.094   Impervious length"
"         1.500   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        50.000   Pervious Max.infiltration"
"        10.000   Pervious Min.infiltration"
"         0.500   Pervious Lag constant (hours)"
"         7.500   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.500   Impervious Lag constant (hours)"
"         7.500   Impervious Depression storage"
"                     0.014     0.000     0.001     0.001 c.m/sec"
"              Catchment 104          Pervious   Impervious Total Area "
"              Surface Area           0.001      0.047      0.048      hectare"
"              Time of concentration  12.010     1.555      1.589      minutes"
"              Time to Centroid       84.030     94.639     94.604     minutes"
"              Rainfall depth         52.991     52.991     52.991     mm"
"              Rainfall volume        0.43       25.00      25.44      c.m"
"              Rainfall losses        44.350     7.500      8.126      mm"
"              Runoff depth           8.641      45.491     44.865     mm"
"              Runoff volume          0.07       21.46      21.54      c.m"
"              Runoff coefficient     0.163      0.858      0.847      "
"              Maximum flow           0.000      0.014      0.014      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.014     0.014     0.001     0.001"
" 51           PIPE DESIGN"
"         0.014   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         1.000   Diameter    metre"
"         1.000   Gradient   %"
"              Depth of flow                 0.055    metre"
"              Velocity                      0.836    m/sec"
"              Pipe capacity                 2.398    c.m/sec"
"              Critical depth                0.065    metre"
" 53           ROUTE Zero Route"
"          0.00   Zero Route Reach length   ( metre)"
"                     0.014     0.014     0.014     0.001 c.m/sec"
" 40           HYDROGRAPH   Combine    4"
"             6   Combine "
"             4   Node #"
"                 "
"              Maximum flow                  0.015    c.m/sec"
"              Hydrograph volume            22.511    c.m"
"                     0.014     0.014     0.014     0.015"
" 40           HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                     0.014     0.000     0.014     0.015"
" 33           CATCHMENT 105"
"             2   Rectangular"
"             1   Equal length"
"             2   Horton equation"
"           105   No description"
"       100.000   % Impervious"
"         0.053   Total Area"
"        11.522   Flow length"
"         1.500   Overland Slope"
"         0.000   Pervious Area"
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"       11.522   Pervious length"
"        1.500   Pervious slope"
"        0.053   Impervious Area"
"       11.522   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                    0.016     0.000     0.014     0.015 c.m/sec"
"             Catchment 105          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.053      0.053      hectare"
"             Time of concentration  10.214     1.322      1.322      minutes"
"             Time to Centroid       82.460     94.639     94.639     minutes"
"             Rainfall depth         52.991     52.991     52.991     mm"
"             Rainfall volume        0.00       28.09      28.09      c.m"
"             Rainfall losses        44.350     7.500      7.500      mm"
"             Runoff depth           8.641      45.491     45.491     mm"
"             Runoff volume          0.00       24.11      24.11      c.m"
"             Runoff coefficient     0.000      0.858      0.858      "
"             Maximum flow           0.000      0.016      0.016      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.016     0.016     0.014     0.015"
" 51          PIPE DESIGN"
"        0.016   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        0.200   Diameter    metre"
"        0.500   Gradient   %"
"             Depth of flow                0.121    metre"
"             Velocity                     0.795    m/sec"
"             Pipe capacity                0.023    c.m/sec"
"             Critical depth               0.108    metre"
" 53          ROUTE    Pipe Route 16"
"        16.00      Pipe Route 16 Reach length   ( metre)"
"        0.000   X-factor <= 0.5"
"       15.100   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.501   Beta weighting factor"
"       30.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                 0.016    c.m/sec"
"                    0.016     0.016     0.016     0.015 c.m/sec"
" 40          HYDROGRAPH   Combine    4"
"            6   Combine "
"            4   Node #"
"                "
"             Maximum flow                 0.031    c.m/sec"
"             Hydrograph volume           46.622    c.m"
"                    0.016     0.016     0.016     0.031"
" 40          HYDROGRAPH   Confluence    2"
"            7   Confluence "
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"            2   Node #"
"                "
"             Maximum flow                    0.019    c.m/sec"
"             Hydrograph volume              28.413    c.m"
"                     0.016     0.019     0.016     0.000"
" 51          PIPE DESIGN"
"         0.019   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         0.250   Diameter    metre"
"         1.000   Gradient    %"
"              Depth of flow                  0.097    metre"
"              Velocity                       1.074    m/sec"
"              Pipe capacity                  0.059    c.m/sec"
"              Critical depth                 0.110    metre"
" 53          ROUTE    Pipe Route 5"
"          4.60      Pipe Route 5 Reach length   ( metre)"
"         0.000   X-factor <= 0.5"
"         3.213   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.540   Beta weighting factor"
"         6.977   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                   0.019    c.m/sec"
"                     0.016     0.019     0.019     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    100"
"             6   Combine "
"           100   Node #"
"                 "
"             Maximum flow                    0.019    c.m/sec"
"             Hydrograph volume              28.413    c.m"
"                     0.016     0.019     0.019     0.019"
" 40          HYDROGRAPH   Confluence    4"
"             7   Confluence "
"             4   Node #"
"                 "
"             Maximum flow                    0.031    c.m/sec"
"             Hydrograph volume              46.622    c.m"
"                     0.016     0.031     0.019     0.000"
" 51          PIPE DESIGN"
"         0.031   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         0.250   Diameter    metre"
"         1.000   Gradient    %"
"              Depth of flow                  0.127    metre"
"              Velocity                       1.220    m/sec"
"              Pipe capacity                  0.059    c.m/sec"
"              Critical depth                 0.142    metre"
" 53          ROUTE    Pipe Route 5"
"          5.10      Pipe Route 5 Reach length   ( metre)"
"         0.000   X-factor <= 0.5"
"         3.136   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.596   Beta weighting factor"
"         7.692   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                   0.030    c.m/sec"
```

```
"                    0.016     0.031     0.030     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    100"
"              6   Combine "
"            100   Node #"
"                  "
"              Maximum flow                  0.049    c.m/sec"
"              Hydrograph volume            75.035    c.m"
"                    0.016     0.031     0.030     0.049"
" 40          HYDROGRAPH Start - New Tributary"
"              2   Start - New Tributary"
"                    0.016     0.000     0.030     0.049"
" 33          CATCHMENT 98"
"              2   Rectangular"
"              1   Equal length"
"              2   Horton equation"
"             98   No description"
"         60.700   % Impervious"
"          0.006   Total Area"
"          2.353   Flow length"
"          1.500   Overland Slope"
"          0.002   Pervious Area"
"          2.353   Pervious length"
"          1.500   Pervious slope"
"          0.004   Impervious Area"
"          2.353   Impervious length"
"          1.500   Impervious slope"
"          0.250   Pervious Manning 'n'"
"         50.000   Pervious Max.infiltration"
"         10.000   Pervious Min.infiltration"
"          0.500   Pervious Lag constant (hours)"
"          7.500   Pervious Depression storage"
"          0.015   Impervious Manning 'n'"
"          0.000   Impervious Max.infiltration"
"          0.000   Impervious Min.infiltration"
"          0.500   Impervious Lag constant (hours)"
"          7.500   Impervious Depression storage"
"                    0.001     0.000     0.030     0.049 c.m/sec"
"              Catchment 98           Pervious   Impervious Total Area "
"              Surface Area           0.002      0.004      0.006      hectare"
"              Time of concentration  3.938      0.510      0.885      minutes"
"              Time to Centroid       81.480     94.639     93.198     minutes"
"              Rainfall depth         52.991     52.991     52.991     mm"
"              Rainfall volume        1.25       1.93       3.18       c.m"
"              Rainfall losses        44.350     7.500      21.982     mm"
"              Runoff depth           8.641      45.491     31.009     mm"
"              Runoff volume          0.20       1.66       1.86       c.m"
"              Runoff coefficient     0.163      0.858      0.585      "
"              Maximum flow           0.000      0.001      0.001      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"              4   Add Runoff "
"                    0.001     0.001     0.030     0.049"
" 51          PIPE DESIGN"
"          0.001   Current peak flow    c.m/sec"
"          0.013   Manning 'n'"
"          1.000   Diameter    metre"
"          1.000   Gradient   %"
"              Depth of flow                 0.019    metre"
"              Velocity                      0.410    m/sec"
"              Pipe capacity                 2.398    c.m/sec"
"              Critical depth                0.020    metre"
```

```
" 53          ROUTE Zero Route"
"          0.00   Zero Route Reach length   ( metre)"
"                      0.001     0.001     0.001     0.049 c.m/sec"
" 40          HYDROGRAPH   Combine    101"
"             6   Combine "
"           101   Node #"
"                 "
"             Maximum flow                    0.001    c.m/sec"
"             Hydrograph volume               1.861    c.m"
"                      0.001     0.001     0.001     0.001"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                      0.001     0.000     0.001     0.001"
" 33          CATCHMENT 99"
"             2   Rectangular"
"             1   Equal length"
"             2   Horton equation"
"            99   No description"
"         0.000   % Impervious"
"         0.017   Total Area"
"         4.048   Flow length"
"         1.500   Overland Slope"
"         0.017   Pervious Area"
"         4.048   Pervious length"
"         1.500   Pervious slope"
"         0.000   Impervious Area"
"         4.048   Impervious length"
"         1.500   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        50.000   Pervious Max.infiltration"
"        10.000   Pervious Min.infiltration"
"         0.500   Pervious Lag constant (hours)"
"         7.500   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.500   Impervious Lag constant (hours)"
"         7.500   Impervious Depression storage"
"                      0.002     0.000     0.001     0.001 c.m/sec"
"              Catchment 99            Pervious   Impervious Total Area "
"              Surface Area            0.017      0.000      0.017      hectare"
"              Time of concentration   5.453      0.706      5.453      minutes"
"              Time to Centroid        81.612     94.639     81.612     minutes"
"              Rainfall depth          52.991     52.991     52.991     mm"
"              Rainfall volume         9.01       0.00       9.01       c.m"
"              Rainfall losses         44.350     7.500      44.350     mm"
"              Runoff depth            8.641      45.491     8.641      mm"
"              Runoff volume           1.47       0.00       1.47       c.m"
"              Runoff coefficient      0.163      0.000      0.163      "
"              Maximum flow            0.002      0.000      0.002      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.002     0.002     0.001     0.001"
" 51          PIPE DESIGN"
"         0.002   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         1.000   Diameter    metre"
"         1.000   Gradient   %"
"              Depth of flow                 0.023    metre"
"              Velocity                      0.465    m/sec"
```

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"            Pipe capacity                  2.398    c.m/sec"
"            Critical depth                 0.025    metre"
" 53         ROUTE Zero Route"
"       0.00   Zero Route Reach length   ( metre)"
"                  0.002     0.002     0.002     0.001 c.m/sec"
" 40         HYDROGRAPH   Combine    101"
"          6   Combine "
"        101   Node #"
"              "
"            Maximum flow                   0.003    c.m/sec"
"            Hydrograph volume              3.330    c.m"
"                  0.002     0.002     0.002     0.003"
" 40         HYDROGRAPH   Confluence    100"
"          7   Confluence "
"        100   Node #"
"              "
"            Maximum flow                   0.049    c.m/sec"
"            Hydrograph volume             75.035    c.m"
"                  0.002     0.049     0.002     0.000"
" 56         DIVERSION"
"        100   Node number"
"      0.016   Overflow threshold"
"      1.000   Required diverted fraction"
"          0   Conduit type; 1=Pipe;2=Channel"
"            Peak of diverted flow          0.033    c.m/sec"
"            Volume of diverted flow       20.698    c.m"
"            DIV00100.005hyd"
"            Divert to Underground Storage 20.638 cu.m. (21.6 cu.m.)"
"                  0.002     0.049     0.016     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"          5   Next link "
"                  0.002     0.016     0.016     0.000"
" 51         PIPE DESIGN"
"      0.016   Current peak flow    c.m/sec"
"      0.013   Manning 'n'"
"      1.000   Diameter    metre"
"      1.000   Gradient   %"
"           Depth of flow                  0.058    metre"
"           Velocity                       0.867    m/sec"
"           Pipe capacity                  2.398    c.m/sec"
"           Critical depth                 0.069    metre"
" 53         ROUTE Zero Route"
"       0.00   Zero Route Reach length   ( metre)"
"                  0.002     0.016     0.016     0.000 c.m/sec"
" 40         HYDROGRAPH   Combine    101"
"          6   Combine "
"        101   Node #"
"              "
"            Maximum flow                   0.019    c.m/sec"
"            Hydrograph volume             57.667    c.m"
"                  0.002     0.016     0.016     0.019"
" 40         HYDROGRAPH   Confluence    101"
"          7   Confluence "
"        101   Node #"
"              "
"            Maximum flow                   0.019    c.m/sec"
"            Hydrograph volume             57.667    c.m"
"                  0.002     0.019     0.016     0.000"
" 38         START/RE-START TOTALS 101"
"            3   Runoff Totals on EXIT"
```

```
"              Total Catchment area                    0.196    hectare"
"              Total Impervious area                   0.167    hectare"
"              Total % impervious                     85.049"
" 19           EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                                Version 2.25  rev. 473"
"                MIDUSS created                                        February-07-10"
"           10   Units used:                                              ie METRIC"
"                Job folder:                                  C:\swm\MIDUSS\16025"
"                Output filename:                                        Pst25.out"
"                Licensee name:                                                Bob"
"                Company                                                         "
"                Date & Time last used:                 31/07/2022 at 9:39:02 AM"
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      721.533   Coefficient A"
"        2.253   Constant B"
"        0.679   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          127.011    mm/hr"
"             Total depth                 63.151    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          101   No description"
"        0.000   % Impervious"
"        0.004   Total Area"
"       20.000   Flow length"
"        1.500   Overland Slope"
"        0.004   Pervious Area"
"       20.000   Pervious length"
"        1.500   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                    0.001     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.000      0.004      hectare"
"             Time of concentration  11.604     1.723      11.604     minutes"
"             Time to Centroid       85.752     94.030     85.752     minutes"
"             Rainfall depth         63.151     63.151     63.151     mm"
"             Rainfall volume        2.53       0.00       2.53       c.m"
"             Rainfall losses        47.786     7.500      47.786     mm"
"             Runoff depth           15.365     55.651     15.365     mm"
"             Runoff volume          0.61       0.00       0.61       c.m"
"             Runoff coefficient     0.243      0.000      0.243      "
```

```
"             Maximum flow           0.001      0.000      0.001      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.001     0.001     0.000     0.000"
" 51          PIPE DESIGN"
"         0.001   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         0.250   Diameter    metre"
"         1.100   Gradient   %"
"              Depth of flow                 0.019    metre"
"              Velocity                      0.423    m/sec"
"              Pipe capacity                 0.062    c.m/sec"
"              Critical depth                0.020    metre"
" 53          ROUTE    Pipe Route 22"
"         22.30      Pipe Route 22 Reach length   ( metre)"
"         0.478   X-factor <= 0.5"
"        39.533   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.500   Beta weighting factor"
"        40.000   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                  0.001    c.m/sec"
"                    0.001     0.001     0.001     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                "
"              Maximum flow                  0.001    c.m/sec"
"              Hydrograph volume             0.615    c.m"
"                    0.001     0.001     0.001     0.001"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.001     0.000     0.001     0.001"
" 33          CATCHMENT 102"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          102   No description"
"        99.400   % Impervious"
"         0.062   Total Area"
"        35.227   Flow length"
"         1.500   Overland Slope"
"         0.000   Pervious Area"
"        35.227   Pervious length"
"         1.500   Pervious slope"
"         0.062   Impervious Area"
"        35.227   Impervious length"
"         1.500   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        50.000   Pervious Max.infiltration"
"        10.000   Pervious Min.infiltration"
"         0.500   Pervious Lag constant (hours)"
"         7.500   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.500   Impervious Lag constant (hours)"
"         7.500   Impervious Depression storage"
```

```
"                    0.022     0.000     0.001     0.001 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.062      0.062      hectare"
"             Time of concentration  16.298     2.420      2.443      minutes"
"             Time to Centroid       88.853     94.030     94.021     minutes"
"             Rainfall depth         63.151     63.151     63.151     mm"
"             Rainfall volume        0.23       38.92      39.15      c.m"
"             Rainfall losses        47.786     7.500      7.742      mm"
"             Runoff depth           15.365     55.651     55.409     mm"
"             Runoff volume          0.06       34.30      34.35      c.m"
"             Runoff coefficient     0.243      0.881      0.877      "
"             Maximum flow           0.000      0.022      0.022      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.022     0.022     0.001     0.001"
" 51          PIPE DESIGN"
"         0.022   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         1.000   Diameter    metre"
"         1.000   Gradient   %"
"              Depth of flow                0.067    metre"
"              Velocity                     0.952    m/sec"
"              Pipe capacity                2.398    c.m/sec"
"              Critical depth               0.081    metre"
" 53          ROUTE Zero Route"
"          0.00   Zero Route Reach length   ( metre)"
"                    0.022     0.022     0.022     0.001 c.m/sec"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                "
"              Maximum flow                 0.022    c.m/sec"
"              Hydrograph volume           34.968    c.m"
"                    0.022     0.022     0.022     0.022"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.022     0.000     0.022     0.022"
" 33          CATCHMENT 103"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          103   No description"
"       20.700   % Impervious"
"        0.006   Total Area"
"       20.690   Flow length"
"        1.500   Overland Slope"
"        0.005   Pervious Area"
"       20.690   Pervious length"
"        1.500   Pervious slope"
"        0.001   Impervious Area"
"       20.690   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
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"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                    0.001     0.000     0.022     0.022 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
"             Surface Area           0.005      0.001      0.006      hectare"
"             Time of concentration  11.843     1.759      6.942      minutes"
"             Time to Centroid       85.952     94.030     89.878     minutes"
"             Rainfall depth         63.151     63.151     63.151     mm"
"             Rainfall volume        3.00       0.78       3.79       c.m"
"             Rainfall losses        47.786     7.500      39.447     mm"
"             Runoff depth           15.365     55.651     23.704     mm"
"             Runoff volume          0.73       0.69       1.42       c.m"
"             Runoff coefficient     0.243      0.881      0.375      "
"             Maximum flow           0.001      0.000      0.001      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.001     0.001     0.022     0.022"
" 51          PIPE DESIGN"
"        0.001   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        0.250   Diameter    metre"
"        1.800   Gradient   %"
"             Depth of flow                 0.022    metre"
"             Velocity                      0.599    m/sec"
"             Pipe capacity                 0.080    c.m/sec"
"             Critical depth                0.027    metre"
" 53          ROUTE    Pipe Route 20"
"       19.60      Pipe Route 20 Reach length   ( metre)"
"        0.483   X-factor <= 0.5"
"       24.541   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       25.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.001    c.m/sec"
"                    0.001     0.001     0.001     0.022 c.m/sec"
" 40          HYDROGRAPH   Combine    4"
"            6   Combine "
"            4   Node #"
"                "
"             Maximum flow                  0.001    c.m/sec"
"             Hydrograph volume             1.422    c.m"
"                    0.001     0.001     0.001     0.001"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.001     0.000     0.001     0.001"
" 33          CATCHMENT 104"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          104   No description"
"       98.300   % Impervious"
"        0.048   Total Area"
"       15.094   Flow length"
"        1.500   Overland Slope"
"        0.001   Pervious Area"
"       15.094   Pervious length"
"        1.500   Pervious slope"
```

```
"        0.047   Impervious Area"
"       15.094   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                     0.017     0.000     0.001     0.001 c.m/sec"
"             Catchment 104          Pervious   Impervious Total Area "
"             Surface Area           0.001      0.047      0.048      hectare"
"             Time of concentration  9.801      1.455      1.495      minutes"
"             Time to Centroid       84.160     94.030     93.983     minutes"
"             Rainfall depth         63.151     63.151     63.151     mm"
"             Rainfall volume        0.52       29.80      30.31      c.m"
"             Rainfall losses        47.786     7.500      8.185      mm"
"             Runoff depth           15.365     55.651     54.966     mm"
"             Runoff volume          0.13       26.26      26.38      c.m"
"             Runoff coefficient     0.243      0.881      0.870      "
"             Maximum flow           0.000      0.017      0.017      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.017     0.017     0.001     0.001"
" 51          PIPE DESIGN"
"        0.017   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        1.000   Diameter    metre"
"        1.000   Gradient   %"
"             Depth of flow                 0.060    metre"
"             Velocity                      0.880    m/sec"
"             Pipe capacity                 2.398    c.m/sec"
"             Critical depth                0.071    metre"
" 53          ROUTE Zero Route"
"         0.00   Zero Route Reach length   ( metre)"
"                     0.017     0.017     0.017     0.001 c.m/sec"
" 40          HYDROGRAPH   Combine    4"
"            6   Combine "
"            4   Node #"
"                "
"             Maximum flow                  0.018    c.m/sec"
"             Hydrograph volume            27.806    c.m"
"                     0.017     0.017     0.017     0.018"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.017     0.000     0.017     0.018"
" 33          CATCHMENT 105"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          105   No description"
"      100.000   % Impervious"
"        0.053   Total Area"
"       11.522   Flow length"
"        1.500   Overland Slope"
"        0.000   Pervious Area"
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"       11.522   Pervious length"
"        1.500   Pervious slope"
"        0.053   Impervious Area"
"       11.522   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                    0.019     0.000     0.017     0.018 c.m/sec"
"             Catchment 105          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.053      0.053      hectare"
"             Time of concentration  8.335      1.238      1.238      minutes"
"             Time to Centroid       83.889     94.030     94.030     minutes"
"             Rainfall depth         63.151     63.151     63.151     mm"
"             Rainfall volume        0.00       33.47      33.47      c.m"
"             Rainfall losses        47.786     7.500      7.500      mm"
"             Runoff depth           15.365     55.651     55.651     mm"
"             Runoff volume          0.00       29.49      29.49      c.m"
"             Runoff coefficient     0.000      0.881      0.881      "
"             Maximum flow           0.000      0.019      0.019      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.019     0.019     0.017     0.018"
" 51          PIPE DESIGN"
"        0.019   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        0.200   Diameter    metre"
"        0.500   Gradient   %"
"             Depth of flow                0.136    metre"
"             Velocity                     0.821    m/sec"
"             Pipe capacity                0.023    c.m/sec"
"             Critical depth               0.117    metre"
" 53          ROUTE    Pipe Route 16"
"        16.00      Pipe Route 16 Reach length   ( metre)"
"        0.000   X-factor <= 0.5"
"       14.611   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.563   Beta weighting factor"
"       31.579   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                 0.018    c.m/sec"
"                    0.019     0.019     0.018     0.018 c.m/sec"
" 40          HYDROGRAPH   Combine    4"
"            6   Combine "
"            4   Node #"
"                "
"             Maximum flow                 0.036    c.m/sec"
"             Hydrograph volume           57.301    c.m"
"                    0.019     0.019     0.018     0.036"
" 40          HYDROGRAPH   Confluence    2"
"            7   Confluence "
```

```
"            2   Node #"
"                "
"             Maximum flow                    0.022    c.m/sec"
"             Hydrograph volume              34.968    c.m"
"                    0.019     0.022     0.018     0.000"
" 51          PIPE DESIGN"
"        0.022   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        0.250   Diameter    metre"
"        1.000   Gradient   %"
"             Depth of flow                   0.106    metre"
"             Velocity                        1.127    m/sec"
"             Pipe capacity                   0.059    c.m/sec"
"             Critical depth                  0.120    metre"
" 53          ROUTE    Pipe Route 5"
"         4.60      Pipe Route 5 Reach length   ( metre)"
"        0.000   X-factor <= 0.5"
"        3.062   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.567   Beta weighting factor"
"        7.059   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                    0.022    c.m/sec"
"                    0.019     0.022     0.022     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    100"
"            6   Combine "
"          100   Node #"
"                "
"             Maximum flow                    0.022    c.m/sec"
"             Hydrograph volume              34.968    c.m"
"                    0.019     0.022     0.022     0.022"
" 40          HYDROGRAPH   Confluence    4"
"            7   Confluence "
"            4   Node #"
"                "
"             Maximum flow                    0.036    c.m/sec"
"             Hydrograph volume              57.301    c.m"
"                    0.019     0.036     0.022     0.000"
" 51          PIPE DESIGN"
"        0.036   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        0.250   Diameter    metre"
"        1.000   Gradient   %"
"             Depth of flow                   0.141    metre"
"             Velocity                        1.272    m/sec"
"             Pipe capacity                   0.059    c.m/sec"
"             Critical depth                  0.155    metre"
" 53          ROUTE    Pipe Route 5"
"         5.10      Pipe Route 5 Reach length   ( metre)"
"        0.000   X-factor <= 0.5"
"        3.006   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.636   Beta weighting factor"
"        8.108   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                    0.036    c.m/sec"
```

```
"                    0.019     0.036     0.036     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    100"
"             6   Combine "
"           100   Node #"
"                 "
"             Maximum flow                  0.059    c.m/sec"
"             Hydrograph volume            92.269    c.m"
"                    0.019     0.036     0.036     0.059"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                    0.019     0.000     0.036     0.059"
" 33          CATCHMENT 98"
"             2   Rectangular"
"             1   Equal length"
"             2   Horton equation"
"            98   No description"
"        60.700   % Impervious"
"         0.006   Total Area"
"         2.353   Flow length"
"         1.500   Overland Slope"
"         0.002   Pervious Area"
"         2.353   Pervious length"
"         1.500   Pervious slope"
"         0.004   Impervious Area"
"         2.353   Impervious length"
"         1.500   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        50.000   Pervious Max.infiltration"
"        10.000   Pervious Min.infiltration"
"         0.500   Pervious Lag constant (hours)"
"         7.500   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.500   Impervious Lag constant (hours)"
"         7.500   Impervious Depression storage"
"                    0.002     0.000     0.036     0.059 c.m/sec"
"             Catchment 98           Pervious   Impervious Total Area "
"             Surface Area           0.002      0.004      0.006      hectare"
"             Time of concentration  3.213      0.477      0.892      minutes"
"             Time to Centroid       82.778     94.030     92.323     minutes"
"             Rainfall depth         63.151     63.151     63.151     mm"
"             Rainfall volume        1.49       2.30       3.79       c.m"
"             Rainfall losses        47.786     7.500      23.332     mm"
"             Runoff depth           15.365     55.651     39.819     mm"
"             Runoff volume          0.36       2.03       2.39       c.m"
"             Runoff coefficient     0.243      0.881      0.631      "
"             Maximum flow           0.000      0.001      0.002      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.002     0.002     0.036     0.059"
" 51          PIPE DESIGN"
"         0.002   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         1.000   Diameter    metre"
"         1.000   Gradient   %"
"             Depth of flow                 0.021    metre"
"             Velocity                      0.442    m/sec"
"             Pipe capacity                 2.398    c.m/sec"
"             Critical depth                0.023    metre"
```

```
" 53          ROUTE Zero Route"
"         0.00   Zero Route Reach length   ( metre)"
"                     0.002     0.002     0.002     0.059 c.m/sec"
" 40          HYDROGRAPH   Combine    101"
"             6   Combine "
"           101   Node #"
"                 "
"             Maximum flow                   0.002    c.m/sec"
"             Hydrograph volume              2.389    c.m"
"                     0.002     0.002     0.002     0.002"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                     0.002     0.000     0.002     0.002"
" 33          CATCHMENT 99"
"             2   Rectangular"
"             1   Equal length"
"             2   Horton equation"
"            99   No description"
"         0.000   % Impervious"
"         0.017   Total Area"
"         4.048   Flow length"
"         1.500   Overland Slope"
"         0.017   Pervious Area"
"         4.048   Pervious length"
"         1.500   Pervious slope"
"         0.000   Impervious Area"
"         4.048   Impervious length"
"         1.500   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        50.000   Pervious Max.infiltration"
"        10.000   Pervious Min.infiltration"
"         0.500   Pervious Lag constant (hours)"
"         7.500   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.500   Impervious Lag constant (hours)"
"         7.500   Impervious Depression storage"
"                     0.003     0.000     0.002     0.002 c.m/sec"
"               Catchment 99          Pervious   Impervious Total Area "
"               Surface Area          0.017      0.000      0.017      hectare"
"               Time of concentration 4.450      0.661      4.450      minutes"
"               Time to Centroid      82.939     94.030     82.939     minutes"
"               Rainfall depth        63.151     63.151     63.151     mm"
"               Rainfall volume       10.74      0.00       10.74      c.m"
"               Rainfall losses       47.786     7.500      47.786     mm"
"               Runoff depth          15.365     55.651     15.365     mm"
"               Runoff volume         2.61       0.00       2.61       c.m"
"               Runoff coefficient    0.243      0.000      0.243      "
"               Maximum flow          0.003      0.000      0.003      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.003     0.003     0.002     0.002"
" 51          PIPE DESIGN"
"         0.003   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         1.000   Diameter    metre"
"         1.000   Gradient   %"
"               Depth of flow                 0.029    metre"
"               Velocity                      0.544    m/sec"
```

```
"            Pipe capacity                  2.398    c.m/sec"
"            Critical depth                 0.032    metre"
" 53         ROUTE Zero Route"
"       0.00   Zero Route Reach length   ( metre)"
"                 0.003     0.003     0.003     0.002 c.m/sec"
" 40         HYDROGRAPH   Combine    101"
"          6   Combine "
"        101   Node #"
"              "
"            Maximum flow                   0.005    c.m/sec"
"            Hydrograph volume              5.001    c.m"
"                 0.003     0.003     0.003     0.005"
" 40         HYDROGRAPH   Confluence    100"
"          7   Confluence "
"        100   Node #"
"              "
"            Maximum flow                   0.059    c.m/sec"
"            Hydrograph volume             92.269    c.m"
"                 0.003     0.059     0.003     0.000"
" 56         DIVERSION"
"        100   Node number"
"      0.023   Overflow threshold"
"      1.000   Required diverted fraction"
"          0   Conduit type; 1=Pipe;2=Channel"
"            Peak of diverted flow          0.036    c.m/sec"
"            Volume of diverted flow       21.407    c.m"
"            DIV00100.005hyd"
"            Divert to Underground Storage 21.407 cu.m. (21.6 cu.m.)"
"                 0.003     0.059     0.023     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"          5   Next link "
"                 0.003     0.023     0.023     0.000"
" 51         PIPE DESIGN"
"      0.023   Current peak flow    c.m/sec"
"      0.013   Manning 'n'"
"      1.000   Diameter    metre"
"      1.000   Gradient   %"
"            Depth of flow                  0.069    metre"
"            Velocity                       0.968    m/sec"
"            Pipe capacity                  2.398    c.m/sec"
"            Critical depth                 0.083    metre"
" 53         ROUTE Zero Route"
"       0.00   Zero Route Reach length   ( metre)"
"                 0.003     0.023     0.023     0.000 c.m/sec"
" 40         HYDROGRAPH   Combine    101"
"          6   Combine "
"        101   Node #"
"              "
"            Maximum flow                   0.028    c.m/sec"
"            Hydrograph volume             75.864    c.m"
"                 0.003     0.023     0.023     0.028"
" 40         HYDROGRAPH   Confluence    101"
"          7   Confluence "
"        101   Node #"
"              "
"            Maximum flow                   0.028    c.m/sec"
"            Hydrograph volume             75.864    c.m"
"                 0.003     0.028     0.023     0.000"
" 38         START/RE-START TOTALS 101"
"            3   Runoff Totals on EXIT"
```

```
"              Total Catchment area                    0.196    hectare"
"              Total Impervious area                   0.167    hectare"
"              Total % impervious                     85.049"
" 19           EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                                Version 2.25  rev. 473"
"                MIDUSS created                                        February-07-10"
"           10   Units used:                                              ie METRIC"
"                Job folder:                                  C:\swm\MIDUSS\16025"
"                Output filename:                                        Pst50.out"
"                Licensee name:                                                Bob"
"                Company                                                         "
"                Date & Time last used:                 31/07/2022 at 9:36:13 AM"
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      766.038   Coefficient A"
"        1.898   Constant B"
"        0.668   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          141.545    mm/hr"
"             Total depth                 71.090    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          101   No description"
"        0.000   % Impervious"
"        0.004   Total Area"
"       20.000   Flow length"
"        1.500   Overland Slope"
"        0.004   Pervious Area"
"       20.000   Pervious length"
"        1.500   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                    0.001     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.000      0.004      hectare"
"             Time of concentration  10.434     1.650      10.434     minutes"
"             Time to Centroid       86.925     93.609     86.925     minutes"
"             Rainfall depth         71.090     71.090     71.090     mm"
"             Rainfall volume        2.84       0.00       2.84       c.m"
"             Rainfall losses        49.748     7.500      49.748     mm"
"             Runoff depth           21.342     63.590     21.342     mm"
"             Runoff volume          0.85       0.00       0.85       c.m"
"             Runoff coefficient     0.300      0.000      0.300      "
```

```
"             Maximum flow           0.001      0.000      0.001      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.001     0.001     0.000     0.000"
" 51          PIPE DESIGN"
"         0.001   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         0.250   Diameter    metre"
"         1.100   Gradient    %"
"              Depth of flow                 0.022    metre"
"              Velocity                      0.473    m/sec"
"              Pipe capacity                 0.062    c.m/sec"
"              Critical depth                0.025    metre"
" 53          ROUTE    Pipe Route 22"
"        22.30      Pipe Route 22 Reach length   ( metre)"
"         0.476   X-factor <= 0.5"
"        35.324   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.500   Beta weighting factor"
"        35.294   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                  0.001    c.m/sec"
"                    0.001     0.001     0.001     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                "
"              Maximum flow                  0.001    c.m/sec"
"              Hydrograph volume             0.854    c.m"
"                    0.001     0.001     0.001     0.001"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.001     0.000     0.001     0.001"
" 33          CATCHMENT 102"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          102   No description"
"        99.400   % Impervious"
"         0.062   Total Area"
"        35.227   Flow length"
"         1.500   Overland Slope"
"         0.000   Pervious Area"
"        35.227   Pervious length"
"         1.500   Pervious slope"
"         0.062   Impervious Area"
"        35.227   Impervious length"
"         1.500   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        50.000   Pervious Max.infiltration"
"        10.000   Pervious Min.infiltration"
"         0.500   Pervious Lag constant (hours)"
"         7.500   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.500   Impervious Lag constant (hours)"
"         7.500   Impervious Depression storage"
```

```
"                    0.024     0.000     0.001     0.001 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.062      0.062      hectare"
"             Time of concentration  14.655     2.317      2.342      minutes"
"             Time to Centroid       90.401     93.609     93.603     minutes"
"             Rainfall depth         71.090     71.090     71.090     mm"
"             Rainfall volume        0.26       43.81      44.08      c.m"
"             Rainfall losses        49.748     7.500      7.753      mm"
"             Runoff depth           21.342     63.590     63.336     mm"
"             Runoff volume          0.08       39.19      39.27      c.m"
"             Runoff coefficient     0.300      0.894      0.891      "
"             Maximum flow           0.000      0.024      0.024      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.024     0.024     0.001     0.001"
" 51          PIPE DESIGN"
"        0.024   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        1.000   Diameter    metre"
"        1.000   Gradient   %"
"             Depth of flow                0.071    metre"
"             Velocity                     0.984    m/sec"
"             Pipe capacity                2.398    c.m/sec"
"             Critical depth               0.085    metre"
" 53          ROUTE Zero Route"
"         0.00   Zero Route Reach length   ( metre)"
"                    0.024     0.024     0.024     0.001 c.m/sec"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                "
"             Maximum flow                 0.025    c.m/sec"
"             Hydrograph volume            40.122   c.m"
"                    0.024     0.024     0.024     0.025"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.024     0.000     0.024     0.025"
" 33          CATCHMENT 103"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          103   No description"
"       20.700   % Impervious"
"        0.006   Total Area"
"       20.690   Flow length"
"        1.500   Overland Slope"
"        0.005   Pervious Area"
"       20.690   Pervious length"
"        1.500   Pervious slope"
"        0.001   Impervious Area"
"       20.690   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
```

```
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                     0.002     0.000     0.024     0.025 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
"             Surface Area           0.005      0.001      0.006      hectare"
"             Time of concentration  10.649     1.684      6.727      minutes"
"             Time to Centroid       87.146     93.609     89.974     minutes"
"             Rainfall depth         71.090     71.090     71.090     mm"
"             Rainfall volume        3.38       0.88       4.27       c.m"
"             Rainfall losses        49.748     7.500      41.003     mm"
"             Runoff depth           21.342     63.590     30.087     mm"
"             Runoff volume          1.02       0.79       1.81       c.m"
"             Runoff coefficient     0.300      0.894      0.423      "
"             Maximum flow           0.001      0.000      0.002      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.002     0.002     0.024     0.025"
" 51          PIPE DESIGN"
"        0.002   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        0.250   Diameter    metre"
"        1.800   Gradient   %"
"             Depth of flow                 0.025    metre"
"             Velocity                      0.653    m/sec"
"             Pipe capacity                 0.080    c.m/sec"
"             Critical depth                0.032    metre"
" 53          ROUTE    Pipe Route 20"
"       19.60      Pipe Route 20 Reach length   ( metre)"
"        0.482   X-factor <= 0.5"
"       22.499   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       23.077   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.002    c.m/sec"
"                     0.002     0.002     0.002     0.025 c.m/sec"
" 40          HYDROGRAPH   Combine    4"
"            6   Combine "
"            4   Node #"
"                "
"             Maximum flow                  0.002    c.m/sec"
"             Hydrograph volume             1.805    c.m"
"                     0.002     0.002     0.002     0.002"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.002     0.000     0.002     0.002"
" 33          CATCHMENT 104"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          104   No description"
"       98.300   % Impervious"
"        0.048   Total Area"
"       15.094   Flow length"
"        1.500   Overland Slope"
"        0.001   Pervious Area"
"       15.094   Pervious length"
"        1.500   Pervious slope"
```

```
"         0.047   Impervious Area"
"        15.094   Impervious length"
"         1.500   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        50.000   Pervious Max.infiltration"
"        10.000   Pervious Min.infiltration"
"         0.500   Pervious Lag constant (hours)"
"         7.500   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.500   Impervious Lag constant (hours)"
"         7.500   Impervious Depression storage"
"                     0.019     0.000     0.002     0.002 c.m/sec"
"              Catchment 104          Pervious   Impervious Total Area "
"              Surface Area           0.001      0.047      0.048      hectare"
"              Time of concentration  8.813      1.394      1.437      minutes"
"              Time to Centroid       86.177     93.609     93.566     minutes"
"              Rainfall depth         71.090     71.090     71.090     mm"
"              Rainfall volume        0.58       33.54      34.12      c.m"
"              Rainfall losses        49.748     7.500      8.218      mm"
"              Runoff depth           21.342     63.590     62.871     mm"
"              Runoff volume          0.17       30.00      30.18      c.m"
"              Runoff coefficient     0.300      0.894      0.884      "
"              Maximum flow           0.000      0.019      0.019      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.019     0.019     0.002     0.002"
" 51           PIPE DESIGN"
"         0.019   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         1.000   Diameter    metre"
"         1.000   Gradient   %"
"              Depth of flow                 0.063    metre"
"              Velocity                      0.910    m/sec"
"              Pipe capacity                 2.398    c.m/sec"
"              Critical depth                0.075    metre"
" 53           ROUTE Zero Route"
"          0.00   Zero Route Reach length   ( metre)"
"                     0.019     0.019     0.019     0.002 c.m/sec"
" 40           HYDROGRAPH   Combine    4"
"             6   Combine "
"             4   Node #"
"                 "
"              Maximum flow                  0.020    c.m/sec"
"              Hydrograph volume            31.984    c.m"
"                     0.019     0.019     0.019     0.020"
" 40           HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                     0.019     0.000     0.019     0.020"
" 33           CATCHMENT 105"
"             2   Rectangular"
"             1   Equal length"
"             2   Horton equation"
"           105   No description"
"       100.000   % Impervious"
"         0.053   Total Area"
"        11.522   Flow length"
"         1.500   Overland Slope"
"         0.000   Pervious Area"
```

```
"       11.522   Pervious length"
"        1.500   Pervious slope"
"        0.053   Impervious Area"
"       11.522   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                    0.021     0.000     0.019     0.020 c.m/sec"
"            Catchment 105          Pervious   Impervious Total Area "
"            Surface Area           0.000      0.053      0.053      hectare"
"            Time of concentration  7.495      1.185      1.185      minutes"
"            Time to Centroid       85.764     93.609     93.609     minutes"
"            Rainfall depth         71.090     71.090     71.090     mm"
"            Rainfall volume        0.00       37.68      37.68      c.m"
"            Rainfall losses        49.748     7.500      7.500      mm"
"            Runoff depth           21.342     63.590     63.590     mm"
"            Runoff volume          0.00       33.70      33.70      c.m"
"            Runoff coefficient     0.000      0.894      0.894      "
"            Maximum flow           0.000      0.021      0.021      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.021     0.021     0.019     0.020"
" 51         PIPE DESIGN"
"        0.021   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        0.200   Diameter    metre"
"        0.500   Gradient   %"
"            Depth of flow                0.148    metre"
"            Velocity                     0.835    m/sec"
"            Pipe capacity                0.023    c.m/sec"
"            Critical depth               0.124    metre"
" 53         ROUTE    Pipe Route 16"
"        16.00      Pipe Route 16 Reach length   ( metre)"
"        0.000   X-factor <= 0.5"
"       14.367   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.610   Beta weighting factor"
"       35.294   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"            Peak outflow                 0.021    c.m/sec"
"                    0.021     0.021     0.021     0.020 c.m/sec"
" 40         HYDROGRAPH   Combine    4"
"           6   Combine "
"           4   Node #"
"               "
"            Maximum flow                 0.041    c.m/sec"
"            Hydrograph volume           65.686    c.m"
"                    0.021     0.021     0.021     0.041"
" 40         HYDROGRAPH   Confluence    2"
"           7   Confluence "
```

```
"            2   Node #"
"                "
"             Maximum flow                    0.025    c.m/sec"
"             Hydrograph volume              40.122    c.m"
"                     0.021     0.025     0.021     0.000"
" 51          PIPE DESIGN"
"         0.025   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         0.250   Diameter    metre"
"         1.000   Gradient   %"
"              Depth of flow                  0.114    metre"
"              Velocity                       1.162    m/sec"
"              Pipe capacity                  0.059    c.m/sec"
"              Critical depth                 0.128    metre"
" 53          ROUTE    Pipe Route 5"
"          4.60      Pipe Route 5 Reach length   ( metre)"
"         0.000   X-factor <= 0.5"
"         2.969   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.587   Beta weighting factor"
"         7.143   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                   0.025    c.m/sec"
"                     0.021     0.025     0.025     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    100"
"             6   Combine "
"           100   Node #"
"                 "
"             Maximum flow                    0.025    c.m/sec"
"             Hydrograph volume              40.122    c.m"
"                     0.021     0.025     0.025     0.025"
" 40          HYDROGRAPH   Confluence    4"
"             7   Confluence "
"             4   Node #"
"                 "
"             Maximum flow                    0.041    c.m/sec"
"             Hydrograph volume              65.686    c.m"
"                     0.021     0.041     0.025     0.000"
" 51          PIPE DESIGN"
"         0.041   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         0.250   Diameter    metre"
"         1.000   Gradient   %"
"              Depth of flow                  0.152    metre"
"              Velocity                       1.306    m/sec"
"              Pipe capacity                  0.059    c.m/sec"
"              Critical depth                 0.165    metre"
" 53          ROUTE    Pipe Route 5"
"          5.10      Pipe Route 5 Reach length   ( metre)"
"         0.000   X-factor <= 0.5"
"         2.929   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.665   Beta weighting factor"
"         8.696   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                   0.041    c.m/sec"
```

```
"                    0.021     0.041     0.041     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    100"
"             6   Combine "
"           100   Node #"
"                 "
"             Maximum flow                  0.066    c.m/sec"
"             Hydrograph volume           105.808    c.m"
"                    0.021     0.041     0.041     0.066"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                    0.021     0.000     0.041     0.066"
" 33          CATCHMENT 98"
"             2   Rectangular"
"             1   Equal length"
"             2   Horton equation"
"            98   No description"
"        60.700   % Impervious"
"         0.006   Total Area"
"         2.353   Flow length"
"         1.500   Overland Slope"
"         0.002   Pervious Area"
"         2.353   Pervious length"
"         1.500   Pervious slope"
"         0.004   Impervious Area"
"         2.353   Impervious length"
"         1.500   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        50.000   Pervious Max.infiltration"
"        10.000   Pervious Min.infiltration"
"         0.500   Pervious Lag constant (hours)"
"         7.500   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.500   Impervious Lag constant (hours)"
"         7.500   Impervious Depression storage"
"                    0.002     0.000     0.041     0.066 c.m/sec"
"             Catchment 98           Pervious   Impervious Total Area "
"             Surface Area           0.002      0.004      0.006      hectare"
"             Time of concentration  2.889      0.457      0.891      minutes"
"             Time to Centroid       84.486     93.609     91.981     minutes"
"             Rainfall depth         71.090     71.090     71.090     mm"
"             Rainfall volume        1.68       2.59       4.27       c.m"
"             Rainfall losses        49.748     7.500      24.103     mm"
"             Runoff depth           21.342     63.590     46.986     mm"
"             Runoff volume          0.50       2.32       2.82       c.m"
"             Runoff coefficient     0.300      0.894      0.661      "
"             Maximum flow           0.001      0.001      0.002      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.002     0.002     0.041     0.066"
" 51          PIPE DESIGN"
"         0.002   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         1.000   Diameter    metre"
"         1.000   Gradient   %"
"             Depth of flow                 0.022    metre"
"             Velocity                      0.463    m/sec"
"             Pipe capacity                 2.398    c.m/sec"
"             Critical depth                0.025    metre"
```

```
" 53          ROUTE Zero Route"
"         0.00   Zero Route Reach length   ( metre)"
"                     0.002     0.002     0.002     0.066 c.m/sec"
" 40          HYDROGRAPH   Combine    101"
"             6   Combine "
"           101   Node #"
"                 "
"             Maximum flow                   0.002    c.m/sec"
"             Hydrograph volume              2.819    c.m"
"                     0.002     0.002     0.002     0.002"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                     0.002     0.000     0.002     0.002"
" 33          CATCHMENT 99"
"             2   Rectangular"
"             1   Equal length"
"             2   Horton equation"
"            99   No description"
"         0.000   % Impervious"
"         0.017   Total Area"
"         4.048   Flow length"
"         1.500   Overland Slope"
"         0.017   Pervious Area"
"         4.048   Pervious length"
"         1.500   Pervious slope"
"         0.000   Impervious Area"
"         4.048   Impervious length"
"         1.500   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        50.000   Pervious Max.infiltration"
"        10.000   Pervious Min.infiltration"
"         0.500   Pervious Lag constant (hours)"
"         7.500   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.500   Impervious Lag constant (hours)"
"         7.500   Impervious Depression storage"
"                     0.005     0.000     0.002     0.002 c.m/sec"
"              Catchment 99           Pervious   Impervious Total Area "
"              Surface Area           0.017      0.000      0.017      hectare"
"              Time of concentration  4.001      0.633      4.001      minutes"
"              Time to Centroid       84.677     93.609     84.677     minutes"
"              Rainfall depth         71.090     71.090     71.090     mm"
"              Rainfall volume        12.09      0.00       12.09      c.m"
"              Rainfall losses        49.748     7.500      49.748     mm"
"              Runoff depth           21.342     63.590     21.342     mm"
"              Runoff volume          3.63       0.00       3.63       c.m"
"              Runoff coefficient     0.300      0.000      0.300      "
"              Maximum flow           0.005      0.000      0.005      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.005     0.005     0.002     0.002"
" 51          PIPE DESIGN"
"         0.005   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         1.000   Diameter    metre"
"         1.000   Gradient   %"
"              Depth of flow                  0.032    metre"
"              Velocity                       0.590    m/sec"
```

```
"            Pipe capacity                  2.398    c.m/sec"
"            Critical depth                 0.037    metre"
" 53         ROUTE Zero Route"
"       0.00   Zero Route Reach length   ( metre)"
"                  0.005     0.005     0.005     0.002 c.m/sec"
" 40         HYDROGRAPH   Combine    101"
"          6   Combine "
"        101   Node #"
"              "
"            Maximum flow                   0.007    c.m/sec"
"            Hydrograph volume              6.447    c.m"
"                  0.005     0.005     0.005     0.007"
" 40         HYDROGRAPH   Confluence    100"
"          7   Confluence "
"        100   Node #"
"              "
"            Maximum flow                   0.066    c.m/sec"
"            Hydrograph volume            105.808    c.m"
"                  0.005     0.066     0.005     0.000"
" 56         DIVERSION"
"        100   Node number"
"      0.030   Overflow threshold"
"      1.000   Required diverted fraction"
"          0   Conduit type; 1=Pipe;2=Channel"
"            Peak of diverted flow          0.036    c.m/sec"
"            Volume of diverted flow       21.566    c.m"
"            DIV00100.005hyd"
"            Divert to Underground Storage 21.566 cu.m. (21.6 cu.m.)"
"                  0.005     0.066     0.030     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"          5   Next link "
"                  0.005     0.030     0.030     0.000"
" 51         PIPE DESIGN"
"      0.030   Current peak flow    c.m/sec"
"      0.013   Manning 'n'"
"      1.000   Diameter    metre"
"      1.000   Gradient   %"
"           Depth of flow                  0.078    metre"
"           Velocity                       1.049    m/sec"
"           Pipe capacity                  2.398    c.m/sec"
"           Critical depth                 0.095    metre"
" 53         ROUTE Zero Route"
"       0.00   Zero Route Reach length   ( metre)"
"                  0.005     0.030     0.030     0.000 c.m/sec"
" 40         HYDROGRAPH   Combine    101"
"          6   Combine "
"        101   Node #"
"              "
"            Maximum flow                   0.037    c.m/sec"
"            Hydrograph volume             90.690    c.m"
"                  0.005     0.030     0.030     0.037"
" 40         HYDROGRAPH   Confluence    101"
"          7   Confluence "
"        101   Node #"
"              "
"            Maximum flow                   0.037    c.m/sec"
"            Hydrograph volume             90.690    c.m"
"                  0.005     0.037     0.030     0.000"
" 38         START/RE-START TOTALS 101"
"            3   Runoff Totals on EXIT"
```

```
"                Total Catchment area                    0.196    hectare"
"                Total Impervious area                   0.167    hectare"
"                Total % impervious                     85.049"
" 19             EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                                Version 2.25  rev. 473"
"                MIDUSS created                                        February-07-10"
"           10   Units used:                                              ie METRIC"
"                Job folder:                                  C:\swm\MIDUSS\16025"
"                Output filename:                                      Pst100.out"
"                Licensee name:                                                Bob"
"                Company                                                         "
"                Date & Time last used:                 31/07/2022 at 9:14:22 AM"
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      801.044   Coefficient A"
"        1.501   Constant B"
"        0.657   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          155.783    mm/hr"
"             Total depth                 78.830    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          101   No description"
"        0.000   % Impervious"
"        0.004   Total Area"
"       20.000   Flow length"
"        1.500   Overland Slope"
"        0.004   Pervious Area"
"       20.000   Pervious length"
"        1.500   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                    0.001     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.004      0.000      0.004      hectare"
"             Time of concentration  9.625      1.588      9.625      minutes"
"             Time to Centroid       89.241     0.000      89.241     minutes"
"             Rainfall depth         78.830     78.830     78.830     mm"
"             Rainfall volume        3.15       0.00       3.15       c.m"
"             Rainfall losses        51.075     78.830     51.075     mm"
"             Runoff depth           27.755     0.000      27.755     mm"
"             Runoff volume          1.11       0.00       1.11       c.m"
"             Runoff coefficient     0.352      0.000      0.352      "
```

```
"             Maximum flow           0.001      0.000      0.001      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                   0.001     0.001     0.000     0.000"
" 51          PIPE DESIGN"
"         0.001   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         0.250   Diameter    metre"
"         1.100   Gradient    %"
"              Depth of flow                 0.025    metre"
"              Velocity                      0.510    m/sec"
"              Pipe capacity                 0.062    c.m/sec"
"              Critical depth                0.028    metre"
" 53          ROUTE    Pipe Route 22"
"         22.30      Pipe Route 22 Reach length   ( metre)"
"         0.474   X-factor <= 0.5"
"        32.813   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.500   Beta weighting factor"
"        33.333   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                  0.001    c.m/sec"
"                     0.001     0.001     0.001     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                "
"              Maximum flow                  0.001    c.m/sec"
"              Hydrograph volume             1.110    c.m"
"                     0.001     0.001     0.001     0.001"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                   0.001     0.000     0.001     0.001"
" 33          CATCHMENT 102"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          102   No description"
"        99.400   % Impervious"
"         0.062   Total Area"
"        35.227   Flow length"
"         1.500   Overland Slope"
"         0.000   Pervious Area"
"        35.227   Pervious length"
"         1.500   Pervious slope"
"         0.062   Impervious Area"
"        35.227   Impervious length"
"         1.500   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        50.000   Pervious Max.infiltration"
"        10.000   Pervious Min.infiltration"
"         0.500   Pervious Lag constant (hours)"
"         7.500   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.500   Impervious Lag constant (hours)"
"         7.500   Impervious Depression storage"
```

```
"                    0.027     0.000     0.001     0.001 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.062      0.062      hectare"
"             Time of concentration  13.518     2.230      2.257      minutes"
"             Time to Centroid       92.687     93.300     93.299     minutes"
"             Rainfall depth         78.830     78.830     78.830     mm"
"             Rainfall volume        0.29       48.58      48.87      c.m"
"             Rainfall losses        51.075     7.500      7.761      mm"
"             Runoff depth           27.755     71.330     71.069     mm"
"             Runoff volume          0.10       43.96      44.06      c.m"
"             Runoff coefficient     0.352      0.905      0.902      "
"             Maximum flow           0.000      0.027      0.027      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.027     0.027     0.001     0.001"
" 51          PIPE DESIGN"
"         0.027   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         1.000   Diameter    metre"
"         1.000   Gradient   %"
"              Depth of flow                0.074    metre"
"              Velocity                     1.013    m/sec"
"              Pipe capacity                2.398    c.m/sec"
"              Critical depth               0.089    metre"
" 53          ROUTE Zero Route"
"          0.00   Zero Route Reach length   ( metre)"
"                    0.027     0.027     0.027     0.001 c.m/sec"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                "
"              Maximum flow                 0.028    c.m/sec"
"              Hydrograph volume           45.173    c.m"
"                    0.027     0.027     0.027     0.028"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.027     0.000     0.027     0.028"
" 33          CATCHMENT 103"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          103   No description"
"       20.700   % Impervious"
"        0.006   Total Area"
"       20.690   Flow length"
"        1.500   Overland Slope"
"        0.005   Pervious Area"
"       20.690   Pervious length"
"        1.500   Pervious slope"
"        0.001   Impervious Area"
"       20.690   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
```

```
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                     0.002     0.000     0.027     0.028 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
"             Surface Area           0.005      0.001      0.006      hectare"
"             Time of concentration  9.823      1.621      6.530      minutes"
"             Time to Centroid       89.313     93.290     90.910     minutes"
"             Rainfall depth         78.830     78.830     78.830     mm"
"             Rainfall volume        3.75       0.98       4.73       c.m"
"             Rainfall losses        51.075     7.500      42.055     mm"
"             Runoff depth           27.755     71.330     36.775     mm"
"             Runoff volume          1.32       0.89       2.21       c.m"
"             Runoff coefficient     0.352      0.905      0.467      "
"             Maximum flow           0.002      0.001      0.002      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.002     0.002     0.027     0.028"
" 51          PIPE DESIGN"
"        0.002   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        0.250   Diameter    metre"
"        1.800   Gradient   %"
"             Depth of flow                 0.028    metre"
"             Velocity                      0.698    m/sec"
"             Pipe capacity                 0.080    c.m/sec"
"             Critical depth                0.035    metre"
" 53          ROUTE    Pipe Route 20"
"       19.60      Pipe Route 20 Reach length   ( metre)"
"        0.480   X-factor <= 0.5"
"       21.068   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       21.429   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.002    c.m/sec"
"                     0.002     0.002     0.002     0.028 c.m/sec"
" 40          HYDROGRAPH   Combine    4"
"            6   Combine "
"            4   Node #"
"                "
"             Maximum flow                  0.002    c.m/sec"
"             Hydrograph volume             2.207    c.m"
"                     0.002     0.002     0.002     0.002"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.002     0.000     0.002     0.002"
" 33          CATCHMENT 104"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          104   No description"
"       98.300   % Impervious"
"        0.048   Total Area"
"       15.094   Flow length"
"        1.500   Overland Slope"
"        0.001   Pervious Area"
"       15.094   Pervious length"
"        1.500   Pervious slope"
```

```
"        0.047   Impervious Area"
"       15.094   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                     0.021     0.000     0.002     0.002 c.m/sec"
"             Catchment 104          Pervious   Impervious Total Area "
"             Surface Area           0.001      0.047      0.048      hectare"
"             Time of concentration  8.130      1.341      1.387      minutes"
"             Time to Centroid       88.679     93.290     93.259     minutes"
"             Rainfall depth         78.830     78.830     78.830     mm"
"             Rainfall volume        0.64       37.20      37.84      c.m"
"             Rainfall losses        51.075     7.500      8.241      mm"
"             Runoff depth           27.755     71.330     70.590     mm"
"             Runoff volume          0.23       33.66      33.88      c.m"
"             Runoff coefficient     0.352      0.905      0.895      "
"             Maximum flow           0.000      0.020      0.021      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.021     0.021     0.002     0.002"
" 51          PIPE DESIGN"
"        0.021   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        1.000   Diameter    metre"
"        1.000   Gradient   %"
"             Depth of flow                 0.066    metre"
"             Velocity                      0.937    m/sec"
"             Pipe capacity                 2.398    c.m/sec"
"             Critical depth                0.079    metre"
" 53          ROUTE Zero Route"
"         0.00   Zero Route Reach length   ( metre)"
"                     0.021     0.021     0.021     0.002 c.m/sec"
" 40          HYDROGRAPH   Combine    4"
"            6   Combine "
"            4   Node #"
"                "
"             Maximum flow                  0.023    c.m/sec"
"             Hydrograph volume            36.090    c.m"
"                     0.021     0.021     0.021     0.023"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.021     0.000     0.021     0.023"
" 33          CATCHMENT 105"
"            2   Rectangular"
"            1   Equal length"
"            2   Horton equation"
"          105   No description"
"      100.000   % Impervious"
"        0.053   Total Area"
"       11.522   Flow length"
"        1.500   Overland Slope"
"        0.000   Pervious Area"
```

```
"       11.522   Pervious length"
"        1.500   Pervious slope"
"        0.053   Impervious Area"
"       11.522   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious Max.infiltration"
"       10.000   Pervious Min.infiltration"
"        0.500   Pervious Lag constant (hours)"
"        7.500   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.500   Impervious Lag constant (hours)"
"        7.500   Impervious Depression storage"
"                    0.023     0.000     0.021     0.023 c.m/sec"
"            Catchment 105          Pervious   Impervious Total Area "
"            Surface Area           0.000      0.053      0.053      hectare"
"            Time of concentration  6.914      1.141      1.141      minutes"
"            Time to Centroid       0.000      93.290     93.290     minutes"
"            Rainfall depth         78.830     78.830     78.830     mm"
"            Rainfall volume        0.00       41.78      41.78      c.m"
"            Rainfall losses        78.830     7.500      7.500      mm"
"            Runoff depth           0.000      71.330     71.330     mm"
"            Runoff volume          0.00       37.81      37.81      c.m"
"            Runoff coefficient     0.000      0.905      0.905      "
"            Maximum flow           0.000      0.023      0.023      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.023     0.023     0.021     0.023"
" 51         PIPE DESIGN"
"        0.023   Current peak flow    c.m/sec"
"        0.013   Manning 'n'"
"        0.200   Diameter    metre"
"        0.500   Gradient   %"
"            Depth of flow                0.162    metre"
"            Velocity                     0.842    m/sec"
"            Pipe capacity                0.023    c.m/sec"
"            Critical depth               0.130    metre"
" 53         ROUTE    Pipe Route 16"
"        16.00      Pipe Route 16 Reach length   ( metre)"
"        0.000   X-factor <= 0.5"
"       14.259   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.656   Beta weighting factor"
"       40.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"            Peak outflow                 0.023    c.m/sec"
"                    0.023     0.023     0.023     0.023 c.m/sec"
" 40         HYDROGRAPH   Combine    4"
"           6   Combine "
"           4   Node #"
"               "
"            Maximum flow                 0.045    c.m/sec"
"            Hydrograph volume           73.895    c.m"
"                    0.023     0.023     0.023     0.045"
" 40         HYDROGRAPH   Confluence    2"
"           7   Confluence "
```

```
"            2   Node #"
"                "
"             Maximum flow                    0.028    c.m/sec"
"             Hydrograph volume              45.173    c.m"
"                     0.023     0.028     0.023     0.000"
" 51          PIPE DESIGN"
"         0.028   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         0.250   Diameter    metre"
"         1.000   Gradient   %"
"              Depth of flow                  0.121    metre"
"              Velocity                       1.193    m/sec"
"              Pipe capacity                  0.059    c.m/sec"
"              Critical depth                 0.135    metre"
" 53          ROUTE    Pipe Route 5"
"          4.60      Pipe Route 5 Reach length   ( metre)"
"         0.000   X-factor <= 0.5"
"         2.892   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.605   Beta weighting factor"
"         7.229   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                   0.028    c.m/sec"
"                     0.023     0.028     0.028     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    100"
"             6   Combine "
"           100   Node #"
"                 "
"             Maximum flow                    0.028    c.m/sec"
"             Hydrograph volume              45.173    c.m"
"                     0.023     0.028     0.028     0.028"
" 40          HYDROGRAPH   Confluence    4"
"             7   Confluence "
"             4   Node #"
"                 "
"             Maximum flow                    0.045    c.m/sec"
"             Hydrograph volume              73.895    c.m"
"                     0.023     0.045     0.028     0.000"
" 51          PIPE DESIGN"
"         0.045   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         0.250   Diameter    metre"
"         1.000   Gradient   %"
"              Depth of flow                  0.163    metre"
"              Velocity                       1.333    m/sec"
"              Pipe capacity                  0.059    c.m/sec"
"              Critical depth                 0.174    metre"
" 53          ROUTE    Pipe Route 5"
"          5.10      Pipe Route 5 Reach length   ( metre)"
"         0.000   X-factor <= 0.5"
"         2.868   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.696   Beta weighting factor"
"         9.375   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                   0.045    c.m/sec"
```

```
"                    0.023     0.045     0.045     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    100"
"             6   Combine "
"           100   Node #"
"                 "
"             Maximum flow                  0.073    c.m/sec"
"             Hydrograph volume           119.068    c.m"
"                    0.023     0.045     0.045     0.073"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                    0.023     0.000     0.045     0.073"
" 33          CATCHMENT 98"
"             2   Rectangular"
"             1   Equal length"
"             2   Horton equation"
"            98   No description"
"        60.700   % Impervious"
"         0.006   Total Area"
"         2.353   Flow length"
"         1.500   Overland Slope"
"         0.002   Pervious Area"
"         2.353   Pervious length"
"         1.500   Pervious slope"
"         0.004   Impervious Area"
"         2.353   Impervious length"
"         1.500   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        50.000   Pervious Max.infiltration"
"        10.000   Pervious Min.infiltration"
"         0.500   Pervious Lag constant (hours)"
"         7.500   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.500   Impervious Lag constant (hours)"
"         7.500   Impervious Depression storage"
"                    0.002     0.000     0.045     0.073 c.m/sec"
"             Catchment 98           Pervious   Impervious Total Area "
"             Surface Area           0.002      0.004      0.006      hectare"
"             Time of concentration  2.665      0.440      0.888      minutes"
"             Time to Centroid       86.750     93.290     91.974     minutes"
"             Rainfall depth         78.830     78.830     78.830     mm"
"             Rainfall volume        1.86       2.87       4.73       c.m"
"             Rainfall losses        51.075     7.500      24.625     mm"
"             Runoff depth           27.755     71.330     54.205     mm"
"             Runoff volume          0.65       2.60       3.25       c.m"
"             Runoff coefficient     0.352      0.905      0.688      "
"             Maximum flow           0.001      0.002      0.002      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.002     0.002     0.045     0.073"
" 51          PIPE DESIGN"
"         0.002   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         1.000   Diameter    metre"
"         1.000   Gradient   %"
"             Depth of flow                 0.024    metre"
"             Velocity                      0.482    m/sec"
"             Pipe capacity                 2.398    c.m/sec"
"             Critical depth                0.026    metre"
```

```
" 53          ROUTE Zero Route"
"         0.00   Zero Route Reach length   ( metre)"
"                     0.002     0.002     0.002     0.073 c.m/sec"
" 40          HYDROGRAPH   Combine    101"
"             6   Combine "
"           101   Node #"
"                 "
"             Maximum flow                   0.002    c.m/sec"
"             Hydrograph volume              3.252    c.m"
"                     0.002     0.002     0.002     0.002"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                     0.002     0.000     0.002     0.002"
" 33          CATCHMENT 99"
"             2   Rectangular"
"             1   Equal length"
"             2   Horton equation"
"            99   No description"
"         0.000   % Impervious"
"         0.017   Total Area"
"         4.048   Flow length"
"         1.500   Overland Slope"
"         0.017   Pervious Area"
"         4.048   Pervious length"
"         1.500   Pervious slope"
"         0.000   Impervious Area"
"         4.048   Impervious length"
"         1.500   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        50.000   Pervious Max.infiltration"
"        10.000   Pervious Min.infiltration"
"         0.500   Pervious Lag constant (hours)"
"         7.500   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.500   Impervious Lag constant (hours)"
"         7.500   Impervious Depression storage"
"                     0.006     0.000     0.002     0.002 c.m/sec"
"              Catchment 99           Pervious   Impervious Total Area "
"              Surface Area           0.017      0.000      0.017      hectare"
"              Time of concentration  3.691      0.609      3.691      minutes"
"              Time to Centroid       86.961     0.000      86.961     minutes"
"              Rainfall depth         78.830     78.830     78.830     mm"
"              Rainfall volume        13.40      0.00       13.40      c.m"
"              Rainfall losses        51.075     78.830     51.075     mm"
"              Runoff depth           27.755     0.000      27.755     mm"
"              Runoff volume          4.72       0.00       4.72       c.m"
"              Runoff coefficient     0.352      0.000      0.352      "
"              Maximum flow           0.006      0.000      0.006      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.006     0.006     0.002     0.002"
" 51          PIPE DESIGN"
"         0.006   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         1.000   Diameter    metre"
"         1.000   Gradient   %"
"              Depth of flow                 0.036    metre"
"              Velocity                      0.627    m/sec"
```

```
"            Pipe capacity                  2.398    c.m/sec"
"            Critical depth                 0.040    metre"
" 53         ROUTE Zero Route"
"       0.00   Zero Route Reach length   ( metre)"
"                  0.006     0.006     0.006     0.002 c.m/sec"
" 40         HYDROGRAPH   Combine    101"
"          6   Combine "
"        101   Node #"
"              "
"            Maximum flow                   0.008    c.m/sec"
"            Hydrograph volume              7.971    c.m"
"                  0.006     0.006     0.006     0.008"
" 40         HYDROGRAPH   Confluence    100"
"          7   Confluence "
"        100   Node #"
"              "
"            Maximum flow                   0.073    c.m/sec"
"            Hydrograph volume            119.068    c.m"
"                  0.006     0.073     0.006     0.000"
" 56         DIVERSION"
"        100   Node number"
"      0.037   Overflow threshold"
"      1.000   Required diverted fraction"
"          0   Conduit type; 1=Pipe;2=Channel"
"            Peak of diverted flow          0.036    c.m/sec"
"            Volume of diverted flow       21.617    c.m"
"            DIV00100.005hyd"
"            Divert to Underground Storage 21.617 cu.m. (21.6 cu.m.)"
"                  0.006     0.073     0.037     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"          5   Next link "
"                  0.006     0.037     0.037     0.000"
" 51         PIPE DESIGN"
"      0.037   Current peak flow    c.m/sec"
"      0.013   Manning 'n'"
"      1.000   Diameter    metre"
"      1.000   Gradient   %"
"           Depth of flow                  0.087    metre"
"           Velocity                       1.118    m/sec"
"           Pipe capacity                  2.398    c.m/sec"
"           Critical depth                 0.105    metre"
" 53         ROUTE Zero Route"
"       0.00   Zero Route Reach length   ( metre)"
"                  0.006     0.037     0.037     0.000 c.m/sec"
" 40         HYDROGRAPH   Combine    101"
"          6   Combine "
"        101   Node #"
"              "
"            Maximum flow                   0.045    c.m/sec"
"            Hydrograph volume            105.421    c.m"
"                  0.006     0.037     0.037     0.045"
" 40         HYDROGRAPH   Confluence    101"
"          7   Confluence "
"        101   Node #"
"              "
"            Maximum flow                   0.045    c.m/sec"
"            Hydrograph volume            105.421    c.m"
"                  0.006     0.045     0.037     0.000"
" 38         START/RE-START TOTALS 101"
"            3   Runoff Totals on EXIT"
```

```
"              Total Catchment area                    0.196    hectare"
"              Total Impervious area                   0.167    hectare"
"              Total % impervious                     85.049"
" 19           EXIT"
```

Stormceptor®

Rinker MATERIALS

Stormceptor EF Sizing Report

Imbrium® Systems
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

03/06/2024

Province:	Ontario
City:	Delhi
Nearest Rainfall Station:	BRANTFORD MOE
Climate Station Id:	6140954
Years of Rainfall Data:	41

Site Name:	78 King Street Delhi

Drainage Area (ha):	0.20
% Imperviousness:	85.50

Runoff Coefficient 'c': 0.81

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0

Project Name:	78 King St Delhi
Project Number:	16025
Designer Name:	Robert Phillips
Designer Company:	J H Cohoon Engineering Limited
Designer Email:	rphillips@cohooneng.com
Designer Phone:	519-753-2656
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	5.92
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Influent TSS Concentration (mg/L):	200
Estimated Average Annual Sediment Load (kg/yr):	209
Estimated Average Annual Sediment Volume (L/yr):	170

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	94
EFO6	98
EFO8	100
EFO10	100
EFO12	100

Recommended Stormceptor EFO Model: EFO4

Estimated Net Annual Sediment (TSS) Load Reduction (%): 94

Water Quality Runoff Volume Capture (%): > 90

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THIRD-PARTY TESTING AND VERIFICATION

▶**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

▶**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

▶The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

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Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	9.1	9.1	0.23	14.0	11.0	100	9.1	9.1
1.00	19.6	28.8	0.45	27.0	23.0	100	19.6	28.8
2.00	15.6	44.4	0.90	54.0	45.0	100	15.6	44.4
3.00	9.6	54.0	1.36	81.0	68.0	100	9.6	54.0
4.00	8.7	62.7	1.81	108.0	90.0	97	8.4	62.4
5.00	6.2	68.9	2.26	136.0	113.0	95	5.8	68.3
6.00	4.4	73.3	2.71	163.0	136.0	92	4.1	72.3
7.00	4.7	77.9	3.16	190.0	158.0	89	4.2	76.5
8.00	3.2	81.1	3.62	217.0	181.0	86	2.7	79.2
9.00	2.0	83.1	4.07	244.0	203.0	83	1.6	80.9
10.00	2.7	85.7	4.52	271.0	226.0	82	2.2	83.1
11.00	1.7	87.4	4.97	298.0	249.0	81	1.4	84.4
12.00	1.6	89.0	5.42	325.0	271.0	80	1.2	85.6
13.00	0.9	89.8	5.88	353.0	294.0	79	0.7	86.3
14.00	2.0	91.8	6.33	380.0	316.0	78	1.5	87.9
15.00	1.4	93.2	6.78	407.0	339.0	77	1.1	88.9
16.00	0.5	93.7	7.23	434.0	362.0	76	0.4	89.3
17.00	1.1	94.8	7.68	461.0	384.0	75	0.8	90.1
18.00	0.8	95.5	8.14	488.0	407.0	74	0.6	90.7
19.00	0.7	96.2	8.59	515.0	429.0	72	0.5	91.2
20.00	0.8	97.0	9.04	542.0	452.0	72	0.6	91.8
21.00	0.3	97.4	9.49	570.0	475.0	71	0.2	92.0
22.00	0.5	97.8	9.94	597.0	497.0	70	0.3	92.3
23.00	0.1	97.9	10.40	624.0	520.0	68	0.1	92.4
24.00	0.4	98.3	10.85	651.0	542.0	67	0.3	92.7
25.00	0.0	98.3	11.30	678.0	565.0	66	0.0	92.7
30.00	1.3	99.6	13.56	814.0	678.0	64	0.8	93.5
35.00	0.2	99.8	15.82	949.0	791.0	63	0.1	93.6
40.00	0.2	100.0	18.08	1085.0	904.0	62	0.1	93.7
45.00	0.0	100.0	20.34	1220.0	1017.0	61	0.0	93.7
Estimated Net Annual Sediment (TSS) Load Reduction =								**94 %**

Climate Station ID: 6140954 *Years of Rainfall Data*: 41

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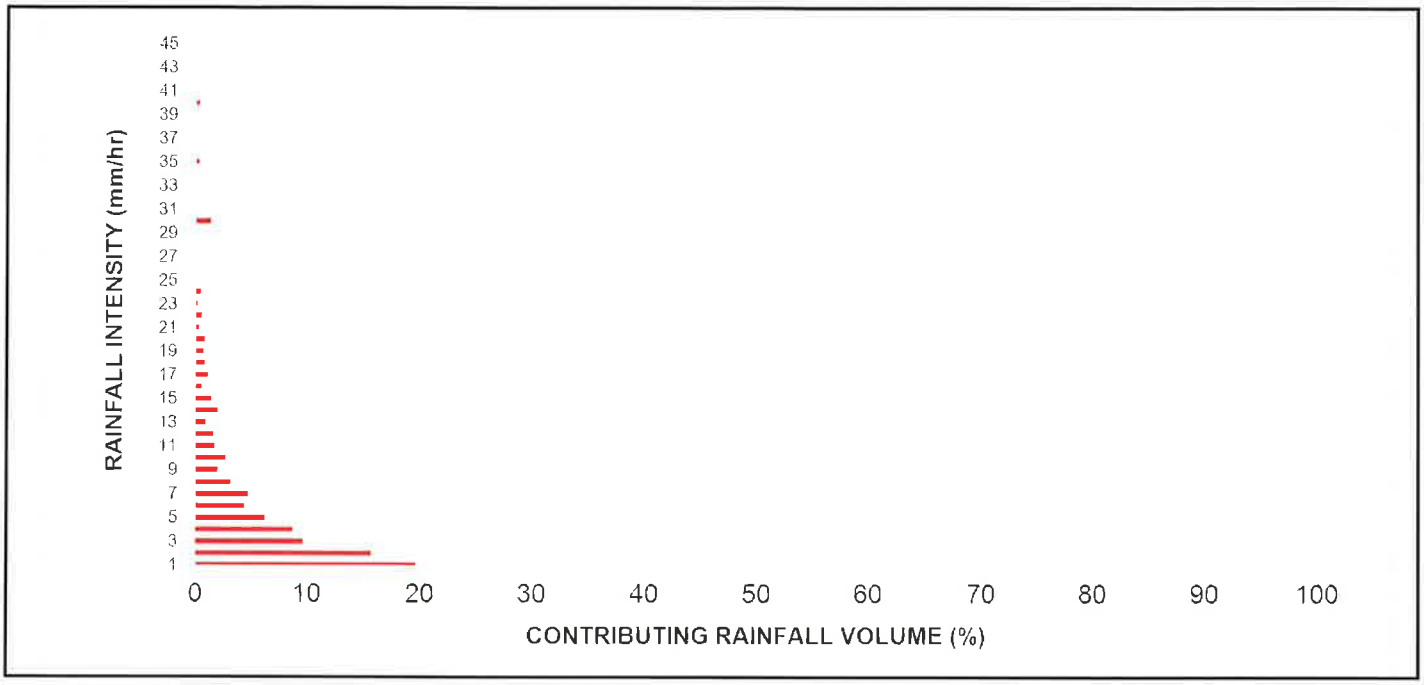
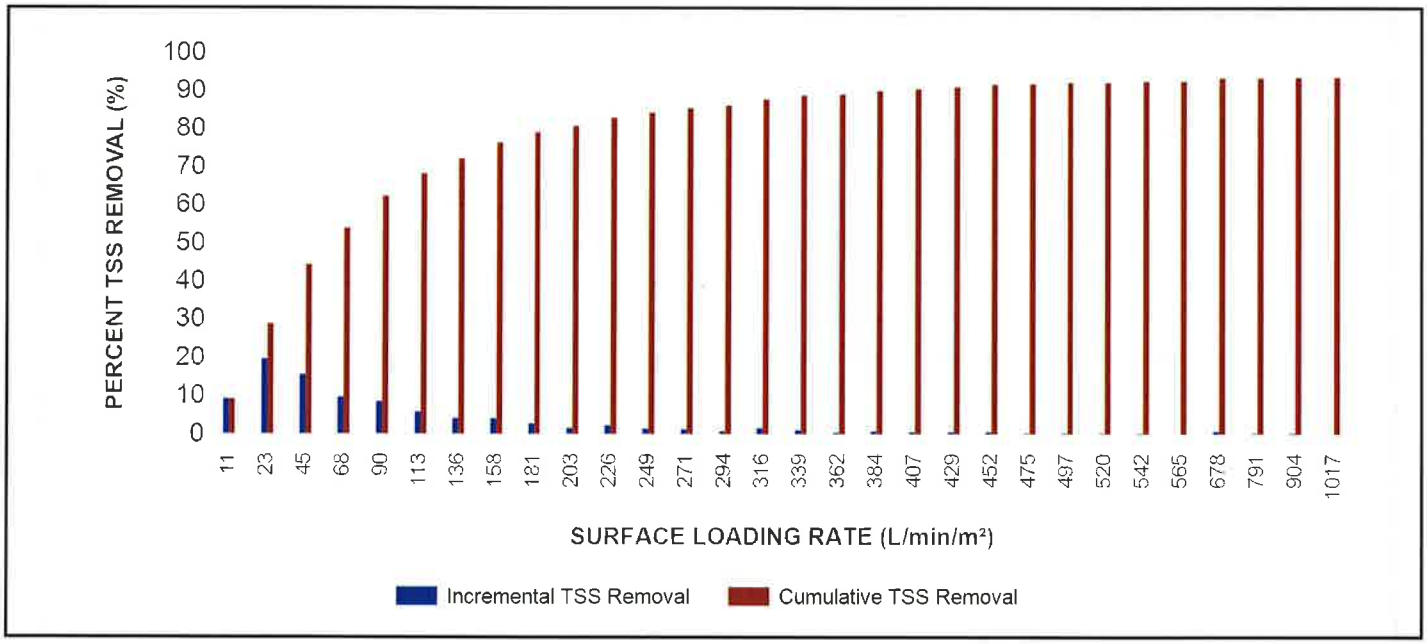
RAINFALL DATA FROM BRANTFORD MOE RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



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Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

▶**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

DESIGN FLEXIBILITY

▶**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

▶While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.

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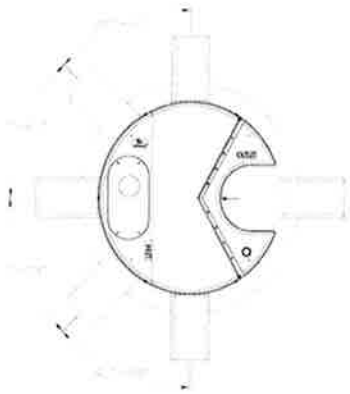


INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

imbrium

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall

remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to

assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

Appendix 'E'
Preliminary Storm Sewer Design Calculations

STORM SEWER DESIGN

Designed by: R. W. Phillips, P.Eng.
Company: J.H. Cohoon Engineering Limited
Date : March 5, 2024

MN 78 King Street
Proposed Residential Subdivision
County of Norfolk

$I = A / [(B + Tc)^{c}]$

n = 0.013

A = 583.02
B = 3.01
c= 0.703

Area No.	Street Name	From MH	To MH	Area (ha)	Runoff Coeff	A * C	Accum A * C	Time of Conc	Intensity (mm/hr)	Qpeak (cms)	Dia (mm)	Slope (%)	Length (m)	Capacity (cms)	Velocity (m/s)	Travel Time	%Full
	MN 78 King Street	*ST1*	*ST2*	*0.004*	*0.00*	*0.00*	*0.00*	*15.00*	*76.4*	*0.000*	*250*	*1.1%*	*22.3*	*0.065*	*1.3*	*0.29*	*0%*
		ST2	*ST5*	*0.062*	*0.99*	*0.06*	*0.06*	*15.29*	*75.6*	*0.013*	*250*	*1.0%*	*12.5*	*0.062*	*1.2*	*0.17*	*21%*
		ST3	*ST4*	*0.006*	*0.21*	*0.00*	*0.00*	*15.00*	*76.4*	*0.000*	*250*	*1.8%*	*19.6*	*0.083*	*1.6*	*0.20*	*0%*
		ST4	*ST5*	*0.048*	*0.98*	*0.05*	*0.05*	*15.20*	*75.8*	*0.010*	*250*	*1.0%*	*12.4*	*0.062*	*1.2*	*0.17*	*16%*
		BLDG	*ST2*	*0.053*	*1.00*	*0.05*	*0.05*	*15.00*	*76.4*	*0.011*	*200*	*0.5%*	*16.0*	*0.024*	*0.7*	*0.36*	*47%*
		ST5	*Infiltration*	*0.000*	*0.00*	*0.11*	*0.11*	*15.46*	*75.1*	*0.023*	*300*	*1.0%*	*16.0*	*0.101*	*1.4*	*0.19*	*23%*

Proposed Multi-Use Building

NORFOLK COUNTY - MN 78 King Street Delhi, Ontario

SECURITIES AND CONSTRUCTION ESTIMATES

REVISION

August 23,2023 - Preliminary Estimate	**05-Mar-24**
DATE - COLLECTED AT REGISTRATION	
DATE - HELD AFTER ACCEPTANCE	

ITEM	DESCRIPTION	UNIT	QTY.	UNIT PRICE	TOTAL COST	Securities	
						10%	100%
BELOW GROUND							
SANITARY SEWERS							
	Sanitary Sewer						
	a) 150mm Diameter	M	15	$125	$1,875	$188	$0
	b) 150mm Diameter	M	14	$125	$1,788	$0	$1,788
	1200mm Diameter Manholes	EACH	2	$4,000	$8,000	$800	$0
	Video Inspection and Report	L.S.	1	$750	$750	$75	$0
	TOTAL SANITARY SEWERS				**$12,413**	**$1,063**	**$1,788**
WATERMAIN							
	Watermain						
	a) 150mm Diameter	M	23	$175	$4,025	$403	$0
	b) 50 mm Diameter	M	23	$100	$2,300	$230	$0
	c) 150mm Diameter	M	6.5	$175	$1,138	$0	$1,138
	Watervalves						
	a) 150mm Diameter	EACH	1	$2,250	$2,250	$225	$0
	b) 50mm Diameter	EACH	1	$1,000	$1,000	$100	$0
	c) 150mm Diameter	EACH	1	$2,250	$2,250	$0	$2,250
	TOTAL WATERMAIN				**$12,963**	**$958**	**$3,388**
STORM SEWERS							
	Storm Sewer						
	a)250mm Diameter	M	67	$150	$10,050	$1,005	$0
	b)300mm Diameter	M	3	$200	$600	$60	$0
	Catchbasins	EA	4	$1,500	$6,000	$600	$0
	Infiltration Gallery	L.S.	1	$20,000	$20,000	$2,000	$0
	Stormceptor	L.S.	1	$25,000	$25,000	$2,500	$0
	Video Inspection and Report	L.S.	1	$1,500	$1,500	$150	$0
	TOTAL BELOW STORM SEWER				**$63,150**	**$6,315**	**$0**
					$88,525	**$8,335**	**$5,175**
ABOVE GROUND							
ROAD CONSTRUCTION							
	Granular 'A'	Sq.m.	985	$17	$16,745	$1,675	$0
	Granular 'A'	Sq.m.	60	$17	$1,020	$0	$1,020
	Granular 'B'	Sq.m.	985	$11	$10,835	$1,084	$0
	Granular 'B'	Sq.m.	60	$11	$660	$0	$660
	Curb and Gutter	M	172	$50	$8,600	$860	$0
	Curb and Gutter	M	6	$50	$300	$0	$300
	HL4 Base Asphalt	Tonne	185	$140	$25,900	$2,590	$0
	HL4 Base Asphalt	Tonne	10	$140	$1,400	$0	$1,400
	HL3 Surface Asphalt	Tonne	125	$140	$17,500	$1,750	$0
	HL3 Surface Asphalt	Tonne	6	$140	$840	$0	$840
	Sidewalk	M^2	166	$40	$6,640	$664	$0

ITEM	DESCRIPTION	UNIT	QTY.	UNIT PRICE	TOTAL COST	Securities	
						10%	100%
	Tactile (at sidewalk ramps)	L.S.	1	$700	$700	$70	$0
	Painted Linework on Pavement	L.S.	1	$2,500	$2,500	$250	$0
	Supply and Install Street Signs	L.S.	1	$550	$550	$55	$0
	TOTAL ROAD CONSTRUCTION				**$94,190**	**$8,997**	**$4,220**
					$94,190	**$8,997**	**$4,220**

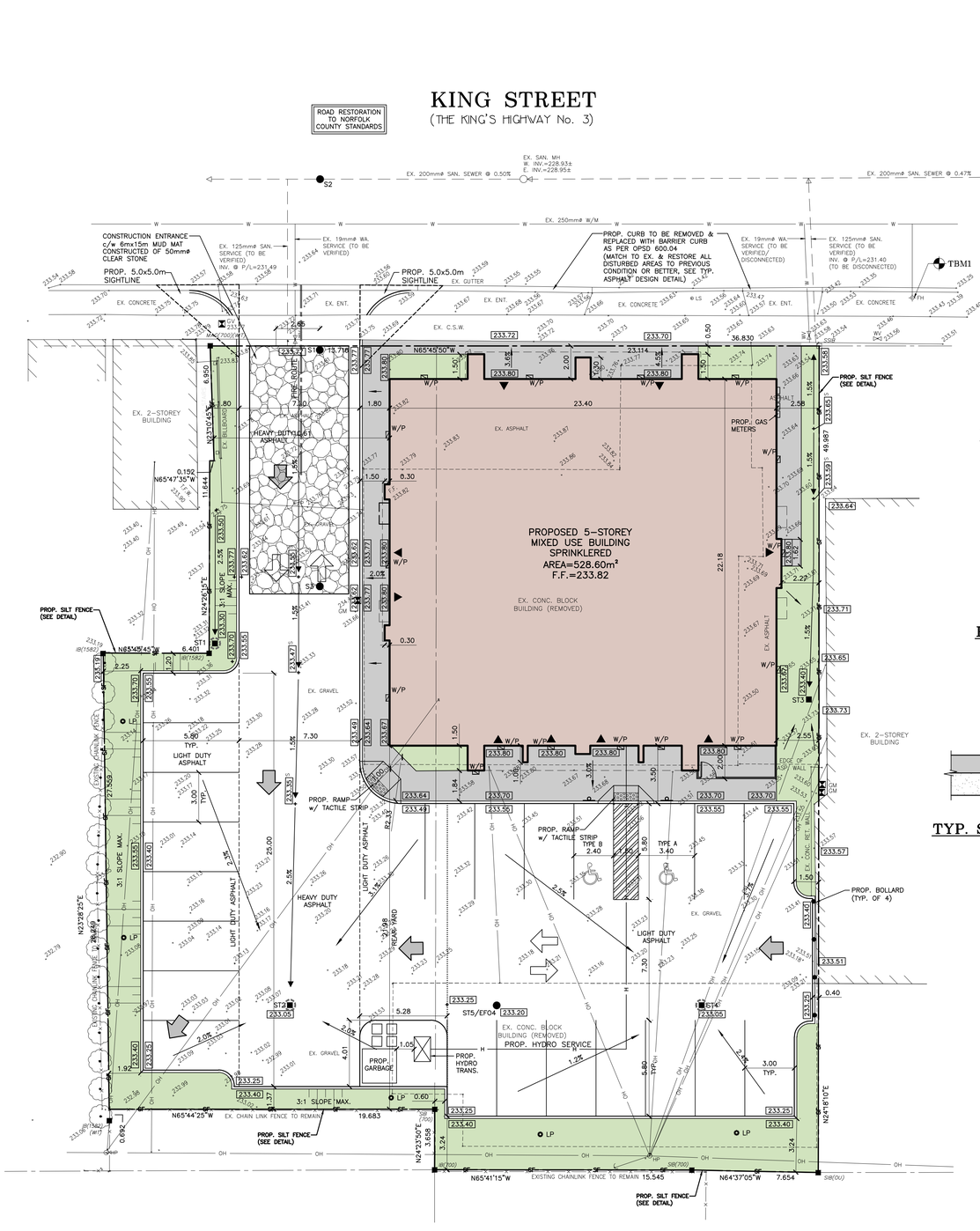
FINISHING WORKS

Top Soil and Sodding	M²	175	$11	$1,925	$193	$1,925
A/C Drawings	L.S.	1	$1,500	$1,500	$150	$1,500
				$3,425	**$343**	**$3,425**

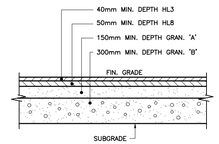
SUMMARY

BELOW GROUND	$88,525	$8,335	$5,175
ABOVE GROUND	$94,190	$8,997	$4,220
FINISHING WORKS	$3,425	$343	$3,425

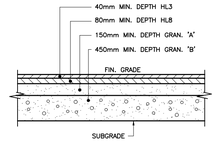
TOTAL SECURITIES REQUIRED AT REGISTRATION **$30,495**



KEY PLAN



LIGHT DUTY ASPHALT DESIGN
N.T.S.



HEAVY DUTY ASPHALT DESIGN
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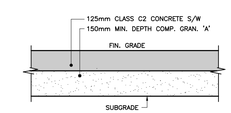
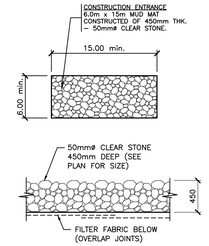


TYP. SIDEWALK DETAIL
N.T.S.



MUD MAT DETAIL
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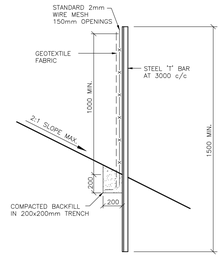
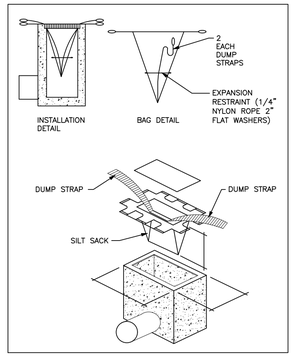


HEAVY DUTY SILT FENCE DETAIL OPSD 219.130
N.T.S.



SILT SACK DETAIL
N.T.S.

GENERAL NOTES:

1. CONSTRUCTION OF SEWERS, WATERMAINS AND RELATED APPURTENANCES SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE CURRENT STANDARD DRAWINGS OF THE COUNTY OF NORFOLK, AND THE ONTARIO PROVINCIAL STANDARDS DRAWINGS (OPSD). THE COUNTY OF NORFOLK DRAWINGS SHALL TAKE PRECEDENCE OVER THE OPSD DRAWINGS.
2. INFORMATION REGARDING ANY EXISTING SERVICES AND/OR UTILITIES SHOWN ON THE APPROVED SET OF CONSTRUCTION DRAWINGS IS FURNISHED AS THE BEST AVAILABLE INFORMATION. THE CONTRACTOR SHALL INTERPRET THIS INFORMATION AS THEY SEE FIT WITH THE UNDERSTANDING THAT THE OWNER AND HIS AGENTS DISCLAIM ALL RESPONSIBILITY FOR ITS ACCURACY AND/OR SUFFICIENCY.
3. ALL DIMENSIONS SHALL BE CHECKED AND VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO ANY CONSTRUCTION AND HE SHALL REPORT ANY DISCREPANCIES IMMEDIATELY TO THE ENGINEER.
4. RELOCATION OF EXISTING SERVICES AND/OR UTILITIES SHALL BE CONSTRUCTED AS SHOWN ON THE DRAWINGS OR AS DIRECTED BY THE ENGINEER.
5. THE CONTRACTOR SHALL OBTAIN ALL PERMITS FOR CONSTRUCTION.
6. FOR ALL SEWERS AND WATERMAIN IN FILL SECTIONS, THE COMPACTION SHALL BE VERIFIED PRIOR TO LAYING OF PIPE.
7. NO SUBSTITUTIONS WILL BE ALLOWED WITHOUT WRITTEN APPROVAL FROM THE COUNTY OF NORFOLK OR THE ENGINEER.
8. NO BLASTING WILL BE PERMITTED.
9. ALL EXCAVATIONS TO BE BACKFILLED WITH SELECT NATIVE MATERIAL, APPROVED BY THE ENGINEER, TO 95% S.P.D.
10. THE DEVELOPER AND/OR CONTRACTOR IS RESPONSIBLE FOR INSTALLING AND MAINTAINING (UNTIL ROAD CONSTRUCTION IS FINISHED) SILT CONTROL DEVICES AS SHOWN ON THE DRAWINGS AND AS DIRECTED BY THE ENGINEER.
11. TREE PROTECTION PROCEDURES TO BE IMPLEMENTED IN ACCORDANCE WITH COUNTY OF NORFOLK STANDARDS.
12. ALL WORKS SHALL BE DESIGNED AND CONSTRUCTED SO AS TO COMPLY WITH APPLICABLE LAW, TO BE CONSISTENT WITH THE COUNTY OF NORFOLK DEVELOPMENT & ENGINEERING STANDARDS AND IN ACCORDANCE WITH CURRENT GUIDELINES, CODES, REGULATIONS AND STANDARDS PRESCRIBED BY THE COUNTY.
13. ALL BOULEVARD AREAS TO BE RESTORED WITH #1 NURSERY SOD ON A MINIMUM 100mm OF SELECT TOPSOIL.
14. ALL TRENCH BACKFILL UNDER EXISTING ROADWAYS SHALL BE COMPACTED IN MINIMUM 230mm LIFTS TO 98% STANDARD PROCTOR DENSITY. A GEOTECHNICAL ENGINEER'S REPRESENTATIVE SHALL BE ON SITE DURING THE WORK TO VERIFY THE COMPACTION OF EACH LIFT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS OF RE-TESTING.
15. AN ENGINEER IS REQUIRED TO BE ONSITE FOR INSPECTION OF ALL UNDERGROUND SERVICES.
16. DRIVEWAYS MUST HAVE MINIMUM 1.0m CLEARANCE FROM CATCHBASINS, VALVES, HYDRANTS STREETLIGHT POLES, TRANSFORMERS, CANADA POST COMMUNITY MAILBOX LOCATIONS ETC.
17. ALL EXISTING OVERHEAD HYDRO SERVICES WILL BE REMOVED AND RELOCATED TO A UNDERGROUND SERVICES.
18. ROAD RESTORATION WITHIN THE R.O.W. TO BE 40mmHL3, 100HL8, 150mm GRANULAR 'A', 450mm GRANULAR 'B'.
19. CONCRETE SIDEWALK RESTORATION SHALL BE 125mm CLASS C2 CONCRETE ON 150mm GRANULAR 'A'.

ROADWORKS:

1. ROADWAYS & RELATED WORKS SHALL BE DESIGNED AND CONSTRUCTED SO AS TO COMPLY WITH APPLICABLE LAW, TO BE CONSISTENT WITH THE COUNTY OF NORFOLK DEVELOPMENT AND ENGINEERING STANDARDS AND IN ACCORDANCE WITH CURRENT GUIDELINES, CODES, REGULATIONS, BEST PRACTICES AND STANDARDS PRESCRIBED BY THE COUNTY.
2. CATCH BASIN CONNECTIONS TO BE PVC PIPE CSA B182.4, SDR 35 OR 'ULTRA RIB'. SINGLE CATCH BASIN LEADS TO BE MIN. 250mm DIA. DOUBLE CATCH BASIN LEADS TO BE MIN. 300mm DIA. REAR LOT CATCHBASIN LEADS AND DITCH INLET LEADS TO BE CSA A257.1 EXTRA STRENGTH CL3 CONC. 300mm DIA. AT 1.0% MIN.
3. SINGLE CATCH BASINS AS PER OPSD 705.010 FRAME AND COVER AS PER OPSD 400.110.
4. FINAL ROADWAY CROSSFALL TO BE 2.0%
5. VALVES, MANHOLES AND CATCH BASINS SHALL BE PLACED AT ASPHALT BINDER COURSE (HL4) ELEVATION AS DIRECTED BY THE ENGINEER.
6. AT SAG POINTS, CATCH BASIN ADJUSTMENT AND PAVING TO BE PLACED IN SUCH MANNER THAT WILL NOT OBSTRUCT DRAINAGE.
7. FINAL ASPHALT COURSE (HL3) SHALL BE PLACED IN ACCORDANCE WITH APPROVED COUNTY OF NORFOLK STANDARDS FOR TIMING, AS DIRECTED BY THE ENGINEER AND AS PER THE REQUIREMENTS STIPULATED IN THE DEVELOPMENT AGREEMENT.
8. FOR MANHOLE AND CATCH BASIN TOP ADJUSTMENTS, ALL PERMANENT ADJUSTMENTS ARE TO BE POURED IN PLACE OR APPROVED EQUIVALENT (e.g. MODULOC).
9. ALL BEDDING AND BACKFILL MATERIAL, ROAD SUB-GRADES AND GRANULAR ROAD BASES SHALL BE COMPACTED TO MIN 100% SPD UNLESS OTHERWISE SPECIFIED.
10. SILTATION CONTROL BARRIERS SHALL BE PLACED AS DETAILED ON THE SILTATION AND EROSION CONTROL PLAN.
11. ADDITIONAL SILT CONTROL LOCATIONS MAY BE REQUIRED AS DETERMINED BY THE COUNTY AND/OR THE ENGINEER.
12. ANY ROADWORK OR RESTORATION SPECIFICATION REQUIRED EIS DEPARTMENT ENGINEERING APPROVAL.

LICENSED PROFESSIONAL ENGINEERS
06/03/24
R.W. PHILLIPS
PROVINCE OF ONTARIO

LEGEND:

- 200.00 — EXISTING ELEVATIONS
- 200.00 — PROPOSED ELEVATIONS
- 200.00 S — PROPOSED SWALE ELEVATIONS
- PROPOSED SWALE
- GENERAL DRAINAGE
- SILTATION FENCE
- CB — SILT SOCK AS SHOWN
- CONSTRUCTION ENTRANCE c/w 6mx15m MUD MAT CONSTRUCTED OF 50mmø CLEAR STONE
- OVERLAND FLOW ROUTE
- CB — EXISTING CATCHBASIN
- DCB — EXISTING DOUBLE CATCHBASIN
- DICB — EXISTING DITCH INLET CATCHBASIN
- FH — EXISTING FIRE HYDRANT
- V&B — EXISTING VALVE & BOX
- WB — EXISTING WATER BOX
- LS — EXISTING LIGHT STANDARD
- W/P — PROPOSED WALL PACK LIGHTING
- LP — PROPOSED LIGHT POLE

NOTES:

1. ALL ELEVATIONS SHOWN ARE METRIC.
2. BUILDER/OWNER TO VERIFY COMPLIANCE WITH ZONING BYLAWS (ie. SIDEYARDS, SETBACKS, REARYARDS ETC.)
3. BOUNDARY AND TOPOGRAPHIC SURVEY PROVIDED BY JEWITT AND DIXON SURVEYING (PROJECT 22-3363 DATED MAY 26, 2022)
4. THE SILTATION & EROSION CONTROL (SEC) MEASURES ILLUSTRATED ON THIS PLAN ARE CONSIDERED TO BE THE MINIMUM REQUIREMENT. SITE CONDITIONS MAY REQUIRE ADDITIONAL MEASURES WHICH WILL BE IDENTIFIED BY THE ENGINEER DURING CONSTRUCTION.
5. ALL SEC MEASURES ARE TO BE IN PLACE PRIOR TO COMMENCEMENT OF CONSTRUCTION.
6. OWNER/CONTRACTOR TO MAINTAIN EROSION CONTROL MEASURES THROUGHOUT SITE UNTIL A COMPLETE GRASS/VEGETATION COVER IS ACHIEVED.
7. ONLY AT THE DIRECTION OF THE ENGINEER ARE THE SEC MEASURES TO BE REMOVED.
8. ALL EXPOSED AREAS NOT SUBJECT TO ACTIVE CONSTRUCTION WITHIN 30 DAYS ARE TO BE REVEGETATED AS PER O.P.S.S. 572 IMMEDIATELY UPON COMPLETION OF AREA GRADING.
9. ALL RAINWATER LEADERS FROM EACH HOUSE ARE TO BE DIRECTED TOWARDS THE RIGHT-OF-WAY. UNLESS NOTED OTHERWISE.
10. CONTRACTOR TO PROVIDE SILT FENCE AROUND PERIMETER OF ALL ON SITE STOCKPILES.
11. CONTRACTOR TO PROVIDE SILT SACKS ON TOP OF ALL EXISTING AND PROPOSED STORM STRUCTURES WITHIN THE INFLUENCE OF RUNOFF DURING CONSTRUCTION UNTIL ADEQUATE VEGETATIVE COVER IS ACHIEVED.
12. SEC CONSULTANT TO VISIT DEVELOPMENT, AT A MINIMUM, ON A WEEKLY BASIS AND ALSO DURING AND AFTER EACH STORM EVENT TO ENSURE SEC MEASURES ARE FUNCTIONING PROPERLY.
13. SEC CONSULTANT SHALL PROVIDE THE CITY WITHIN 48 HRS. OF A STORM EVENT A LIST OF DEFICIENCIES AND TIMEFRAME FOR THE COMPLETION OF NECESSARY CORRECTIVE MEASURES.

T.B.M. No. 1 ELEV. = 234.25m (GEO)
TOP OF MAIN OUTLET OF FIRE HYDRANT AS SHOWN (TO BE VERIFIED).

NO.	REVISION	DATE (MM/DD/YY)	BY
4	STORMCEPTOR/ASPHALT DESIGN	03/06/24	S.L.M.
3	HYDRO SERVICE	02/16/24	S.L.M.
2	WATER & SANITARY SERVICING	02/06/24	K.P.B.
1	AS PER COUNTY COMMENTS	01/19/24	S.L.M.

J.H. COHOON ENGINEERING LIMITED
CONSULTING ENGINEERS
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TEL. (519) 753-2656 FAX. (519) 753-4263 www.cohooneng.com

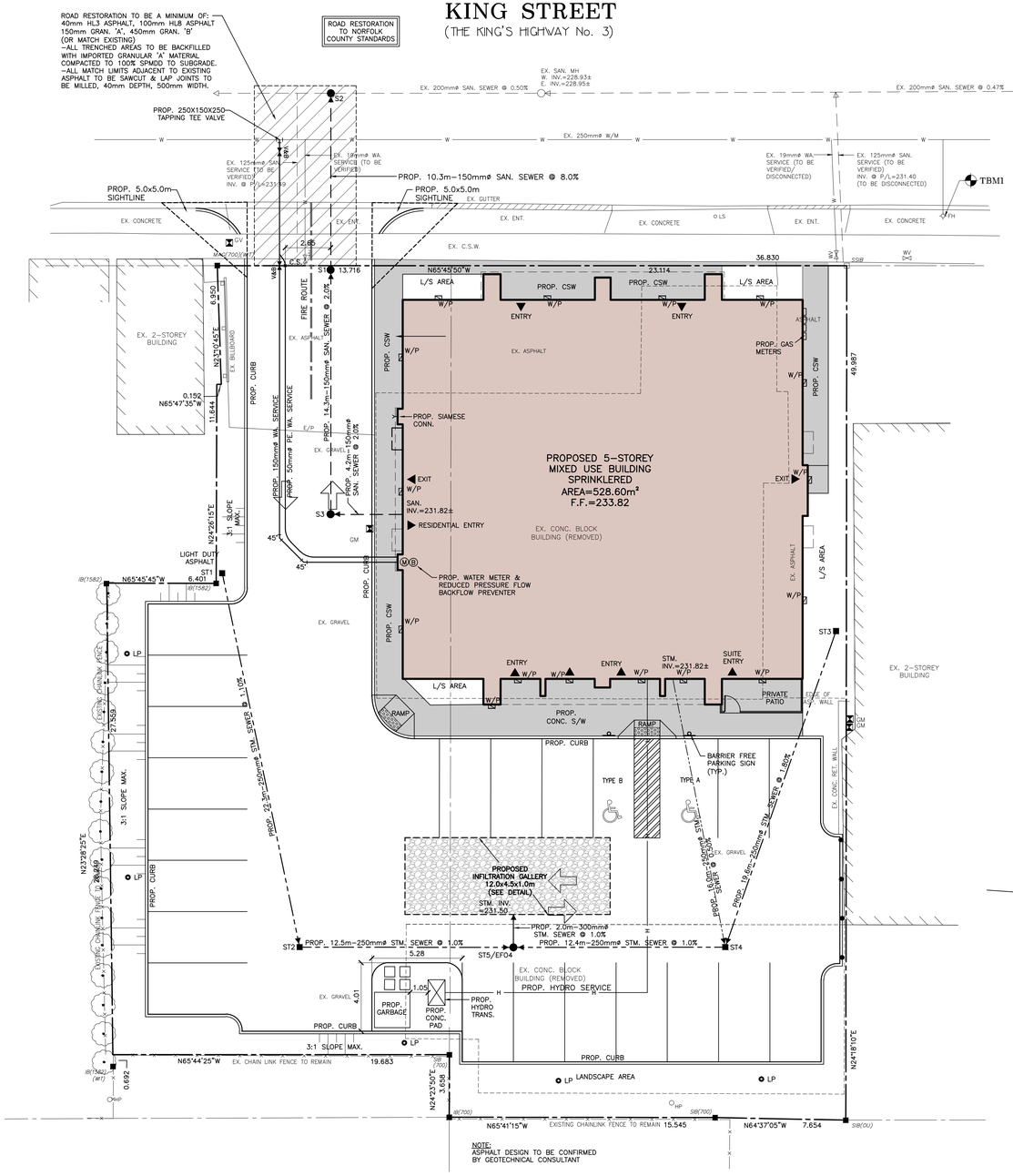
PROJECT:
PROPOSED MIXED USE BUILDING
LOTS 2 & 3, BLOCK 16
R-PLAN 189
78 KING STREET, DELHI
NORFOLK COUNTY

CLIENT:
SENTRY GROUP

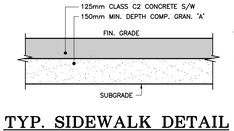
GRADING & SILTATION CONTROL PLAN

DESIGN:	R.W.P.	SCALE:	1:150
DRAWN:	S.L.M./K.P.B.	JOB No:	16025
CHECKED:	R.W.P.		
SHEET:	1 of 2	DWG. No:	16025-1
DATE:	APR. 20/23		

KING STREET
(THE KING'S HIGHWAY No. 3)

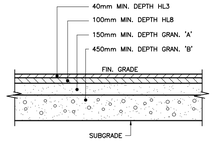


NOTE:
ASPHALT DESIGN TO BE CONFIRMED BY GEOTECHNICAL CONSULTANT



NOTES:
1. SIDEWALK GRADE TO BE 0.5 to 6.0%
2. SIDEWALK CROSSFALL TO BE 2.0 to 4.0%
3. SIDEWALK WIDTH TO BE 1.5m OR MATCH EXISTING

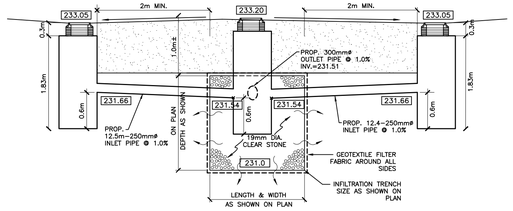
TYP. SIDEWALK DETAIL
N.T.S.



ASPHALT DESIGN FOR ROAD RESTORATION
N.T.S.

WATERMAINS:

1. WATERMAINS AND RELATED APPURTENANCES SHALL BE DESIGNED AND CONSTRUCTED SO AS TO COMPLY WITH APPLICABLE LAW, TO BE CONSISTENT WITH THE COUNTY OF NORFOLK DEVELOPMENT AND ENGINEERING STANDARDS AND IN ACCORDANCE WITH CURRENT GUIDELINES, CODES, REGULATIONS, BEST PRACTICES AND STANDARDS PRESCRIBED BY THE COUNTY.
2. WATERMAINS TO BE INSTALLED WITH A MINIMUM DEPTH OF COVER OF 1.70m BELOW FINISHED GRADE.
3. WATERMAINS TO BE INSTALLED IN ACCORDANCE WITH OPSD 802.010 TYPE 2. TRENCH BEDDING TO BE GRANULAR 'A' UNLESS OTHERWISE NOTED.
4. WATERMAINS TO BE PVC DR–18 IN ACCORDANCE WITH AWWA C900 & CSA B137.3. THE PIPE SHALL BE SHIPPED TO THE SITE WITH THE ENDS FACTORY CAPPED.
5. FOR PVC WATERMAIN DEFLECTION:
   – MAXIMUM ALLOWABLE DEFLECTION OF 1 DEGREE PER JOINT SHALL NOT BE EXCEEDED.
   – EACH JOINT SHALL BE DEFLECTED AN EQUAL AMOUNT.
6. ALL WATER MAINS TO BE SWABBED, TESTED, DISINFECTED AND FLUSHED UNDER THE SUPERVISION OF THE ENGINEER TO THE SATISFACTION OF THE COUNTY OF NORFOLK PRIOR TO CONNECTION TO THE EXISTING MUNICIPAL SYSTEM. REFER TO OPSS 701.07.25, AWWA C651 & COUNTY OF NORFOLK GENERAL WATERMAIN DISINFECTION PROCEDURES.
7. A REDUCED PRESSURE FLOW BACKFLOW PREVENTER IS REQUIRED ON THE TEMPORARY SUPPLY LINES USED FOR FILLING AND FLUSHING/SWABBING OF WATERMAINS AND TO BE TESTED AND CERTIFIED ON SITE.
8. UPON COMPLETION OF INSTALLATION, THE CONTRACTOR SHALL PERFORM A PRESSURE TEST ON THE WATERMAINS AS PER OPSS 701.07.24 AND COUNTY OF NORFOLK SPECIFICATIONS. WATERMAIN IS TO BE TESTED UNDER THE SUPERVISION OF THE ENGINEER PRIOR TO CONNECTION TO EXISTING WATERMAINS USING TEMPORARY CAPS OR PLUGS.
9. PIPE CLOSURES WHERE REQUIRED, ARE TO BE SUPPLIED BY THE CONTRACTOR. THE CONTRACTOR SHALL ALSO SUPPLY AND INSTALL ALL ADAPTOR PIECES IN ORDER TO CONNECT EXISTING WATERMAINS.
10. ALL WATER SERVICE CONNECTIONS 19mm DIA. ASTM B88 TYPE 'K' SOFT COPPER AS PER OPSD 1104.01 & COUNTY OF NORFOLK ENGINEERING STANDARDS, WITH SAND BEDDING.
11. WATER SERVICES TO BE LOCATED AS PER TYPICAL SERVICING DETAIL ON THIS SHEET AND CURB STOPS TO BE MUELLER A–726 OR EQUIVALENT APPROVED BY THE COUNTY OF NORFOLK.
12. 3–WAY HYDRANTS TO BE INSTALLED AS PER OPSD 1105.01 (SHALL OPEN LEFT – COUNTER CLOCKWISE) & PAINTED RED. HYDRANTS TO BE CANADA VALVE CENTURY HYDRANT OR EQUIVALENT APPROVED BY THE COUNTY OF NORFOLK.
13. ALL WATERMAIN VALVES, BENDS AND FITTINGS TO HAVE MECHANICAL JOINTS.
14. CATHODIC PROTECTION TO BE PROVIDED AT ALL VALVES, BENDS AND FITTINGS WITH 11.0 KG ZINC ANODES AND ON ALL WATER SERVICE CONNECTIONS WITH 5.5 KG ZINC ANODES.
15. SHOULD AIR IN THE WATERMAIN BE DEMONSTRATED TO BE A PROBLEM, THE CONTRACTOR WILL BE REQUIRED TO INSTALL AN AIR RELIEF VALVE(s) TO THE SATISFACTION OF THE COUNTY OF NORFOLK.
16. THE APPLICANT AND/OR CONTRACTOR MUST SUBMIT A DETAILED DISINFECTION AND COMMISSIONING PLAN TO THE COUNTY OF NORFOLK PUBLIC WORKS PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.
17. NO WORK ON WATER SERVICES CAN TAKE PLACE WITHOUT SUPERVISION OF A LICENSED NORFOLK COUNTY WATER OPERATOR ON–SITE.
18. EXISTING WATER SERVICE LOCATED ON THE EAST SIDE OF THE PROPERTY IS TO BE DECOMMISSIONED.
19. TRACER WIRE TO BE INSTALLED AND NOTED PER NORFOLK COUNTY DESIGN CRITERIA SECTION 10.6.0
20. DOMESTIC WATER SERVICE WILL REQUIRE REDUCED PRESSURE FLOW ASSEMBLY AFTER WATER METER. NO BYPASS WILL BE ALLOWED WITHOUT THE APPROVAL OF THE DIRECTOR OF ENVIRONMENTAL SERVICES. IF THE BYPASS IS ALLOWED THEN ADDITIONAL WATER METER WILL BE REQUIRED WITH A RPZ ASSEMBLY AND THE OWNER WILL BE BILLED MONTHLY FOR THE METER CONSUMPTION.



INFILTRATION GALLERY DETAIL
N.T.S.

KEY PLAN

SANITARY & STORM SEWERS:

1. SANITARY & STORM SEWERS & RELATED APPURTENANCES SHALL BE DESIGNED AND CONSTRUCTED SO AS TO COMPLY WITH APPLICABLE LAW, TO BE CONSISTENT WITH THE COUNTY OF NORFOLK DEVELOPMENT AND ENGINEERING STANDARDS AND IN ACCORDANCE WITH CURRENT GUIDELINES, CODES, REGULATIONS, BEST PRACTICES AND STANDARDS PRESCRIBED BY THE COUNTY.
2. COVER AND BEDDING MATERIAL FOR CONCRETE PIPE AS PER OPSD 802.030 CLASS 'B' BEDDING SHALL BE GRANULAR 'A' MATERIAL UNLESS OTHERWISE INDICATED.
3. COVER AND BEDDING MATERIAL FOR PVC PIPE AS PER OPSD 802.010 TYPE 2 TRENCH BEDDING SHALL BE GRANULAR 'A' MATERIAL UNLESS OTHERWISE INDICATED.
4. PVC PIPE WILL REQUIRE SPECIAL CONSTRUCTION PROCEDURES FOR LEAKAGE AND TESTING, PIPE DEFLECTION, ETC.
5. ALL SEWERS TO BE FLUSHED & VIDEOED PRIOR TO THE SUBMISSION OF THE FIRST INTERIM COMPLETION CERTIFICATE AND PRIOR TO THE FINAL COMPLETION CERTIFICATE.
6. ALTERNATE MATERIALS MAY BE ACCEPTABLE, PROVIDED APPROVAL HAS FIRST BEEN OBTAINED FROM THE COUNTY OF NORFOLK AND ENGINEER IN WRITING.
9. ALL STORM MANHOLES AND CATCHBASINS TO BE PRECAST CONCRETE STRUCTURES MANUFACTURED IN PRE QUALIFIED PLANTS IN ACCORDANCE WITH THE LATEST APPLICABLE ONTARIO PROVINCIAL STANDARD (OPS) DRAWINGS AND SPECIFICATIONS.
10. ALL SEWER INSTALLATIONS TO CONFORM WITH OPSD 802.031 TYPE 3 SOIL.
11. ALL MANHOLE FRAMES AND COVERS TO CONFORM WITH OPSD 401.010 TYPE 'A' CLOSED COVER.
12. MANHOLES SHALL BE SUPPLIED TO THE SITE PRE–BENCHED UNLESS OTHERWISE NOTED.
13. PRIVATE SANITARY & STORM DRAINS TO BE LOCATED AS PER THE TYPICAL LOT SERVICING DETAIL THIS SHEET.
14. PRIVATE SANITARY DRAINS TO 150mmø PVC DR28 PIPE.
15. A 38x89mm x 2.0m LONG MARKER IS TO BE PLACED FROM THE CAPPED LATERAL AND EXTEND 1.0m ABOVE GROUND AND PAINTED GREEN FOR SANITARY AND WHITE FOR STORM.
16. BEDDING FOR PRIVATE SANITARY & STORM DRAINS AS PER OPSD 1006.02 TYPE 2 TRENCH WITH GRANULAR 'A' BEDDING AND COVER MATERIAL.
17. MINIMUM FALL FOR PRIVATE SANITARY & STORM DRAINS TO BE 2.0%
18. INFILTRATION GALLERIES/PROPOSED DRYWELLS ARE NOT THE RESPONSIBILITY OF NORFOLK COUNTY.
19. ALL APPLICABLE PERMITS ARE TO BE APPLIED FOR PRIOR TO THE INSTALLATION OF ANY SERVICES.
20. ALL ON–SITE STORM SEWERS TO BE REMOVED OR FILLED WITH GROUT.
21. ALL SANITARY SEWER LATERAL CONNECTIONS SHALL BE INSTALLED USING PREFABRICATED TEES. THE USE OF SERVICE SADDLES MUST BE APPROVED BY NORFOLK COUNTY ENVIRONMENTAL SERVICES DIVISION. ALL CONNECTIONS SHALL CONFORM TO CURRENT OPSD 1006.010 AND OPSS 410.
22. NO DEFLECTIONS OF SANITARY LATERALS ALLOWED FROM MAIN TO PROPERTY LINE. NEW CONNECTIONS MUST BE 3.0m FROM PROPERTY LINE BARS OR AS APPROVED BY THE MANAGER OF ENVIRONMENTAL SERVICES. AFTER THE PROPERTY LINE ONLY 22.5° & 45° 1.2m SWEEPS ARE ALLOWED. CLEANOUTS ARE REQUIRED EVERY 30.5m AND PRIVATE MANHOLES EVERY 91.3m.
23. SPATIAL SEPARATION FROM WATER SERVICE CONNECTIONS OF NOT LESS THAN 2.50m MEASURED HORIZONTALLY FROM UNDISTURBED OR COMPACTED EARTH OR AS APPROVED BY THE MANAGER OF ENVIRONMENTAL SERVICES.
24. EXISTING SANITARY SERVICE LOCATED ON THE EAST SIDE OF PROPERTY TO BE DECOMMISSIONED.
25. ALL SANITARY, STORM OR FORCE MAINS SHALL MEET THE NORFOLK COUNTY DESIGN CRITERIA OR DESIGN CRITERIA FOR SANITARY SEWER, STORM SEWER AND FORCE MAINS FOR ALTERATION AUTHORIZED UNDER AN ENVIRONMENTAL COMPLIANCE APPROVAL MINISTRY OF ENVIRONMENT, CONSERVATION AND PARKS. ALL WATER MAIN INFRASTRUCTURE SHALL MEET THE NORFOLK COUNTY DESIGN AND CRITERIA OR WATERMAIN DESIGN CRITERIA FOR ALTERATION AUTHORIZED UNDER A DRINKING WATER PERMIT ENVIRONMENTAL COMPLIANCE APPROVAL MINISTRY OF ENVIRONMENT, CONSERVATION AND PARKS.

STORM SYSTEM			
MH No.	*DESCRIPTION*	*T/G*	*INVERTS*
ST1	0.6x0.6x1.52m P/C CB	233.30	S 231.93
ST2	0.6x0.6x1.52m P/C CB	233.05	N 231.68 E 231.66
ST3	0.6x0.6x1.52m P/C CB	233.40	S 232.03
ST4	0.6x0.6x1.52m P/C CB	233.05	N 231.68 W 231.66 NW 231.74
ST5	STORMCEPTOR EFO4	233.20	N 231.52 W 231.54 E 231.54

SANITARY SYSTEM			
MH No.	*DESCRIPTION*	*T/G*	*INVERTS*
S1	1.2mø P/C MH (INSPECTION MANHOLE)	233.75±	N 231.30 S 231.36
S2	1.2mø P/C MH c/w DROP STRUCTURE	233.75±	EX. 228.87 S 230.48
S3	1.2mø P/C MH	233.58	N 231.65 E 231.73

WATERMAIN SUMMARY – JOINT RESTRAINTS	
LOCATION / DESCRIPTION	*LENGTH TO BE RESTRAINED (L_r)*
150mm DIA. PVC – 45° HORZ. BEND	2.1m
250x250x150mm PVC – TEE	Lr – MAIN LINE – 0.91m L – BRANCH LINE –4.88m

INPUT PARAMETERS:
SOIL TYPE: ML, FACTOR OF SAFETY: 1.5:1, TRENCH TYPE: 5,
DEPTH OF BURY: 1.7m, TEST PRESSURE: 200 P.S.I.

THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND ABOVEGROUND UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE COMMENCING WORK, THE CONTRACTOR SHALL FAMILIARIZE HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

LEGEND:

S1	EXISTING SANITARY MANHOLE
ST1	EXISTING STORM MANHOLE
CB	EXISTING CATCHBASIN
DCB	EXISTING DOUBLE CATCHBASIN
DICB	EXISTING DITCH INLET CATCHBASIN
FH	EXISTING FIRE HYDRANT
V&B	EXISTING VALVE & BOX
WB	EXISTING WATER BOX
LS	EXISTING LIGHT STANDARD
S1	PROPOSED SANITARY MANHOLE
	PROPOSED SANITARY SERVICE
	PROPOSED STORM SERVICE
ST1	PROPOSED STORM MANHOLE
ST1	PROPOSED CATCHBASIN MANHOLE
CB	PROPOSED CATCHBASIN
V&B	PROPOSED VALVE & BOX
CS	PROPOSED WATER SERVICE & CURBSTOP
W/P	PROPOSED WALL PACK LIGHTING
LP	PROPOSED LIGHT POLE

NOTES:

1. ALL ELEVATIONS SHOWN ARE METRIC.
2. BUILDER/OWNER TO VERIFY COMPLIANCE WITH ZONING BYLAWS (ie. SIDEYARDS, SETBACKS, REARYARDS ETC.)
3. BOUNDARY AND TOPOGRAPHIC SURVEY PROVIDED BY JEWITT AND DIXON SURVEYING (PROJECT 22–3363 DATED MAY 26, 2022)
4. A ROAD OCCUPANCY PERMIT WILL BE REQUIRED FOR EXCAVATION AND INSTALLATION OF SANITARY LATERAL AND INSPECTION MANHOLE, REMOVAL OF EXISTING WATER AND SANITARY SERVICES AND PLACEMENT OF THE NEW WATER SERVICE. THE PERMIT MUST BE OBTAINED PRIOR TO THE START OF ANY EXCITATION.

T.B.M. No. 1 ELEV. = 234.25m (GEO)
TOP OF MAIN OUTLET OF FIRE HYDRANT AS SHOWN (TO BE VERIFIED).

NO.	REVISION	DATE (MM/DD/YY)	BY
4	STORMCEPTOR/ASPHALT DESIGN	03/06/24	S.L.M.
3	HYDRO SERVICE	02/16/24	S.L.M.
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PROJECT:
PROPOSED MIXED USE BUILDING
LOTS 2 & 3, BLOCK 16
R–PLAN 189
78 KING STREET, DELHI
NORFOLK COUNTY

CLIENT:
SENTRY GROUP

SERVICING PLAN

DESIGN:	R.W.P.	SCALE:	1:150
DRAWN:	S.L.M./K.P.B.	JOB No:	16025
CHECKED:	R.W.P.		
SHEET:	2 of 2	DWG. No:	16025–2
DATE:	APR. 20/23		

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#16025

March 6, 2024

Norfolk County
Community Development Division
185 Robinson Street
Suite 200
Simcoe, Ontario
N3Y 5L6

Attention: Ms. Annette Helmig, Dipl.M.A., AMP, CMMIII
Agreement and Development Coordinator

Dear Ms. Helmig:

Re: **SPPL202318 (5-Storey Apartment Development)**
78 King Street
Delhi, Ontario
Agency Comments

In response to the comments with regards to the above noted application, we have provided you with the updated drawings representing the changes that have occurred. We have included the comments received with the appropriate explanation for your review and approval.

Planning: Reviewed. Comments are as follows:

1) Exterior Bicycle parking? Bicycle parking shown on interior of building. Show proposed bicycle parking on site plan. **The proposal does not include exterior bycle parking with the provision of the indoor bicycle parking being available**
2) Wooden Privacy fencing to be shown on site plan, specifically around the parking area. **Currently existing fencing exists along the south and west parking areas and are proposed to remain.**

Building: Reviewed. Conditions are as follows:
Prior to Building Permit Application:

1. The Owner shall agree to make application for a Building Permit, and obtain the necessary Building Permits prior to commencing construction.
Information only and acknowledged.

2. AND FURTHR THAT - all applicable law approvals as required by the Ontario Building Code and supporting documentation from approval agencies re submitted with a building permit application. [OBC Division A 1.4.1.3]
   Information only and acknowledged.

3. AND FURTHER THAT - the Ontario Building Code requires that the project described above be designed and reviewed during construction by an architect, professional engineer or both that are licensed to practice in Ontario; including Site Servicing. NOW THEREFORE the Owner, being the person who intends to construct or have the building constructed hereby warrants that: 1. The undersigned architect and/or professional engineers have been retained to provide general reviews of the construction of the building to determine whether the construction is in general conformity with the plans and other documents that form the basis for the issuance of a building permit, in accordance with the performance standards of the Ontario Association of Architects (OAA) and/or Professional Engineers Ontario (PEO); 2. All general review reports by the architect and/or professional engineers will be forwarded promptly to the Chief Building Official, and 3. Should any retained architect or professional engineer cease to provide general reviews for any reason during construction, the Chief Building Official will be notified in writing immediately, and another architect or engineer will be appointed so that general review continues without interruption during construction.
   Information only and acknowledged.

4. AND FURTHER THAT - indicate barrier free path of travel from parking area to building entrance to the satisfaction of the Building Department. Construction of curb cuts and location of tactile attention indicators is required. [OBC 3.8.1.3, & 3.8.3.2]
   Information only and acknowledged. The site plan includes barrier free access points including curb cuts and tactile indicators as required.

5. AND FURTHER THAT - A letter signed by a Professional Engineer licensed in the Province of Ontario regarding multi-level roof drifting snow load is required. Provide calculation as required by Ontario Building Code 4.1.6.5. If additional snow load is calculated to fall a neighbouring structure, an engineered analysis of the neighbouring is required. Completion of compensating construction to the neighbouring structure may also be required. Separate building permit required for compensating construction.
   To be handled by others.

Prior to Occupancy:

All final letters of general conformity by the architect and/or professional engineers will be forwarded promptly to the Chief Building Official, including site services.
Information only and acknowledged.

Development Engineering: Development Engineering has reviewed the **1st submission** for **SPPL2023178** and have the following Condition(s) and/or Comment(s):

Comments

GENERAL:

1. Securities will be required in the form of a Schedule 'H' template. 10% for site works completed on private property and 100% of works completed within the municipal R.O.W.

    a. As-constructed drawings must be included as part of the securities. The minimum amount of $1500.00 @ 100% will be required.

    Updated security estimate included in the analysis.

2. Please note that prior to final Site Plan approval Sanitary and Water modelling must be completed. Modelling is currently underway. Further comments will be supplied once modelling is received.
    Information only and acknowledged.

3. As per Norfolk County design criteria section 16.4.01 please include an Electrical Services Plan with your next submission.
    The electrical servicing is illustrated on the enclosed servicing plan.

FUNCTIONAL SERVICING REPORT (Dated Dec 17, 2021):

4. When calculating Total Main Floor area for sanitary design flows: what is the reason for multiplying 527 sq.m. (total area) by 50% to equal 267.5 sq.m. +/- ?
    An updated functional servicing report is enclosed with this submission. However, the main floor was a mixed use calculation.

5. In the utilities section of the FSR it refers to Brantford Power as the Hydro Distributor. Please change this to Hydro One in your next submission.
    An updated functional servicing report is enclosed with this submission

6. Development Engineering is concerned that potential contamination from parking lot runoff water is being infiltrated. Per Norfolk County Design Criteria Section 7.4.00, Areas subject to the collection of contaminants or spills shall be fitted with adequate oil/grit separators
    The site has been modified to include an oil grit separator prior to discharge into the storm infiltration gallery.

GRADING PLAN (DWG. 16025-1)

7. Please provide more grades along the southern and eastern property line which indicate that the site is self-containing storm water.
    Additional grades have been shown on the grading plan as requested.

8. Boulevard located at the eastern side of parking lot is to be flush and maintain the 1.5m setback from the eastern property line.

This setback is in close proximity to the building next door with the provision of some protection for the building. An updated functional servicing report is enclosed with this submission

9. Confirm all overhead services for hydro at southern limit of property are being removed.
   Confirmed

10. Please confirm adequate clearance to aerial trespass of hydro service 86 King St.
    This hydro service will be relocated to a U/G service to remove all aerial obstructions

11. Street restoration is required where roll over curb is present along the boulevard of King St. This is to be replaced with barrier curb per OPSD 600.04 and may be held to a higher standard than typical restoration to match existing adjacent frontages (i.e. Matching colored stamped concrete).
    The site plan has been updated accordingly.

SERVICING PLAN (DWG. 16025-2)

12. Development engineering is concerned proposed infiltration gallery is too close to proposed hydro transformer. Please confirm dimensions are adequate to meet Hydro One clearance criteria.
    The infiltration gallery has been relocated to provide additional clearance to the transformer.

13. Please confirm clearance distances between proposed hydro transformer and proposed garbage enclosure. Please confirm dimensions are adequate to meet Hydro One clearance criteria.
    Confirmed by others

14. All onsite storm sewers designed at 250mm. Please confirm this is adequately sized for the storm water design calculations.
    Confirmed

15. Proposed 150mm san. Sewer service at 24.3% is not permitted within municipal ROW. Redesign to conform to OPSD 1006.010. as per note #21
    The arrangement of the sanitary sewer service has been modified as requested. The maximum slope of 8.0% has been achieved.

16. It should be noted on the drawings that the following restoration will be required within the ROW:
    a. 40mm HL3
    b. 100mm HL8
    c. 150mm GRANULAR A
    d. 450mm GRANULAR B

This will also be a requirement on the Road Occupancy Permit.
An updated functional servicing report is enclosed with this submission

17. Concrete Sidewalk restoration shall be 125mm CLASS C2 Concrete on 150mm GRANULAR A
The sidewalk detail in accordance with these specifications have been added to the drawings as requested.

18. A Road Occupancy Permit will be required for excavation and installation of sanitary lateral and inspection manhole, removal of existing water and sanitary services and placement of the new water service. The permit must be obtained prior to the start of any excavation. This shall be mentioned on all the drawings as a note. King St is a Connecting Link Road and will require a higher standard of Traffic Control Plan submitted with Road Occupancy Permit
Information only and acknowledged.

19. All road restoration is to maintain the standard installed by the County in 2020 during the reconstruction of King St. See applicable as constructed drawings attached with these comments.
Information only and acknowledged.

20. Tracer wire to be installed and noted per Norfolk County Design Criteria Section 10.6.0.
Information only and acknowledged.

21. Existing Water and Sanitary service to the east of the property is to be removed. Add appropriate notes to each service being decommissioned.
The site plan has been updated accordingly.

22. Ensure the correct tapping valve and sleeve are used at the incoming water service off of the watermain (when service is greater than half the diameter of the watermain).
Information only and acknowledged.

23. Water service to include a Testable DCVA and waterproof chamber just after the property line valve.
The configuration of the water servicing has been modified to limit the amount of the enclosed water within the fire service to the building. As such, we would respectfully suggest that the provision of the chamber (and associated check value assembly is not required). The appropriate check valve assembly is proposed to be installed within the building.

24. The storm sewer from ST1 to ST2 needs 2.5 meter clearance from the fire service where it turns the 45 degree bend. In addition, Hydro drawings are required since there is a hydro transformer station at the back of the property. This is to makes certain all separation distances can be met. Gas lines, internet, bell etc.
The appropriate clearances have been maintained on the property as requested.

25. Mechanical Drawings of the Fire Service and Domestic Servicing Metering and RPZ installation required. Note: No bypasses are allowed except approved in writing to from ES Department
By others.

26. Due to the bends in the water main, please have the consulting engineer supply a restraint table. Also, include drawings showing proposed conflicts and possible areas which may have to be insulated if available.
The restraint distances have been calculated and included on the servicing drawings.

27. Watermains Note #7: The proper name is Reduced Pressure Flow Backflow Preventer or Reduced Pressure Flow Assembly (RPZ)
The appropriate notes have been updated accordingly.

28. Sanitary & Storm Sewers Notes: Type of Pipe required (Manufacturer, Type & Size)
The appropriate notes have been updated accordingly.

29. Sanitary & Storm Sewer Note #14 has to be a minimum 150 mm PVC DR 28 for sanitary & storm
The appropriate notes have been updated accordingly.

30. Sanitary & Storm Note #22: After the property line only 22.5 degree & 45-degree 1.2 m sweeps are allowed, no fittings.
The appropriate notes have been updated accordingly.

31. Sanitary & Storm Note #23: spatial separation from storm and sanitary is 2.5 meters
The appropriate notes have been updated accordingly.

32. Additional notes to be added:
    a. All sanitary, storm or force mains shall meet the Norfolk County Design Criteria or Design Criteria for Sanitary Sewers, Storm Sewers and Force mains for Alterations Authorized under an Environmental Compliance Approval Ministry of Environment, Conservation and Parks. All water main infrastructure shall meet the Norfolk County Design Criteria or Watermain Design Criteria for Alterations Authorized under a Drinking Water Permit Environmental Compliance Approval Ministry of Environment, Conservation and Parks.
    The appropriate notes have been updated accordingly.

    b. Any roadwork or restoration specifications requires EIS Department Engineering Approval
    The appropriate notes have been updated accordingly.

TRAFFIC IMPACT BRIEF:

33. Although a Traffic Impact Brief was not requested at pre consultation stage, sightlines for entrances are to be included on the Site Plan (DWG. A.01)
By others.

Zoning: Reviewed. Comments are as follows:
- zoning table well done, meets requirements
- 22 parking spaces supplied on site including accessible

Information only and acknowledged.

GIS: Please contact NorfolkGIS for new civic addresses when building
Information only and acknowledged. By others

Realty Services: Reviewed. Comments are as follows:

1) If a Site Plan/Development Agreement is being entered into, postponements of all charges/mortgages registered on title will be required.

Information only and acknowledged.

2) Note that this property is still in the Land Registry system (as opposed to Land Titles system). Therefore, the Agreement will need to be prepared/registered in accordance with the Land Registry system unless the Property Owner is going through the first app process to put this property into Land Titles Absolute.

Information only and acknowledged.

Environmental Services: Reviewed. Comments are as follows:

Site Servicing Drawing

1. Two existing sets of water and sanitary sewer services to 78 King Street will have to be permanently disconnected at the water main and inspected and approved by Norfolk County Permit fees will be required. Attached plan D-0357 indicates location of the servicing.
The appropriate notes have been added to the site plan relating to the decommissioning of the services.

2. Fire Service approximately 48 metres from Property Line to entry to building therefore a testable DCVA & Chamber (Waterproof) required at Property line Owner responsible for annual testing and submitting results to Norfolk County Environmental Services
The configuration of the water main has been modified with the entry point going into the building being modified. The amount of water stored in the pipe is minimal with the re-configuration. As such, we have not included an exterior chamber but are proposing an interior check valve.

3. Show measurement of 1 metres separation from fire line to domestic water service from property line to building.
   The site plan has been updated accordingly.

4. Show measurement of separation distance between sanitary sewer service from main to property line from domestic water service at the property line.
   The site plan has been updated accordingly.

5. Note: Domestic Water Service will require a Reduced Pressure Flow Assembly after the water meter. No Bypasses will be allowed without approval by the Director of Environmental Services. If the bypass assembly allowed then an additional water meter will be required with a RPZ Assembly and owner will be billed monthly for the meter and consumption.
   Information only and acknowledged.

6. Mechanical Drawings & Layout of the Meter Installation and type and model of RPZ has to be approved by Environmental Services prior to installation.
   By others.

7. Water main Restraint Table is attached Note: If Ipex Bionax pipe is installed, then manufacturer approved restraints have to be used.
   Note that domestic water and fire water service lines will be PEX/PVC respectively.

8. Only materials approved by Norfolk County Material List can be installed.
   Information only and acknowledged.

9. Note 14 Sanitary & Storm Sewers has to be changed to 150mm
   The site plan has been updated accordingly.

10. Storm sewer separation from domestic & fire services has to be 2.5 metres
    The site plan has been updated accordingly.

11. Attached MECP Water main Design Criteria for Future Alterations Authorized Under a Drinking Water Work Permit & MECP Design Criteria for Sanitary Sewers, Storm Sewers and Force mains for Alterations Authorized under an Environmental Compliance Approval these requirements have to be followed and Norfolk County Design Criteria & Standards and Specifications which ever are more stringent.
    Information only and acknowledged.

Agreement Coordinator: Reviewed. Comments are as follows:

Agreement Comments
A condition of your site plan approval will be to enter into a development agreement with the County. The agreement will be registered on title at the owner's expense. If there are any

mortgage holders they will be added as a party to the agreement. We will collect and hold your performance securities for infrastructure and landscaping works until the end of your maintenance period if your site remains in compliance and deficiency free.
The Owner will be required, at its expense, to obtain and keep in force and good standing, insurance coverage until the full securities have been released at the completion of your project.
Your surveyor, engineer and architect will also be required to provide insurance for professional liability.
A further condition of the development of land, could also include the County requiring a cash-in-lieu parkland payment. This payment is determined from a land appraisal (preconstruction) prepared for the Owner at its expense.
Please reach out when you are ready to start your agreement or if you have any questions.
To be addressed by others.

Paramedic Services: No Comments.
Information only and acknowledged.

If you have any further questions, or concerns, please do not hesitate to contact this office.

Yours truly,

J. H. COHOON ENGINEERING LIMITED

R. W. Phillips, P. Eng.
RWP/lc

CYNTHIA ZAHORUK ARCHITECTS

Date: March13, 2024

To: **Norfolk County**
Attn: Fabian Serra –Planner

From: Cynthia Zahoruk

Application: **SPPL202318 – 5 Storey Apartment Development**

Address: 78 King Street Delhi, Ontario

Subject: **Response to Site Plan Comments**

Dear Fabian,

Reference to the Development engineering comments received on the subject application, please see below our responses as follows:

Planning: Reviewed. Comments are as follows:

1. Exterior Bicycle parking? Bicycle parking shown on interior of building. Show proposed bicycle parking on site plan.

Response: *This proposal does not include exterior bicycle parking since the building has an indoor bicycle storage room and the Zoning by-law does not require bike parking.*

2. Wooden Privacy fencing to be shown on site plan, specifically around the parking area.

Response: *Existing fences are shown along the south and west parking areas and are proposed to remain.*

Building: Reviewed. Conditions are as follows:

Prior to Building Permit Application:

1. The Owner shall agree to make application for a Building Permit and obtain the necessary Building Permits prior to commencing construction.

Response: *Noted. Permit application will be submitted after obtaining final SPA.*

2. AND FURTHR THAT - all applicable law approvals as required by the Ontario Building Code and supporting documentation from approval agencies re submitted with a building permit application. [OBC Division A 1.4.1.3]

Response: *Noted.*

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Email: cz@czarchitect.com

CYNTHIA ZAHORUK ARCHITECTS

3. AND FURTHER THAT - the Ontario Building Code requires that the project described above be designed and reviewed during construction by an architect, professional engineer or both that are licensed to practice in Ontario, including Site Servicing. NOW THEREFORE the Owner, being the person who intends to construct or have the building constructed hereby warrants that: 1. The undersigned architect and/or professional engineers have been retained to provide general reviews of the construction of the building to determine whether the construction is in general conformity with the plans and other documents that form the basis for the issuance of a building permit, in accordance with the performance standards of the Ontario Association of Architects (OAA) and/or Professional Engineers Ontario (PEO); 2. All general review reports by the architect and/or professional engineers will be forwarded promptly to the Chief Building Official, and 3. Should any retained architect or professional engineer cease to provide general reviews for any reason during construction, the Chief Building Official will be notified in writing immediately, and another architect or engineer will be appointed so that general review continues without interruption during construction.

Response: *Noted. General review reports will be provided during construction and upon completion of works as per the requirements of the Ontario Building Code.*

4. AND FURTHER THAT - indicate barrier free path of travel from parking area to building entrance to the satisfaction of the Building Department. Construction of curb cuts and location of tactile attention indicators is required. [OBC 3.8.1.3, & 3.8.3.2]

Response: *Noted. The site plan includes barrier free path of travel, barrier free entrance, curb ramps and tactile indicators in conformance with the requirements of the Ontario Building Code.*

5. AND FURTHER THAT - A letter signed by a Professional Engineer licensed in the Province of Ontario regarding multi-level roof drifting snow load is required. Provide calculation as required by Ontario Building Code 4.1.6.5. If additional snow load is calculated to fall a neighboring structure, an engineered analysis of the neighboring is required. Completion of compensating construction to the neighboring structure may also be required. Separate building permit required for compensating construction.

Response: *Noted. The structural engineer will review the snow loads and provide required calculations as part of the building permit submission package.*

Prior to Occupancy:

All final letters of general conformity by the architect and/or professional engineers will be forwarded promptly to the Chief Building Official, including site services.

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Response: *Noted. General review reports will be provided during construction and upon completion of works as per the requirements of the Ontario Building Code.*

Development Engineering:

Response: *Please find attached response letter and revised drawings from J,H Cohoon Engineering Limited that address Development Engineering comments.*

Traffic Impact Brief:

33. Although a Traffic Impact Brief was not requested at pre-consultation stage, sightlines for entrances are to be included on the Site Plan (DWG. A.01)

Response: *Please see attached revised site plan A0.1 after adding 5 m x 5 m sightlines at entrance.*

Zoning: Reviewed. Comments are as follows:

- zoning table well done, meets requirements.
- 22 parking spaces supplied on site including accessible.

Response: *Noted. No action required.*

We trust that the above responses and the attached revised drawings and reports meet the requirements of Norfolk County.

Sincerely,

Per/ *Nevine Soliman*

Cynthia Zahoruk
O.A.A., MRAIC, LEED Ap
B.E.S., B. Arch

Attachments:

- J.H Cohoon Engineering Limited, revised civil plans and reports dated March 6, 2024.
- Cynthia Zahoruk Architect Inc, Revised architectural drawings dated March 13, 2024.

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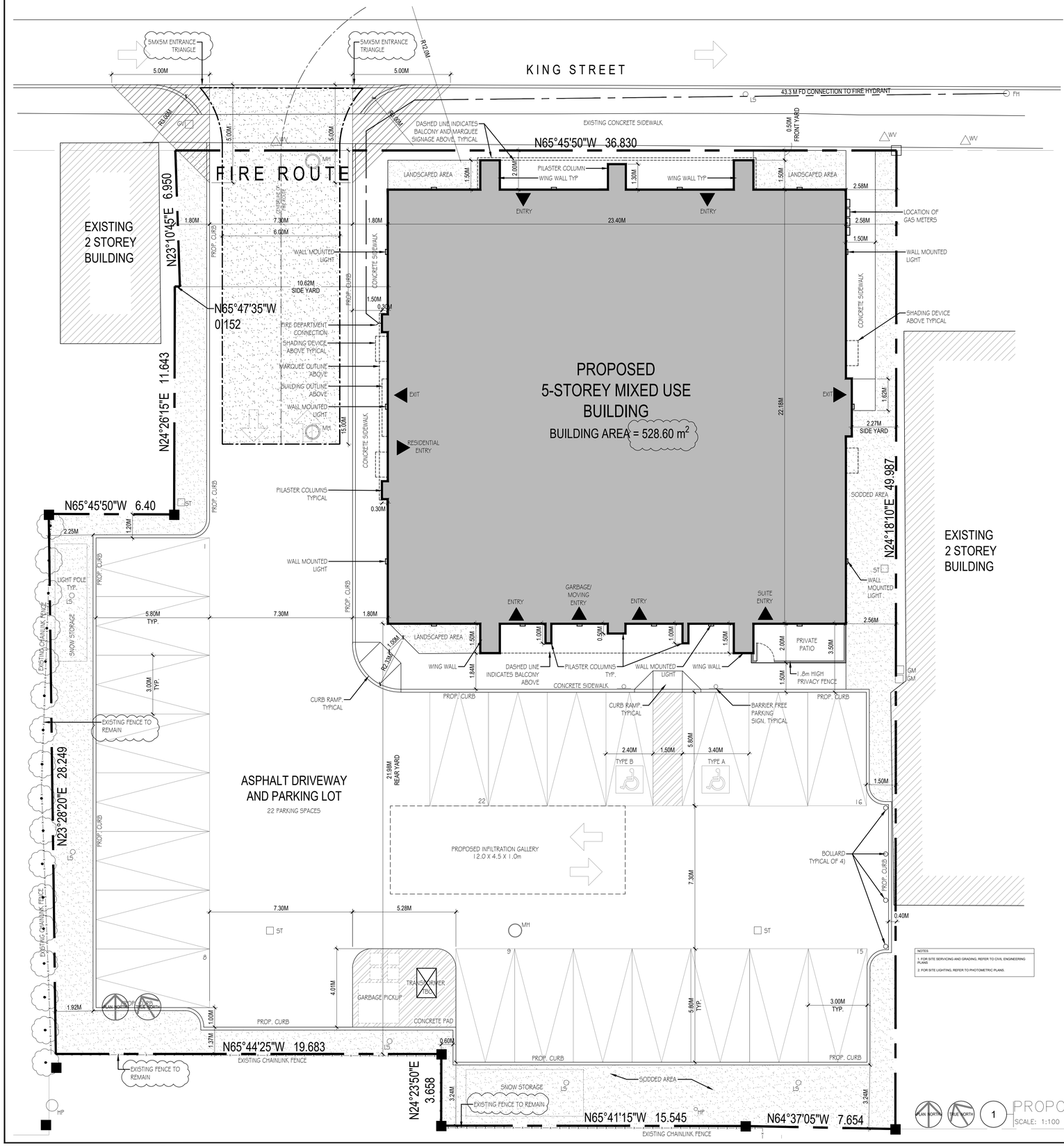

1 PROPOSED SITE PLAN
SCALE: 1:100

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ELEVATION REFERENCE: X / AX.X / X — DWG. REF. NO. / DWG. ON PAGE	SC1 SCREEN IDENTIFICATION
	W1 WALL IDENTIFICATION
	C GRID MARKER
	3 REVISION NUMBER
	101 ROOM NUMBER
	INTERCONNECTED SMOKE & CO ALARM
	INTERCONNECTED SMOKE ALARM
	EXHAUST FAN
	EMERGENCY LIGHT
	FE PORTABLE FIRE EXTINGUISER

DEVELOPMENT STATISTICS			Mar 13, 2024
Municipal Address	**78 King St., Delhi**		
Legal Description	**Part of Lots 2 & 3 – Block 16 – Registered Plan 189 – Town of Delhi in Norfolk County**		
Existing Zoning	**CBD – Central Business District**		
Existing Use	**Commercial**		
Proposed Use	**Mixed Use Building (Residential Apartments and Commercial Units)**		
ZONING REGULATIONS	**CBD**	**Proposed**	**Compliance ✓or ×**
Site Data			
Lot Area	N/A	1,957 m²	✓
Lot Coverage	80% max.	27 %	✓
Yards & Setbacks			
Front Yard (North)	0.0 m min., 3.0 m max.	0.5 m	✓
Interior Side Yard (East)	0.0 m min., 1.2 m min. if abutting residential zone (N/A)	2.27 m	✓
Interior Side Yard (West)	0.0 m min., 1.2 m min. if abutting residential zone (N/A)	10.62 m	✓
Rear Yard (South)	0.0 m 6.0 m if abutting residential zone (N/A)	21.98 m	✓
Building Size & Use			
Height	6 Storeys max.	5 Storeys	✓
Location of First Storey	Any dwelling units shall not occupy more than 50 percent of the usable floor area of the first storey.	Residential units at Ground floor occupy 15.5 % of the usable floor area.	✓
Use of First Storey	Frontage of first storey shall be dedicated to retail, office or service uses.	Frontage of first storey is dedicated to Retail/Office use.	✓
Encroachments into Required Yards			
Balconies	1.5 m into required front, rear or exterior side yard	No encroachments	✓
Parking			
Number of Parking Spaces	No parking spaces are required for lands identified in the CBD Zone.	22 Spaces	✓
Barrier Free Parking	No barrier free parking spaces are required.	1 Type A space 1 Type B Space	✓
	Type A: 3.40 m x 5.80 m Type B: 2.40 m x 5.80m Plus 1.50 m Access aisle	Type A: 3.40 m x 5.80 m Type B: 2.40 m x 5.80m Plus 1.50 m Access aisle	✓
Location of parking on a lot	For apartment dwelling, no parking lot shall be located closer than 3.00 m from any dwelling on the lot	3.50 m between parking lot and BF dwelling unit on ground floor	✓
Floor Area			
Ground Floor		528.60	
Second Floor		528.81	
Third Floor		528.81	
Fourth Floor		528.81	
Fifth Floor		521.70	
Total		**2,636.73**	
Number of Residential Units			
First Floor		1 Barrier free Unit	

ZONING REGULATIONS	CBD	Proposed	Compliance ✓or ×
Second Floor		6 Units	
Third Floor		6 Units	
Fourth Floor		5 Units	
Fifth Floor		5 Units	
Total		**23 Units**	

AREA FOR E-FILE COMMENTS

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4488
ONTARIO ASSOCIATION OF ARCHITECTS

NOTES:
1.THE CONTRACTOR OR PROJECT MANAGER WILL CHECK AND VERIFY ALL DIMENSIONS AND JOB CONDITIONS ON THE JOB AND REPORT ANY DISCREPANCIES TO THE ARCHITECT PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. COORDINATION OF WORK IS THE RESPONSIBILITY OF THE CONTRACTOR OR OWNER/CONTRACTOR
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4.DO NOT SCALE THE DRAWINGS.

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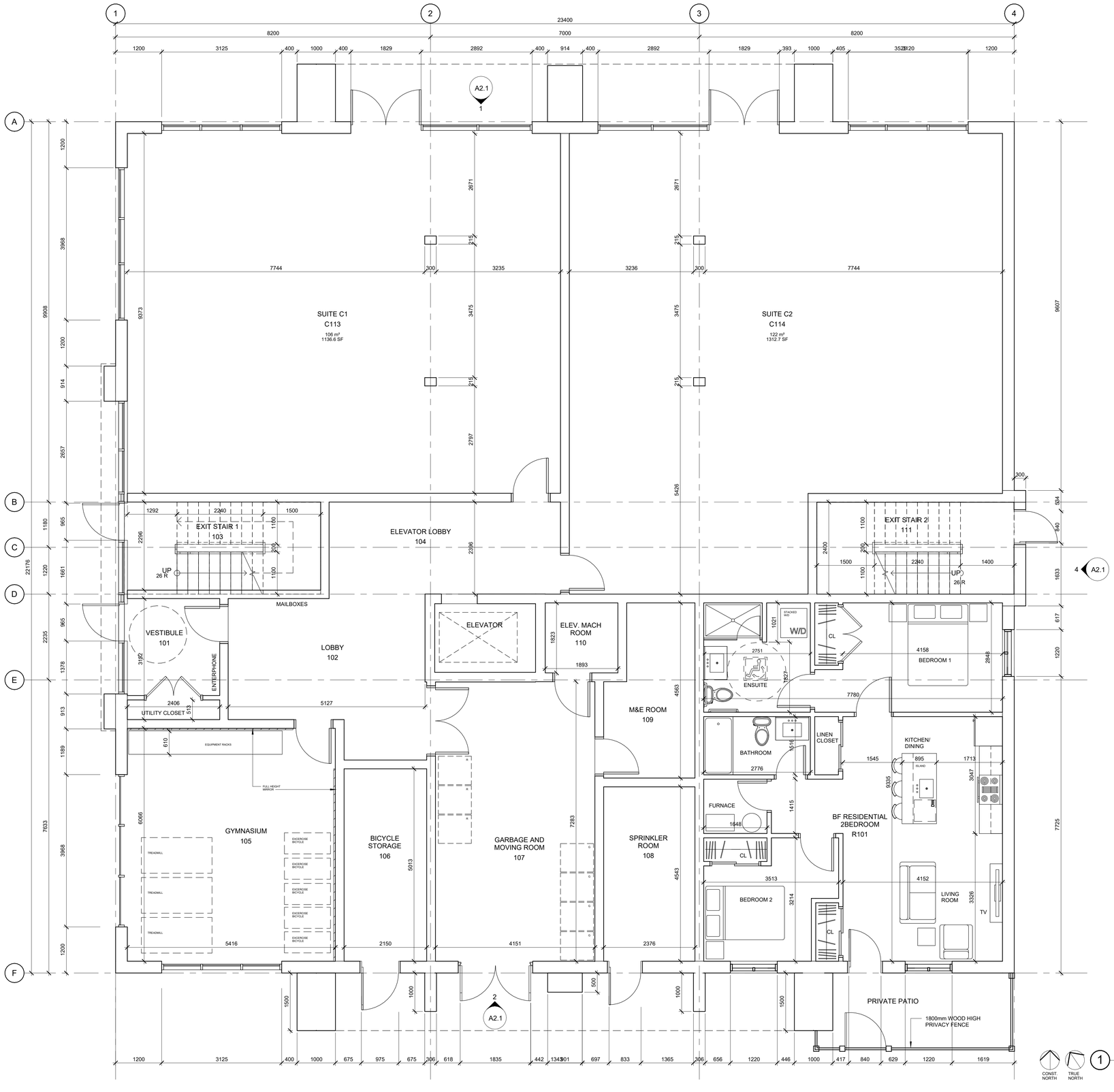
17/10/2022		ISSUED FOR PRE-CONSULTATION MTG.
16/05/2023		ISSUED FOR SPA
13/03/2024		ISSUED FOR FINAL SPA

SCALE: AS NOTED
DRAWN BY: MB/KA
PRINT DATE: 13/03/2024

NEW MIXED USE BUILDING
RESIDENTIAL AND COMMERCIAL
78 KING STREET
DELHI, ONTARIO N4B 1X6

PROPOSED SITE PLAN

A0.1



1 FIRST FLOOR
1 : 50

CONST. NORTH

TRUE NORTH

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	SCx SCREEN IDENTIFICATION
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	X GRID MARKER
	A REVISION NUMBER
	xxx ROOM NUMBER
ELEVATION REFERENCE (Ax.x — DWG. REF. No. / DWG. ON PAGE)	INTERCONNECTED SMOKE & CO ALARM

NOT FOR CONSTRUCTION

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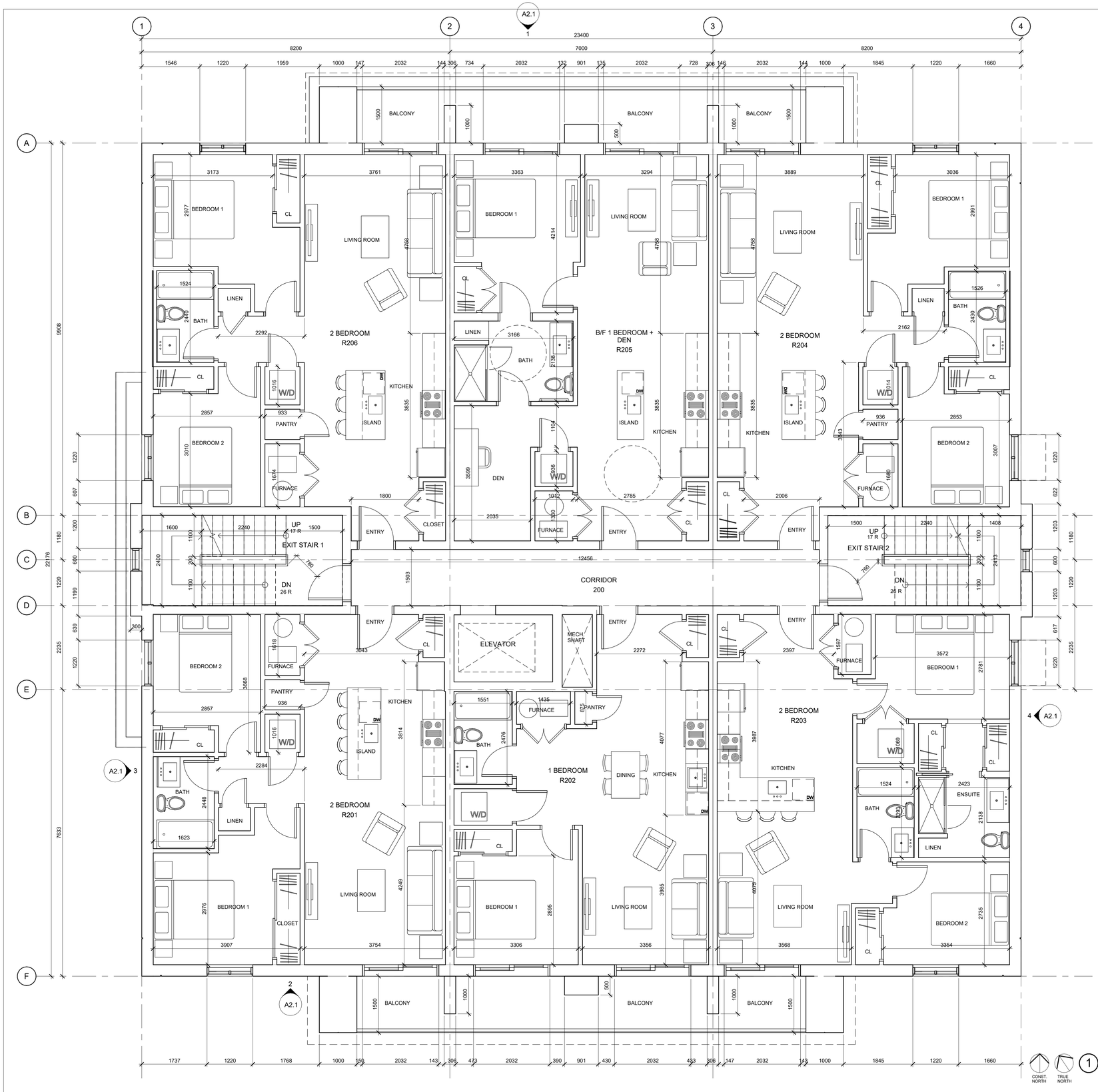
78 KING
MIXED USE BUILDING
78 KING STREET
DELHI, ONTARIO

FIRST FLOOR PLAN

A1.1



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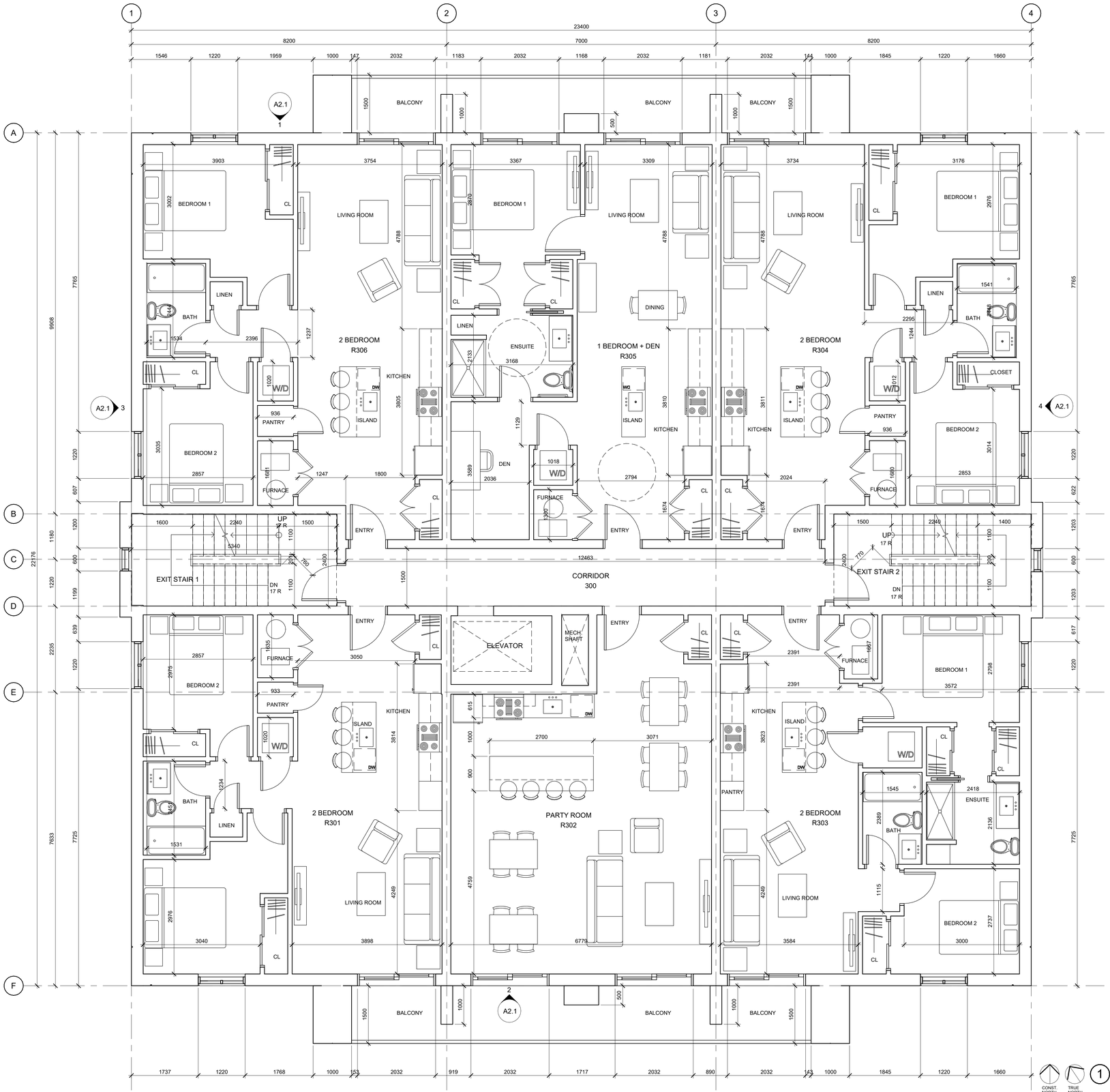
78 KING
MIXED USE BUILDING
78 KING STREET
DELHI, ONTARIO

SECOND/ THIRD FLOOR PLAN

A1.2

CONST. NORTH
TRUE NORTH

1 SECOND/ THIRD FLOOR
1 : 50



CONST. NORTH

TRUE NORTH

1 FOURTH FLOOR
1 : 50

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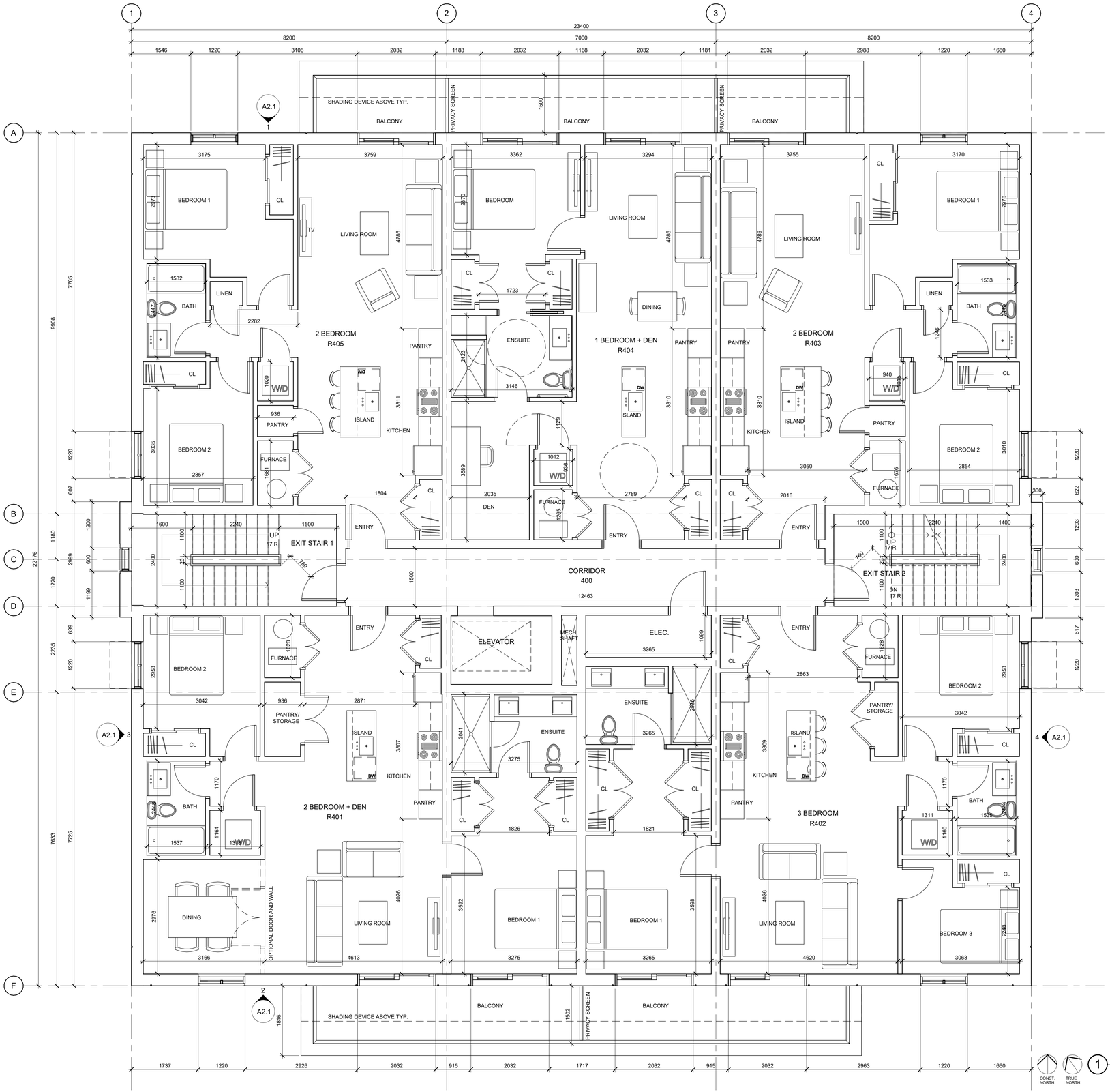
FOURTH FLOOR PLAN

A1.3



CONST. NORTH

TRUE NORTH

1 FIFTH FLOOR
1 : 50

GENERAL NOTES:

1. CONTRACTOR or OWNER ACTING AS GENERAL CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL DIMENSIONS ON SITE PRIOR TO PROCEEDING WITH ANY WORK AND REPORT ANY DISCREPANCIES TO THE ARCHITECT. ARCHITECT IS NOT RESPONSIBLE FOR ANY CHANGES TO THE PROJECT, IN LAYOUT OR MATERIALS UNLESS APPROVED BY THE ARCHITECT PRIOR TO THE CHANGE.
2. CONTRACTOR TO OBTAIN WORKER'S COMPENSATION INSURANCE AND REGISTER "NOTICE OF PROJECT" WITH WSIB IN ACCORDANCE WITH LEGISLATION PROVIDE ALL NECESSARY HEALTH AND SAFETY DEVICES AND BARRIERS.
3. CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS AND INSPECTIONS AS REQUIRED BY CURRENT LEGISLATION.
4. LINEAR DIMENSIONS INDICATING NEW CONSTRUCTION ARE TO FACE OF THE FINISHED WALL. ALL EXISTING DIMENSIONS PROVIDED ARE TO BE USED AS REFERENCE ONLY.
5. ALL CONSTRUCTION TO BE CARRIED OUT IN ACCORDANCE WITH THE ONTARIO BUILDING CODE 2012 EDITION AND APPLICABLE BYLAWS AND LEGISLATION FOR THE MUNICIPALITY AND PROVINCE.
6. THICKNESS OF CONCRETE BLOCK WALLS SHALL BE AS NOTED ON DRAWINGS, HEIGHTS OF THESE WALLS TO BE U/S OF ROOF/FLOOR DECK ABOVE. (UNLESS NOTED OTHERWISE) ALL BLOCK WALLS TO HAVE SOLID TOP COURSE AND ARE TO BE LATERALLY SUPPORTED AT ALL CHASES.
7. WHERE SOUND ATTENUATION BLANKET IS SPECIFIED, APPLY ACOUSTICAL SEALANT TO PARTITION PERIMETER ON BOTH SIDES, TOP & BOTTOM.
8. CONTRACTOR TO PROVIDE SHOP DRAWINGS FOR CONSULTANTS REVIEW PRIOR TO MANUFACTURING FOR ELEVATORS, RAILING, STAIRS, DOORS, WINDOWS, AND ALL OTHER ITEMS AS LISTED ON STRUCTURAL, MECHANICAL, AND ELECTRICAL DRAWINGS.

DWG/DETAIL REFERENCE	IDENTIFICATION REFERENCE
DWG/DETAIL REFERENCE (X / Ax.x — DWG. REF. No. / DWG. ON PAGE)	Wx WINDOW IDENTIFICATION
	Dxxx DOOR IDENTIFICATION
	SCx SCREEN IDENTIFICATION
SECTION/DWG REFERENCE (X / Ax.x — DWG. REF. No. / DWG. ON PAGE)	Wx WALL IDENTIFICATION
	X GRID MARKER
	X REVISION NUMBER
	xxx ROOM NUMBER
ELEVATION REFERENCE (Y / X / Ax.x / X / X — DWG. REF. No. / DWG. ON PAGE)	INTERCONNECTED SMOKE & CO ALARM

NOT FOR CONSTRUCTION

CYNTHIA ZAHORUK ARCHITECTS
3077 NEW STREET,
BURLINGTON, ON L7N1M6
905.331.4480

ONTARIO ASSOCIATION OF ARCHITECTS
CYNTHIA ZAHORUK
LICENCE
4488
ONTARIO ASSOCIATION OF ARCHITECTS

NOTE:
THE CONTRACTOR WILL CHECK AND VERIFY DIMENSIONS AND SITE CONDITIONS ON THE PROJECT AND REPORT ANY DISCREPENCY TO THE ARCHITECT PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. THIS DRAWING MUST NOT BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED BY THE ARCHITECT. ALL DRAWINGS ARE THE PROPERTY OF THE ARCHITECT AND MAY NOT BE COPIED, REPRODUCED OR ALTERED WITHOUT WRITTEN PERMISSION FROM THE ARCHITECT. DO NOT SCALE THE DRAWING.

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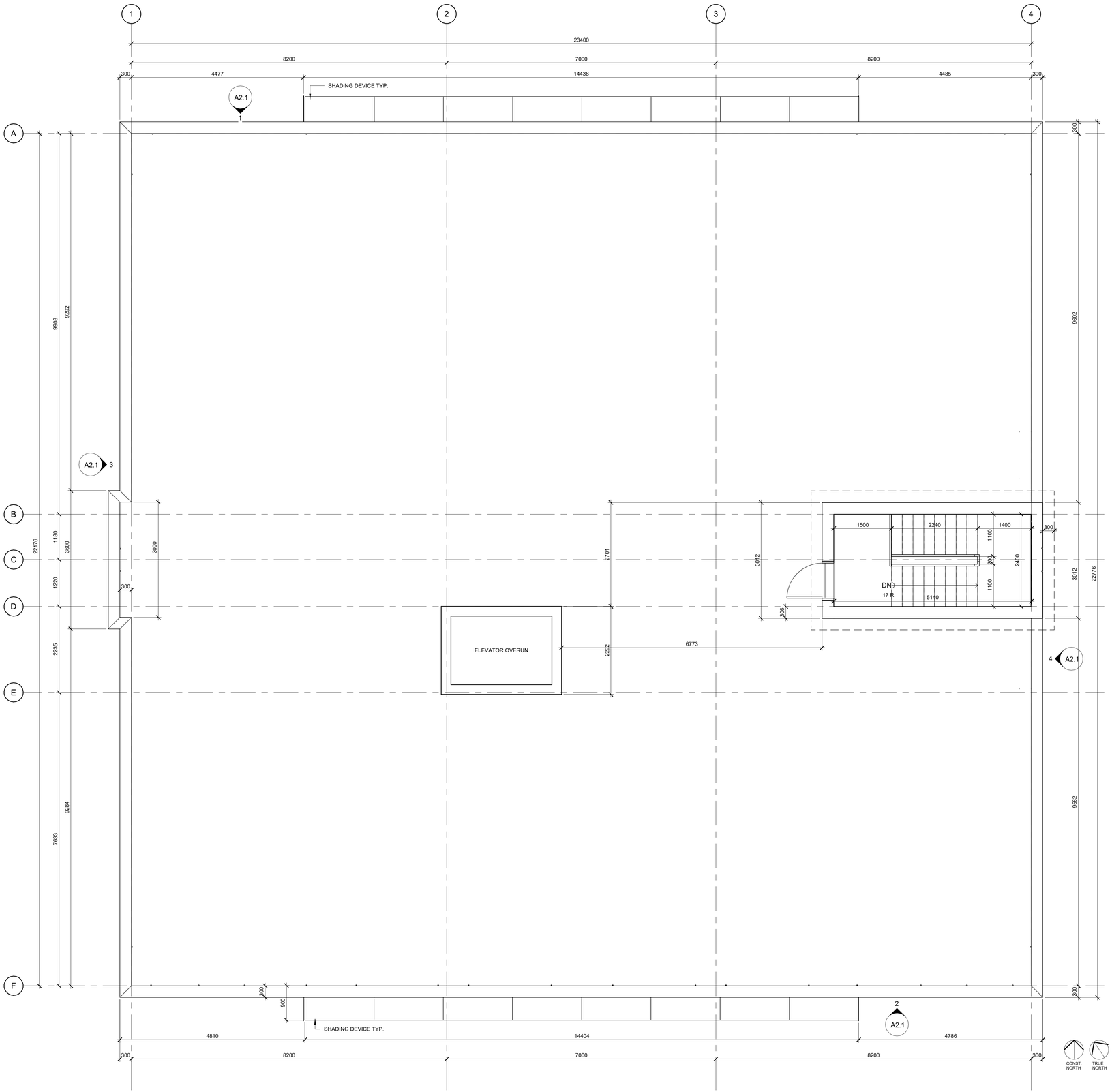
78 KING
MIXED USE BUILDING
78 KING STREET
DELHI, ONTARIO

FIFTH FLOOR PLAN

A1.4



1 ROOF LEVEL
1 : 50

CONST. NORTH
TRUE NORTH

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SECTION/DWG REFERENCE (X / Ax.x — DWG. REF. No. / DWG. ON PAGE)	Wx WALL IDENTIFICATION
	X GRID MARKER
	X REVISION NUMBER
	xxx ROOM NUMBER
ELEVATION REFERENCE (X / Ax.x — DWG. REF. No. / DWG. ON PAGE)	INTERCONNECTED SMOKE & CO ALARM

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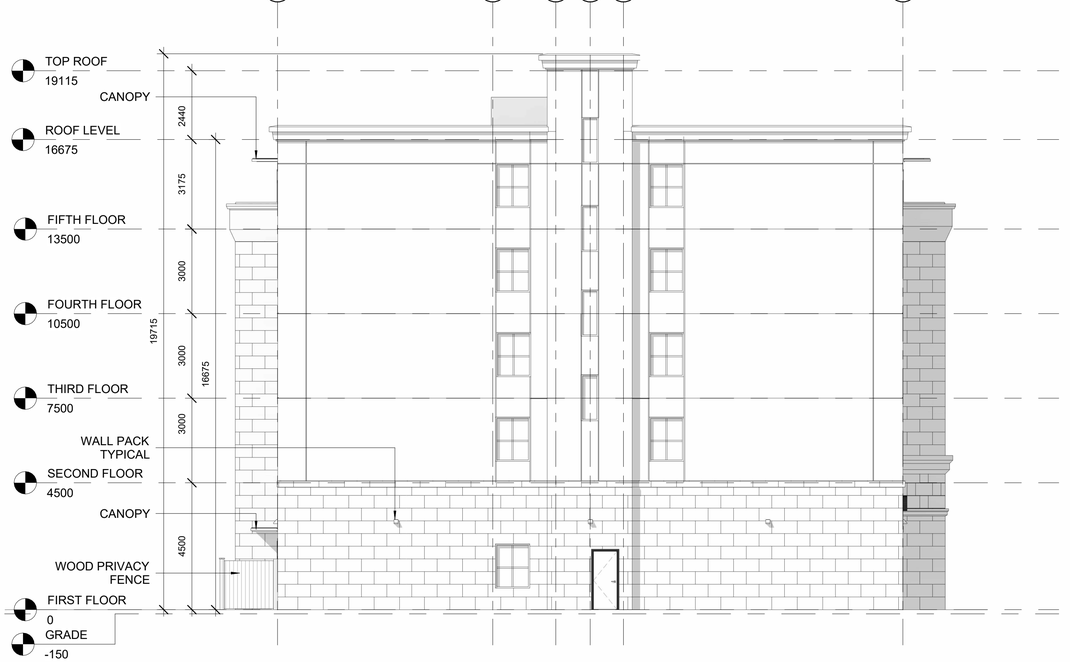
ROOF PLAN

A1.5

1 NORTH ELEVATION - KING STREET
1 : 100

2 SOUTH ELEVATION
1 : 100

3 WEST ELEVATION
1 : 100



4 EAST ELEVATION
1 : 100

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ELEVATIONS

A2.1