UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

Upper Canada Planning & Engineering Ltd.
3-30 Hannover Drive
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October 17, 2022
File: 2221

FUNCTIONAL SERVICING REPORT

4409 Erie Road
Town of Fort Erie

INTRODUCTION

This report is to address the servicing and stormwater management requirements for the 6,858.25m^2 (entire property) and the proposed 5874.3m2 residential single and townhouse condominium development located at 4409 Erie Road in the Crystal Beach area of the Town of Fort Erie. The subject lands are located south side of Erie Road and north of Lake Erie.

The residential development site shall consist of 5 single family dwellings, and 3 townhouse units in a private townhouse condominium setting. A private road will provide access to the proposed dwellings and the existing dwelling at the south limit of the site. This private road will include an asphalt road and parking stalls, concrete curb, catch basins, storm sewers, sanitary sewers and watermain.

The existing dwelling on the property will be a separate parcel with access and servicing easements through the proposed roadway. The servicing for the existing dwelling will be connected to proposed servicing of the development with perpetual rights. The billing for the existing dwelling will be through the proposed development, where the existing dwelling will pay the proposed condominium based on Town billing rates for a single family home and water meter rates.

The objectives of this study are as follows:

1. Identify domestic and fire protection water service needs for the site.

2. Identify sanitary servicing needs for the site.

3. Identify stormwater management needs for the site.

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WATER SERVICING

There is an existing 300mm diameter watermain on the south side of Erie Road and an existing fire hydrant at the northwest corner of the development site.

A new private 200mm diameter water service will be required to provide adequate fire and domestic water supply. The approximate municipal water pressure at this site within the existing watermain is 60PSI (413kPa). The larger diameter watermain provides adequate fire flows to a future on site fire hydrant near the southwest corner of Unit 6. As required by the Town of Fort Erie, a chamber is proposed at the property line for a 200mm diameter Neptune Mach 10 water meter and Watts backflow preventer. Each unit will be provided with an adequately sized water service from the private site water system, including the existing dwelling. Typically, the water service size for each unit is 20mm diameter.

SANITARY SERVICING

There is an existing 250mm diameter municipal sanitary sewer on the south side of Erie Road, and flows from east to west and continues westerly to the Niagara Regional Erie Sewage Pumping Station at 4474 Erie Road. It is proposed to connect the proposed development to the existing maintenance hole near the existing site entrance. The proposed site sanitary sewer shall be 200mm diameter sewer with individual laterals to each unit within the site.

The existing 250mm diameter sewer on Erie Road Avenue has a capacity of 25.6 L/s and the peak sanitary flow from the proposed development is 0.68 L/s, which is approximately 2.7% of the capacity of the receiving sanitary sewer on Erie Road. Therefore, it is expected that there is adequate capacity to service the proposed development.

The approximate depth of the existing sanitary sewer on Erie Road is 3.0m. The proposed dwellings for this development will not have basements, therefore, the existing sanitary sewer depth is more than adequate for this development.

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STORMWATER MANAGEMENT PLAN

The following typical Town and Regional stormwater management criteria has been used for this site development:

1. Stormwater Quality improvements are to be provided to MECP Normal protection levels, 70% Total Suspended Solids (TSS) removal, prior to discharging to the road ditch on the north side of Erie Road; and

2. Future peak stormwater flows discharging from the site are to be controlled to existing levels for the 5 and 100 year design storm events.

To limit the future peak stormwater flows to the existing levels, typically end-of-pipe controls are implemented that may include a control orifice in combination with on-site stormwater storage. In addition, the soils within the site development are loamy sands and sand, which permit lot level infiltration practices. For the infiltration practices, the proposed type of stormwater management practices will include surface infiltration trenches for yard and roof areas.

To improve stormwater quality levels, typically an oil/grit separator can provide the required TSS removal for a development of this type. The stormwater drainage to the oil/grit separator will be from the proposed private roadway, dwelling driveways and front yards.

Design storm hyetographs for this development will use a Chicago distribution based on the Town of Fort Erie Intensity-Duration-Frequency curves.

Existing Conditions

The proposed 0.68 hectare residential development area has historically been used for residential purposes. The present topography of the study area consists of a single drainage area that directs stormwater flows northerly overland to Erie Road roadside ditch and then westerly along Erie Road to a storm sewer outlet to Lake Erie near 4427 Erie Road. There is a small drainage between the existing dwelling and Lake Erie that drains directly to Lake Erie. The existing drainage area consists of approximately 0.81 hectares that outlets to Erie Road and has an approximate imperviousness of 23%, which consists of driveways, and buildings.

Future Conditions

The future drainage area for the proposed residential development is the same as the existing area, as this site stormwater management system drain the slight external areas draining toward this property from the properties east and west of this site limits. The proposed drainage area will have an approximate imperviousness of 51%, which consists of driveways, and buildings, and includes the existing dwelling and adjacent lands.

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Stormwater Quantity Control

Stormwater quantity control for this site control shall include site pipe storage (super pipe) and a control structure to reduce the future flows to existing levels. It has been determined that approximately 25.6m^3, which can be provided in 156m of 450mm diameter storm sewer. The size of the outlet orifice will be determined in the final design of the project, but limited to the minimum 75mm diameter orifice. Stormwater peak flows will be controlled to the existing outflows from the site for the 5 and 100 year design flows.

For stormwater events greater than the 100 year design storm event, flows will surcharge from the internal storm sewer system and be conveyed overland northerly to Erie Road.

Stormwater Quality Control

To improve stormwater quality levels from this residential development, an oil/grit separator is proposed. As per the criteria for this site, a stormwater oil/grit separator is required to provide a minimum of 70% overall TSS removal to achieve the required MECP Normal Protection levels. The contributing drainage area from the residential development to the proposed oil/grit separator is 0.45 hectares, with an average imperviousness of 65%. It is proposed to use a Hydroworks Hydrodome Oil/Grit Separator for this site.

The Hydroworks modelling software has indicated that a Hydroworks HD4 will provide 89.0% TSS removal and capture 99% of the stormwater flows. Therefore, a Hydroworks HD4 will provide the required quality control for this development. The Hydroworks modelling software output file is provided in Appendix C for reference.

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MAINTENANCE OF STORMWATER MANAGEMENT FACILITY

Hydroworks HD4 Oil/Grit Separator

The function of the proposed stormwater quality protection facility, a stormwater oil/grit separator, will require maintenance on an annual basis. The following is a summary of the maintenance activities required.

Regular inspections of the stormwater Maintenance Hole (MH) oil/grit interceptor will indicate whether maintenance is required or not. They should be made after every significant storm during the first two years of operation to ensure that it is functioning properly. This will translate into an average of six inspections per year.

Points of regular inspections are as follows:

- Is there sediment in the separator sump? The level of sediment can be measured from the surface without entry into the oil/grit separator via a dipstick tube equipped with a ball valve (Sludge Judge) or with a graduated pole with a flat attached to the bottom.

- Is there oil in the separator sump? This can be checked from the surface by inserting a dipstick in the 150mm vent tube. The presence of oil is usually indicated by an oily sheen, frothing or unusual colouring. The separator should be cleaned in the event of a major spill contamination.

- Is there debris or trash at the inlet weir and drop pipe? This can be observed from the surface without entry into the separator. Clogging at the inlet drop pipe will cause stormwater to bypass the sedimentation section and continue downstream without treatment.

- Completion of the Inspection Report (a sample report is included in Appendix F for reference purposes). These reports will provide details about the operation and maintenance requirements for this type of stormwater quality device. After an evaluation period (usually 2 years) this information will be used to maximize efficiency and minimize the costs of operation and maintenance for the maintenance hole oil/grit separator.

Typically, stormwater MH oil/grit separators are cleaned out using vacuum pumping. No entry into the unit is required for maintenance. Cleaning should occur annually or whenever the accumulation reaches sediment storage specified by the manufacturer and after any major spills have occurred. Oil levels greater than 2.5 centimetres should be removed immediately by a licensed waste management firm.

Generally, the sediment removed from the separator will not be contaminated to the point that it would be classified as hazardous waste. However, the sediment should be tested to determine the disposal options. The Ministry of Environment, Conservation and Parks publishes sediment disposal guidelines which should be consulted for up-to-date information pertaining to the exact parameters and acceptable levels for the various disposal options.

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The preferred option is an off-site disposal, arranged by a licensed waste management firm.

The future owners of a Hydroworks facility are provided with an Owner's Manual upon installation, which explains the function, maintenance requirements and procedures for the facility with extensive use. It is recommended to follow the manufacturer's instructions to allow the oil/grit separator to perform as intended.

The future site owners should perform regular cleaning and vacuuming of the on-site catch basins, as well as regular flushing and vacuuming of the storm sewers due to the minimal storm sewer slope and increased chance of sediment buildup.

CONCLUSIONS AND RECOMMENDATIONS

Therefore, based on the above comments and enclosed design calculations, the following summarizes the servicing for this site:

1. The existing 300mm diameter watermain on Erie Road, and the proposed 200mm diameter site water service shall have sufficient capacity to provide both domestic water supply and fire protection;

2. The existing 250mm diameter sanitary sewer on Erie road shall have adequate capacity for the proposed residential development;

3. Stormwater quantity controls will be provided by the proposed control structure and underground storm sewer to control the future peak flows to existing conditions for the 5 and 100 year design storm; and

4. Stormwater quality protection will be provided by a Hydroworks HD4 stormwater oil/grit separator or approved equivalent.

Based on the above and there exists adequate municipal servicing for this development. We trust the above comments and enclosed calculations are satisfactory for approval.

Should you have any questions or concerns regarding the information provided, please do not hesitate to contact our office.

Yours very truly,

Jason Schooley, P. Eng.

LICENSED PROFESSIONAL ENGINEER
J. P. SCHOOLEY
PROVINCE OF ONTARIO

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APPENDICES

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APPENDIX A

Fire Hydrant Assessment

Headloss in a Single Ended Lead for Fire Hydrant

Project Location:	4409 Erie Road, Crystal Beach, Town of Fort Erie
Project Number:	2221
Date:	October 2022
Prepared by:	J. Schooley, P.Eng.

Proposed Hydrant: On Site

Single Lead Length (m):	3.0m		
Single Lead Diameter (mm):	150mm		0.15m
Internal W/M Loop Length (m):	125.0m	0.0m	
Internal W/M Loop Diameter (mm)	200mm	000mm	
Hydrant Elevation (m):	176.00m		
Theoretical Flow at 20PSI (L/s):	145 L/s		2300 USgpm
Reduced Hydrant Flow (L/s):	131 L/s		2070 USgpm
Hydrant Rating (NFPA 291):	BLUE		
Fire Pressure (PSI):	20.4PSI		140308.30 Pa

Backflow Preventor:	Watts 8" 709 Backflow	8.3 PSI
Fireflow Meter:	Sensus 8" F2 Fireline	2.6 PSI

	SINGLE	INTERNAL	
Total Number of 90° Elbows:	0	0	ke = 0.9
Valves:	1	3	ke = 0.2
Total Number of 45° Elbows:	0	7	ke = 0.4
Reducer:	0	1	ke = 0.06
Increaser:	0	0	ke = 0.15
Number Tee Fittings (straight):	0	0	ke = 0.4
Number of Tee Fittings (turn):	0	1	ke = 1.8

Known Hydrant - 4409 Erie Road, Crystal Beach Fort Erie

Approximate Elevation (m):	175.74m		
Known Static Pressure (PSI):	86PSI		592949.10 Pa
Feeder Main Diameter (mm):	300mm		0.30m

			INTERNAL LOOP	
Calculated Headloss		SINGLE	SMALL	LARGE
	D:	0.15	0.20	0.00
	Re:	8.16E+05	6.12E+05	3.06E-05
	V2:	8.21 m/s	4.62E+00	4.62E+00
	Q:	0.1451 m3/s	0.1451 m3/s	0.0000 m3/s
	A:	0.018 m2	0.031 m2	0.000 m2
	y:	1.51E-06		
	ks:	0.0015		
	f:	0.038	0.038	0.038
	Density:	9810		
	g:	9.81 m2/s		

Bernoulli Terms

	P1:	60.44 m	P2:	14.30 m
	V1:	0.05 m	V2:	3.44 m
	z1:	175.74m	Z2:	176.00m
			Fittings:	6.41 m
			Backflow:	5.81 m
			Fire:	1.83 m
			Straight:	28.45 m
TOTAL HEAD 1:		236.24 m	=	236.24 m

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APPENDIX B

Sanitary Sewer Calculations

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DESIGN FLOWS

RESIDENTIAL: 320 LITRES/PERSON/DAY (AVERAGE DAILY FLOW)
INFILTRATION RATE: 0.265 LITRES/HECTARE (M.O.E FLOW ALLOWANCE IS BETWEEN 0.10 & 0.28 LITRES/HECTAR
POPULATION DENSITY: 35.0 PERSONS/HECTARE (SINGLE/SEMI FAMILY)
80.0 PERSONS/HECTARE (TOWNHOUSES)

SEWER DESIGN

PIPE ROUGHNESS: 0.013 FOR MANNING'S EQUATION
PIPE SIZES: 1.016 IMPERIAL EQUIVALENT FACTOR
PERCENT FULL: TOTAL PEAK FLOW / CAPACITY

MUNICIPALITY: TOWN OF FORT ERIE
PROJECT : 4409 ERIE ROAD, CRYSTAL BEACH
PROJECT NO: 2221

SANITARY SEWER DESIGN SHEET

LOCATION			AREA		POPULATION			ACCUMULATED PEAK FLOW				DESIGN FLOW					
Description	From M.H	To M.H.	Increment (hectares)	Accumulated (hectares)	Population Density (persons/hectare)	Population Increment	Total Popln Served	Peaking Factor	Flow (L/s)	Infiltration Flow L/s	Total Peak Flow (L/s)	Pipe Diameter (mm)	Pipe Length (m)	Pipe Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Check Percent Full
A1	ERIE	SITE	0.69	0.69	43	30	30	4.5	0.50	0.18	0.68	200	13.8	0.40	0.67	21.6	3.2%
											0.68	250	13.8	0.17	0.50	25.6	2.7%

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APPENDIX C

Stormwater Flow & Storage Calculations

PEAK FLOW DESIGN SHEET

PROJECT: 4409 ERIE ROAD, CRYSTAL BEACH, FORT ERIE

LOCATION						TIME OF FLOW		STORMWATER ANALYSIS				
DESCRIPTION	**FROM M.H.**	**TO M.H.**	**PIPE LENGTH (m)**	**INCREMENT AREA (hectares)**	**TOTAL AREA (hectares)**	**TO UPPER END (min)**	**IN SECTION (min)**	**RUNOFF COEFF**	**SECTION A X R**	**ACCUMLD A x R**	**RAINFALL INTENSITY (mm/hr)**	**PEAK FLOW (L/s)**
EXISTING CONDITIONS												
EXISTING TO ERIE ROAD	SITE	OUTLET		0.810	0.810	10.00	0.00	0.55	0.45	0.45	137.317	**169.9**
PROPOSED CONDITIONS												
ROADWAY SYSTEM	ROAD	OUTLET		0.450	0.45	10.00	0.00	0.65	0.29	0.29	137.317	**111.6**
REAR YARD SYSTEM	REARS	OUTLET		0.360	0.36	10.00	0.00	0.50	0.18	0.18	137.317	**68.7**
					0.81	10.00		0.58		0.47	137.317	**180.2**
ALLOWABLE FROM SITE SEWER												**101.3**

DESIGN BY: **UPPER CANADA CONSULTANTS**
3-30 HANNOVER DRIVE
ST. CATHARINES, ON L2W 1A3
DESIGN BY: **J. SCHOOLEY, P.ENG.**

RAINFALL PARAMETERS:

Time to Upper End = 10 min.

Town of Fort Erie - 100 Year IDF Curve

a = 1083.55 mm/hr

b = 6.62 minutes

c = 0.74

Modified Rational Method (MRM) Required Storage Volume

Project:	4409 ERIE ROAD, CRYSTAL BEACH, FORT ERIE
Project No:	2221
Date:	OCTOBER 11, 2022
Design By:	J. SCHOOLEY, P.ENG.
Description:	*Stormwater Management Plan, Quantity Control Storage Volume Calculation*

Storm Event: **Town of Fort Erie - 100 Year IDF Curve**

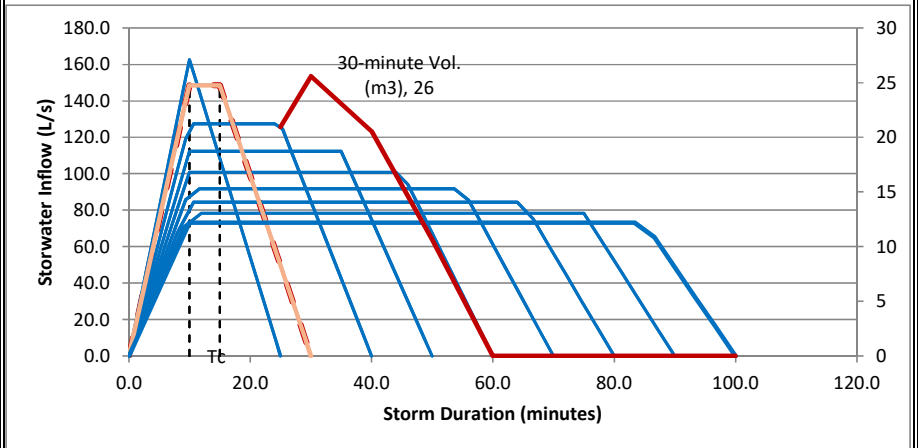
a =	1083.55	mm/hr
b =	6.62	minutes
c =	0.74	

Critical Storm Duration:	30.00 minutes	Tail Multiplier (x1-1.5) 1.5
Tc From Design:	10.00 minutes	
Storm Tail Time:	15.00 minutes	
Accumulated Area x R (Ha):	0.473	<-- Area x Runoff Coefficient (Sewer Design Sheet)
Peak Rainfall Intensity:	113.18 mm/hr	
Peak Inflow at Tc:	148.55 L/s	
Maximum Release Rate:	101.3	<-- Outlet Full Flow Capacity (Design Sheet)
Time When Outlet Exceeded:		

Time (min)	Intensity (mm/hr)	Inflow (L/s)	Outflow (L/s)	Interval Volume (m3)	Total Required Volume (m3)
0.0	0.00	0.00	101.27	-6.1	0.0
1.0	11.32	14.85	101.27	-5.2	0.0
2.0	22.64	29.71	101.27	-4.3	0.0
3.0	33.95	44.56	101.27	-3.4	0.0
4.0	45.27	59.42	101.27	-2.5	0.0
5.0	56.59	74.27	101.27	-1.6	0.0
6.0	67.91	89.13	101.27	-0.7	0.0
7.0	79.22	103.98	101.27	0.2	0.2
8.0	90.54	118.84	101.27	1.1	1.2
9.0	101.86	133.69	101.27	1.9	3.2
10.0	113.18	148.55	101.27	2.8	6.0
11.0	113.18	148.55	101.27	2.8	8.8
12.0	113.18	148.55	101.27	2.8	11.7
13.0	113.18	148.55	101.27	2.8	14.5
14.0	113.18	148.55	101.27	2.8	17.3
15.0	113.18	148.55	101.27	2.8	20.2
16.0	105.63	138.64	101.27	2.2	22.4
17.0	98.09	128.74	101.27	1.6	24.1
18.0	90.54	118.84	101.27	1.1	25.1
19.0	83.00	108.93	101.27	0.5	***25.6***
20.0	75.45	99.03	101.27	-0.1	25.4
21.0	67.91	89.13	101.27	-0.7	24.7
22.0	60.36	79.22	101.27	-1.3	23.4
23.0	52.82	69.32	101.27	-1.9	21.5
24.0	45.27	59.42	101.27	-2.5	19.0
25.0	37.73	49.52	101.27	-3.1	15.9
26.0	30.18	39.61	101.27	-3.7	12.2
27.0	22.64	29.71	101.27	-4.3	7.9
28.0	15.09	19.81	101.27	-4.9	3.0
29.0	7.55	9.90	101.27	-5.5	0.0
30.0	0.00	0.00	101.27	-6.1	0.0

Variable Storm Duration Storage Requirements

Duration	*Max Storage*	*Duration*	*Max Storage*	*Duration*	*Max Storage*
25 Min	21.0 m3	50 Min	10.6 m3	80 Min	0.0 m3
30 Min	**25.6 m3**	60 Min	0.0 m3	90 Min	0.0 m3
40 Min	20.6 m3	70 Min	0.0 m3	100 Min	0.0 m3



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APPENDIX D

Stormwater Quality Modelling

```
        ***********************************************
        *      Storm Water Management Sizing Model      *
        *               Hydroworks, LLC                 *
        *                Version 4.4                    *
        *                                               *
        *        Continuous Simulation Program          *
        *              Based on SWMM 4.4H               *
        *              Hydroworks, LLC                  *
        *               Graham Bryant                   *
        *                2003 - 2021                    *
        ***********************************************
                         Developed by
        ***********************************************
        *               Hydroworks, LLC                 *
        *             Metcalf & Eddy, Inc.              *
        *            University of Florida              *
        *       Water Resources Engineers, Inc.         *
        *      (Now Camp Dresser & McKee, Inc.)         *
        *               Modified SWMM 4.4               *
        ***********************************************
                  Distributed and Maintained by
        ***********************************************
        *                                               *
        *               Hydroworks, LLC                 *
        *                888-290-7900                   *
        *              www.hydroworks.com               *
        *                                               *
        ***********************************************
        ***********************************************
        *     If any problems occur executing this      *
        *     model, contact Mr. Graham Bryant at       *
        *     Hydroworks, LLC by phone at 908-272-4411  *
        *     or by e-mail: support@hydroworks.com      *
        ***********************************************
        ***********************************************
        *     This model is based on EPA SWMM 4.4       *
        *  "Nature is full of infinite causes which     *
        *   have never occurred in experience" da Vinci *
        ***********************************************
***************************************************
* Entry made to the Rain Block                    *
* Created by the University of Florida - 1988     *
* Updated by Oregon State University, March 2000  *
***************************************************

        4409 Erie Road, Crystal Beach, Town of Fort Erie
        Copyright Hydroworks, LLC, 2021

     ########################################
     #  Precipitation Block Input Commands  #
     ########################################
    Station Name.......................  St. Catherines A
    Station Location...................  Ontario
    Station, ISTA......................    7287
    Beginning date, IYBEG (Yr/Mo/Dy)...  1971/ 1/ 1
    Ending date, IYEND (Yr/Mo/Dy)......  2005/12/31
    Minimum interevent time, MIT.......     1
    Number of ranked storms, NPTS......    10
    NWS format, IFORM (See text).......     1
    Print storm summary, ISUM (O-No 1-Yes)     0
    Print all rainfall, IYEAR (O-No 1-Yes)     0
    Save storm event data on NSCRAT(1)....     0
    (IFILE =0 -Do not save, =1 -Save data)
    IDECID 0 - Create interface file
           1 - Create file and analyze
           2 - Synoptic analysis.......     2
    Plotting position parameter, A.....  0.40
    Storm event statistics, NOSTAT.....  1100
    KODEA (from optional group B0).....     2
     = 0, Do not include NCDC cumulative values.
     = 1, Average NCDC cumulative values.
     = 2, Use NCDC cumulative value as inst. rain.
    KODEPR (from optional group B0).....     0
     Print NCDC special codes in event summary:
     = 0, only on days with events.
     = 1, on all days with codes present.
     Codes: A = accumulated value, I = incomplete value,
            M = missing value,     O = other code present

*****************************************************
*  Precipitation output created using the Rain block   *
*  Number of precipitation stations...         1       *
*****************************************************
Location Station Number
-------- --------------
       1.     7287
STATION ID ON PRECIP. DATA INPUT FILE = 7287
REQUESTED STATION ID =     7287  CHECK TO BE SURE THEY MATCH.

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
Note, 15-min. data are being processed, but hourly
print-out, summaries, and statistics are based on
hourly totals only.  Data placed on interface file
are at correct 15-min. intervals.
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

#####################################################
# Entry made to the Runoff Block, last updated by #
# Oregon State University, and Camp, Dresser and  #
# McKee, Inc., March 2002.                        #
#####################################################
# "And wherever water goes, amoebae go along for  #
#  the ride"                      Tom Robbins     #
#####################################################
```

```
Snowmelt parameter - ISNOW.....................          0
Number of rain gages - NRGAG...................          1
Horton infiltration equation used - INFILM.....          2
Maximum infiltration volume is limited to RMAXINF input on  subcatchment lines.
Infiltration volume regenerates during  non rainfall periods.
Quality is simulated - KWALTY..................          1
IVAP is negative.  Evaporation will be set to zero
    during time steps with rainfall.
Read evaporation data on line(s) F1 (F2) - IVAP..          1
Hour of day at start of storm - NHR............          1
Minute of hour at start of storm - NMN.........          1
Time TZERO at start of storm (hours)...........      1.017
Use Metric units for I/O - METRIC..............          1
 ===> Ft-sec units used in all internal computations
Runoff input print control...                             0
Runoff graph plot control....                             1
Runoff output print control..                             0
Print headers every 50 lines - NOHEAD (0=yes, 1=no)       0
Print land use load percentages -LANDUPR (0=no, 1=yes)    0
Limit number of groundwater convergence messages to 10000 (if simulated)
Month, day, year of start of storm is:             1/ 1/1971
Wet time step length (seconds).......                 300.
Dry time step length (seconds).......                 900.
Wet/Dry time step length (seconds)...                 450.
Simulation length is.....                    20051231.0 Yr/Mo/Dy
Percent of impervious area with zero detention depth    25.0
Horton infiltration model being used
Rate for regeneration of infiltration = REGEN * DECAY
DECAY is read in for each subcatchment
REGEN = ......................................   0.01000

*****************************************************
*   Processed Precipitation will be read from file     *
*****************************************************

  ##############################
  #        Data Group F1       #
  # Evaporation Rate (mm/day) #
  ##############################
 JAN.  FEB.  MAR.  APR.  MAY   JUN.  JUL.  AUG.  SEP.  OCT.  NOV.  DEC.
 ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----
 0.00  0.00  0.00  2.54  2.54  3.81  3.81  3.81  2.54  2.54  0.00  0.00

*****************************************************
*         C H A N N E L  A N D  P I P E  D A T A       *
*****************************************************
Input   NAMEG:     Drains                          Invert  L Side   R Side  Intial     Max  Mann-   Full
equen  Channel      to     Channel  Width  Length    Slope   Slope    Slope   Depth   Depth   ings   Flow
umber    ID #      NGTO:    Type     (m)    (m)     (m/m)   (m/m)    (m/m)    (m)     (m)   "N"   (cms)
-----  ----------------- -------- ------ ------- -------- ------- -------- ------- ------- -----  -----
  1        201        200   Dummy     0.0     0.0    0.0000   0.0000  0.0000     0.0     0.0  0.0000 0.00E+00

 ************************************************
 *          S U B C A T C H M E N T  D A T A      *
 ************************************************
*NOTE. SEE LATER TABLE FOR OPTIONAL SUBCATCHMENT PARAMETERS*
      SUBCATCH-  CHANNEL      WIDTH    AREA  PERCENT    SLOPE    RESISTANCE  FACTOR    DEPRES. STORAGE(MM) INFILTRATION   DECAY RATE GAGE  MAXIMUM
       MENT NO.  OR INLET       (M)    (HA)  IMPERV.    (M/M)     IMPERV.     PERV.   IMPERV.     PERV.      RATE(MM/HR)    (1/SEC)    NO.  VOLUME
                                                                                                          MAXIMUM MINIMUM                      (MM)
 ---  --------   --------  --------- --------  -----   -------     -------  --------     ------     ------     ----   -------  --------  ------ -------
  1        300        200     67.08     0.45  65.00    0.0200      0.015     0.250     0.510     5.080     63.50   10.16    0.00055     1  101.60000

TOTAL NUMBER OF SUBCATCHMENTS...              1
TOTAL TRIBUTARY AREA (HECTARES).           0.45
IMPERVIOUS AREA (HECTARES)......           0.29
PERVIOUS AREA (HECTARES)........           0.16
TOTAL WIDTH (METERS)............          67.08
PERCENT IMPERVIOUSNESS..........          65.00

*****************************************************
*      G R O U N D W A T E R   I N P U T   D A T A     *
*****************************************************
    SUB-     CHANNEL     ========== E L E V A T I O N S ========  =========== F L O W   C O N S T A N T S ============
    CATCH        OR      GROUND  BOTTOM   STAGE     BC       TW        A1         B1         A2         B2         A3
    NUMBER     INLET       (M)     (M)      (M)     (M)      (M) (MM/HR-M^B1)          (MM/HR-M^B2)          (MM/HR-M^2)
    ------     -----     -------  ------  ------  ------  ------ -----------  -------  -----------  -------  -----------
         0       602        3.05    0.00    0.00    0.61    0.61   3.484E-04    2.600   0.000E+00    1.000    0.00E+00

*****************************************************
* G R O U N D W A T E R   I N P U T   D A T A (CONTINUED) *
*****************************************************
              S O I L   P R O P E R T I E S
                     SATURATED                                          PERCOLATION     E T  P A R A M E T E R S
       SUBCAT.         HYDRAULIC  WILTING  FIELD   INITIAL     MAX. DEEP   PARAMETERS         DEPTH  FRACTION OF ET
       NO.   POROSITY CONDUCTIVITY  POINT  CAPACITY MOISTURE  PERCOLATION   HCO    PCO        OF ET  TO UPPER ZONE
                        (mm/hr)                               (mm/hr)                          (m)
       ----  ------    -------    ------  ------   ------    ----------  ------  ------      ------       ------
          0   .4000     127.000     .1500   .3000    .3000     5.080E-02   10.00    4.57       4.27       0.350

*****************************************************
*    Arrangement of Subcatchments and Channel/Pipes     *
*****************************************************
* See second subcatchment output table for connectivity *
* of subcatchment to subcatchment flows.                *
*****************************************************
   Channel
   or Pipe
       201     No Tributary Channel/Pipes
               No Tributary Subareas.....
    INLET
       200     Tributary Channel/Pipes...        201
               Tributary Subareas........        300

*****************************************************
* Hydrographs will be stored for the following   1 INLETS *
*****************************************************
          200
```

```
#####################################################
#             Quality Simulation                    #
#####################################################
#      General Quality Control Data Groups          #
#####################################################

 Description                            Variable       Value
 -----------                            --------       -----
 Number of quality constituents.....    NQS.......         1
 Number of land uses.................  JLAND.......         1
 Standard catchbasin volume.........  CBVOL.......      1.22 cubic meters
 Erosion is not simulated.........    IROS........         0
 DRY DAYS PRIOR TO START OF STORM... DRYDAY.......      3.00 DAYS
 DRY DAYS REQUIRED TO RECHARGE
 CATCHBASIN CONCENTRATION TO
 INITIAL VALUES..................... DRYBSN.......      5.00 DAYS
 DUST AND DIRT
 STREET SWEEPING EFFICIENCY......... REFFDD.......     0.300
 DAY OF YEAR ON WHICH STREET
 SWEEPING BEGINS.................... KLNBGN.......       120
 DAY OF YEAR ON WHICH STREET
 SWEEPING ENDS...................... KLNEND.......       270

##############################################
#     Land use data on data group J2         #
##############################################
                                                                LIMITING                                CLEANING  AVAIL.    DAYS SINCE
                                                                BUILDUP    BUILDUP   BUILDUP   INTERVAL  FACTOR       LAST
AND USE   BUILDUP EQUATION TYPE   FUNCTIONAL DEPENDENCE OF     QUANTITY   POWER     COEFF.    IN DAYS   FRACTION   SWEEPING
LNAME)            (METHOD)        BUILDUP PARAMETER(JACGUT)  (DDLIM)    (DDPOW)   (DDFACT)  (CLFREQ)  (AVSWP)     (DSLCL)
-------   ---------------------   -------------------------  --------   -------   --------  --------  -------    ---------
Urban De  EXPONENTIAL(1)                  AREA(1)           2.802E+01     0.500    67.250    30.000     0.300    30.000

##############################################
#     Constituent data on data group J3      #
##############################################
                              Total Su
                              --------
Constituent units........      mg/l
Type of units............           0
KALC.....................           2
Type of buildup calc.....    EXPONENTIAL(2)
KWASH....................           0
Type of washoff calc.....  POWER EXPONEN.(0)
KACGUT...................           1
Dependence of buildup....          AREA(1)
LINKUP...................           0
Linkage to snowmelt......   NO SNOW LINKAGE
Buildup param 1 (QFACT1).         28.020
Buildup param 2 (QFACT2).          0.500
Buildup param 3 (QFACT3).         67.250
Buildup param 4 (QFACT4).          0.000
Buildup param 5 (QFACT5).          0.000
Washoff power (WASHPO)...          1.100
Washoff coef. (RCOEF)....          0.086
Init catchb conc (CBFACT)        100.000
Precip. conc. (CONCRN)...          0.000
Street sweep effic (REFF)          0.300
Remove fraction (REMOVE).          0.000
1st order QDECAY, 1/day..          0.000
Land use number.........               1

************************************************
* Constant Groundwater Quality Concentration(s) *
************************************************
 Total Susp has a concentration of..    0.0000   mg/l

************************************************
* REMOVAL FRACTIONS FOR SELECTED CHANNEL/PIPES *
* FROM J7 LINES                                *
************************************************
  CHANNEL/   CONSTITUENT
     PIPE Total Susp
----------  --------
       201     0.000

****************************************************
*     Subcatchment surface quality on data group L1 *
****************************************************
                             Total   Number   Input
                      Land    Gutter     of    Loading
               Land     Use    Length   Catch-  load/ha
         No.  Usage    No.      Km     Basins   Total Su
       ------ --------  ----   -------- --------  -------
   1        300 Urban De  1         0.13     2.00  0.0E+00
   Totals (Loads in kg or other)    0.13     2.00  0.0E+00

    **********************
    *    DATA GROUP M1    *
    **********************
TOTAL NUMBER OF PRINTED GUTTERS/INLETS...NPRNT..        1
NUMBER OF TIME STEPS BETWEEN PRINTINGS..INTERV..        0
STARTING AND STOPPING PRINTOUT DATES............        0        0

    **********************
    *    DATA GROUP M3    *
    **********************
CHANNEL/INLET PRINT DATA GROUPS......       -200


          ****************************************
          * Rainfall from Nat. Weather Serv. file  *
          * in units of hundredths of an inch      *
          ****************************************

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```

Rainfall Station St. Catherines A
State/Province Ontario
Rainfall Depth Summary (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1971.	31.	0.	0.	0.	0.	0.	126.	93.	52.	60.	29.	0.	391.
1972.	0.	0.	0.	47.	65.	100.	39.	115.	63.	90.	1.	0.	521.
1973.	0.	0.	0.	103.	77.	71.	53.	29.	63.	139.	0.	0.	534.
1974.	0.	0.	0.	67.	105.	62.	50.	31.	74.	37.	110.	0.	536.
1975.	0.	0.	0.	0.	0.	94.	78.	76.	73.	56.	59.	6.	442.
1976.	0.	0.	0.	119.	136.	87.	101.	60.	72.	73.	13.	1.	662.
1977.	0.	0.	0.	94.	29.	69.	57.	150.	230.	71.	0.	1.	701.
1978.	0.	0.	0.	72.	43.	72.	43.	86.	156.	95.	0.	0.	567.
1979.	0.	0.	0.	84.	92.	33.	91.	88.	84.	129.	71.	0.	673.
1980.	0.	0.	0.	81.	39.	122.	60.	32.	79.	96.	45.	0.	554.
1981.	0.	0.	0.	91.	71.	106.	122.	61.	123.	91.	84.	0.	749.
1982.	0.	0.	0.	28.	65.	97.	36.	66.	82.	25.	143.	0.	544.
1983.	0.	0.	0.	78.	100.	65.	55.	106.	75.	122.	92.	0.	694.
1984.	0.	0.	0.	31.	113.	136.	19.	51.	144.	24.	44.	0.	562.
1985.	0.	0.	67.	32.	52.	64.	40.	94.	42.	109.	0.	1.	501.
1986.	0.	0.	0.	93.	113.	60.	85.	83.	98.	80.	43.	65.	719.
1987.	0.	2.	11.	77.	42.	80.	122.	97.	99.	71.	94.	34.	730.
1988.	0.	0.	41.	71.	42.	21.	110.	82.	70.	68.	75.	5.	585.
1989.	0.	0.	13.	63.	137.	108.	36.	45.	89.	73.	84.	0.	647.
1990.	0.	2.	38.	99.	124.	44.	68.	95.	56.	112.	96.	0.	735.
1991.	0.	0.	86.	124.	67.	31.	85.	57.	79.	64.	61.	28.	682.
1992.	0.	0.	29.	127.	56.	92.	185.	116.	77.	47.	103.	38.	869.
1993.	3.	0.	7.	83.	56.	86.	32.	61.	71.	92.	80.	38.	610.
1994.	0.	0.	44.	88.	105.	124.	48.	77.	117.	15.	0.	15.	633.
1995.	112.	23.	16.	48.	37.	60.	123.	66.	8.	137.	94.	0.	724.
1998.	0.	0.	0.	0.	51.	54.	64.	29.	9.	0.	1.	0.	207.
1999.	0.	0.	0.	79.	59.	35.	61.	58.	116.	78.	0.	0.	487.
2000.	0.	0.	0.	123.	134.	216.	51.	0.	0.	0.	10.	0.	534.
2001.	0.	0.	0.	56.	88.	45.	25.	30.	81.	129.	0.	0.	454.
2002.	0.	0.	0.	73.	104.	64.	53.	49.	52.	65.	8.	0.	468.
2003.	0.	0.	0.	10.	163.	77.	81.	64.	67.	73.	2.	0.	537.
2004.	0.	0.	0.	131.	126.	99.	115.	40.	88.	17.	0.	0.	616.
2005.	0.	0.	0.	38.	42.	78.	53.	120.	112.	0.	0.	0.	443.

Total Rainfall Depth for Simulation Period 19310. (mm)

Rainfall Intensity Analysis (mm/hr)

(mm/hr)	(#)	(%)	(mm)	(%)
2.50	21481	74.6	6454.	33.4
5.00	3585	12.4	3088.	16.0
7.50	1973	6.8	2886.	14.9
10.00	575	2.0	1233.	6.4
12.50	389	1.4	1070.	5.5
15.00	194	0.7	660.	3.4
17.50	210	0.7	846.	4.4
20.00	66	0.2	306.	1.6
22.50	92	0.3	487.	2.5
25.00	39	0.1	232.	1.2
27.50	37	0.1	246.	1.3
30.00	34	0.1	245.	1.3
32.50	29	0.1	228.	1.2
35.00	5	0.0	42.	0.2
37.50	10	0.0	90.	0.5
40.00	10	0.0	97.	0.5
42.50	12	0.0	124.	0.6
45.00	9	0.0	99.	0.5
47.50	1	0.0	12.	0.1
50.00	3	0.0	37.	0.2
>50.00	49	0.2	829.	4.3

Total # of Intensities 28803

Daily Rainfall Depth Analysis (mm)

(mm)	(#)	(%)	(mm)	(%)
2.50	1077	38.9	1247.	6.5
5.00	507	18.3	1850.	9.6
7.50	326	11.8	2006.	10.4
10.00	226	8.2	1958.	10.1
12.50	150	5.4	1672.	8.7
15.00	111	4.0	1495.	7.7
17.50	100	3.6	1620.	8.4
20.00	67	2.4	1260.	6.5
22.50	45	1.6	958.	5.0
25.00	37	1.3	881.	4.6
27.50	23	0.8	609.	3.2
30.00	20	0.7	575.	3.0
32.50	20	0.7	631.	3.3
35.00	12	0.4	405.	2.1
37.50	8	0.3	290.	1.5
40.00	9	0.3	350.	1.8
42.50	4	0.1	165.	0.9
45.00	4	0.1	173.	0.9
47.50	2	0.1	91.	0.5
50.00	4	0.1	192.	1.0
>50.00	15	0.5	882.	4.6

Total # Days with Rain 2767

```
************************************************
*      End of time step DO-loop in Runoff      *
************************************************
Final Date (Mo/Day/Year)   =                  1/ 1/2006
Total number of time steps =                    2056359
Final Julian Date  =                            2006001
Final time of day  =                                2. seconds.
Final time of day  =                             0.00   hours.
Final running time =                        306816.0000   hours.
Final running time =                         12784.0000    days.

************************************************
*     Extrapolation Summary for Watersheds     *
* # Steps ==> Total Number of Extrapolated Steps *
* # Calls ==> Total Number of OVERLND Calls     *
************************************************
 Subcatch   # Steps   # Calls  Subcatch   # Steps   # Calls  Subcatch   # Steps   # Calls
 --------   -------   -------  --------   -------   -------  --------   -------   -------
      300   6150276   1561984
```

```
************************************************
*     Extrapolation Summary for Channel/Pipes    *
* # Steps ==> Total Number of Extrapolated Steps *
* # Calls ==> Total Number of GUTNR Calls        *
************************************************
```

Chan/Pipe	# Steps	# Calls	Chan/Pipe	# Steps	# Calls	Chan/Pipe	# Steps	# Calls
201	0	0						

```
*******************************************
*       Continuity Check for Surface Water   *
*******************************************
```

	cubic meters	Millimeters over Total Basin
Total Precipitation (Rain plus Snow)	86681.	19263.
Total Infiltration	30185.	6708.
Total Evaporation	5563.	1236.
Surface Runoff from Watersheds	51525.	11450.
Total Water remaining in Surface Storage	0.	0.
Infiltration over the Pervious Area...	30185.	19166.

Infiltration + Evaporation + Surface Runoff + Snow removal + Water remaining in Surface Storage + Water remaining in Snow Cover.....	87273.	19394.
Total Precipitation + Initial Storage.	86681.	19263.

```
The error in continuity is calculated as
************************************
* Precipitation + Initial Snow Cover  *
*      - Infiltration -               *
*Evaporation - Snow removal -         *
*Surface Runoff from Watersheds -     *
*Water in Surface Storage -           *
*Water remaining in Snow Cover        *
*-----------------------------------*
* Precipitation + Initial Snow Cover  *
************************************
Error.................................       -0.683 Percent

*******************************************
*       Continuity Check for Channel/Pipes   *
*******************************************
```

	cubic meters	Millimeters over Total Basin
Initial Channel/Pipe Storage.....	0.	0.
Final Channel/Pipe Storage.....	0.	0.
Surface Runoff from Watersheds.....	51525.	11450.
Baseflow.....	0.	
Groundwater Subsurface Inflow.....	0.	0.
Evaporation Loss from Channels.....	0.	0.
Channel/Pipe/Inlet Outflow.....	51525.	11450.
Initial Storage + Inflow.....	51525.	11450.
Final Storage + Outflow.....	51525.	11450.

```
*******************************************
* Final Storage + Outflow + Evaporation  - *
* Watershed Runoff - Groundwater Inflow  - *
*     Initial Channel/Pipe Storage         *
*     ----------------------------------   *
*  Final Storage + Outflow  + Evaporation  *
*******************************************
Error.....................................      0.000 Percent

************************************************
*     Continuity Check for Subsurface Water       *
************************************************
```

	cubic meters	Millimeters over Subsurface Basin
Total Infiltration	0.	0.
Total Upper Zone ET	0.	0.
Total Lower Zone ET	0.	0.
Total Groundwater flow	0.	0.
Total Deep percolation	0.	0.
Initial Subsurface Storage	4115.	914.
Final Subsurface Storage	4115.	914.
Upper Zone ET over Pervious Area	0.	0.
Lower Zone ET over Pervious Area	0.	0.

```
*****************************************
* Infiltration + Initial Storage - Final *
* Storage - Upper and Lower Zone ET -    *
* Groundwater Flow - Deep Percolation    *
* -------------------------------------- *
*     Infiltration + Initial Storage     *
*****************************************
Error ....................................     0.000 Percent
```

SUMMARY STATISTICS FOR SUBCATCHMENTS

SUBCATCHMENT NO.	GUTTER OR INLET NO.	AREA (HA)	PERCENT IMPER.	PERVIOUS AREA: TOTAL SIMULATED RAINFALL (MM)	PERVIOUS AREA: TOTAL RUNOFF DEPTH (MM)	PERVIOUS AREA: TOTAL LOSSES (MM)	PERVIOUS AREA: PEAK RUNOFF RATE (CMS)	IMPERVIOUS AREA: RUNOFF DEPTH (MM)	IMPERVIOUS AREA: PEAK RUNOFF RATE (CMS)	TOTAL SUBCATCHMENT AREA: RUNOFF DEPTH (MM)	TOTAL SUBCATCHMENT AREA: PEAK RUNOFF RATE (CMS)	TOTAL SUBCATCHMENT AREA: PEAK UNIT RUNOFF (MM/HR)
300	200	0.45	65.01	9262.47	98.307********	0.05	117560.865	0.159	11448.970	0.210	169.723	

*** NOTE *** IMPERVIOUS AREA STATISTICS AGGREGATE IMPERVIOUS AREAS WITH AND WITHOUT DEPRESSION STORAGE

SUMMARY STATISTICS FOR CHANNEL/PIPES

CHANNEL NUMBER	FULL FLOW (CMS)	FULL VELOCITY (M/S)	FULL DEPTH (M)	MAXIMUM COMPUTED INFLOW (CMS)	MAXIMUM COMPUTED OUTFLOW (CMS)	MAXIMUM COMPUTED DEPTH (M)	MAXIMUM COMPUTED VELOCITY (M/S)	TIME OF OCCURRENCE DAY HR.	LENGTH OF SURCHARGE (HOUR)	MAXIMUM SURCHARGE VOLUME (CU-M)	RATIO OF MAX. TO FULL FLOW	RATIO OF MAX. DEPTH TO FULL DEPTH
201				0.00				1/ 0/1900 0.00				
200				0.21				8/14/1972 14.25				

TOTAL NUMBER OF CHANNELS/PIPES = 2

*** NOTE *** THE MAXIMUM FLOWS AND DEPTHS ARE CALCULATED AT THE END OF THE TIME INTERVAL

```
 ###################################################
 #            Runoff Quality Summary Page          #
 # If NDIM = 0 Units for:   loads    mass rates     #
 #             METRIC = 1    lb        lb/sec       #
 #             METRIC = 2    kg        kg/sec       #
 # If NDIM = 1 Loads are in units of quantity       #
 #             and mass rates are quantity/sec      #
 # If NDIM = 2 loads are in units of concentration  #
 #             times volume and mass rates have units#
 #             of concentration times volume/second #
 ###################################################

Total Su NDIM =  0
METRIC =  2
                        Total Su
                        --------
Inputs
------
 1. INITIAL SURFACE LOAD........       10.
 2. TOTAL SURFACE BUILDUP.......     7544.
 3. INITIAL CATCHBASIN LOAD.....        0.
 4. TOTAL CATCHBASIN LOAD.......        0.
 5. TOTAL CATCHBASIN AND
    SURFACE BUILDUP (2+4).......     7544.
Remaining Loads
---------------
 6. LOAD REMAINING ON SURFACE...        4.
 7. REMAINING IN CATCHBASINS....        0.
 8. REMAINING IN CHANNEL/PIPES..        0.
Removals
--------
 9. STREET SWEEPING REMOVAL.....      671.
10. NET SURFACE BUILDUP (2-9)...     6873.
11. SURFACE WASHOFF.............     6868.
12. CATCHBASIN WASHOFF..........        0.
13. TOTAL WASHOFF (11+12).......     6868.
14. LOAD FROM OTHER CONSTITUENTS        0.
15. PRECIPITATION LOAD..........        0.
15a.SUM SURFACE LOAD (13+14+15).     6868.
16. TOTAL GROUNDWATER LOAD......        0.
16a.TOTAL I/I LOAD..............        0.
17. NET SUBCATCHMENT LOAD
    (15a-15b-15c-15d+16+16a)....     6868.
>>Removal in channel/pipes (17a, 17b):
17a.REMOVE BY BMP FRACTION......        0.
17b.REMOVE BY 1st ORDER DECAY...        0.
18. TOTAL LOAD TO INLETS........     6868.
19. FLOW WT'D AVE.CONCENTRATION  mg/l
    (INLET LOAD/TOTAL FLOW).....      133.
Percentages
-----------
20. STREET SWEEPING (9/2).......        9.
21. SURFACE WASHOFF (11/2)......       91.
22. NET SURFACE WASHOFF(11/10)..      100.
23. WASHOFF/SUBCAT LOAD(11/17)..      100.
24. SURFACE WASHOFF/INLET LOAD
    (11/18).....................      100.
25. CATCHBASIN WASHOFF/
    SUBCATCHMENT LOAD (12/17)...        0.
26. CATCHBASIN WASHOFF/
    INLET LOAD (12/18)..........        0.
27. OTHER CONSTITUENT LOAD/
    SUBCATCHMENT LOAD (14/17)...        0.
28. INSOLUBLE FRACTION/
    INLET LOAD (14/18)..........        0.
29. PRECIPITATION/
    SUBCATCHMENT LOAD (15/17)...        0.
30. PRECIPITATION/
    INLET LOAD (15/18)..........        0.
31. GROUNDWATER LOAD/
    SUBCATCHMENT LOAD (16/17)...        0.
32. GROUNDWATER LOAD/
    INLET LOAD (16/18)..........        0.
32a.INFILTRATION/INFLOW LOAD/
    SUBCATCHMENT LOAD (16a/17)..        0.
32b.INFILTRATION/INFLOW LOAD/
    INLET LOAD (16a/18).........        0.
32c.CH/PIPE BMP FRACTION REMOVAL/
    SUBCATCHMENT LOAD (17a/17)..        0.
32d.CH/PIPE 1st ORDER DECAY REMOVAL/
    SUBCATCHMENT LOAD (17b/17)..        0.
33. INLET LOAD SUMMATION ERROR
    (18+8+6a+17a+17b-17)/17.....        0.

CAUTION. Due to method of quality routing (Users Manual, Appendix IX)
quality routing through channel/pipes is sensitive to the time step.
Large "Inlet Load Summation Errors" may result.
These can be reduced by adjusting the time step(s).
Note: surface accumulation during dry time steps at end of simulation is
not included in totals.  Buildup is only performed at beginning of
wet steps or for street cleaning.

*****************************************************
*            TSS Particle Size Distribution         *
*****************************************************
   Diameter    %     Specific    Settling Velocity   Critical Peclet
     (um)             Gravity        (m/s)               Number
      20.    20.0      2.65         0.000267            0.080977
      30.    10.0      2.65         0.000597            0.104277
      50.    10.0      2.65         0.001629            0.143403
     100.    20.0      2.65         0.006044            0.220958
     250.    20.0      2.65         0.026615            0.391296
    1000.    20.0      2.65         0.111334            0.928988
```

```
**************************************************
*                                                *
*             Summary of TSS Removal             *
*                                                *
**************************************************
```

TSS Removal based on Lab Performance Curve

Model #	Low Q Treated (cms)	High Q Treated (cms)	Runoff Treated (%)	TSS Removed (%)
Unavaila	0.043	0.043	98.9	83.0
HD 4	0.043	0.043	98.9	88.8
HD 5	0.043	0.043	98.9	92.9
HD 6	0.043	0.043	98.9	95.2
Unavaila	0.043	0.043	98.9	96.9
HD 8	0.043	0.043	98.9	97.7
HD 10	0.043	0.043	98.9	98.8
HD 12	0.043	0.043	98.9	99.4

```
**************************************************
*                                                *
*  Summary of Annual Flow Treatmnet & TSS Removal  *
*                                                *
**************************************************
```

HD 4

Year	Flow Vol (m3)	Flow Treated (m3)	TSS IN (kg)	TSS Rem (kg)	TSS Out (kg)	Flow Treated (%)	TSS Removal (%)
1971.	6489.	6202.	135.	116.	19.	95.6	85.9
1972.	8344.	7576.	183.	158.	17.	90.8	86.3
1973.	8237.	8237.	191.	171.	20.	100.0	89.5
1974.	8416.	8247.	204.	188.	13.	98.0	91.9
1975.	7131.	7017.	175.	154.	20.	98.4	87.9
1976.	10614.	10348.	222.	198.	19.	97.5	89.1
1977.	11379.	11081.	218.	180.	34.	97.4	82.5
1978.	9071.	9071.	204.	177.	27.	100.0	86.6
1979.	10866.	10639.	236.	208.	24.	97.9	88.4
1980.	8751.	8750.	217.	191.	26.	100.0	88.0
1981.	12079.	12074.	245.	224.	21.	100.0	91.5
1982.	8504.	8504.	198.	183.	15.	100.0	92.5
1983.	11214.	11088.	254.	224.	27.	98.9	88.3
1984.	9034.	9034.	197.	172.	25.	100.0	87.5
1985.	7884.	7884.	192.	174.	19.	100.0	90.3
1986.	11488.	11476.	264.	241.	23.	99.9	91.3
1987.	11881.	11721.	266.	236.	28.	98.7	88.7
1988.	9520.	9471.	222.	201.	21.	99.5	90.5
1989.	10466.	10439.	216.	200.	16.	99.7	92.7
1990.	11860.	11814.	272.	249.	22.	99.6	91.6
1991.	11114.	11068.	255.	230.	24.	99.6	90.4
1992.	14129.	14129.	298.	262.	36.	100.0	88.0
1993.	9620.	9620.	248.	230.	18.	100.0	92.6
1994.	10322.	9934.	207.	174.	28.	96.2	83.9
1995.	11943.	11783.	247.	213.	30.	98.7	86.2
1998.	3115.	3115.	93.	81.	12.	100.0	87.5
1999.	7599.	7593.	189.	168.	21.	99.9	88.9
2000.	8721.	8721.	167.	140.	27.	100.0	84.0
2001.	6920.	6920.	154.	144.	10.	100.0	93.4
2002.	7226.	7226.	180.	163.	16.	100.0	91.1
2003.	8220.	8209.	186.	164.	22.	99.9	87.8
2004.	9846.	9846.	192.	170.	23.	100.0	88.3
2005.	7127.	6875.	146.	121.	24.	96.5	82.4

```
**************************************************
*  Summary of Quantity and Quality Results at    *
*  Location        200  INFlow in cms.            *
*  Values are instantaneous at indicated time step *
**************************************************


  4409 Erie Road, Crystal Beach, Town of Fort Erie
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     Date     Time        Flow   Total Su
 Mo/Da/Year  Hr:Min        cum/s  mg/l
 ----------  -------    -------  --------
Flow wtd means.....        0.000      133.
Flow wtd std devs..        0.001       65.
Maximum value......        0.210      292.
Minimum value......        0.000        0.
Total loads........       51515.     6872.
                        Cub-Met  KILOGRAM

===> Runoff simulation ended normally.

===> SWMM 4.4    simulation ended normally.
     Always check output file for possible warning messages.

**************************************************
*       SWMM 4.4    Simulation Date and Time Summary  *
**************************************************
* Starting Date... October    18, 2022               *
*          Time...         15:44: 1.123              *
*   Ending Date... October    18, 2022               *
*          Time...         15:44: 4.670              *
*  Elapsed Time...               0.059 minutes.      *
*  Elapsed Time...               3.547 seconds.      *
**************************************************
```