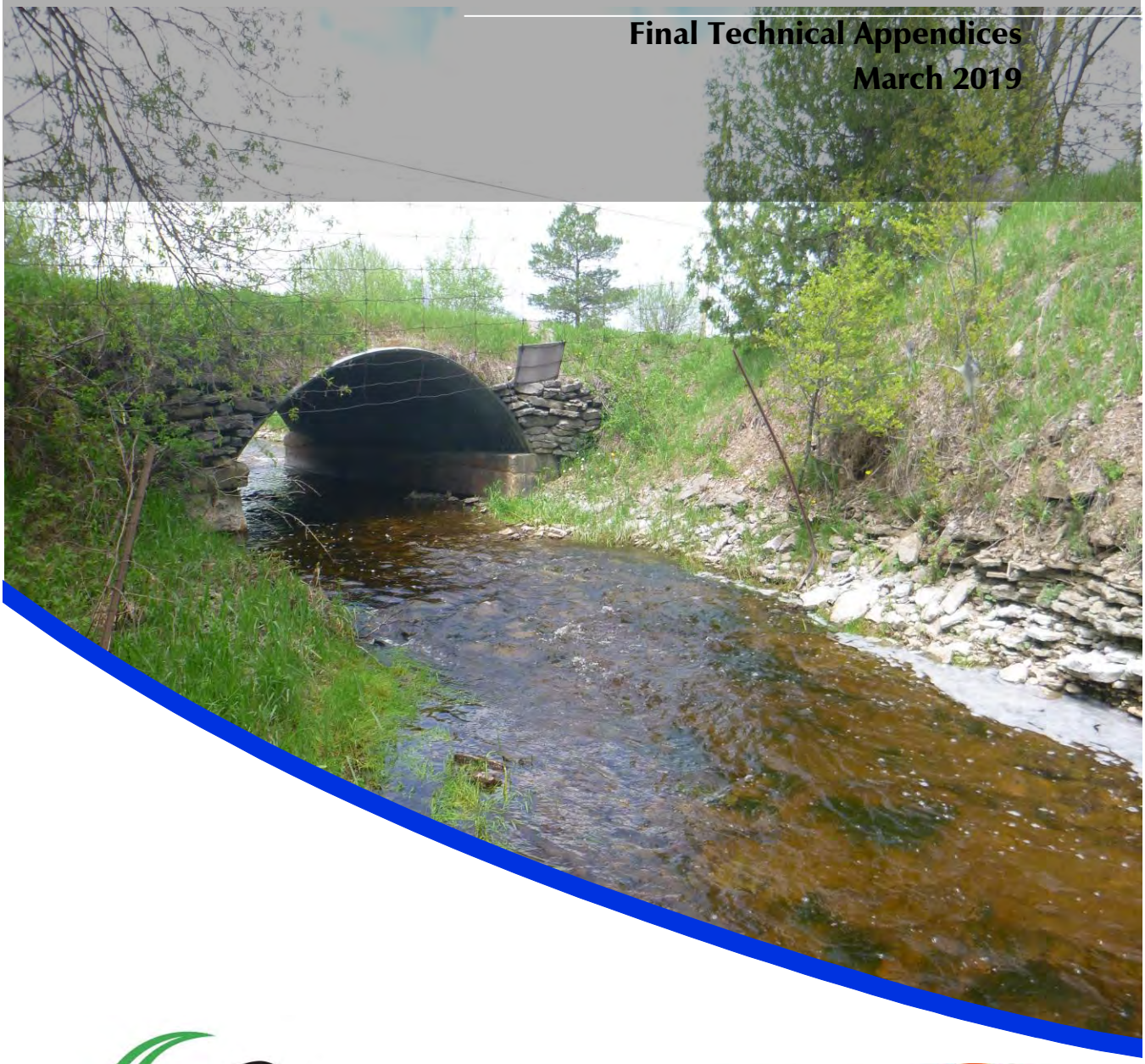
Flood Plain Mapping Study
Dunsford Creek

Final Technical Appendices
March 2019



KAWARTHA CONSERVATION

KAWARTHA LAKES

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Appendix A
Modeling Parameters Selection

Hydrology Modeling Parameters Selection
Hydrologic Modeling (Visual OTTHYMO v 2.4
For Flood Plain Mapping Project, City of Kawartha Lakes
(September 2013)

<table>
<tr><td colspan="3">HYDROLOGICAL MODEL (Visual OTTHYMO 2.4)</td></tr>
<tr><td>COMMAND and PROPOSED ACTION REQUIRED</td><td>PARAMETER</td><td>PROPOSED HYDROLOGY FOR DERIVING PARAMETER VALUES</td></tr>
<tr><td>STANDHYD (should only be used when catchment area TIMP>20%)</td><td>AREA</td><td>LiDAR Survey, GIS ARC-HYDRO, will be used to delineate subcatchment areas. The detail is provided at the end of the document–engineer will confirm GIs catchment delineation</td></tr>
<tr><td></td><td>XIMP</td><td>Directly connected imperviousness to be obtained from SWM reports or site plans. Otherwise, based on a review of the OP, Zoning By-Law and/or air photos to determine land use within the developed area, calculate area-weighted XIMP based on the following table:
<table>
<tr><th>Land use</th><th>[1]XIMP (Roof Leaders to Road)</th><th>[2]XIMP (Roof Leaders to Lawn)</th></tr>
<tr><td>Estate Residential (>3/4 Acre Lot)</td><td>0.14</td><td>0.09</td></tr>
<tr><td>2 Acre Lot (180 ft wide)</td><td>0.11</td><td>0.08</td></tr>
<tr><td>1½Acre Lot (150 ft wide)</td><td>0.14</td><td>0.09</td></tr>
<tr><td>1 Acre Lot (130 ft wide)</td><td>0.17</td><td>0.10</td></tr>
<tr><td>Low Density Residential (1/3 to 3/4 Acre Lot)</td><td>0.23</td><td>0.15</td></tr>
<tr><td>¾ Acre Lot (110 ft wide)</td><td>0.18</td><td>0.13</td></tr>
</table></td></tr>
</table>

		½ Acre Lot (90 ft wide)	0.23	0.15
		1/3 Acre Lot (70 ft wide)	0.29	0.18
		Medium Density Residential (1/10 to 1/4 Acre Lot)	**0.47**	**0.24**
		¼ Acre Lot (60 ft wide)	0.35	0.20
		1/8 Acre Lot (50 ft wide)	0.52	0.25
		1/10 Acre Lot (40 ft wide)	0.55	0.28
		High Density Residential (<1/10 Acre Lot)	**0.65**	**0.35**
		Institutional (e.g. school, religious centre)	**0.55**	**0.30**
		Industrial	**0.80**	**0.70**
		Commercial/ Business	**0.90**	**0.90**
		Park	**0.01**	**0.01**
		Notes: 1. Roof leaders are connected to impervious area (e.g. driveway) and to storm sewer for XIMP calculations. 2. Roof leaders are connected to pervious area (e.g. lawn) for XIMP calculations, 3. Public roads are included in all reported XIMP values, 4. XIMP values derived from review of literature and typical site plans.		
Action Required: KC	TIMP	Total imperviousness to be obtained from SWM reports or site plans. Otherwise, based on a review of the OP, Zoning By-Law and/or air photos to determine land use within the developed area, calculate area-weighted TIMP based on the following table:		

Land use	**TMP (Roof Leaders to Road)**	**Corresponding C**
Estate Residential (>3/4 Acre Lot)		.25
2 Acre Lot	0.11	
1½Acre Lot	0.14	
1 Acre Lot	0.17	
Low Density Residential		.45
¾ Acre Lot	0.18	
½ Acre Lot	0.23	

<table>
<tr><td></td><td></td><td>
<table>
<tr><td>1/3 Acre Lot</td><td>0.29</td><td></td></tr>
<tr><td>Medium Density</td><td>0.47</td><td>.45</td></tr>
<tr><td>¼ Acre Lot (60 ft wide)</td><td>0.35</td><td></td></tr>
<tr><td>1/8 Acre Lot (50 ft wide)</td><td>0.52</td><td></td></tr>
<tr><td>1/10 Acre Lot (40 ft wide)</td><td>0.55</td><td></td></tr>
<tr><td>High Density Residential</td><td>0.65</td><td>.6</td></tr>
<tr><td>Townhouses</td><td></td><td>.75</td></tr>
<tr><td>Institutional (e.g. school, religious centre)</td><td>0.55</td><td>.75</td></tr>
<tr><td>Industrial</td><td>0.80</td><td>.90</td></tr>
<tr><td>Commercial/ Business</td><td>0.90</td><td>.90</td></tr>
<tr><td>Park</td><td>0.01</td><td>.2-.25</td></tr>
</table>
<u>Notes:</u>
1. Public roads are included in all reported XIMP values,
2. TIMP values derived from review of literature and typical site plans.

STANDHYD command should only be used for catchments with a TIMP>20%. In case where TIMP is <20% and there is a sizeable development area, it is often best to split the catchment into two using both NASHYD and STANDHYD command.</td></tr>
<tr><td></td><td>LOSS</td><td>Rainfall loss can be either Halton's Infiltration Method, SCS Modified Curve Number Method or Proportional Loss Coefficient Method when using VO2. <u>However it is proposed to use the SCS Modified Curve Number Method to calculate pervious area losses for the following reasons:</u>
• Horton is not recommended for storm durations ≥ 12 hours as predicted flows are often erroneous (may under estimate runoff if rainfall intensity is < sol infiltration capacity rate);
• Horton's not recommended if there is significant soil variability;
• Horton's typically used for urban conditions with short duration, high intensity storms (e.g. Chicago distribution) and not much soil variability; and
• SCS Modified CN Method is generally more suitable for subwatershed studies and master drainage plans.</td></tr>
<tr><td></td><td>CN</td><td>Same approach as NASHYD. This parameter can be "tweaked" during calibration to adjust runoff volume. Typically, the pervious components within a STANDHYD represents lawn or other grassed</td></tr>
</table>

<table>
<tr><td></td><td></td><td>area. The pervious area curve number value should be determined table xx in Appendix xx. If the assumed pervious area is lawn, the following CN values are recommended:</td></tr>
<tr><td></td><td>IA</td><td>
<table>
<tr><th colspan="2">– Initial Abstraction Values for Various Land</th></tr>
<tr><th>Land Use</th><th>Ia</th></tr>
<tr><td>Commercial</td><td>2.5</td></tr>
<tr><td>Residential High Density</td><td>3.6</td></tr>
<tr><td>Residential Medium/Low Density</td><td>5.4</td></tr>
<tr><td>Residential Estate</td><td>6.6</td></tr>
<tr><td>Major</td><td>2.5</td></tr>
<tr><td>Crop</td><td>10</td></tr>
<tr><td>Pasture</td><td>10</td></tr>
<tr><td>Woodlot</td><td>10</td></tr>
<tr><td>Open Space</td><td>10</td></tr>
</table>
AECOM (2010)
</td></tr>
<tr><td></td><td>SLPP</td><td>Pervious surface slope measured from site plans, LiDAR DEM, other wise assume 2%.</td></tr>
<tr><td></td><td>LGP</td><td>Length of pervious overland flow typically set to 40 m, unless can be calculated otherwise.</td></tr>
<tr><td></td><td>MNP</td><td>Manning’s pervious “n” value determined by looking at tables, otherwise assume 0.25</td></tr>
<tr><td></td><td>DPSI</td><td>For roads, driveways and roofs typically use value between 0.8 and 1.5 mm, otherwise assume 1.0 mm</td></tr>
<tr><td></td><td>SLPI</td><td>Impervious surface slope measured from site plan (typically ranges between 0.5% and 2.0% otherwise assume 1%</td></tr>
<tr><td></td><td>LGI</td><td>Length of impervious overland flow can be measured if subdivision plans available, however, typically best to use $A= 1.5 (LGI)^2$</td></tr>
<tr><td></td><td>MNI</td><td>Manning’s impervious “n” value determined using tables if nature of impervious surface is known, otherwise assume 0.013.</td></tr>
<tr><td>NASHYD</td><td>AREA</td><td>Same approach as STANDHYD area. NASHYD typically used to model rural catchments with little</td></tr>
</table>

		or widely distributed development
	CN	CN values are a function of land use and HSG. Use the same table as STANDHYD CN based on the following approach: 1. Area-weighted land use and soils data to be calculated using GIS, Soils information must be transformed to hydrologic soil group (HSG) classification using soil texture or reference tables such as Chart H2-6A in MTC Drainage Manual (1986). use chart 1.09 MTO Drainage Manual 1007 2. CN values to be calculated on an area-weighted basis using table 1.1 in Attachment1. 3. Traditional SCS Curve Number (CN) to be calculated based on area-weighted CN calculations and then must be transformed from CN to CN* using procedure outlined in the VO2 Reference Manual. This parameter can be "tweaked" during calibration to adjust runoff volume.
	IA	Same as STANDHYD (typically set between 1.0 and 5.0 if using CN*) note chart about shows 1 - 10
	N	Number of linear reservoir typically set to 3.0. This parameter can be "tweaked" during calibration to adjust hydrograph "peakness".
	TP	Time to peak (Tp) is calculated based on time of concentration (Tc). Tp can be "tweaked" during calibration to adjust the hydrograph timing. There are number of different methods used to calculate Tc and/or Tp, including the following: • Upland's Method • Bransby- Williams Method • Airport Method • Watt and Chow Method; and • HYMO Method Typically, Tc is calculated first and then Tp is estimated based on Tp=(N-1)/N*Tc or Tp=0.67Tc Various methods are described in the literature and the VO2 reference manual. It is proposed, however, to use either the Airport method or the Bransby- Williams method. The Airport method is

		to be used when C<0.4 and the Bransby-Williams Method is to be used when c>0.4 (Formula 8.15 and 8.16, 1997 MTO Drainage Manual). Typical c values are provided in table 1.2 in Attachment 1.

STORM DATA FOR HYDROLOGIC MODEL (VO2)	
RETURN PERIOD RAINFALL DEPTH	Return period rainfall depths to be obtained from local AES climate stations for 2-yr, 5-yr, 10-yr, 25-yr, 50-yr, and 100-yr return periods. Although Lindsay Filtration Plant hydrometric station was discontinued during 1989-90 Environment Canada has maintained the old IDF curves for this station during 2012 updates. Technical committee agreed to maintain these curves to be consistent with City of Kawartha Lakes Technical Standard. An comparison with new Peterborough IDF curves showed a difference of 2-6% and was considered tolerable.
STORM DISTRIBUTION	Storm distributions used in southern Ontario typically consist of AES, SCS Type II and Chicago distributions. Chicago distributions are not generally suitable for subwatershed studies unless the area is very heavily developed. SCS distribution is OK for rural watershed with high rates of runoff generated by summer thunderstorms, but it is based on US conditions. The AES distribution was developed in Canada and is based on statistical analysis using local Canadian climate data. Could compare SCS Type II and AES and select critical distribution for each and/or all subwatersheds. – part of engineering analysis and based on each watershed
STORM DURATION	Depending on the storm distribution selected, storm duration typically ranges between 1 hr and 24 hrs. Could use 6-hr, 12 hr and 24 hr duration for this study and either select the critical duration for each subwatershed or report the highest peak flow for all durations. – part of engineering evaluation and based on each watershed

VO2 MODEL CALIBRATION
The following are some general notes regarding model calibration: • Calibration of computer model results in more accurate hydrograph simulation (uncalibrated model can be off by +/- 200%)

- Calibration is not always possible if historical flow and climate data are not available,
- Ideally should have many years of historical data.
- Typically it is only practical to calibrate models for large watershed with available WSC flow data and AES climate data.
- Calibration is not usually possible for small drainage areas (e.g. subdivisions).

The following procedure is proposed for model calibration (if suitable calibration data is available):

1. Obtain historical flow and climate data for selected stations for calibration period.
2. Separate baseflow from event flow data (flows in VO2 usually do not include base flow, unless baseflow constant is added).
3. Select parameter (i.e. CN*, Tp, etc.) values for model based on standard procedures
4. Run calibration events and plot simulate hydrograph with the actual hydrograph,
5. First match hydrograph volume by adjusting the CN* and note the factor by which CN* was adjusted.
6. Determine the Antecedent Precipitation Index (API) for the calibration events (e.g. 10-day API often used)
7. Plot CN* adjustment factor vs API for all calibration events.
8. Select the API corresponding to AMC II and apply this adjustment factor to the "calibrated" model
9. Next match the Tp of the hydrograph to the actual hydrograph for the calibration events.
10. Finally adjust the hydrograph shape and "peakness" by adjusting N (number of linear reservoirs).
11. Run verification events to test the model calibration
12. Using both calibration and verification events, try to establish uncertainty in simulated flows.

GENERAL WATERSHED MAPPING REQUIREMENTS

The following is a list of recommended general watershed mapping requirements:

1. Surficial soil mapping (including HSG)
2. Topography
3. Existing land use
4. Future land use
5. Aquatic and terrestrial natural features (not needed specifically for hydrology or water balance components)
6. Surficial geology

7. Bedrock subsurface

ATTACHYMENT 1
PROPOSED CN AND C-VALUE TABLES

- TABLE 1.1 –RUNOFF CURVE NUMBERS FOR SELECTED LAND USES (AMC II)
- TABLE 1.2 –RUNOFF COEFFICIENTS FOR Tp CALCULATIONS

TABLE 1.1 NOT USED – REFER INSTEAD TO CKL DESIGN GUIDELINES

Curve Numbers CN (II) and Runoff Coefficients (C) for Various Land Uses

Land Use	CN Values							C Values						
	Hydrologic Soil Group													
	A	AB	B	BC	C	CD	D	A	AB	B	BC	C	CD	D
Commercial	89	91	92	93	94	95	95	.9	.9	.9	.9	.9	.9	.9
High Density Residential	77	81	85	88	90	91	92	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Medium/Low Density Residential	59	67	74	78	82	85	87	0.45	0.45	0.45	0.45	0.45	0.45	0.45
Estate	51	60	68	74	79	82	84	.25	.25	.25	0.25	0.25	0.25	0.25
Crop	64	70	75	79	82	84	85	0.22	0.35	0.40	0.45	0.50	0.55	0.55
Pasture	49	62	69	74	79	82	84	0.10	0.28	0.30	0.35	0.40	0.40	0.40
Woodlot	36	48	60	67	73	74	79	0.08	0.25	0.27	0.29	0.30	0.35	0.35
Open Space	49	59	69	74	79	80	80	.25	.25	.25	.25	.25	.25	.25

CN values AECOM (2010) C values – CKL Engineering Technical Standards (2007)

Land Use Description	Hydrologic Soil Group (AMC II)						
	A	AB	B	BC	C	CD	D
Industrial Areas (72% Impervious)	81	85	88	90	91	92	
Paved parking lots, Roofs Driveways	98	98	98	98	98	98	98
Streets and Roads							
Paved with curb and storm sewer connection	98	98	98	98	98	98	98
Gravel	76	81	85	87	89	90	91

Adapted from U.S. Soil Conservation Service National Engineering Handbook (1972) and MTO Drainage Manuals.

Cover	Hydrologic Soil Group A	B	C	D
Woods	36	60	73	79
Meadows	46	66	77	82
Cultivated	66	74	82	86
Lawns	56	71	81	85
Impervious areas	100	100	100	100

CVC Check List

TABLE 1.2

RUNOFF COEFFICIENT FOR Tp CALCULATIONS

Topography and Land Use	SOIL TEXTURE		
	Open Sandy Loam	**Loam and Silt Loam**	**Tight Clay loam and Clay**
WOODLAND			
Flat (≤ 5% slope)	0.08	0.25	0.35
Rolling (5%-10% slope)	0.12	0.30	0.42
Hilly (10%-30% slope)	0.18	0.35	0.52
PASTURE			
Flat (≤ 5% slope)	0.10	0.28	0.40
Rolling (5%-10% slope)	0.15	0.35	0.45
Hilly (10%-30% slope)	0.22	0.40	0.55
CULTIVATED			
Flat (≤ 5% slope)	0.22	0.35	0.55
Rolling (5%-10% slope)	0.3	0.45	0.60
Hilly (10%-30% slope)	0.4	0.65	0.70
URBAN AREAS	**30% TIMP**	**50% TIMP**	**70% TIMP**
Flat (≤ 5% slope)	0.4	0.55	0.65
Rolling (5%-10% slope)	0.5	0.65	0.8

Adaptation from Determination of Runoff from Agricultural Areas (OMAF Publication 52) and MTC Drainage Manual Chapter B (1979).

Runoff coefficients are intended for 5-10 year storms.

TIMP refers to total impervious area.

GIS Portion of Hydrologic Model For Flood Plain Mapping Project

Preliminary Delineating of Catchment Areas within a watershed; (STANDHYD)

1. Obtain elevation data from LiDAR and develop a digital elevation model (DEM)
2. Delineate catchments, using Arc Hydro. A series of steps will be performed using the Terrain Pre Processing Tools;

a) DEM Manipulations - Fill Sinks

The fill sink function fills sinks in a grid. If a cell is surrounded by higher elevation cells, the water is trapped in that cell and cannot flow. The fill sinks function modifies the elevation value to eliminate these problems.

b) Flow Direction

Flow Direction function takes a grid as input, and computes the corresponding flow direction grid. The values of the cells of the flow direction grid indicate the steepest descent from that cell..

c) Flow Accumulations

The flow accumulation function computes the associated flow accumulation grid that contains the accumulated number of cells upstream of a cell, for each cell in the input grid.

d) Stream Definition

The stream definition function takes a flow accumulation grid as input and creates a stream grid for a user-defined threshold. This threshold is defined either as a number of cells or as a drainage area in square kilometres. In general the recommended size for stream threshold definition is 1% of the overall area. The size of the threshold may be increased to reduce the stream network and the number of catchment polygons. The resulting stream grid contains a value of "1" for all the cells in the input grid that have a value greater than the given threshold. All other cells in the stream grid contain no data.

e) Stream Segmentation

The stream segmentation function creates a grid of stream segments that have a unique identification. Either a segment may be a head segment, or it may be defined between two segment junctions. All the cells in a particular segment have the same grid code that is specific to that segment.

f) Catchment Grid Delineation

The Catchment Grid delineation function creates a grid in which each cell carries a value (grid code) indicating to which catchment the cell belongs. The value corresponds to the value carried by the stream segment that drains that area, defined in the input Link grid.

g) Catchment Polygon Processing

The catchment polygon processing function takes as input a catchment grid and converts it into a catchment polygon feature class. The adjacent cells in the grid that have the same grid code are combined in to a single area, whose boundary is then vectorized.

Final output will be one overall watershed polygon and individual catchment polygons that fall within the watershed.

Developing an Impervious Layer; (XIMP)

1. Using a variety of already existing datasets such as SWP Reports, Official Plans, Zoning By-Laws and air photos an impervious layer will be developed in a GIS. The following land use characteristics will be defined;

- Estate Residential
- Low Density Residential
- Medium Density Residential
- High Density Residential

- Institutional
- Industrial
- Commercial/Business
- Park

Developing a Land use and Hydrologic Soil Group (HSG) layers for CN Calculations;

1. Using a variety of already existing datasets such as ELC and impervious layer created in above step, create a land use layer that has the following land use characteristics defined;

- High Density Residential
- Medium Density Residential
- Low Density Residential
- Estate Residential
- Business/Commercial
- Institutional
- Industrial
- Agriculture - Crops
- Agricultural - Pasture, Shrubs
- Open Space, Lawn, Park, Golf Course, Cemetery
- Woodlot, Forest

- Meadow
- Swamp, Fen, Marsh
- Open Water
- Pits, Quarries
- Other

* Some digitizing might need to take place to define more specific land use characteristics.

2. Create a Hydrologic Soil Group layer through GIS by categorizing the soil groups into the following;

- A - Fine Sand
- AB
- B - Fine Sandy Loam
- BC
- C - Silt Loam
- CD - Clay Loam
- D - Clay

CN Values will then be calculated based on the following approach;

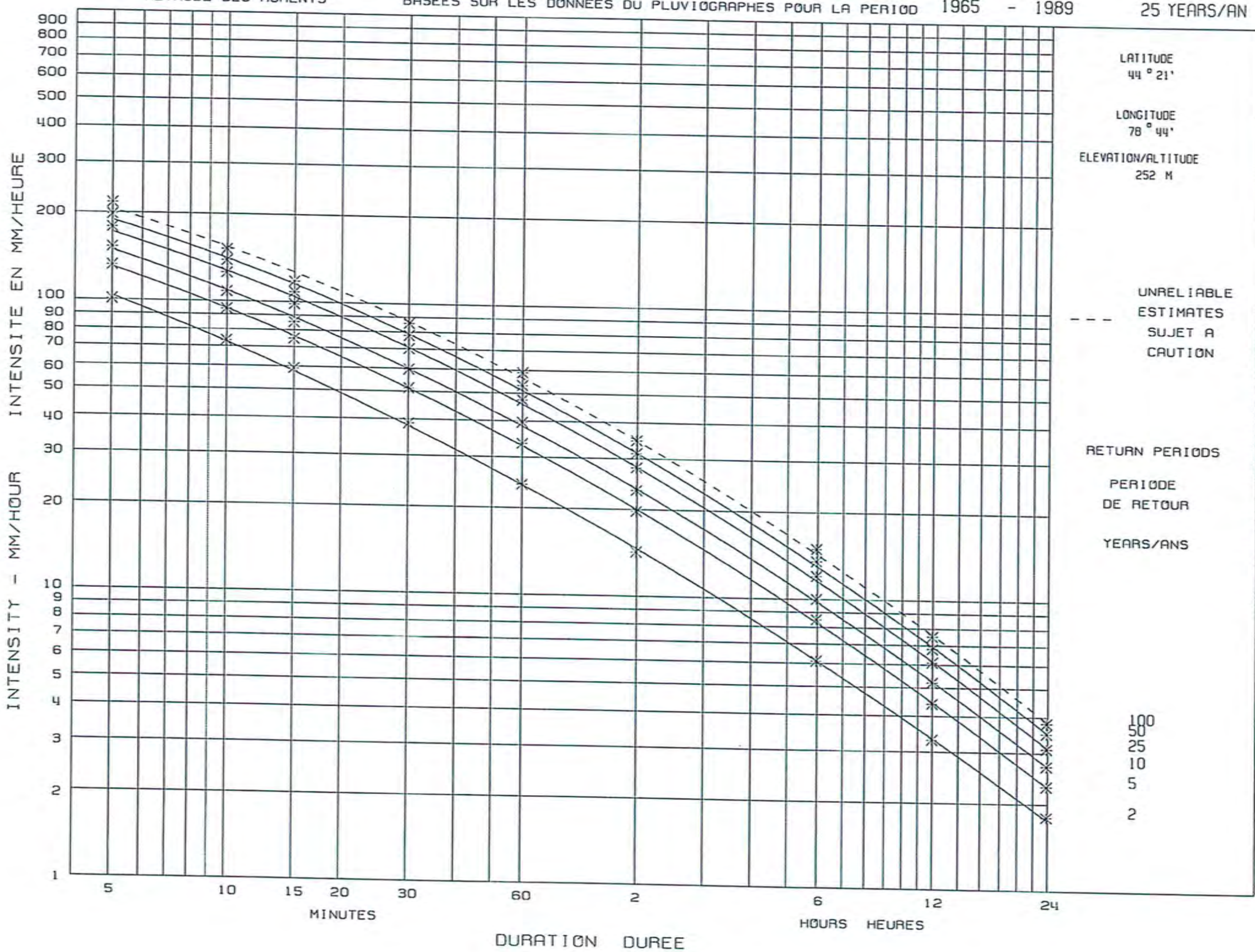
1. Area-weighted land use and soils data will be calculated using GIS. Soils information will be transformed to Hydrologic Soil Group (HSG) classification using soil texture.
2. CN Values will be calculated on area-weighted bases using **Table 1.1 and 1.2 in Attachment 1.**

Appendix B
Rainfall Data

SHORT DURATION RAINFALL INTENSITY-DURATION FREQUENCY DATA FOR-
DONNEES SUR L'INTENSITE,LA DUREE ET LA FREQUENCE DES CHUTES DE PLUIE DE COURTE DUREE A LINDSAY FILTRATION PLANT ONT

GUMBEL-METHOD OF MOMENTS
METHODE DES MOMENTS

BASED ON RECORDING RAIN GAUGE DATA FOR THE PERIOD-
BASEES SUR LES DONNEES DU PLUVIOGRAPHES POUR LA PERIOD 1965 - 1989 25 YEARS/AN



ATMOSPHERIC ENVIRONMENT SERVICE - ENVIRONMENT CANADA
SERVICE DE L'ENVIRONNEMENT ATMOSPHERIQUE - ENVIRONNEMENT CANADA

6164432.txt

ATMOSPHERIC ENVIRONMENT SERVICE
SERVICE DE L"ENVIRONNEMENT ATMOSPHERIQUE

RAINFALL INTENSITY-DURATION FREQUENCY VALUES
INTENSITE, DUREE ET FREQUENCE DES PLUIES

DATA INTEGRATION DIVISION
LA DIVISION DU TRAITEMENT DES DONNEES

GUMBEL - METHOD OF MOMENTS/METHODE DES MOMENTS - 1990

****

TABLE 1 LINDSAY FILTRATION PLANT ONT 6164432

LATITUDE 4421 LONGITUDE 7844 ELEVATION/ALTITUDE 252 M

****

YEAR ANNEE	5 MIN	10 MIN	15 MIN	30 MIN	1 H	2 H	6 H	12 H	24 H
1965	14.7	21.6	22.9	30.7	31.5	32.5	55.9	56.1	56.1
1966	5.8	6.6	8.9	13.5	20.1	30.2	30.5	30.5	30.5
1967	8.4	11.4	14.5	15.5	15.5	18.5	27.4	39.1	49.0
1968	7.1	14.2	17.3	24.4	41.9	55.1	67.3	67.3	67.3
1969	4.6	7.1	8.1	9.4	12.2	12.4	23.4	32.5	40.6
1970	13.0	17.8	19.8	22.9	25.7	30.0	39.1	50.5	55.1
1971	11.9	13.2	17.0	19.6	27.9	33.5	36.6	37.6	39.1
1972	4.6	6.6	8.9	11.9	11.9	15.0	30.5	33.0	34.8
1973	7.4	14.5	15.0	17.5	19.0	22.4	31.0	32.3	43.9
1974	8.1	12.7	15.5	22.6	35.1	45.5	49.0	56.1	56.1
1975	10.4	15.2	15.5	22.4	22.4	29.0	39.1	39.1	40.1
1976	6.3	9.1	10.2	13.7	23.9	23.9	34.0	38.1	38.1
1977	9.7	12.7	14.7	16.8	21.3	21.6	35.8	43.4	43.9
1978	7.6	13.2	19.8	21.6	25.3	27.7	27.9	27.9	32.8
1979	11.0	13.9	13.9	14.1	14.1	16.6	21.0	34.8	35.2
1980	13.3	15.8	20.2	28.3	51.8	53.9	69.8	70.4	82.8
1981	7.8	15.2	19.8	32.4	33.4	33.7	35.3	36.0	36.0
1982	10.0	16.2	19.0	23.4	36.2	41.8	45.6	45.6	45.6
1983	14.0	18.8	18.8	20.1	23.8	23.9	26.4	27.8	30.9
1984	10.7	12.8	19.2	36.8	44.4	57.6	84.3	84.6	84.7
1985	7.7	12.8	17.3	25.2	27.5	32.4	42.4	42.4	42.4
1986	5.8	6.9	7.1	10.5	13.6	26.8	41.1	42.1	42.1
1987	7.1	8.2	10.3	14.6	17.3	20.7	22.7	22.8	34.1
1988	6.6	12.1	18.2	24.4	24.9	24.9	25.2	25.2	40.0
1989	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	48.6

NOTE:-99.9 INDICATES MSG DATA
DONNEES MANQUANTES

# YRS. ANNEES	24	24	24	24	24	24	24	24	25
MEAN MOYENNE	8.9	12.9	15.5	20.5	25.9	30.4	39.2	42.3	46.0
STD. DEV. ECART-TYPE	2.9	3.9	4.5	7.1	10.5	12.4	16.1	15.2	14.4
SKEW DISSYMETRIE	.49	.03	-.51	.45	.79	.90	1.41	1.28	1.58
KURTOSIS KURTOSIS	2.58	3.14	2.52	3.07	3.55	3.48	4.93	4.70	5.40

NOTE: -99.9 INDICATES LESS THAN 10 YEARS OF DATA AVAILABLE
INDIQUE MOINS DE 10 ANNEES DE DONNEES DISPONIBLES

ATMOSPHERIC ENVIRONMENT SERVICE
SERVICE DE L"ENVIRONNEMENT ATMOSPHERIQUE

RAINFALL INTENSITY-DURATION FREQUENCY VALUES
INTENSITE, DUREE ET FREQUENCE DES PLUIES

GUMBEL - METHOD OF MOMENTS/METHODE DES MOMENTS - 1990

TABLE 2 LINDSAY FILTRATION PLANT ONT 6164432

LATITUDE 4421 LONGITUDE 7844 ELEVATION/ALTITUDE 252 M

RETURN PERIOD RAINFALL AMOUNTS (MM)
PERIODE DE RETOUR QUANTITIES DE PLUIE (MM)

DURATION DUREE	2 YR/ANS	5 YR/ANS	10 YR/ANS	25 YR/ANS	50 YR/ANS	100 YR/ANS	# YEARS ANNEES
5 MIN	8.4	11.0	12.7	14.9	16.5	18.1	24
10 MIN	12.2	15.7	18.0	20.9	23.1	25.2	24
15 MIN	14.8	18.7	21.3	24.6	27.1	29.5	24
30 MIN	19.3	25.6	29.8	35.1	39.0	42.8	24
1 H	24.1	33.4	39.6	47.3	53.1	58.8	24
2 H	28.4	39.3	46.6	55.8	62.6	69.4	24
6 H	36.6	50.8	60.2	72.1	80.9	89.7	24
12 H	39.8	53.2	62.2	73.4	81.8	90.1	24
24 H	43.6	56.4	64.8	75.4	83.3	91.2	25

RETURN PERIOD RAINFALL RATES (MM/HR)-95% CONFIDENCE' LIMITS
INTENSITE DE LA PLUIE PAR PERIODE DE RETOUR (MM/H)-LIMITES DE CONFIANCE DE 95%

DURATION DUREE	2 YR/ANS	5 YR/ANS	10 YR/ANS	25 YR/ANS	50 YR/ANS	100 YR/ANS
5 MIN	101.0	132.2	152.8	178.9	198.2	217.5
	+/- 13.0	+/- 21.8	+/- 29.5	+/- 39.7	+/- 47.5	+/- 55.4
10 MIN	73.3	94.2	108.1	125.6	138.5	151.4
	+/- 8.7	+/- 14.6	+/- 19.8	+/- 26.7	+/- 31.9	+/- 37.2
15 MIN	59.1	74.8	85.3	98.4	108.2	117.9
	+/- 6.5	+/- 11.0	+/- 14.9	+/- 20.1	+/- 24.0	+/- 28.0
30 MIN	38.7	51.3	59.6	70.1	77.9	85.7
	+/- 5.2	+/- 8.8	+/- 11.9	+/- 16.0	+/- 19.2	+/- 22.3
1 H	24.1	33.4	39.6	47.3	53.1	58.8
	+/- 3.9	+/- 6.5	+/- 8.8	+/- 11.8	+/- 14.1	+/- 16.5
2 H	14.2	19.7	23.3	27.9	31.3	34.7
	+/- 2.3	+/- 3.8	+/- 5.2	+/- 7.0	+/- 8.4	+/- 9.8
6 H	6.1	8.5	10.0	12.0	13.5	14.9
	+/- 1.0	+/- 1.7	+/- 2.2	+/- 3.0	+/- 3.6	+/- 4.2
12 H	3.3	4.4	5.2	6.1	6.8	7.5
	+/- .5	+/- .8	+/- 1.1	+/- 1.4	+/- 1.7	+/- 2.0
24 H	1.8	2.3	2.7	3.1	3.5	3.8
	+/- .2	+/- .4	+/- .5	+/- .7	+/- .8	+/- .9

ATMOSPHERIC ENVIRONMENT SERVICE
SERVICE DE L"ENVIRONNEMENT ATMOSPHERIQUE

RAINFALL INTENSITY-DURATION FREQUENCY VALUES
INTENSITE, DUREE ET FREQUENCE DES PLUIES

GUMBEL - METHOD OF MOMENTS/METHODE DES MOMENTS - 1990

TABLE 3 LINDSAY FILTRATION PLANT ONT 6164432

LATITUDE 4421 LONGITUDE 7844 ELEVATION/ALTITUDE 252 M

INTERPOLATION EQUATION / EQUATION D"INTERPOLATION: R = A * T ** B
R = RAINFALL RATE / INTENSITE DE LA PLUIE (MM /HR)
T = TIME IN HOURS / TEMPS EN HEURES

STATISTICS STATISTIQUES	2 YR ANS	5 YR ANS	10 YR ANS	25 YR ANS	50 YR ANS	100 YR ANS
MEAN OF R MOYENNE DE R	35.7	46.7	54.0	63.2	70.1	76.9
STD. DEV. R ECART-TYPE	35.1	45.4	52.1	60.7	67.1	73.4
STD. ERROR ERREUR STANDARD	9.4	12.4	14.5	17.1	19.0	21.0
COEFF. (A) COEFFICIENT (A)	20.9	27.8	32.3	38.0	42.3	46.5
EXPONENT (B) EXPOSANT (B)	-.719	-.713	-.710	-.708	-.706	-.705
MEAN % ERROR % D'ERREUR	10.4	12.1	13.1	14.1	14.7	15.2

TABLE D-4

TIMMINS - RAINFALL DEPTHS

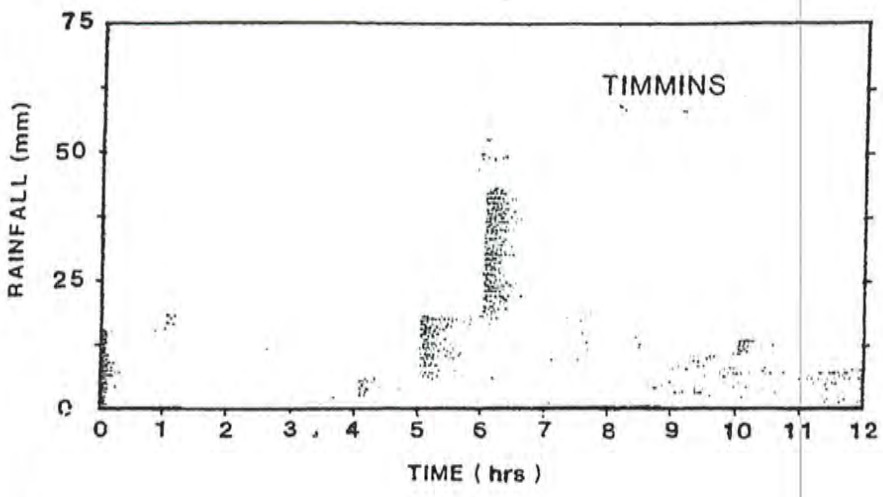
Hour	Depth (mm)	Depth Inches	Percent of 12 Hour
1st	15	0.6	8
2nd	20	0.8	10
3rd	10	0.4	6
4th	3	0.1	1
5th	5	0.2	3
6th	20	0.8	10
7th	43	1.7	23
8th	20	0.8	10
9th	23	0.9	12
10th	13	0.5	6
11th	13	0.5	7
12th	8	0.3	4
TOTAL	193	7.6	

TABLE D-5

TIMMINS - AREAL REDUCTION

Area (km^2)	Reduction Factor Percentage
0 to 25	100 (no reduction)
26 to 50	97
51 to 75	94
76 to 100	90
101 to 150	87
151 to 200	84
201 to 250	82
251 to 375	79
376 to 500	76
501 to 750	74
751 to 1000	70
1001 to 1250	68
1251 to 1500	66
1501 to 1800	65
1801 to 2100	64
2101 to 2300	63
2301 to 2600	62
2601 to 3900	58
3901 to 5200	56
5201 to 6500	53
6501 to 8000	50

NOTE: Reduction factor to be multiplied by the rainfall.



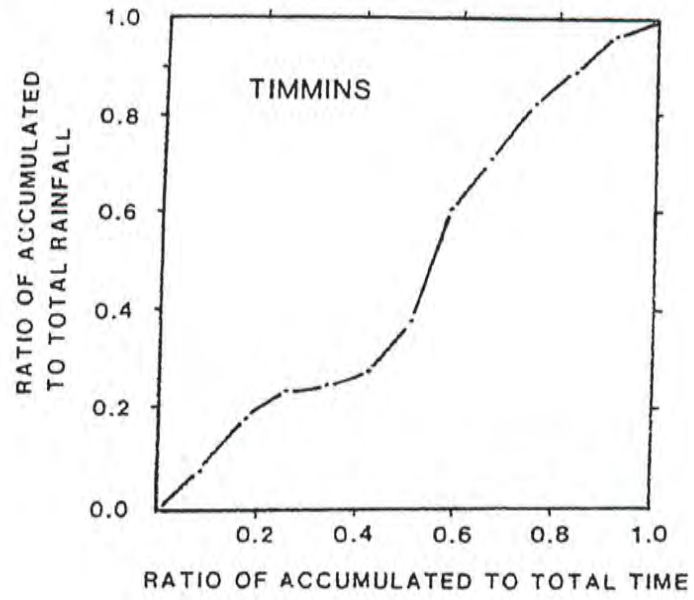


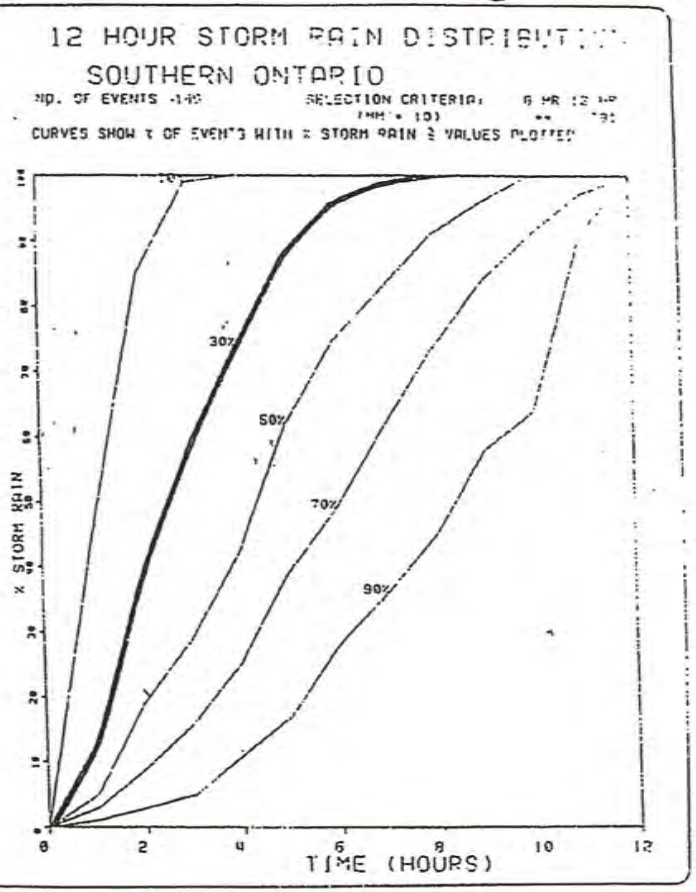
FIGURE D-4
TIMMINS STORM HYETOGRAPH
AND DIMENSIONLESS DISTRIBUTION

Design Chart 1.04: Timmins Storm

	Depth		Percent of 12 hour
	(mm)	(inches)	
1st hour	15	0.6	8
2nd hour	20	0.8	10
3rd hour	10	0.4	6
4th hour	3	0.1	1
5th hour	5	0.2	3
6th hour	20	0.8	10
7th hour	43	1.7	23
8th hour	20	0.8	10
9th hour	23	0.9	12
10th hour	13	0.5	6
11th hour	13	0.5	7
12th hour	8	0.3	4
	193	7.6	100

Drainage Area (km^2)	Percentage
0 to 25	100.0
26 to 50	97
51 to 75	94
76 to 100	90
101 to 150	87
151 to 200	84
201 to 250	82
251 to 375	79
376 to 500	76
501 to 750	74
751 to 1000	70
1001 to 1250	68
1251 to 1500	66
1501 to 1800	65
1801 to 2100	64
2101 to 2300	63
2301 to 2600	62
2601 to 3900	58
3901 to 5200	56
5201 to 6500	53
6501 to 8000	50

Source: Ministry of Transportation, MTO (1989)



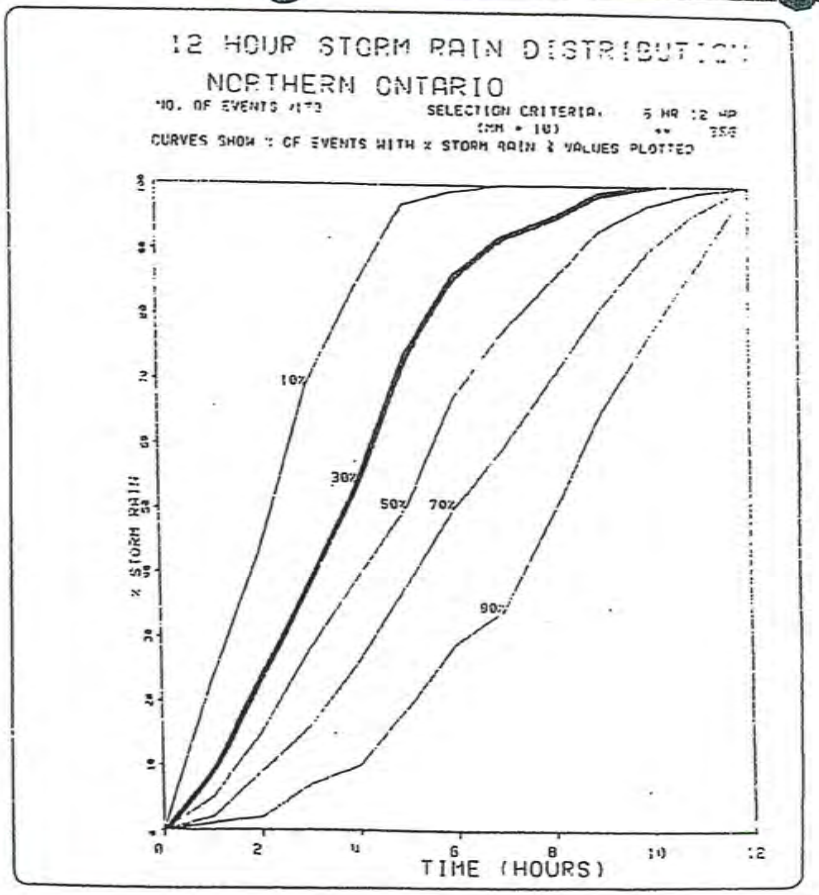


FIGURE D-7

12 – HOUR STORM DISTRIBUTION

TABLE D-8

RAINFALL DISTRIBUTIONS - PERCENT

Type	Reference	Storm Duration	HOURS											
			1	2	3	4	5	6	7	8	9	10	11	12
Probable Maximum Storm	Small Dams	6 Hour	8	9	11	49	15	8	-	-	-	-	-	-
HAZEL	Ministry of Natural Resources	12 Hour	3	2	3	6	8	6	11	6	6	25	18	6
TIMMINS	Ministry of Natural Resources	12 Hour	8	10	6	1	3	10	23	10	12	6	7	4
Return Period Storms	SCS II	24 Hour 2 Hour Increment	2	3	3	4	6	48	16	6	4	3	3	2
	AES, 30% Southern Ontario	12 Hour	15	25	22	14	12	8	3	1	0	0	0	0
	AES, 30% Northern Ontario	12 Hour	8	17	15	14	18	14	6	3	3	1	1	0

NOTE: A.E.S. distributions represent 70% of all storms for which the accumulated hourly rainfall was equal or less than shown. Consequently, only 30% of the storms had higher accumulated rainfall.

For other distribution see page D-16.

Christie Peacock

From: Jessica Mueller [jmueller@grca.on.ca]
Sent: January-07-14 1:41 PM
To: 'Mark'; 'Christina Sisson'; 'Peter Waring'
Cc: jburgess@kawarthaconservation.com; 'Christie Peacock'; pbuckley@kawarthaconservation.com
Subject: Increased/Decreased precipitation data
Attachments: ComparisonPPTvolume_increase_decrease_commercialArea_zoomIN.docx

Dear Technical Committee,
As discussed at the last meeting at KC regarding the floodplain mapping study for the Ops Drain #1/Jennings Creek a precipitation sensitivity analyses was carried-out as per the peer reviewer's recommendation. Please find the results attached and kindly review the memo to indicate which rainfall data should be used to generate the floodlines.

In order to meet the timelines determined during the last meeting, direction to staff is required by Friday 17th, 2014.

Thank you,
Jessica

Jessica Mueller
GIS / EngineeringTechnician
Ganaraska Region Conservation Authority
2216 County Road 28
Port Hope, Ontario
Email: jmueller@grca.on.ca

Memo regarding increased/decreased rainfall volumes by 10 % of the original values

As mentioned in the previous memo the Peterborough gauge experienced an increase in total rainfall volumes in the years following the decommissioning of the Lindsay station. As shown in the memo sent on Jan 7, 2014 this increase has an impact for the commercial area. Consequently KC staff ran a second analysis comparing rainfall data from the Peterborough station versus the Lindsay station.

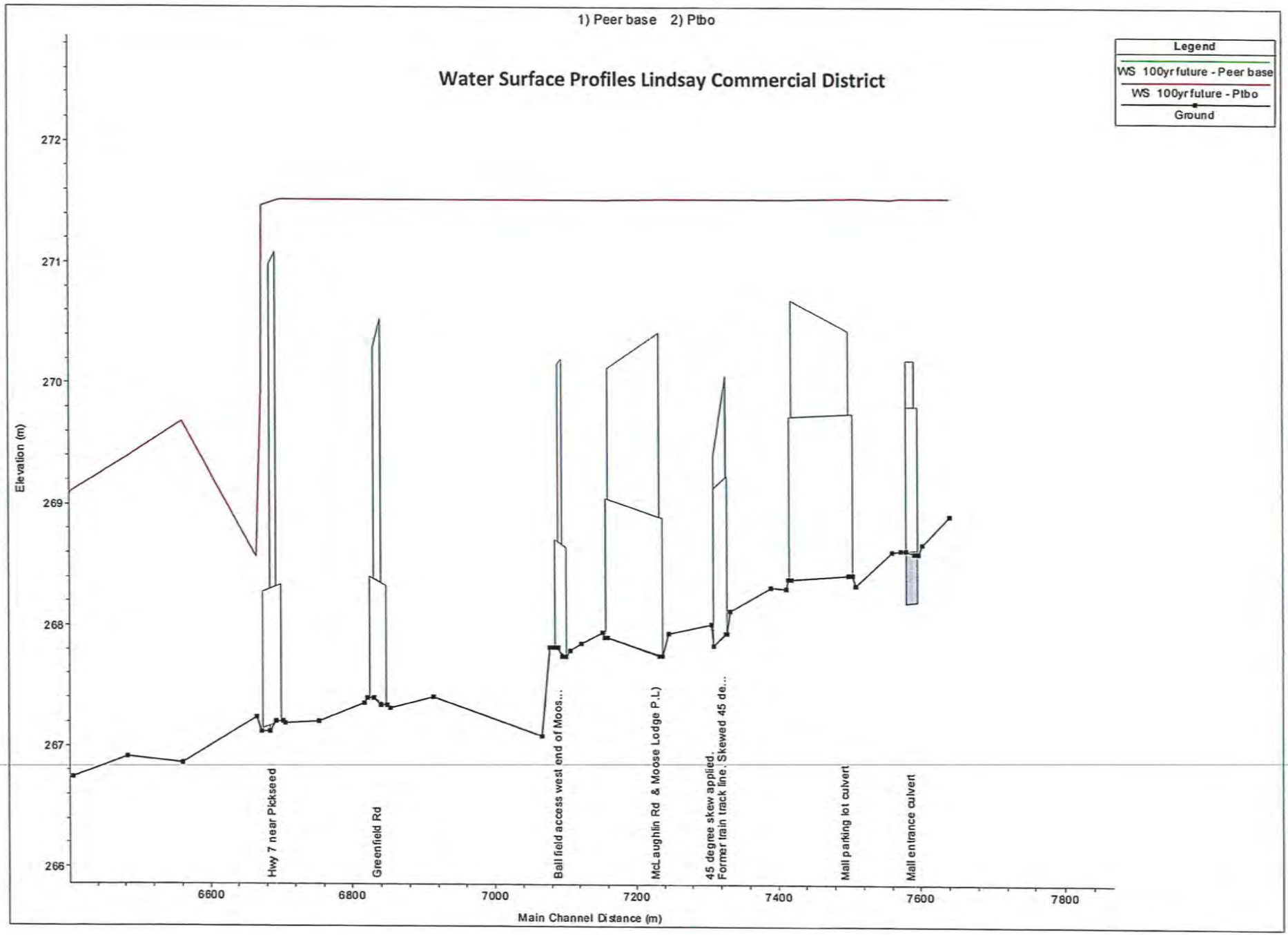
The first figure shows a comparison of the resultant rainfall intensities using respective IDF values for the measured and calculated values from the Peterborough station and the measured, calculated and increased values from the Lindsay station. A significant difference of intensities among curves cannot be observed.

The table compares the future flows obtained from PCSWMM for the Chicago 100 yr storm events to evaluate the impact of the rainfall input adjustments. The results show that the flows with the Peterborough rainfall data are generally the same when compared to the original Lindsay gauge rainfall volumes and somewhat lower compared to the values where storm values were increased by 10 %.

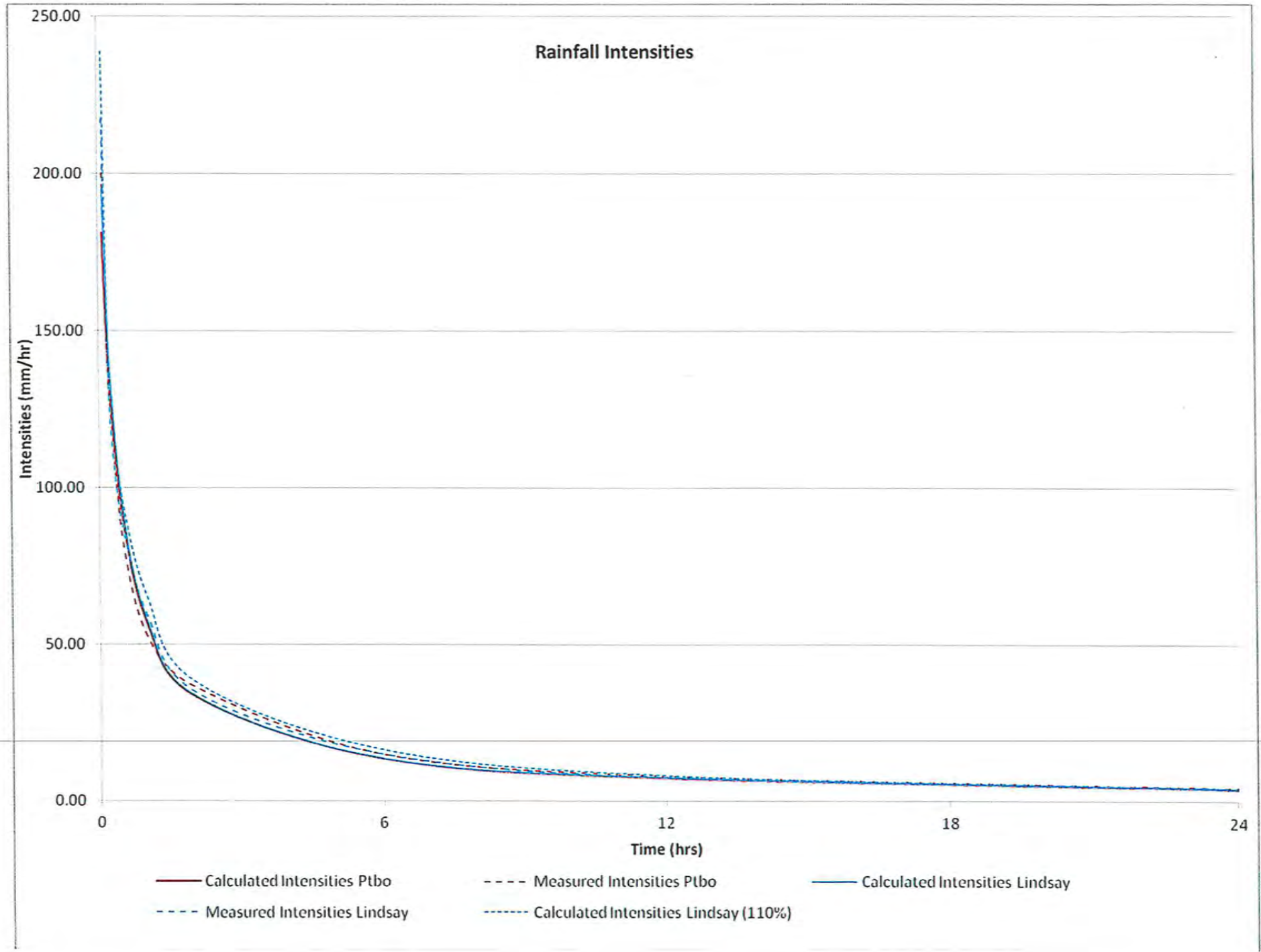
The HEC-Ras profiles compare the differences of water surface elevation generated by the original Lindsay station and the Peterborough station rainfall data, respectively. As can be seen the water surfaces of 271.54 m are identical.

Therefore, staff recommends continue using the original Lindsay station data for the final analyses and report.

1) Peer base 2) Ptbo



Future Flows			
RS	100yr future	Ptbo	Lindsay (110%)
7641.424	23.01	21.77	25.83
7510.949	19.15	18.23	21.24
7328.619	17.78	17.03	19.43
7246.49	16.2	15.57	17.72
7111.02	22.24	21.43	24.57
6853.017	19.34	18.81	21.66
6757.544	26.22	25.50	29.23
6190.578	25.05	24.56	27.33
5880.376	20.42	20.13	23.63
5653.55	33.48	33.24	39.43
5465.266	32.03	31.82	37.12
4968.21	24.37	24.33	29.26
4380.968	16.71	16.73	18.65
3957.179	15.7	15.74	18.64
3509.864	17.43	17.50	21.32
3187.848	43.2	42.96	45.55
2922.176	41.24	41.23	45.01
1455.968	54.49	54.44	67.37
273.7271	61.92	61.92	68.19
154.6483	62.6	62.63	58.09


Rainfall Intensities
250.00
200.00
150.00
100.00
50.00
0.00
Intensities (mm/hr)
0
6
12
18
24
Time (hrs)
Calculated Intensities Ptbo
Measured Intensities Ptbo
Calculated Intensities Lindsay
Measured Intensities Lindsay
Calculated Intensities Lindsay (110%)

Christie Peacock

From: Jessica Mueller [jmueller@grca.on.ca]
Sent: January-15-14 9:59 AM
To: 'Christina Sisson'; 'Mark'; 'Peter Waring'
Cc: jburgess@kawarthaconservation.com; 'Christie Peacock'; pbuckley@kawarthaconservation.com
Subject: Follow up regarding Lindsay/Peterborough station rainfall data
Attachments: MemoComparisonPtboLindsayPPTdata.docx

Greetings!

Please find attached a memo regarding the comparison of the Peterborough versus Lindsay station rainfall data in addition to the memo sent on Jan 7, 2014. This second analysis determines that there is no difference of water surface elevation generated for the area in question if rainfall data of the Lindsay station is compared to the rainfall data recorded at the Peterborough station.

Therefore, staff recommends continuing using the original Lindsay station data for the final report and analyses.

Please kindly discuss these findings and advise staff by Jan 17th, 2014 of your recommendation.

Thank you,

Jessica Mueller
GIS / EngineeringTechnician
Ganaraska Region Conservation Authority
2216 County Road 28
Port Hope, Ontario
Email: jmueller@grca.on.ca

Memo regarding the use of rainfall data from Lindsay Filtration Plant

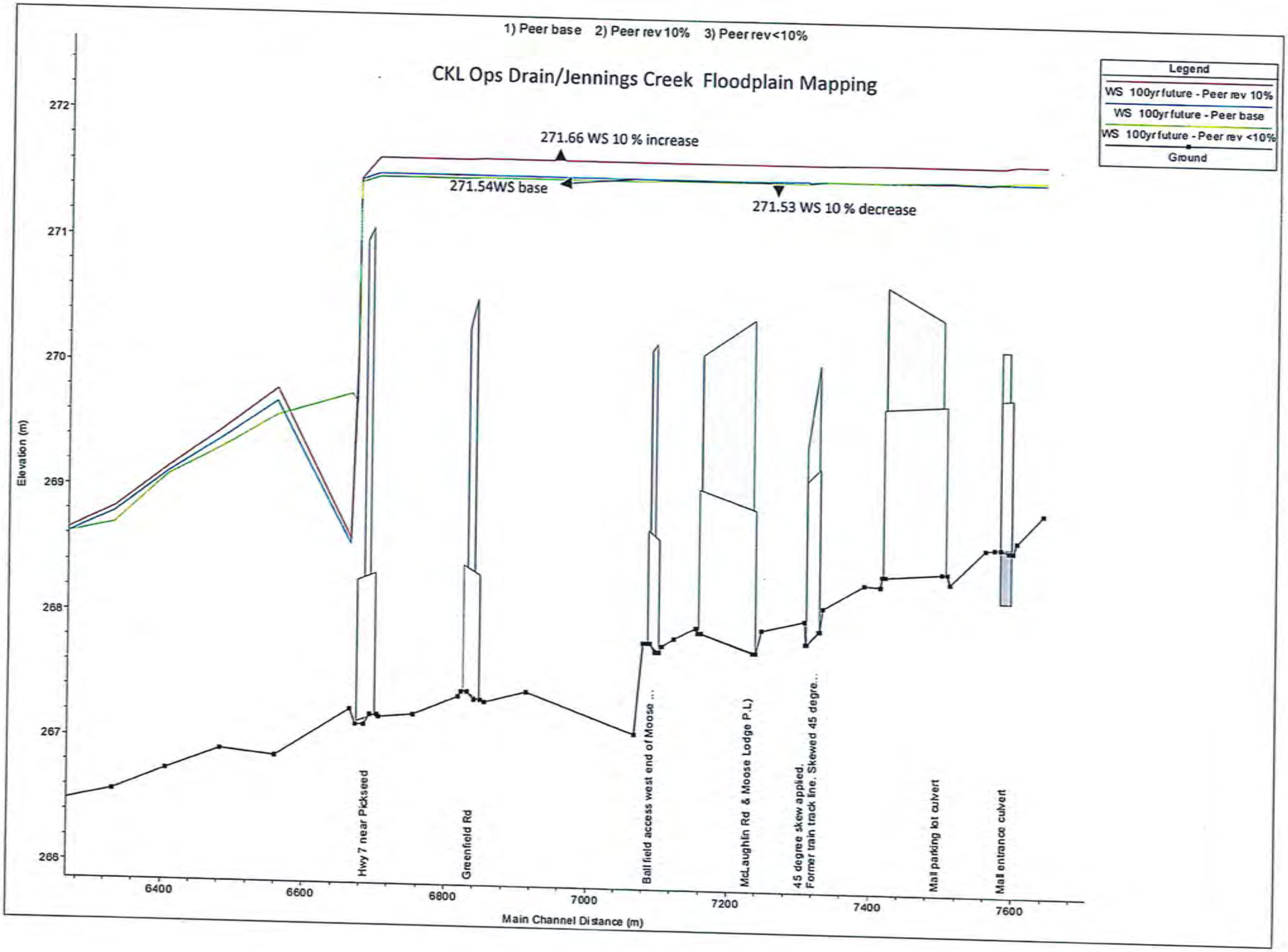
The hydrology peer review compared the Lindsay and Peterborough AES rain gauge data and determined that the Peterborough gauge experienced an increase in total rainfall volumes for the years following the abandonment of the Lindsay rain gauge. The technical committee for the Ops Drain #1/Jennings Creek floodplain model study directed staff to a carry out a sensitivity analysis of the precipitation volumes, as per the peer reviewer's recommendation.

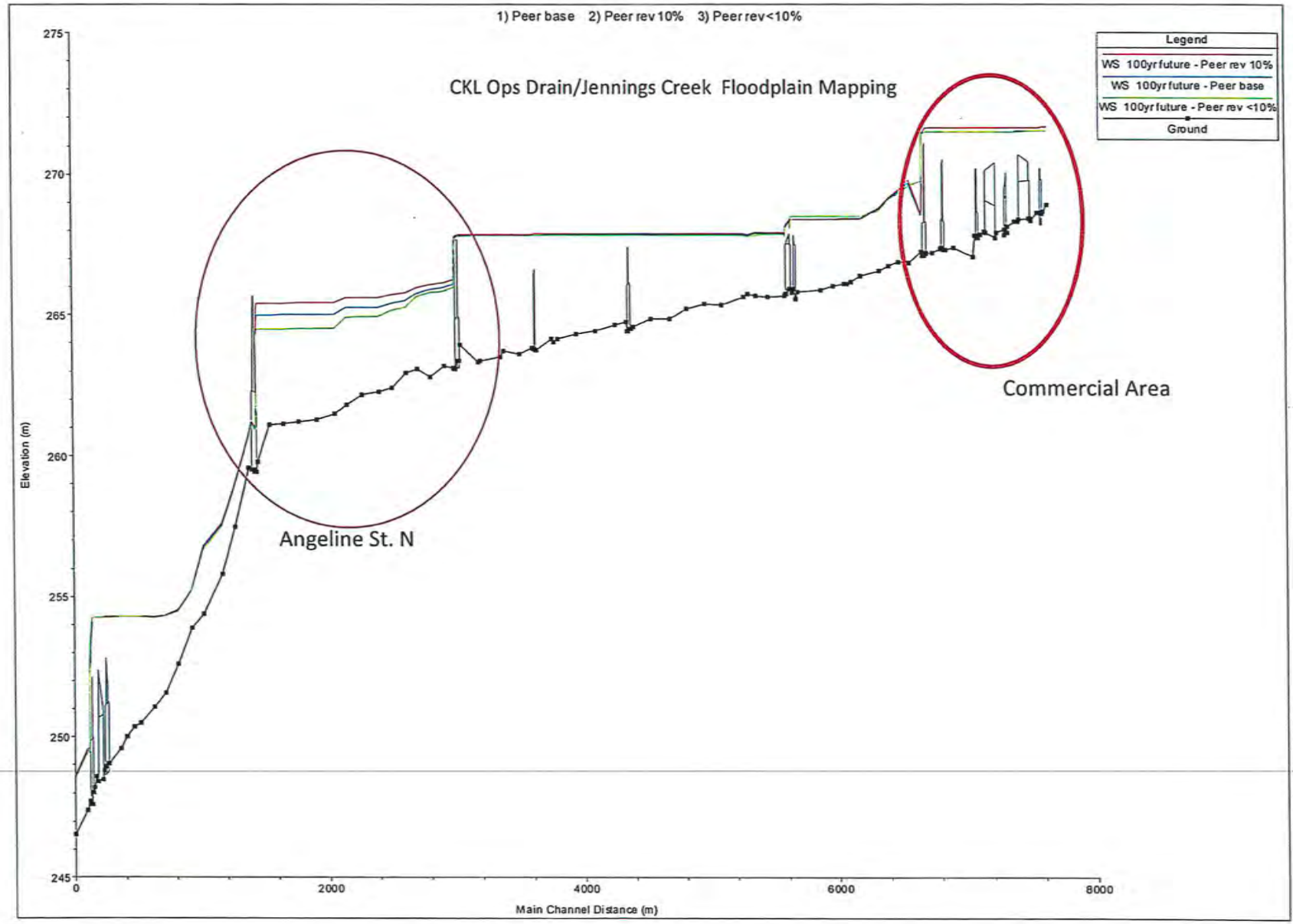
Rainfall volumes were reduced/increased by 10% of the original values and input into the PCSWMM hydrology model to determine the subsequent peak flows for the 12-hour Chicago storm. Resultant peak flows were then entered into the static HEC-RAS model. The figures above show a comparison of the calculated floodlines for the three separate scenarios:

- The pink line represents the floodline when storm volumes are increased 10%
- The blue line represents the original Lindsay gauge rainfall volumes
- The green line represents the floodline when storm volumes are decreased 10%

The results show that a difference in water surface elevations in two areas: upstream of Hwy 7, and between Angeline St and Hwy 35. Only the area upstream of Hwy 7 is of concern since at Angeline St. the Timmins storm is the event that determines the floodplain. The effect of the rainfall adjustment is therefore of consequence only for the commercial area. The second figure is a blow-up that indicates the differing water surface elevations: 271.66 m (10% increase), 271.54 m (original Lindsay data) to 271, 53 m (10% decrease).

In order to complete the report and maps, staff require direction from the committee whether the base rain data or the 10% increase should be used in the final analyses.


1) Peer base 2) Peer rev 10% 3) Peer rev<10%
CKL Ops Drain/Jennings Creek Floodplain Mapping
Legend
WS 100yr future - Peer rev 10%
WS 100yr future - Peer base
WS 100yr future - Peer rev <10%
Ground
271.66 WS 10 % increase
271.54WS base
271.53 WS 10 % decrease
Elevation (m)
272
271
270
269
268
267
266
Hwy 7 near Pickseed
Greenfield Rd
Ball field access west end of Moose ...
McLaughlin Rd & Moose Lodge P.L)
45 degree skew applied.
Former train track line. Skewed 45 degre...
Mall parking lot culvert
Mall entrance culvert
6400
6600
6800
7000
7200
7400
7600
Main Channel Distance (m)


1) Peer base 2) Peer rev 10% 3) Peer rev<10%
CKL Ops Drain/Jennings Creek Floodplain Mapping
Legend
WS 100yr future - Peer rev 10%
WS 100yr future - Peer base
WS 100yr future - Peer rev <10%
Ground
Angeline St. N
Commercial Area
Elevation (m)
275
270
265
260
255
250
245
0
2000
4000
6000
8000
Main Channel Distance (m)

Lindsay AES Data (comparing to Aecom report)

Intensity Values in AES 1965-1989

Minutes	Rainfall Intensity (mm/hr) 2-year	5-year	10-year	25-year	50-year	100-year
5	101.0	132.2	152.8	178.9	198.2	217.5
10	73.3	94.2	108.1	125.6	138.5	151.4
15	59.1	74.8	85.3	98.4	108.2	117.9
30	38.7	51.3	59.6	70.1	77.9	85.7
60	24.1	33.4	39.6	47.3	53.1	58.8
120	14.2	19.7	23.3	27.9	31.3	34.7
360	6.1	8.5	10.0	12.0	13.5	14.9
720	3.3	4.4	5.2	6.1	6.8	7.5
1440	1.8	2.3	2.7	3.1	3.5	3.8

Provided from AES

Return Period Parameters	2-year	5-year	10-year	25-year	50-year	100-year
a	20.9	27.8	32.3	38	42.3	46.5
b	-0.719	-0.713	-0.710	-0.708	-0.706	-0.705

Used in 2010 Aecom Report (CKL Engineering Standards)

Return Period Parameters	2-year	5-year	10-year	25-year	50-year	100-year
a	628.107	820.229	915.845	1041.821	1139.702	1230.783
b	5.3	6.0	6.0	6.0	6.0	6.0
c	0.78	0.768	0.757	0.748	0.743	0.738

Calculated Rainfall Intensities using a, b from AES printout

Minutes	Rainfall Intensity (mm/hr) 2-year	5-year	10-year	25-year	50-year	100-year
5	124.8	163.5	188.5	220.7	244.5	268.1
10	75.8	99.7	115.3	135.1	149.9	164.5
15	56.6	74.7	86.4	101.4	112.6	123.6
30	34.4	45.6	52.8	62.1	69.0	75.8
60	20.9	27.8	32.3	38.0	42.3	46.5
120	12.7	17.0	19.7	23.3	25.9	28.5
360	5.8	7.7	9.1	10.7	11.9	13.1
720	3.5	4.7	5.5	6.5	7.3	8.1
1440	2.1	2.9	3.4	4.0	4.5	4.9

Calculated Rainfall Intensities using a, b, c from Aecom Report

Minutes	Rainfall Intensity (mm/hr) 2-year	5-year	10-year	25-year	50-year	100-year
5	102.1	130.0	149.0	173.0	191.6	209.4
10	74.9	97.5	112.2	130.8	145.1	158.9
15	60.1	79.1	91.4	106.8	118.6	130.0
30	39.0	52.3	60.8	71.4	79.5	87.4
60	24.1	32.8	38.4	45.4	50.7	55.9
120	14.5	20.0	23.5	28.0	31.3	34.7
360	6.3	8.8	10.5	12.6	14.2	15.8
720	3.7	5.2	6.3	7.5	8.5	9.5
1440	2.2	3.1	3.7	4.5	5.1	5.7

Minutes	2-year	5-year	10-year	25-year	50-year	100-year
5	124%	124%	123%	123%	123%	123%
10	103%	106%	107%	108%	108%	109%
15	96%	100%	101%	103%	104%	105%
30	89%	89%	89%	89%	89%	88%
60	87%	83%	82%	80%	80%	79%
120	89%	86%	85%	83%	83%	82%
360	94%	91%	91%	89%	88%	88%
720	106%	107%	106%	107%	108%	108%
1440	118%	125%	125%	129%	128%	130%
average =	101%	101%	101%	101%	101%	101%
median =	96%	100%	101%	103%	104%	105%
min =	87%	83%	82%	80%	80%	79%
max =	124%	125%	125%	129%	128%	130%

Minutes	2-year	5-year	10-year	25-year	50-year	100-year
5	101%	98%	98%	97%	97%	96%
10	102%	103%	104%	104%	105%	105%
15	102%	106%	107%	108%	110%	110%
30	101%	102%	102%	102%	102%	102%
60	100%	98%	97%	96%	95%	95%
120	102%	101%	101%	100%	100%	100%
360	103%	104%	105%	105%	105%	106%
720	112%	118%	120%	124%	125%	127%
1440	120%	133%	137%	145%	146%	151%
average =	105%	107%	108%	109%	109%	110%
median =	102%	103%	104%	104%	105%	105%
min =	100%	98%	97%	96%	95%	95%
max =	120%	133%	137%	145%	146%	151%

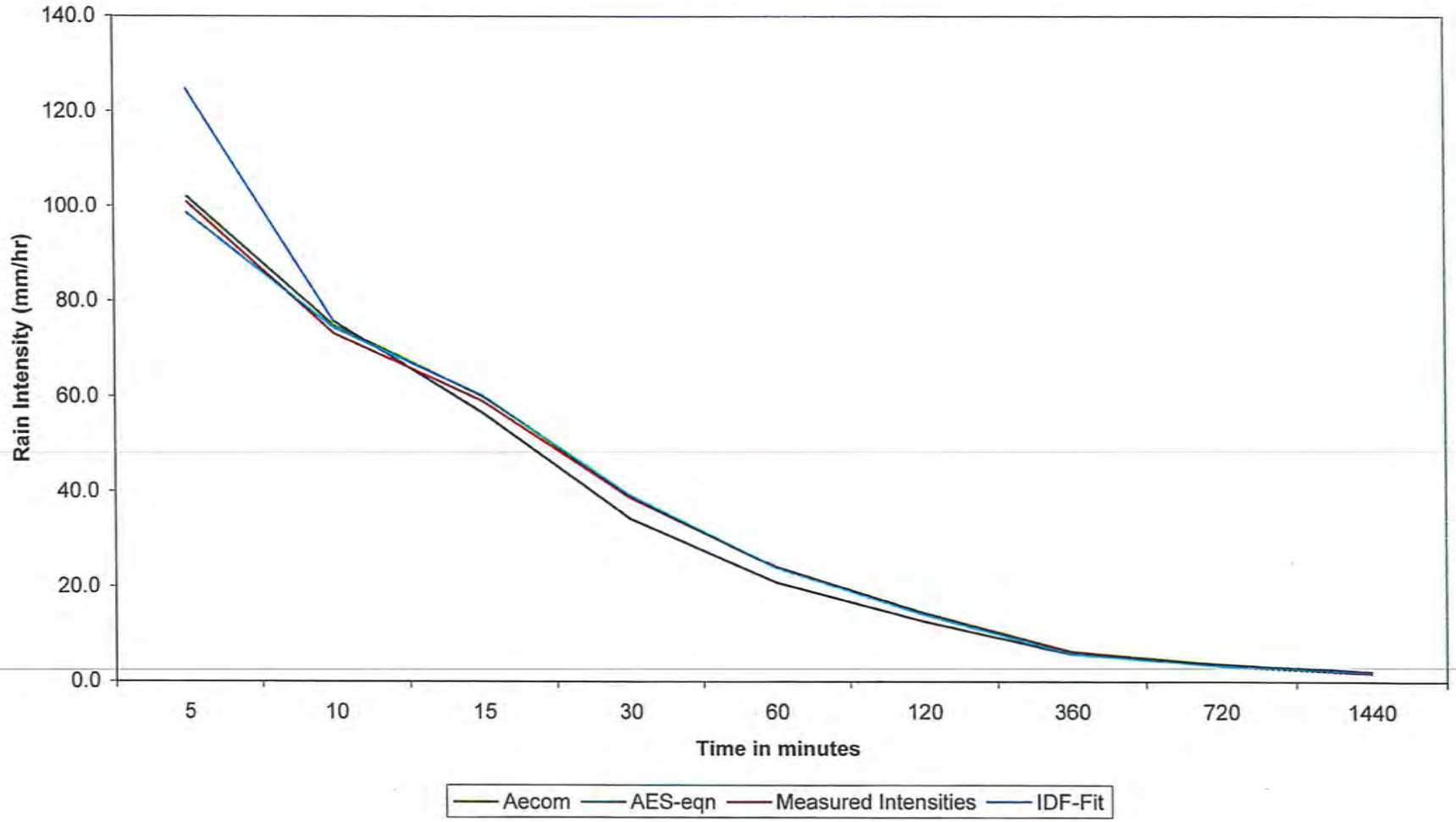
Calculated Rainfall Intensities using a, b,c from IDF-fit spreadsheet

a =	808.299	1248.097	1486.792	1917.848	2142.007	2465.522
b =	7.413	9.760	10.44	11.842	12.182	12.897
c =	0.835	0.857	0.858605	0.872971	0.871993	0.879

Minutes	Rainfall Intensity (mm/hr) 2-year	5-year	10-year	25-year	50-year	100-year
5	98.7	124.2	141.8	163.0	179.4	195.2
10	74.4	96.7	111.4	129.9	143.6	157.2
15	60.2	79.7	92.4	108.5	120.3	132.1
30	39.3	53.1	62.0	73.7	82.0	90.5
60	24.0	32.8	38.5	45.9	51.3	56.8
120	14.1	19.3	22.7	27.0	30.3	33.5
360	5.8	7.9	9.3	10.9	12.3	13.5
720	3.3	4.4	5.2	6.1	6.8	7.5
1440	1.9	2.4	2.9	3.3	3.7	4.1

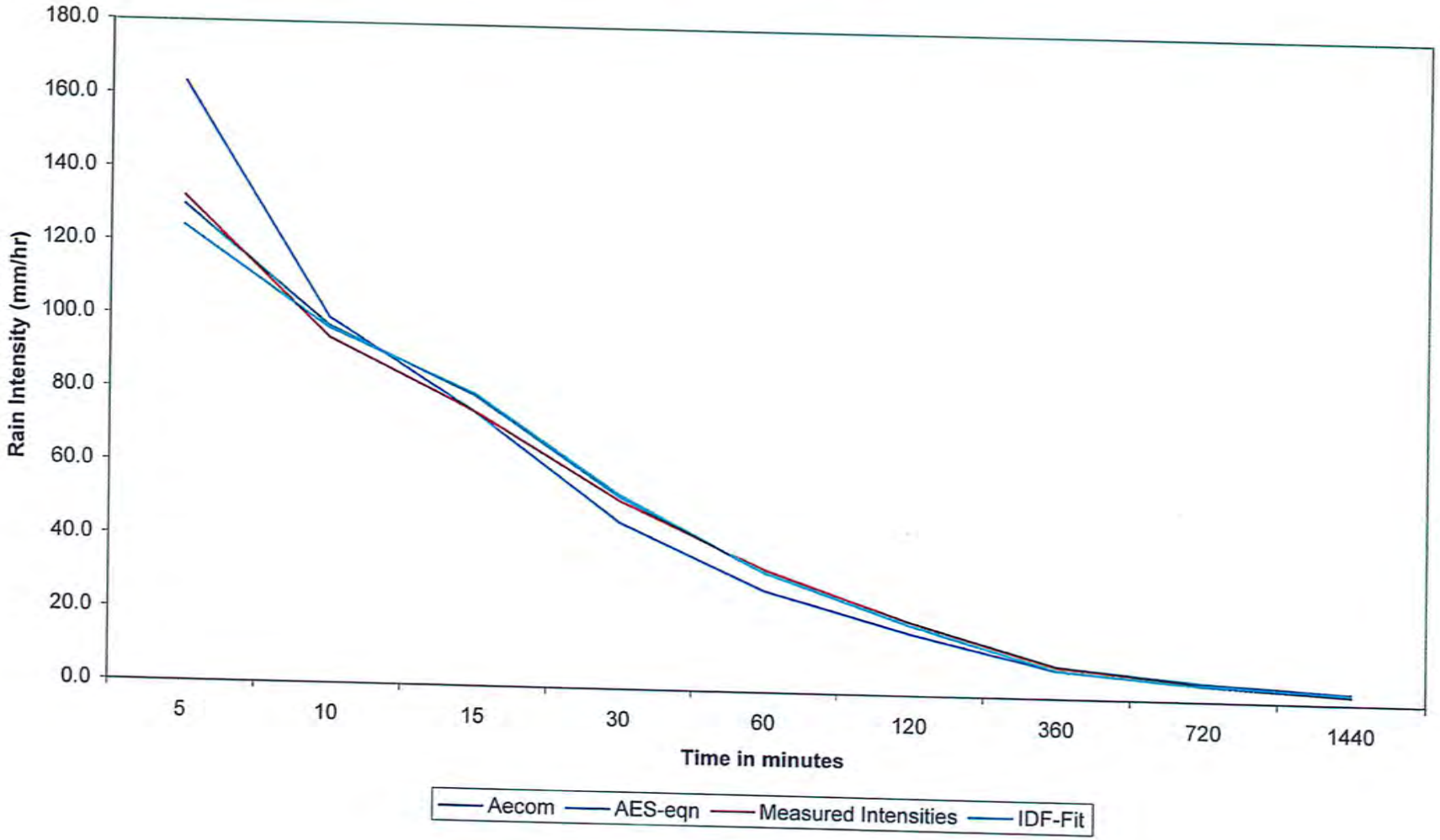
Minutes	2-year	5-year	10-year	25-year	50-year	100-year
5	98%	94%	93%	91%	91%	90%
10	101%	103%	103%	103%	104%	104%
15	102%	107%	108%	110%	111%	112%
30	101%	104%	104%	105%	105%	106%
60	100%	98%	97%	97%	97%	97%
120	99%	98%	97%	97%	97%	97%
360	96%	92%	93%	91%	91%	91%
720	100%	100%	99%	99%	100%	100%
1440	103%	106%	106%	107%	107%	108%
average =	100%	100%	100%	100%	100%	100%
median =	100%	100%	99%	99%	100%	100%
min =	96%	92%	93%	91%	91%	90%
max =	103%	107%	108%	110%	111%	112%

IDF Curve Comparison AES vs Aecom vs IDF-Fit
2-year Return Period
Lindsay Filtration Plant



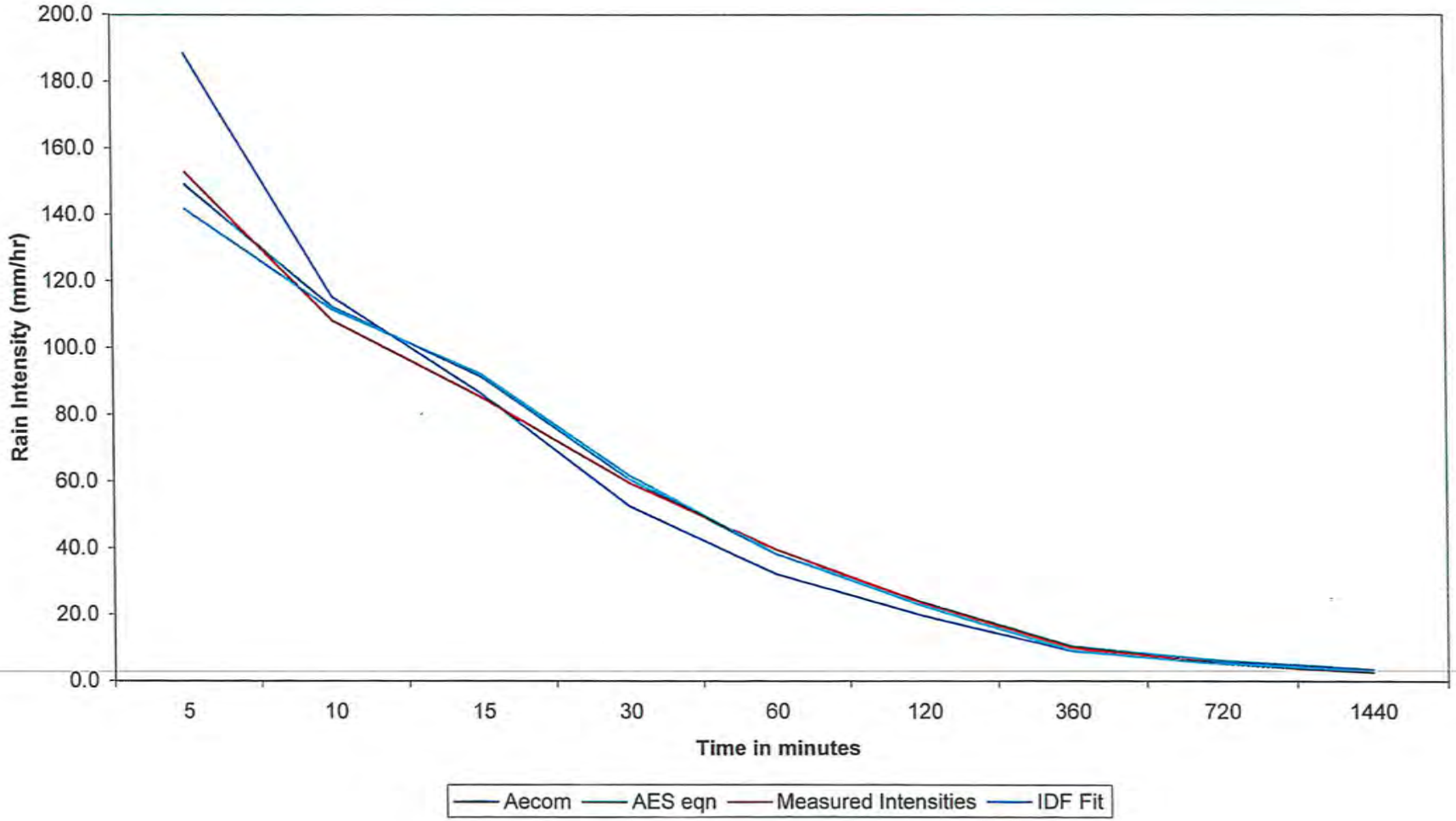
Comparing IDF Lindsay (Ops).xls
sheet: 2 year graph

IDF Curve Comparison AES vs Aecom vs IDF-Fit
5-year Return Period
Lindsay Filtration Plant



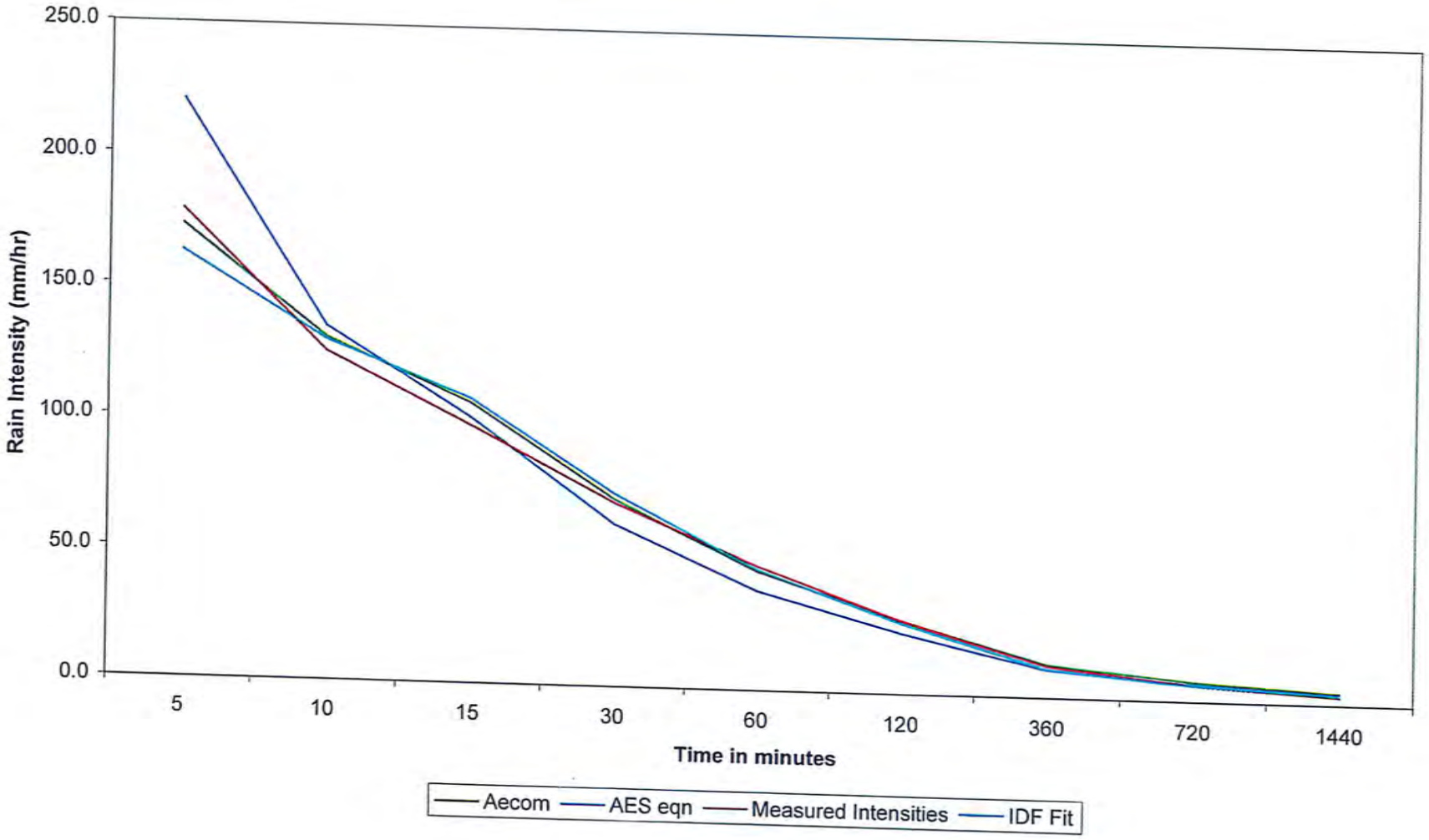
Comparing IDF Lindsay (Ops).xls
sheet: 5 year graph

IDF Curve Comparison AES vs Aecom vs IDF-Fit
10-year Return Period
Lindsay Filtration Plant



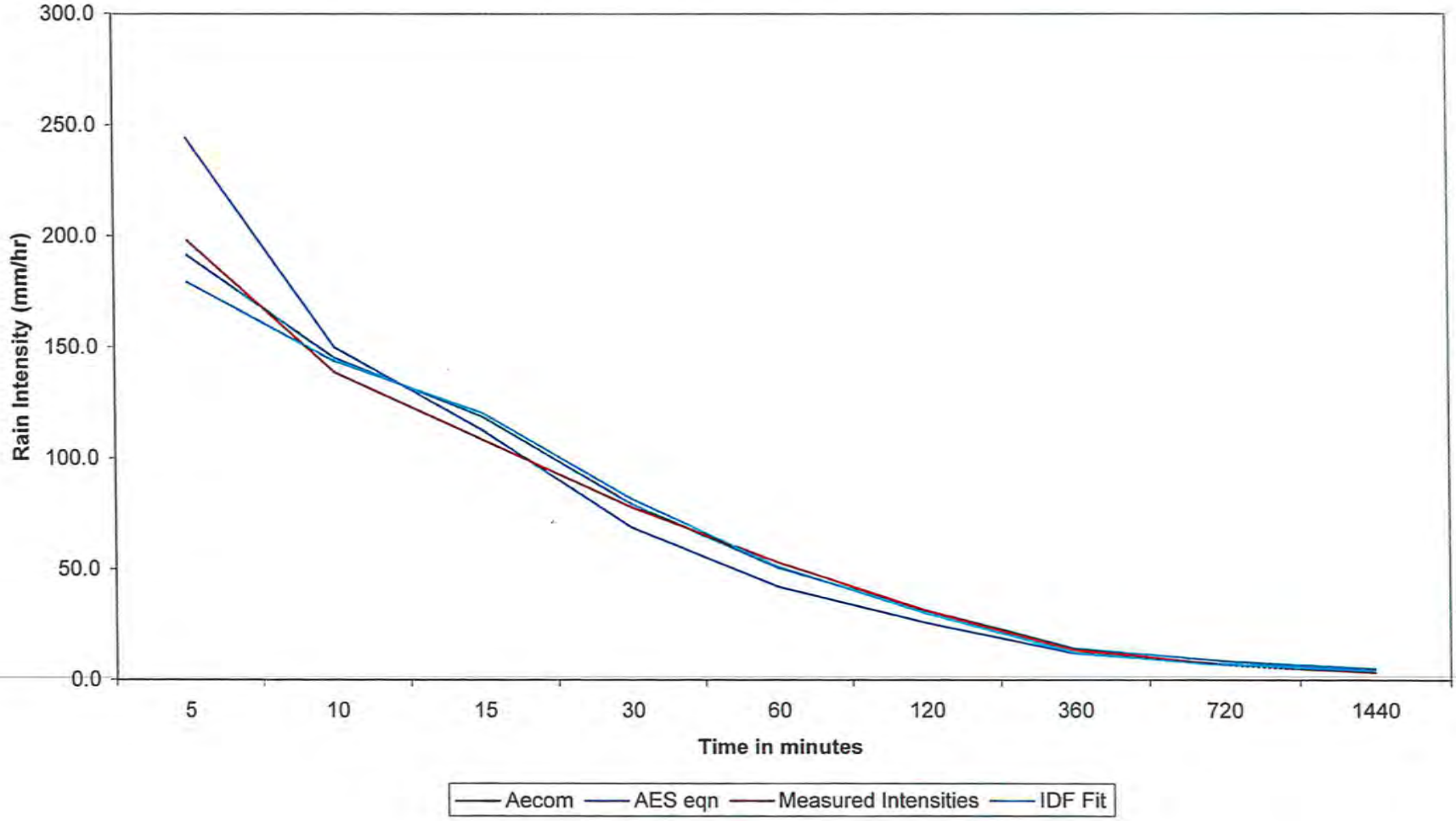
Comparing IDF Lindsay (Ops).xls
sheet: 10 year graph

IDF Curve Comparison AES vs Aecom vs IDF-Fit
25-year Return Period
Lindsay Filtration Plant



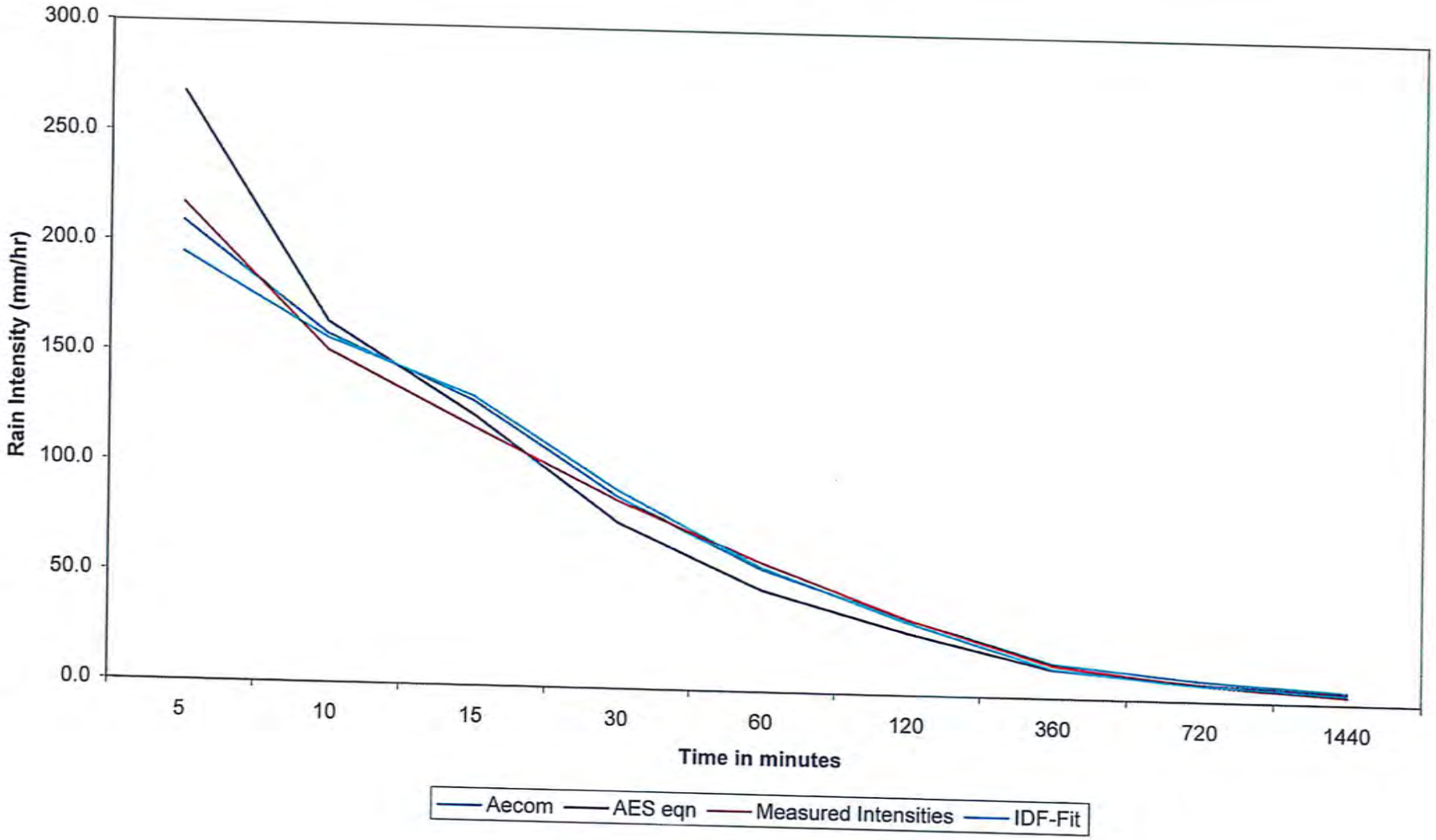
Comparing IDF Lindsay (Ops).xls
sheet: 25 year graph

IDF Curve Comparison AES vs Aecom vs IDF-Fit
50-year Return Period
Lindsay Filtration Plant



Comparing IDF Lindsay (Ops).xls
sheet: 50 year graph

IDF Curve Comparison AES vs Aecom vs IDF-Fit
100-year Return Period
Liindsay Filtration Plant



Comparing IDF Lindsay (Ops).xls
sheet: 100 year graph

Comparing Rainfall Volumes

6-hour Storm

Return Period Storm	Rainfall Volumes (mm)				
	Measured	Using CKL a, b, c	% Diff	Using new a, b, c	% Diff
2	36.6	37.8	103%	35.0	96%
5	50.8	52.9	104%	47.1	93%
10	60.2	63.0	105%	55.6	92%
25	72.1	75.6	105%	65.6	91%
50	80.9	85.2	105%	73.7	91%
100	89.7	94.7	106%	81.1	90%

12-hour Storm

Return Period Storm	Rainfall Volumes (mm)				
	Measured	Using CKL a, b, c	% Diff	Using new a, b, c	% Diff
2	39.8	44.3	111%	39.6	99%
5	53.2	62.5	117%	52.6	99%
10	62.2	75.0	121%	62.1	100%
25	73.4	90.6	123%	72.7	99%
50	81.8	102.4	125%	81.7	100%
100	90.1	114.3	127%	89.6	99%

24-hour Storm

Return Period Storm	Rainfall Volumes (mm)				
	Measured	Using CKL a, b, c	% Diff	Using new a, b, c	% Diff
2	43.6	51.7	119%	44.5	102%
5	56.4	73.6	131%	58.5	104%
10	64.8	89.1	137%	68.9	106%
25	75.4	108.2	143%	79.9	106%
50	83.3	122.7	147%	89.9	108%
100	91.2	137.5	151%	98.2	108%

Appendix C
Subcatchment Data

							Base		RC+20	
Route Channel	VO Node	To VO Node	GIS Node		Elevation		Length (m)	Slope m/m	Length (m)	Slope m/m
			From	To	From	To				
9	800	70	M'	OO	275.23	272.91	1419.19	0.163	1703.028	0.136
124	130	150	UU	QQ	248.59	248.05	409.38	0.132	491.256	0.110
10001	100	20	A*	NN	274.68	272.21	1070.89	0.231	1285.068	0.192
10003	200	20	B'	NN	273.92	272.21	2026.31	0.084	2431.572	0.070
10004	2300	10	MM	PP	274.38	272.68	2142.9	0.079	2571.48	0.066
10005	400	10	PP	FF*	272.68	272.48	230.96	0.087	277.152	0.072
10006	20	30	NN	GG	272.21	271.88	987.43	0.033	1184.916	0.028
10007	10	30	FF*	GG	272.48	271.88	455.747	0.132	546.8964	0.110
10008	30	125	GG	b	271.88	271.81	252.58	0.028	303.096	0.023
10009	125	40	b	y	271.81	271.71	477.76	0.021	573.312	0.017
10010	40	50	y	F	271.71	271.34	1841.33	0.020	2209.596	0.017
10011	70	60	OO	F	272.91	271.34	934.04	0.168	1120.848	0.140
10012	60	80	F	Z	271.34	271.01	825.863	0.040	991.0356	0.033
10013	80	90	Z	R	271.01	267.79	413.71	0.778	496.452	0.649
10014	90	101	R	JJ	267.79	256.91	1028.82	1.058	1234.584	0.881
10015	123	130	PP	UU	249.44	248.59	135.502	0.627	162.6024	0.523
10017	110	123	I'	PP	251.41	249.44	317.98	0.620	381.576	0.516
10130	101	121	JJ	T'	256.91	255.98	302.3	0.308	362.76	0.256
10140	1400	121	TT	T'	267.32	255.98	668.74	1.696	802.488	1.413
10160	121	110	T'	I'	255.98	251.41	260.9	1.752	313.08	1.460
10210	2000	160	HH	W	251.84	248.21	666.467	0.545	799.7604	0.454

RC-20	
Length (m)	Slope m/m
1135.352	0.204
327.504	0.165
856.712	0.288
1621.048	0.105
1714.32	0.099
184.768	0.108
789.944	0.042
364.5976	0.165
202.064	0.035
382.208	0.026
1473.064	0.025
747.232	0.210
660.6904	0.050
330.968	0.973
823.056	1.322
108.4016	0.784
254.384	0.774
241.84	0.385
534.992	2.120
208.72	2.190
533.1736	0.681

Catchment ID	Area (ha)	CN	Travel Length (m)	From	To	Elevation Top	Elevation Bottom	Slope (%)	Runoff	ToC (min)	Tp (hr)
100	197.6	67	4031	A	A*	281.75	274.68	0.002	0.35	275.71	3.06
200	107.2	68	1447	Q	B*	290.52	273.93	0.011	0.33	91.28	1.01
300	315.5	54	4436	B	b	291.72	271.81	0.004	0.35	212.14	2.36
400	228.1	67	3401	B	PP	291.72	272.68	0.006	0.35	172.66	1.92
500	302.3	67	3018	D	FF*	300.87	272.66	0.009	0.35	137.34	1.53
600	299.6	63	3030	X	y	283.04	271.80	0.004	0.32	194.16	2.16
700	181.2	60	3720	EE	F*	286.56	271.34	0.004	0.36	197.61	2.20
800	183.2	68	3484	M	M'	302.92	275.23	0.008	0.33	159.82	1.78
900	236.7	64	4326	N	OO	294.93	272.91	0.005	0.33	206.31	2.29
1000	69.4	67	1532	W	F	280.70	271.34	0.006	0.36	111.12	1.23
1100	203.1	70	3108	J'	Z	282.85	271.01	0.004	0.37	182.43	2.03
1200	30.8	78	1343	G	R	278.93	267.79	0.008	0.4	88.94	0.99
1300	42.9	80	1600	H	JJ	277.21	256.91	0.013	0.42	59.70	0.66
1400	117.7	74	2232	O	TT	297.59	267.32	0.014	0.37	101.68	1.13
1500	37.3	74	1004	JJ*	T'	264.74	255.98	0.009	0.4	75.66	0.84
1600	8.9	74	436	AA	bb	253.68	252.70	0.002	0.37	81.26	0.90
1700	21.8	74	1544	I	P	271.44	249.44	0.014	0.35	85.50	0.95
1800	3.82	78	239	BB	UU	251.34	248.59	0.012	0.42	11.57	**0.13**
1900	10.25	80	745	L	QQ	252.45	248.05	0.006	0.53	37.40	0.42
2000	125	67	3272	DD*	HH	278.87	251.84	0.008	0.31	156.92	1.74
2100	34.3	80	906	RR	W	253.55	248.21	0.006	0.42	40.31	0.45
2200	9.7	78	563	CC	CC'	256.02	247.97	0.014	0.41	23.79	0.26
2300	308.8	64	3880	KK	MM	294.79	274.38	0.005	0.33	193.27	2.15

Catchment ID	Area (ha)	CN	Travel Length (m)	From	To	Elevation (m)		Slope (%)	Runoff Coeff	ToC (min)	Tp (hr)
						Top	Bottom				
100	197.6	67	2799	A	A*	281.75	274.68	0.003	0.35	203.71	2.26
200	107.2	68	1005	Q	B*	290.52	273.93	0.017	0.33	67.45	0.75
300	315.5	54	3081	B	b	291.72	271.81	0.006	0.35	156.74	1.74
400	228.1	67	2362	B	PP	291.72	272.68	0.008	0.35	127.57	1.42
500	302.3	67	2096	D	FF*	300.87	272.66	0.013	0.35	101.48	1.13
600	299.6	63	2104	X	y	283.04	271.80	0.005	0.32	143.46	1.59
700	181.2	60	2583	EE	F*	286.56	271.34	0.006	0.36	146.00	1.62
800	183.2	68	2419	M	M'	302.92	275.23	0.011	0.33	118.08	1.31
900	236.7	64	3004	N	OO	294.93	272.91	0.007	0.33	152.44	1.69
1000	69.4	67	1064	W	F	280.70	271.34	0.009	0.36	82.10	0.91
1100	203.1	70	2158	J'	Z	282.85	271.01	0.005	0.37	134.79	1.50
1200	30.8	78	933	G	R	278.93	267.79	0.012	0.4	65.71	0.73
1300	42.9	80	1111	H	JJ	277.21	256.91	0.018	0.42	38.54	0.43
1400	117.7	74	1550	O	TT	297.59	267.32	0.020	0.37	75.12	0.83
1500	37.3	74	698	JJ*	T'	264.74	255.98	0.013	0.4	55.90	0.62
1600	8.9	74	303	AA	bb	253.68	252.70	0.003	0.37	60.04	0.67
1700	21.8	74	1073	I	P	271.44	249.44	0.021	0.35	63.17	0.70
1800	3.82	78	166	BB	UU	251.34	248.59	0.017	0.42	7.47	**0.08**
1900	10.25	80	518	L	QQ	252.45	248.05	0.009	0.53	24.14	0.27
2000	125	67	2273	DD*	HH	278.87	251.84	0.012	0.31	115.94	1.29
2100	34.3	80	629	RR	W	253.55	248.21	0.008	0.42	26.02	0.29
2200	9.7	78	391	CC	CC'	256.02	247.97	0.021	0.41	15.36	0.17
2300	308.8	64	2694	KK	MM	294.79	274.38	0.008	0.33	142.79	1.59

Catchment ID	CN Base	CN +20%	CN -20%	IA Base	IA +50%	CN -20%
100	67	80.4	53.6	5	7.5	3.3
200	68	81.6	54.4	5	7.5	3.3
300	54	64.8	50	5	7.5	3.3
400	67	80.4	53.6	5	7.5	3.3
500	67	80.4	53.6	5	7.5	3.3
600	63	75.6	50.4	5	7.5	3.3
700	60	72	50	5	7.5	3.3
800	68	81.6	54.4	5	7.5	3.3
900	64	76.8	51.2	5	7.5	3.3
1000	67	80.4	53.6	5	7.5	3.3
1100	70	84	56	5	7.5	3.3
1200	78	93.6	62.4	5	7.5	3.3
1300	80	96	64	5	7.5	3.3
1400	74	88.8	59.2	5	7.5	3.3
1500	74	88.8	59.2	5	7.5	3.3
1600	74	88.8	59.2	5	7.5	3.3
1700	74	88.8	59.2	5	7.5	3.3
1800	78	93.6	**62.4**	5	7.5	3.3
1900	80	96	64	5	7.5	3.3
2000	67	80.4	53.6	5	7.5	3.3
2100	80	96	64	5	7.5	3.3
2200	78	93.6	62.4	5	7.5	3.3
2300	64	76.8	51.2	5	7.5	3.3

Route Channel	To VO Node	GIS Node		Elevation		Length (m)
		From	To	From	To	
10004	10	MM	PP	274.38	272.68	2142.9
10005	10	PP	FF*	272.68	272.48	230.96
10007	30	FF*	GG	272.48	271.88	455.747
10001	20	A*	NN	274.68	272.21	1070.89
10003	20	B'	NN	273.92	272.21	2026.31
10006	30	NN	GG	272.21	271.88	987.43
10008	125	GG	b	271.88	271.81	252.58
10009	40	b	y	271.81	271.71	477.76
10010	50	y	F	271.71	271.34	1841.33
9	70	M'	OO	275.23	272.91	1419.19
10011	60	OO	F	272.91	271.34	934.04
10012	80	F	Z	271.34	271.01	825.863
10013	90	Z	R	271.01	267.79	413.71
10014	101	R	JJ	267.79	256.91	1028.82
10130	121	JJ	T'	256.91	255.98	302.3
10160	110	T'	I'	255.98	251.41	260.9
10017	123	I'	PP	251.41	249.44	317.98
10015	130	PP	UU	249.44	248.59	135.502
124	150	UU	QQ	248.59	248.05	409.38

10210	160	HH	W	251.84	248.21	666.467
	121	TT	T'	267.32	255.98	668.74

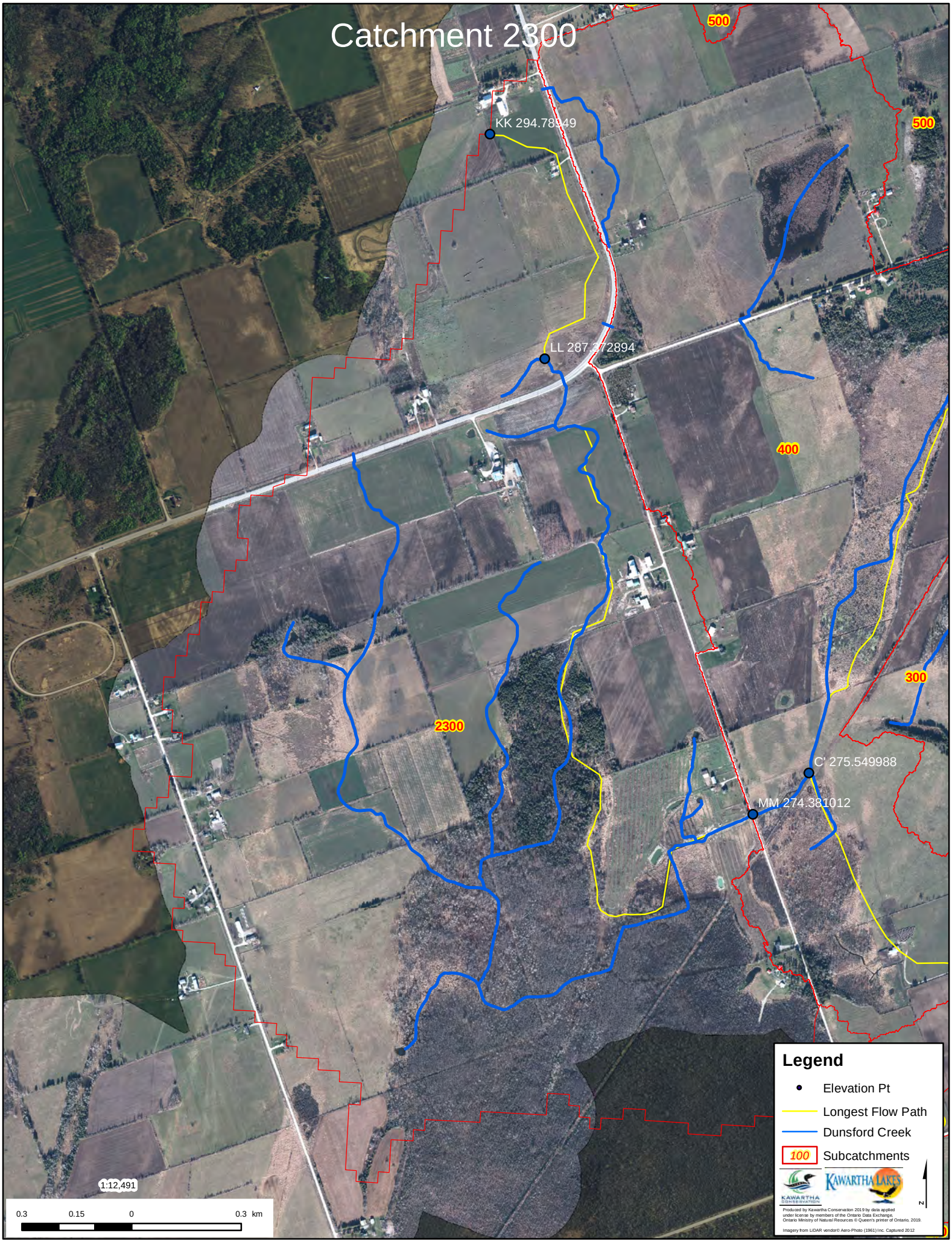
HEC RAS ID	Location	Catchment	VO Flow Node	Regional	100 Year	50 Year	25 Year	10 Year	5 Year	2 year
3532	Top of System, US of Sturgeon	1100	90	64.73	19.01	15.64	12.19	7.92	5.30	2.32
2886	DS of Community Centre	1300	101	65.55	19.07	15.67	12.21	7.94	5.31	2.35
1815	DS of HWY 36 (W)	1500	121	69.77	20.51	16.88	13.22	8.73	5.96	2.95
1498	DS of Cedar Glen Road	1600	110	70.01	20.59	16.93	13.27	8.78	6.00	2.98
1186	DS of HWY 36 (E)	1700	123	70.55	20.78	17.10	13.42	8.92	6.12	3.05
883	DS of Herons Landing	1800	130	70.61	20.78	17.11	13.42	8.92	6.12	3.06
755	DS of Herons Landing 2	1900	150	70.76	20.71	16.67	13.31	8.89	6.10	3.07

Comment
Included flows from Catchment 1200 for simplication (63.99 m3/s vs 64.73 m2/s for regional event)

Location	Hydrologic Flow Node	Base	Curve Number		Initial Abstraction		Subcatchment Travel Length		Channel Routing			Time Step	
			CN+20%	CN-20%	IA+50%	IA-50%	TL+20%	TL-20%	No RC	RC+20%	RC-20%	DT+50%	DT-50%
Top of System, US of Sturgeon	90	65.6	83.7	50.1	64.5	66.3	63.7	67.0	114.0	57.3	74.8	65.6	65.6
DS of Community Centre	101	66.5	84.7	50.1	65.3	67.2	64.4	67.9	116.2	58.0	75.9	66.5	66.5
DS of HWY 36 (W)	121	71.0	90.0	54.1	69.5	71.6	68.6	72.4	124.2	62.0	80.5	70.9	70.9
DS of Cedar Glen Road	110	71.2	90.3	54.2	69.7	71.9	68.8	72.7	124.6	62.2	80.8	71.1	71.1
DS of HWY 36 (E)	123	71.8	91.0	54.7	70.3	71.4	69.3	73.3	125.7	62.8	81.4	71.7	71.7
DS of Herons Landing	130	71.8	91.0	54.7	70.3	72.5	69.3	73.4	125.8	62.8	81.5	71.8	71.8
DS of Herons Landing 2	150	71.8	91.1	54.8	70.5	72.6	69.5	73.5	126.3	62.7	81.3	71.9	71.9

Location	Hydrologic Flow Node	Curve Number		Initial Abstraction		Subcatchment Travel Length		Channel Routing			Time Step	
		CN+20%	CN-20%	IA+50%	IA-50%	TL+20%	TL-20%	No RC	RC+20	RC-20	DT+50%	DT-50%
Top of System, US of Sturgeon	90	27.6%	-23.6%	-1.6%	1.2%	-2.9%	2.1%	74%	-13%	14%	0%	0%
DS of Community Centre	101	27.3%	-24.7%	-1.8%	1.1%	-3.2%	2.1%	75%	-13%	14%	0%	0%
DS of HWY 36 (W)	121	26.8%	-23.8%	-2.1%	0.9%	-3.4%	2.1%	75%	-13%	14%	0%	0%
DS of Cedar Glen Road	110	26.8%	-23.8%	-2.1%	1.0%	-3.3%	2.1%	75%	-13%	14%	0%	0%
DS of HWY 36 (E)	123	26.8%	-23.8%	-2.0%	-0.4%	-3.4%	2.2%	75%	-13%	14%	0%	0%
DS of Herons Landing	130	26.8%	-23.8%	-2.0%	1.0%	-3.5%	2.2%	75%	-13%	13%	0%	0%
DS of Herons Landing 2	150	26.8%	-23.7%	-1.8%	1.0%	-3.3%	2.4%	76%	-13%	13%	0%	0%
	Minimum =	*26.8%*	*-24.7%*	*-2.1%*	*-0.4%*	*-3.5%*	*2.1%*	*73.8%*	*-12.7%*	*13.2%*	*-0.1%*	*-0.1%*
	Average =	*27.0%*	*-23.9%*	*-1.9%*	*0.8%*	*-3.3%*	*2.2%*	*75.0%*	*-12.6%*	*13.6%*	*0.0%*	*0.0%*
	Maximum =	*27.6%*	*-23.6%*	*-1.6%*	*1.2%*	*-2.9%*	*2.4%*	*75.8%*	*-12.5%*	*14.1%*	*0.0%*	*0.0%*

Appendix D
Subcatchment Maps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LL 287.272894
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300
2300
C' 275.549988
MM 274.381012
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100
Subcatchments
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0.15
0
0.3 km
N
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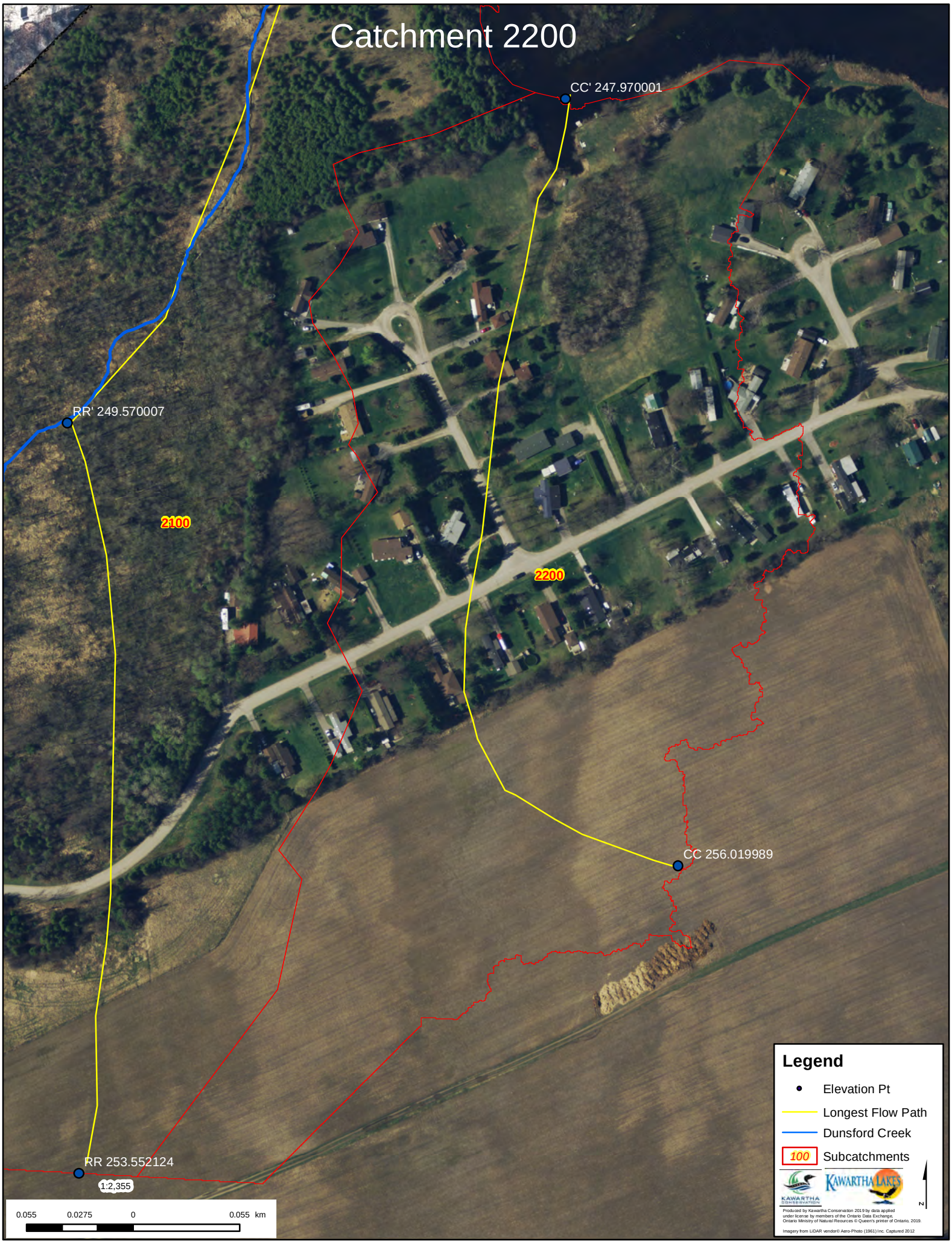
Catchment 2200
CC' 247.970001
RR' 249.570007
2100
2200
CC 256.019989
RR 253.552124
1:2,355
0.055
0.0275
0
0.055 km
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100
Subcatchments
N
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Catchment 2100
1600
1700
1800
1900
2000
2100
2200
BB' 248.589996
UU' 248.589996
VV 248.210007
QQ 248.050003
CC' 247.970001
RR' 249.570007
HH 251.839996
CC 256.019989
RR 253.552124
1:3,832
0.1 0.05 0 0.1 km
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100 Subcatchments
N
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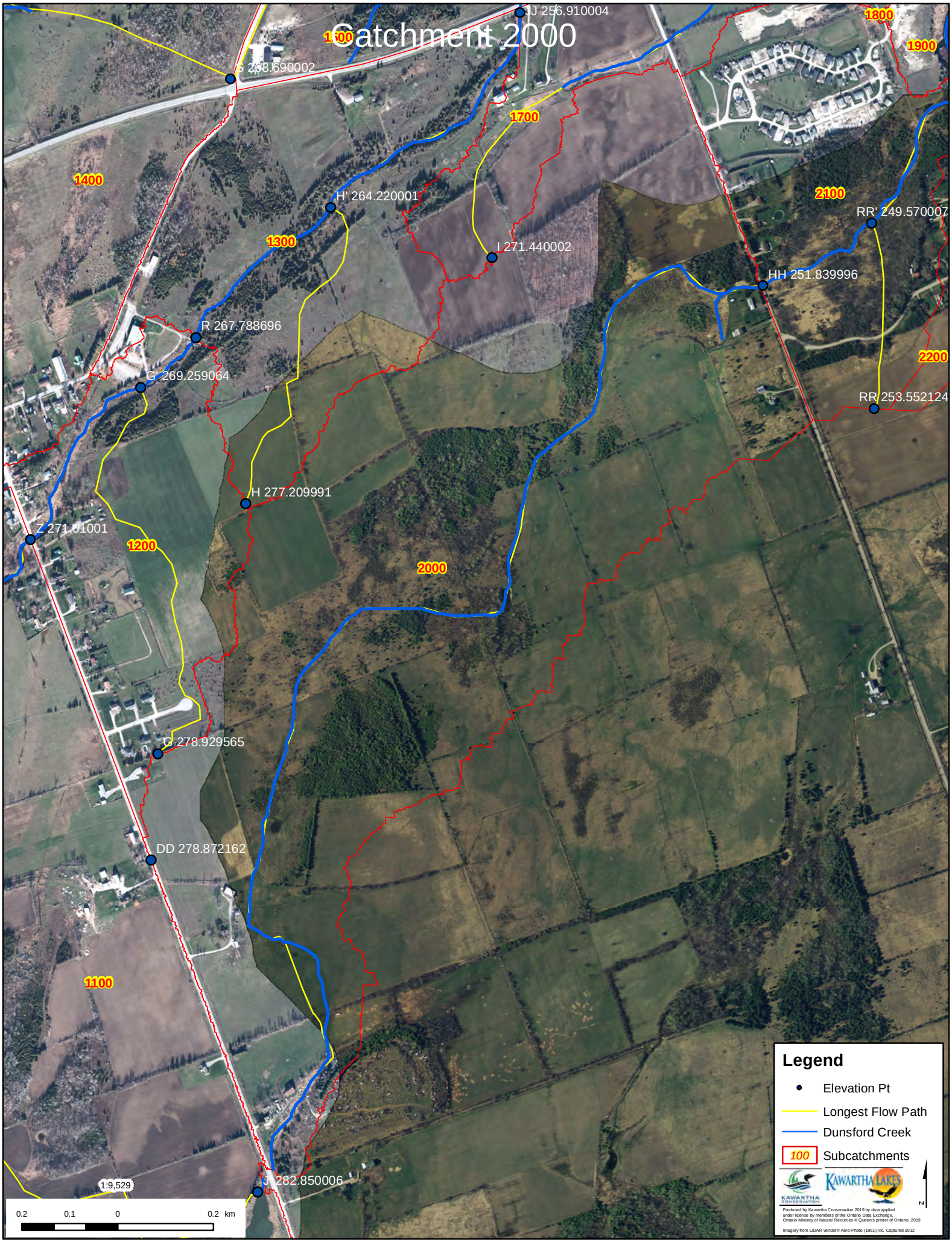
Catchment 2000
J 256.910004
S 268.690002
H' 264.220001
I 271.440002
R 267.788696
G 269.259064
H 277.209991
Z 271.01001
G' 278.929565
DD 278.872162
J' 282.850006
RR' 249.570007
HH 251.839996
RR 253.552124
1800
1900
1700
1400
2100
1300
2200
2000
1200
1100
1:9,529
0.2 0.1 0 0.2 km
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100 Subcatchments
N
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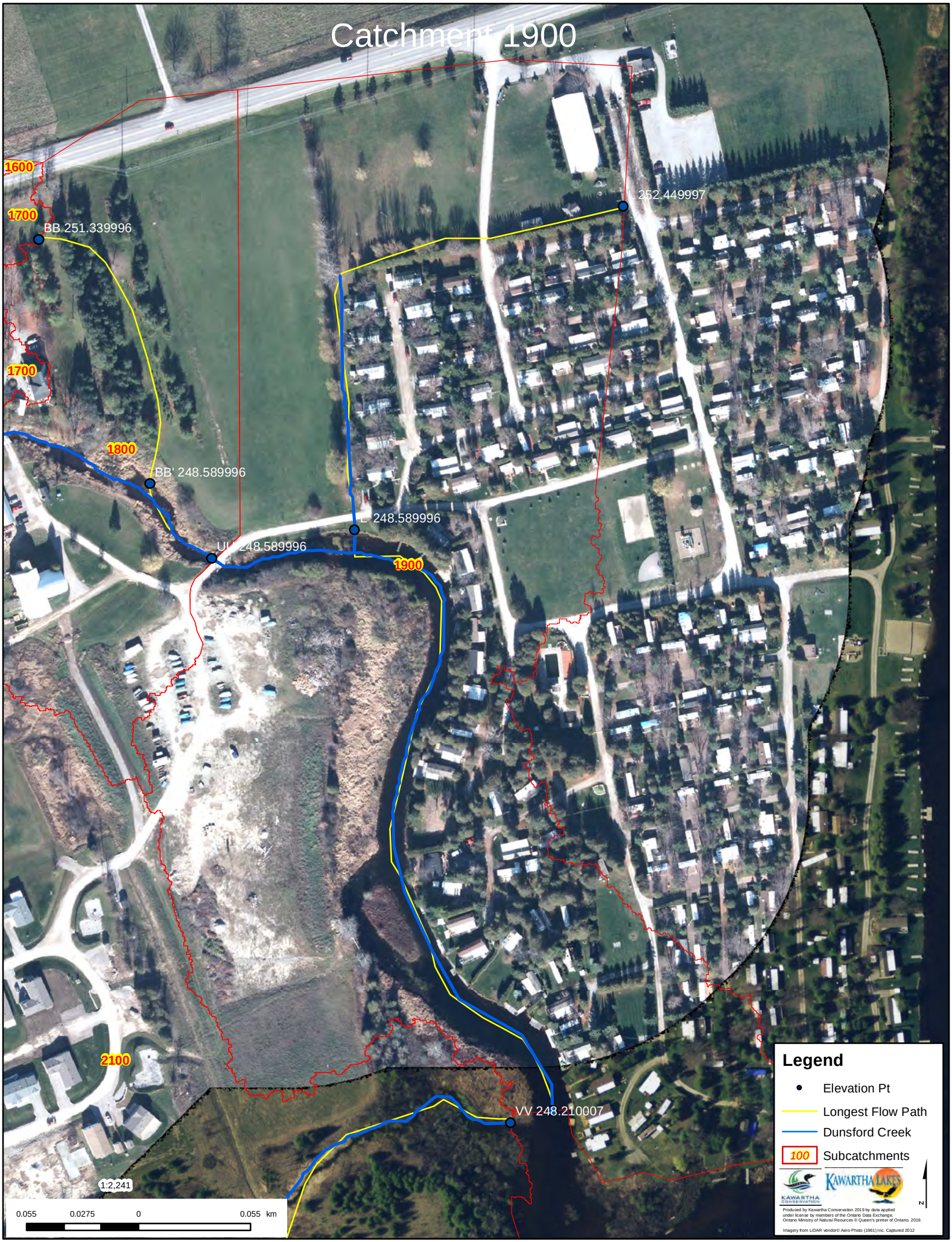
Catchment 1900
1600
1700
BB 251.339996
252.449997
1700
1800
BB' 248.589996
248.589996
248.589996
1900
2100
VV 248.210007
1:2,241
0.055
0.0275
0
0.055 km
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100
Subcatchments
N
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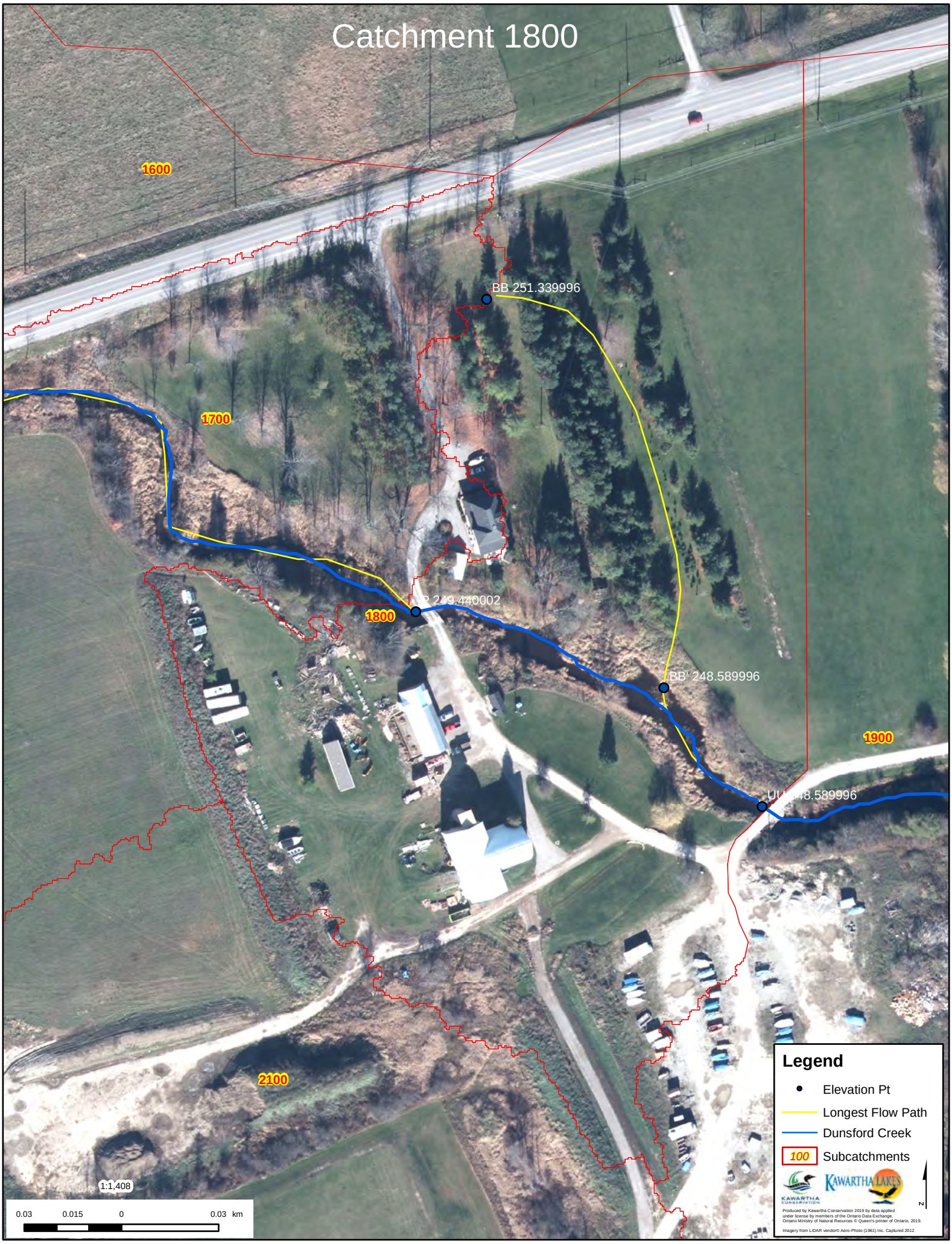
Catchment 1800
1600
1700
1800
1900
2100
BB 251.339996
BB' 248.589996
1:1,408
0.03 0.015 0 0.03 km
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100 Subcatchments
N
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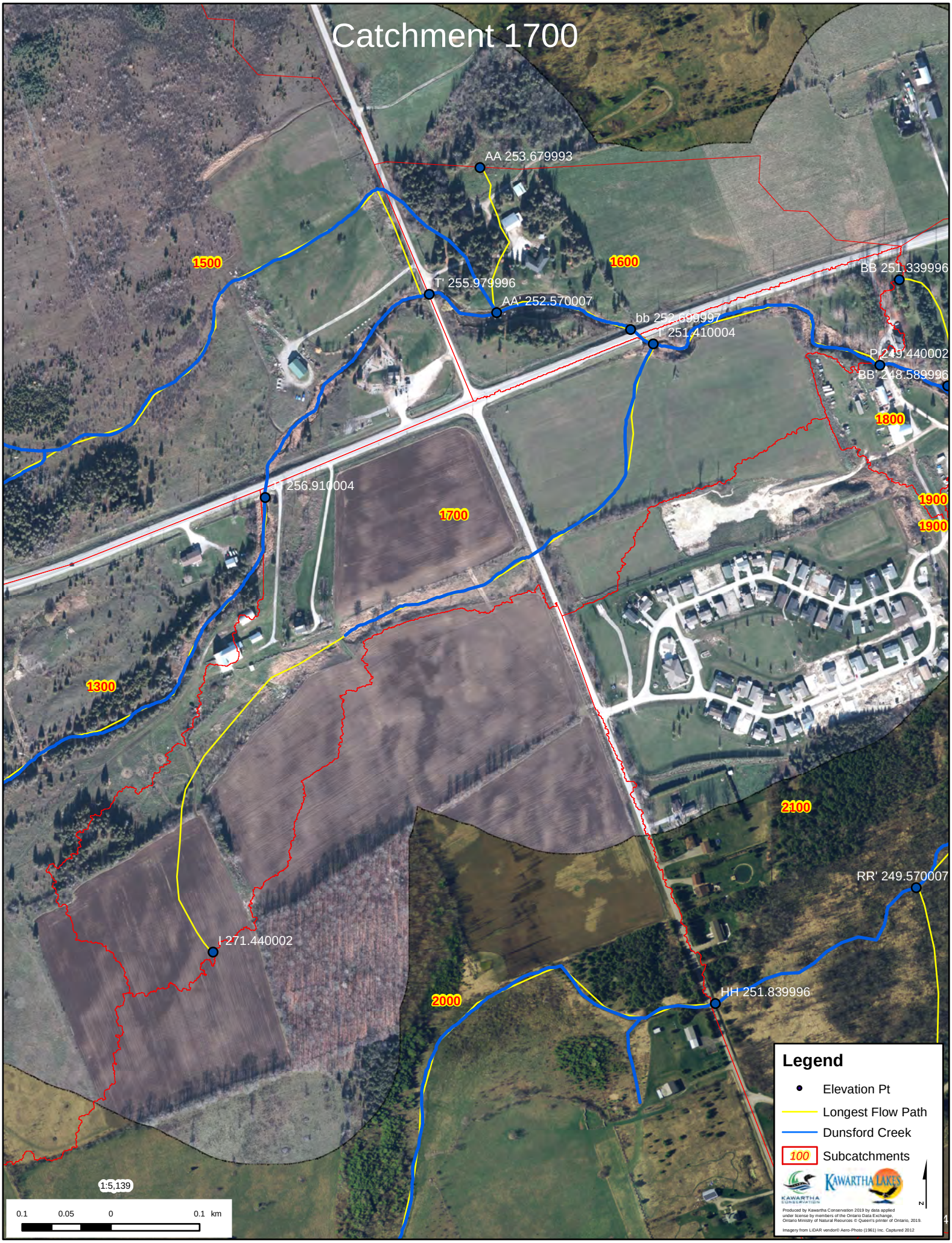
Catchment 1700
AA 253.679993
1500
1600
T' 255.979996
AA' 252.570007
BB 251.339996
bb 252.
T 251.410004
P 249.440002
BB' 248.589996
1800
1900
1900
1700
1300
2100
RR' 249.570007
I 271.440002
HH 251.839996
2000
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100
Subcatchments
1:5,139
0.1 0.05 0 0.1 km
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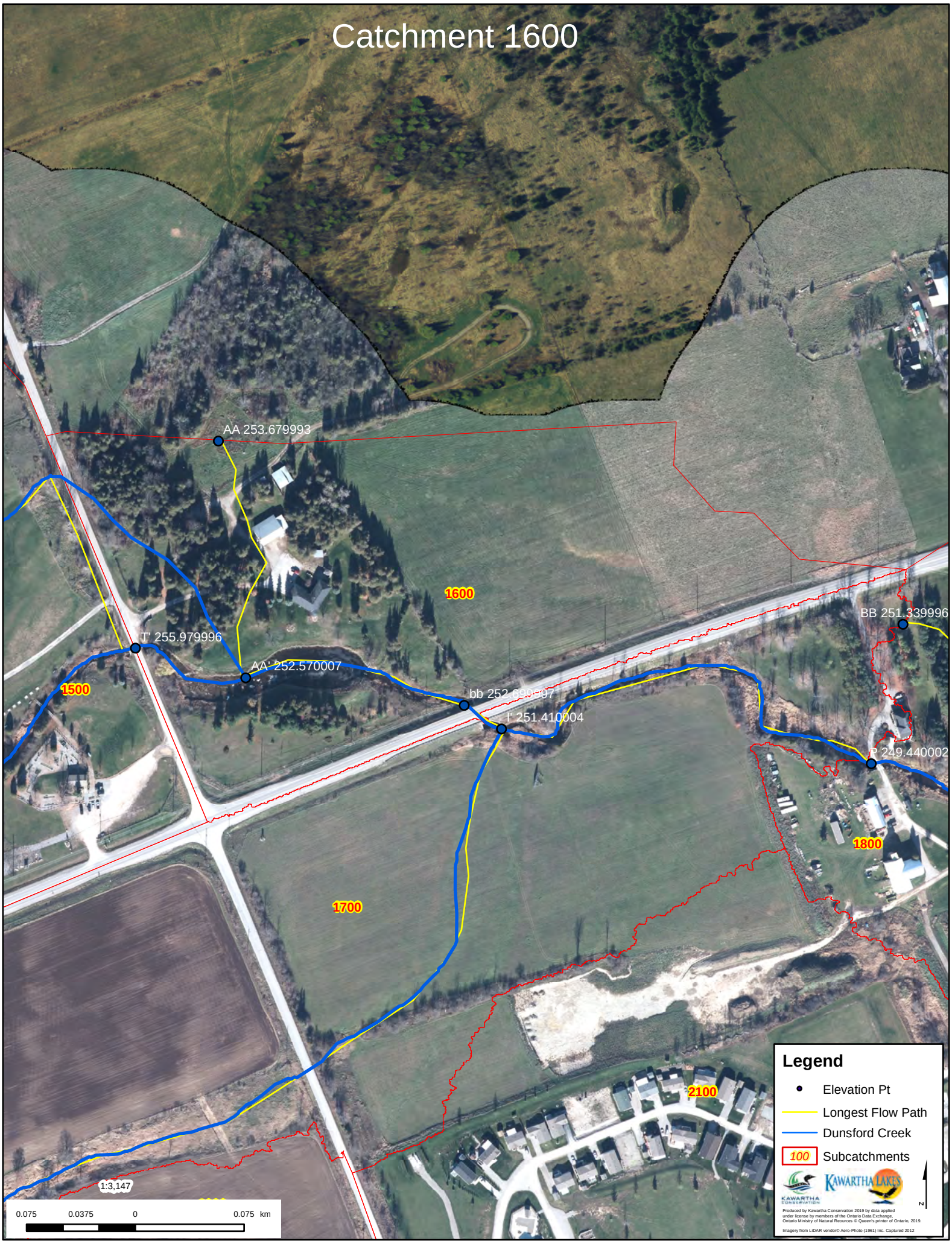
Catchment 1600
AA 253.679993
1600
T' 255.979996
AA' 252.570007
1500
bb 252.699997
I' 251.410004
BB 251.339996
P 249.440002
1800
1700
2100
1:3,147
0.075 0.0375 0 0.075 km
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100 Subcatchments
N
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Catchment 1500
1400
1500
1600
1700
1300
AA 253.679993
T' 255.979996
AA' 252.570007
TT 267.320007
256.910004
268.690002
1:4,403
0.1 0.05 0 0.1 km
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100 Subcatchments
N
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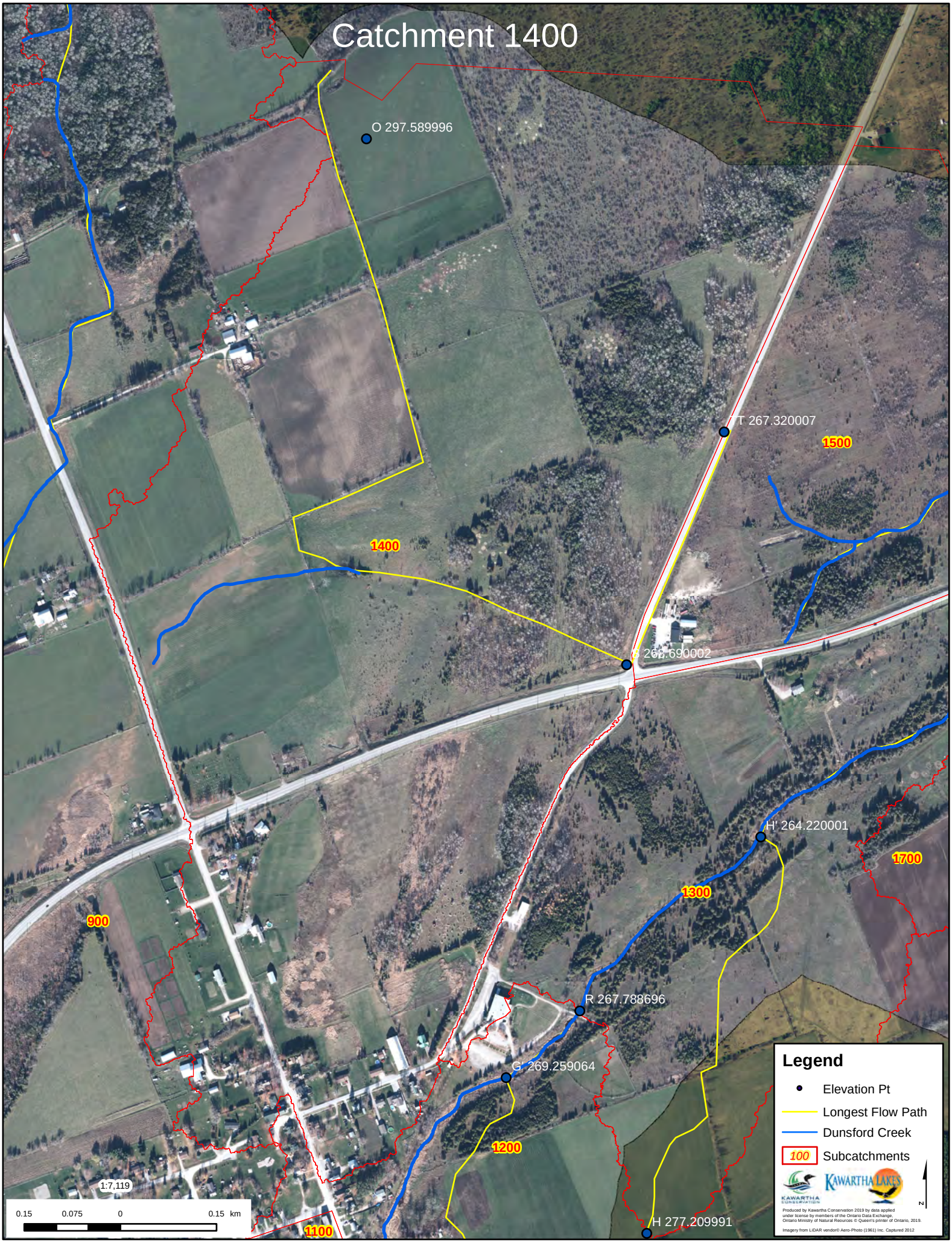
Catchment 1400
O 297.589996
T 267.320007
1500
1400
S 268.690002
H' 264.220001
1700
1300
900
R 267.788696
G' 269.259064
1200
1100
H 277.209991
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100
Subcatchments
1:7,119
0.15 0.075 0 0.15 km
N
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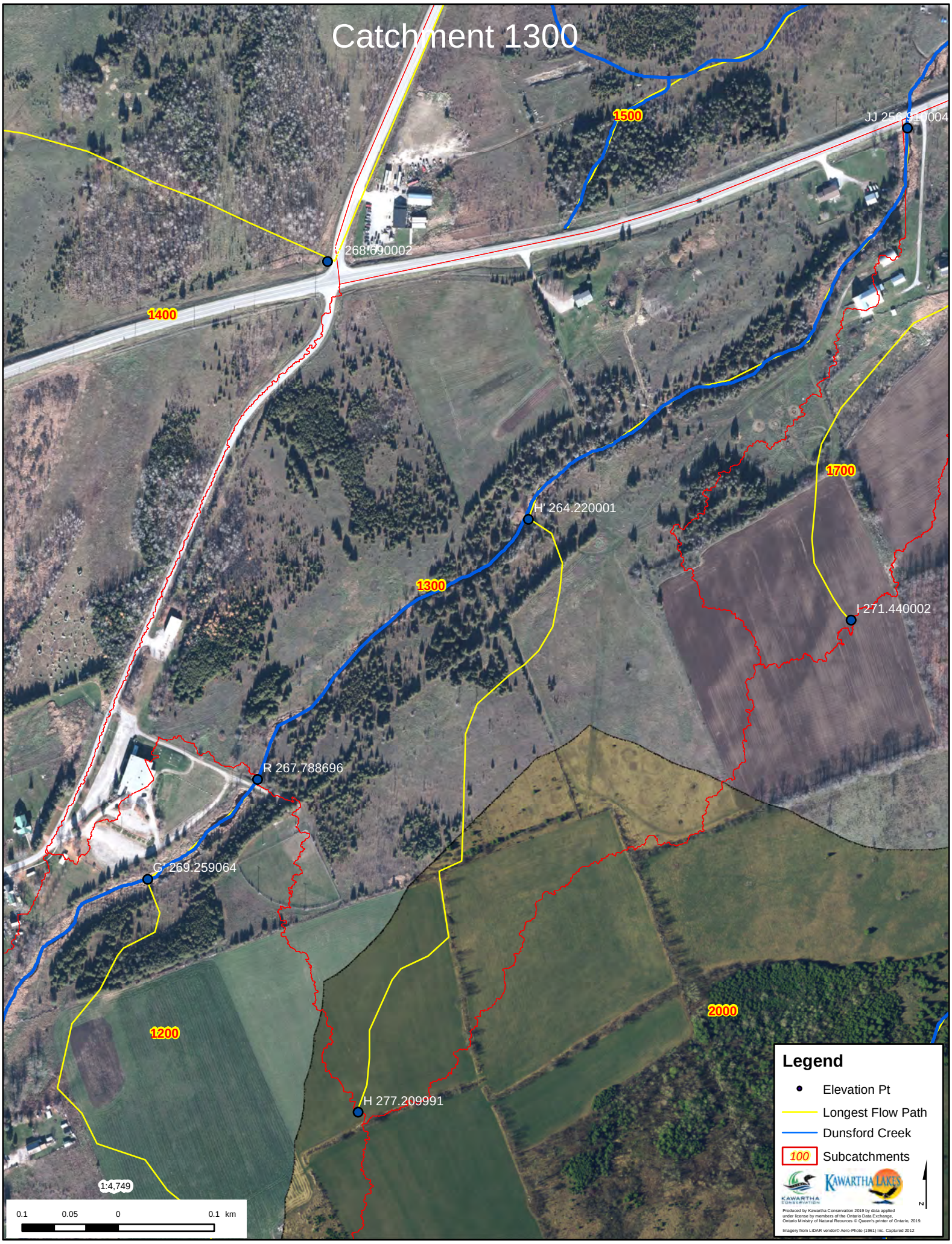
Catchment 1300
1500
1400
1700
1300
1200
2000
268.090002
H' 264.220001
I 271.440002
R 267.788696
G 269.259064
H 277.209991
1:4,749
0.1 0.05 0 0.1 km
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100 Subcatchments
N
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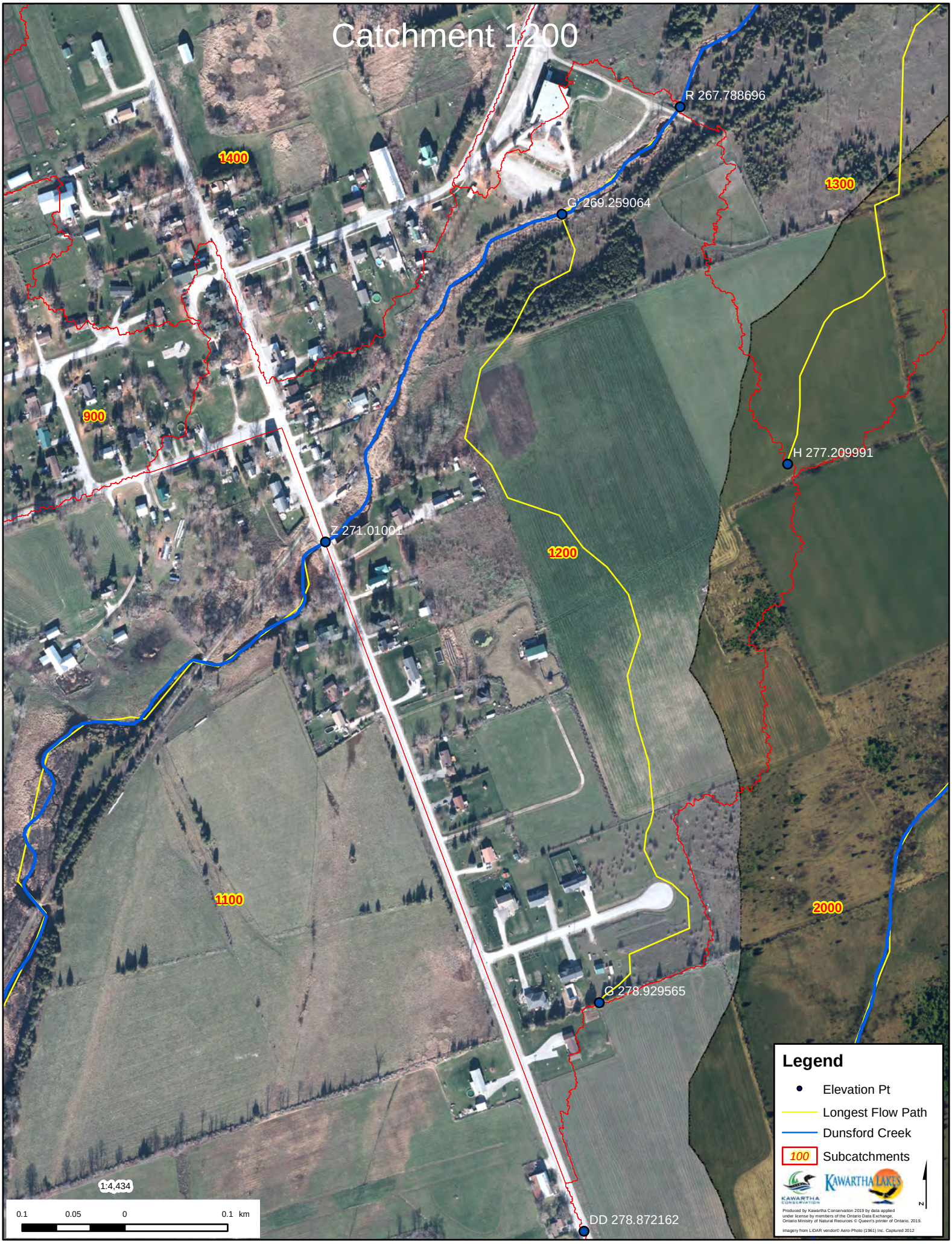
Catchment 1200
R 267.788696
G 269.259064
H 277.209991
Z 271.01001
G 278.929565
DD 278.872162
1400
1300
900
1200
1100
2000
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100
Subcatchments
1:4,434
0.1 0.05 0 0.1 km
N
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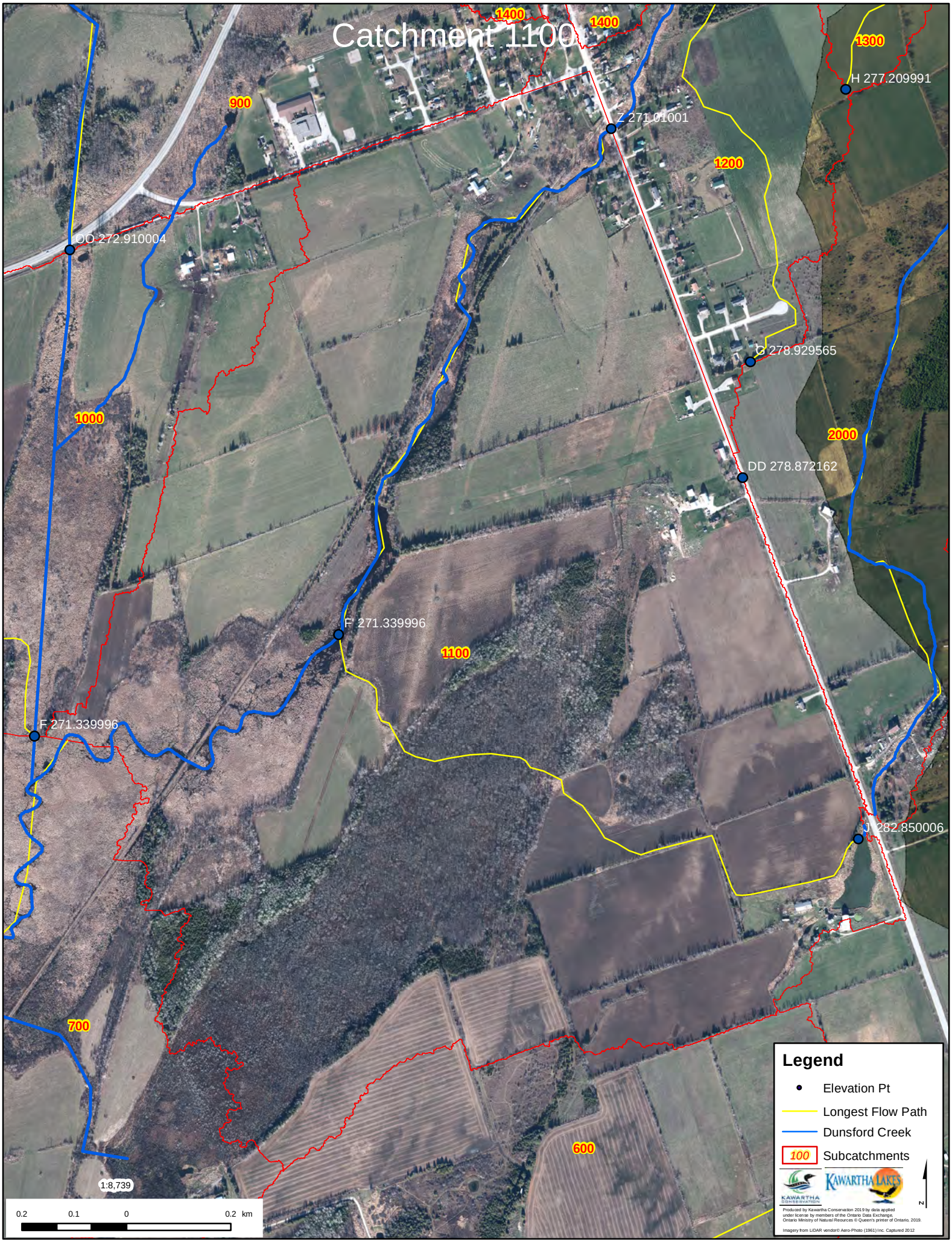
Catchment 1100
1400
1400
1300
H 277.209991
900
Z 271.01001
1200
OO 272.910004
G 278.929565
1000
2000
DD 278.872162
F' 271.339996
1100
F 271.339996
282.850006
700
600
1:8,739
0.2 0.1 0 0.2 km
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100 Subcatchments
N
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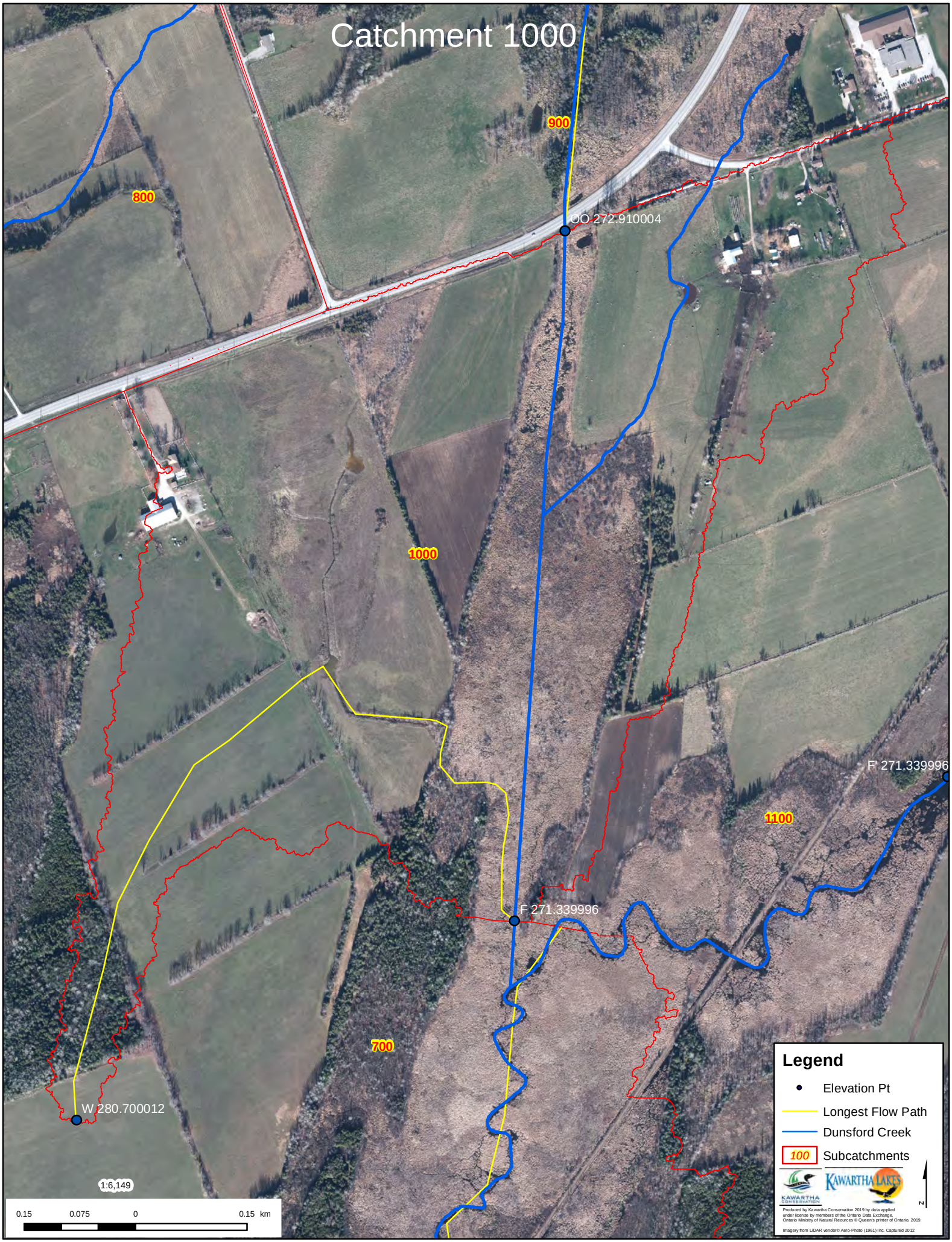
Catchment 1000
900
800
OO 272.910004
1000
F 271.339996
1100
F 271.339996
700
W 280.700012
1:6,149
0.15 0.075 0 0.15 km
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100 Subcatchments
N
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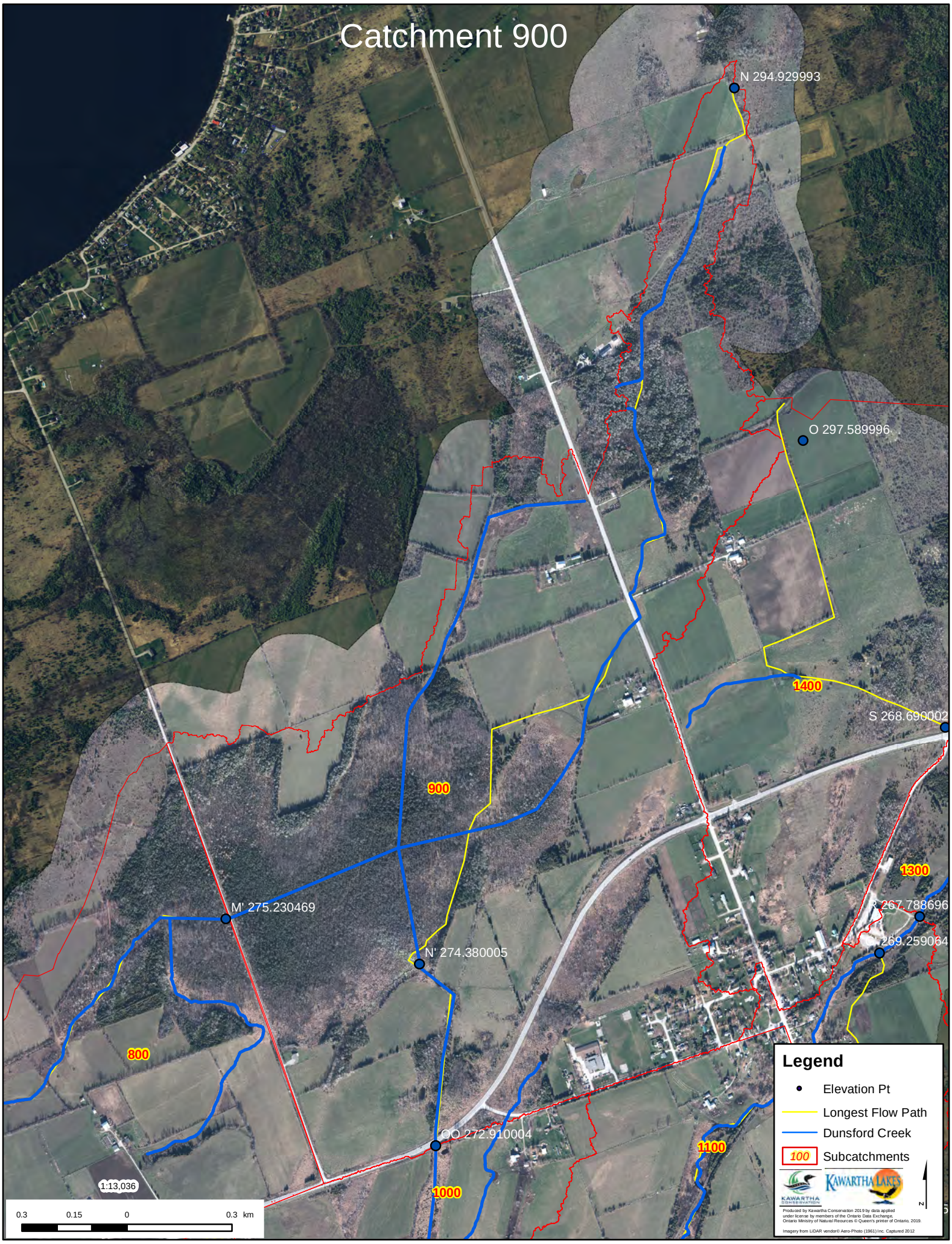
Catchment 900
N 294.929993
O 297.589996
1400
S 268.690002
900
1300
M' 275.230469
N' 274.380005
800
OO 272.910004
1100
1000
1:13,036
0.3 0.15 0 0.3 km
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100 Subcatchments
KAWARTHA LAKES
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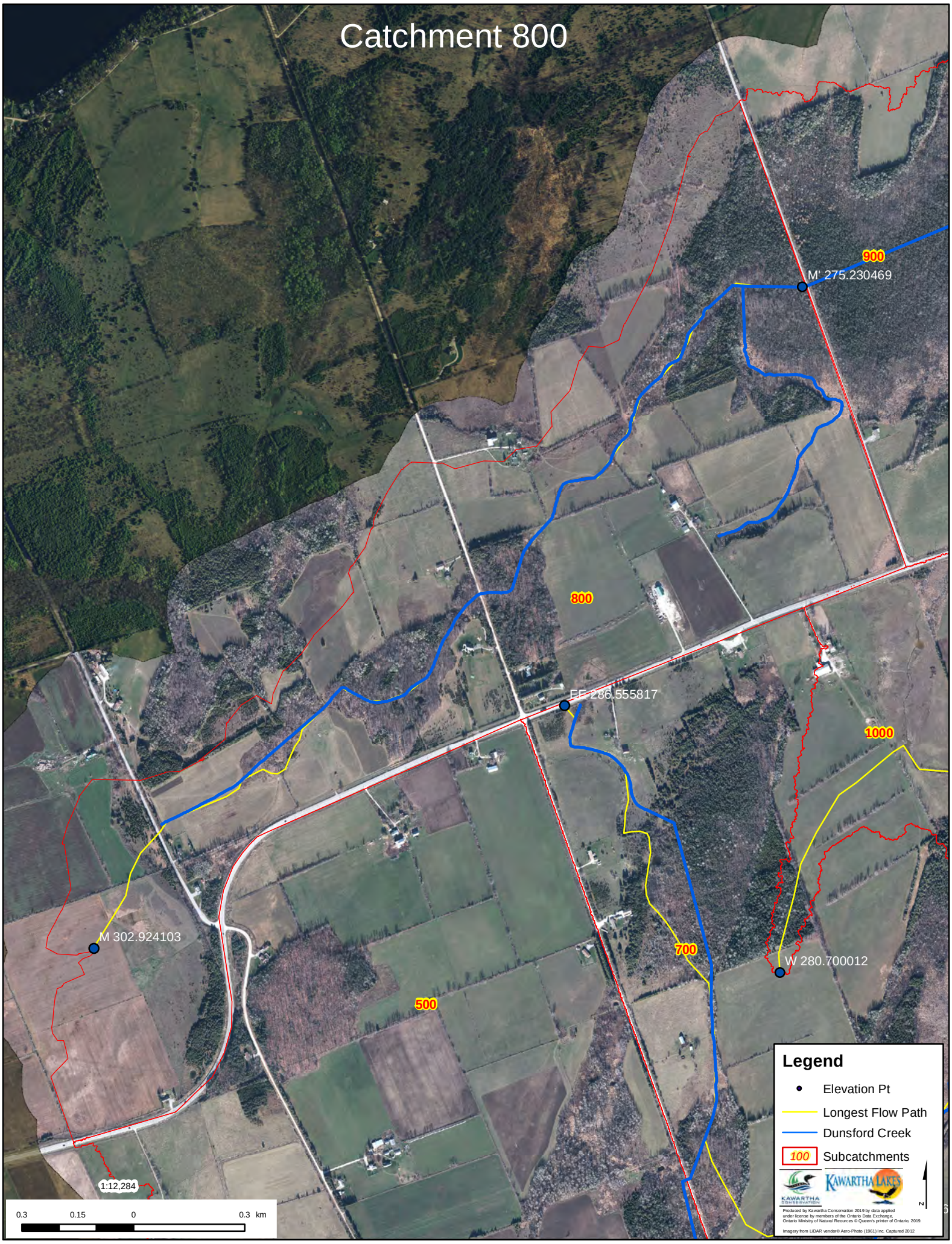
Catchment 800
900
M: 275.230469
800
EE: 286.555817
1000
M 302.924103
700
W 280.700012
500
1:12,284
0.3 0.15 0 0.3 km
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100 Subcatchments
N
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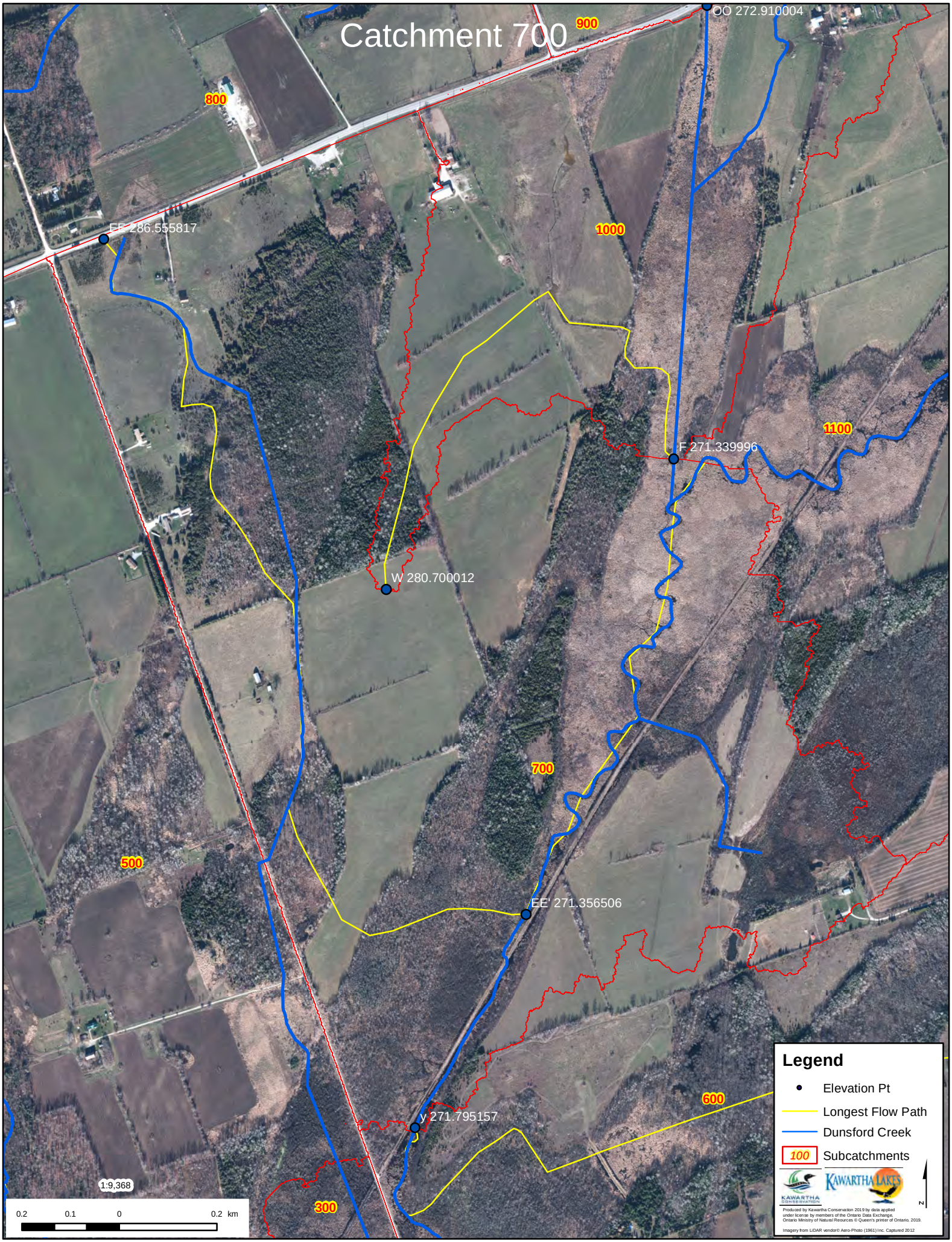
Catchment 700
900
800
1000
1100
700
500
600
300
OO 272.910004
EE 286.555817
F 271.339996
W 280.700012
EE' 271.356506
y 271.795157
1:9,368
0.2 0.1 0 0.2 km
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100 Subcatchments
N
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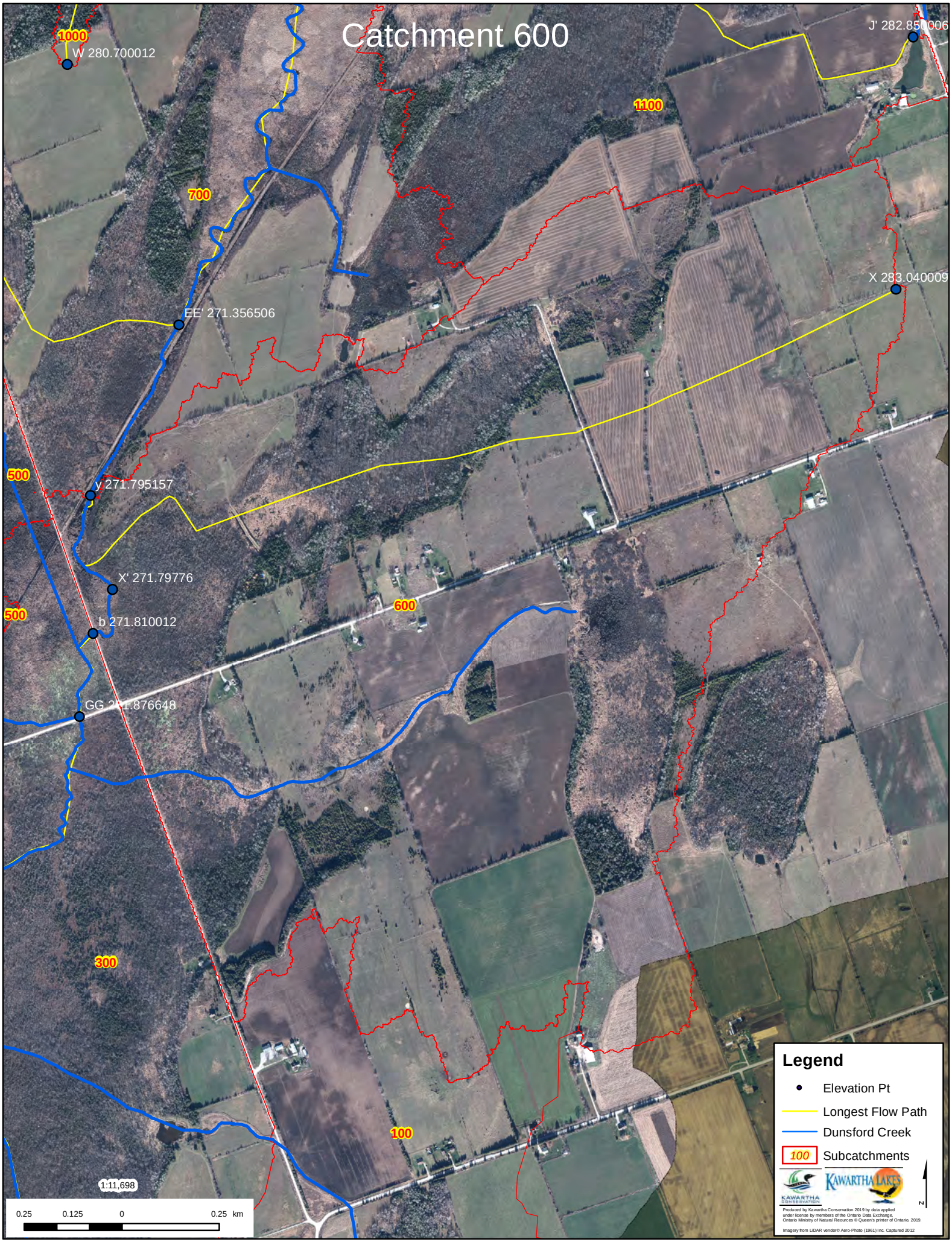
Catchment 600
1000
W 280.700012
J' 282.850006
1100
700
X 283.040009
EE' 271.356506
500
y 271.795157
X' 271.79776
500
600
b 271.810012
GG 271.876648
300
100
1:11,698
0.25 0.125 0 0.25 km
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100 Subcatchments
N
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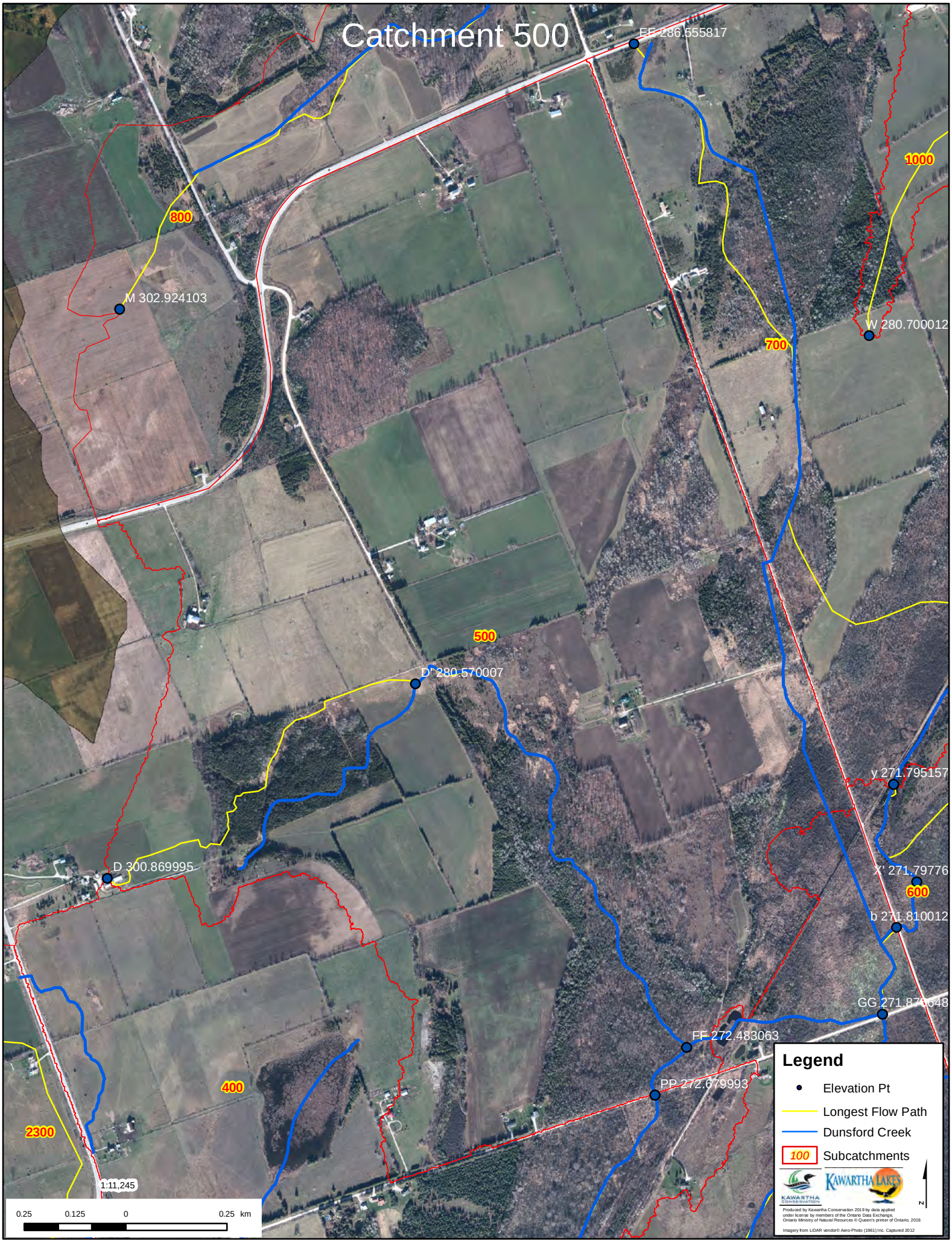
Catchment 500
FF 286.555817
1000
800
M 302.924103
W 280.700012
700
500
D' 280.570007
y 271.795157
D 300.869995
x' 271.79776
600
b 271.810012
GG 271.876548
FF 272.483063
PP 272.679993
400
2300
1:11,245
0.25 0.125 0 0.25 km
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100 Subcatchments
KAWARTHA CONSERVATION
KAWARTHA LAKES
N
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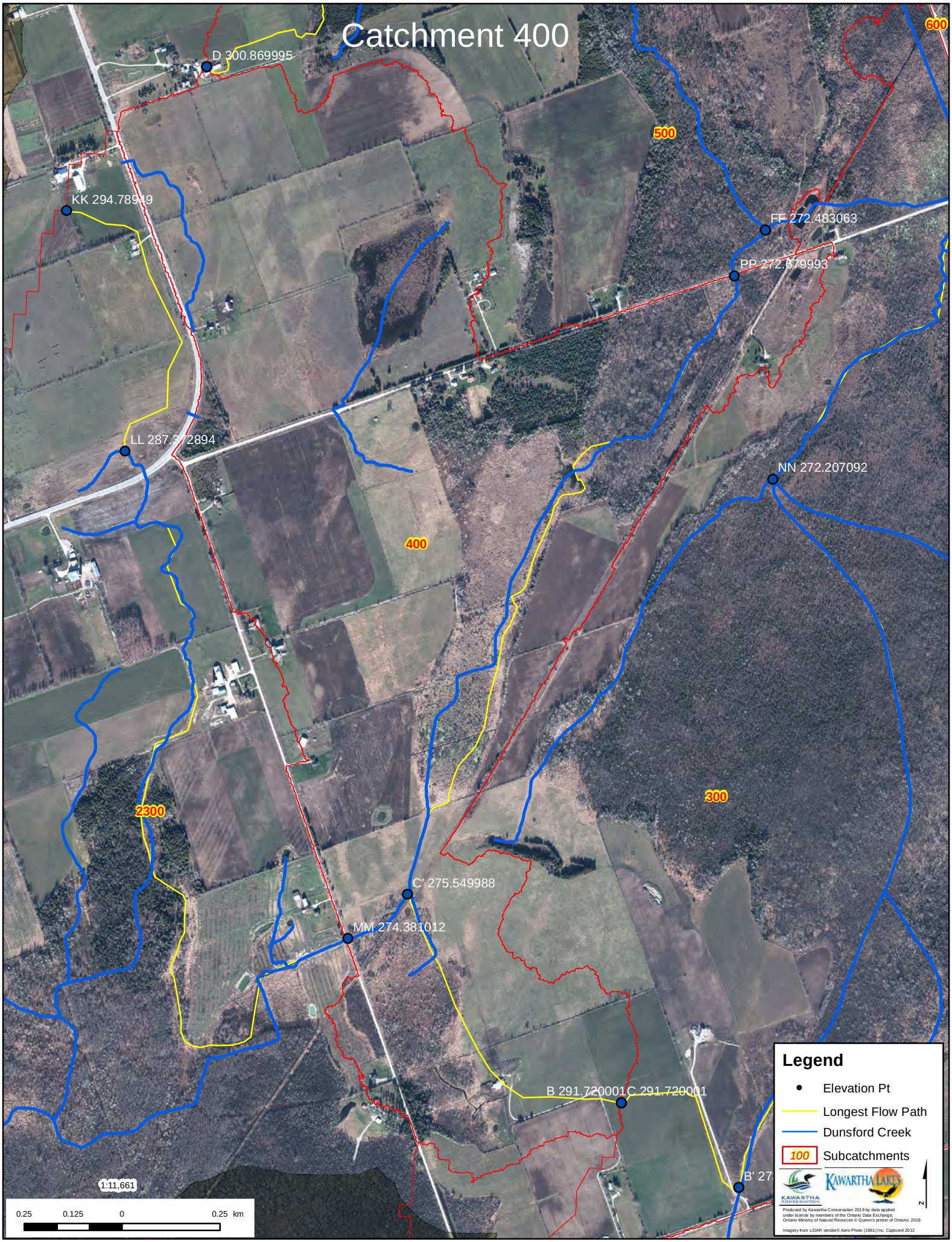
Catchment 400
D 300.869995
KK 294.789429
LL 287.372894
FF 272.483063
PP 272.879993
NN 272.207092
C' 275.549988
MM 274.381012
B 291.720001
C 291.720001
B' 27
600
500
400
300
2300
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100
Subcatchments
1:11,661
0.25 0.125 0 0.25 km
N
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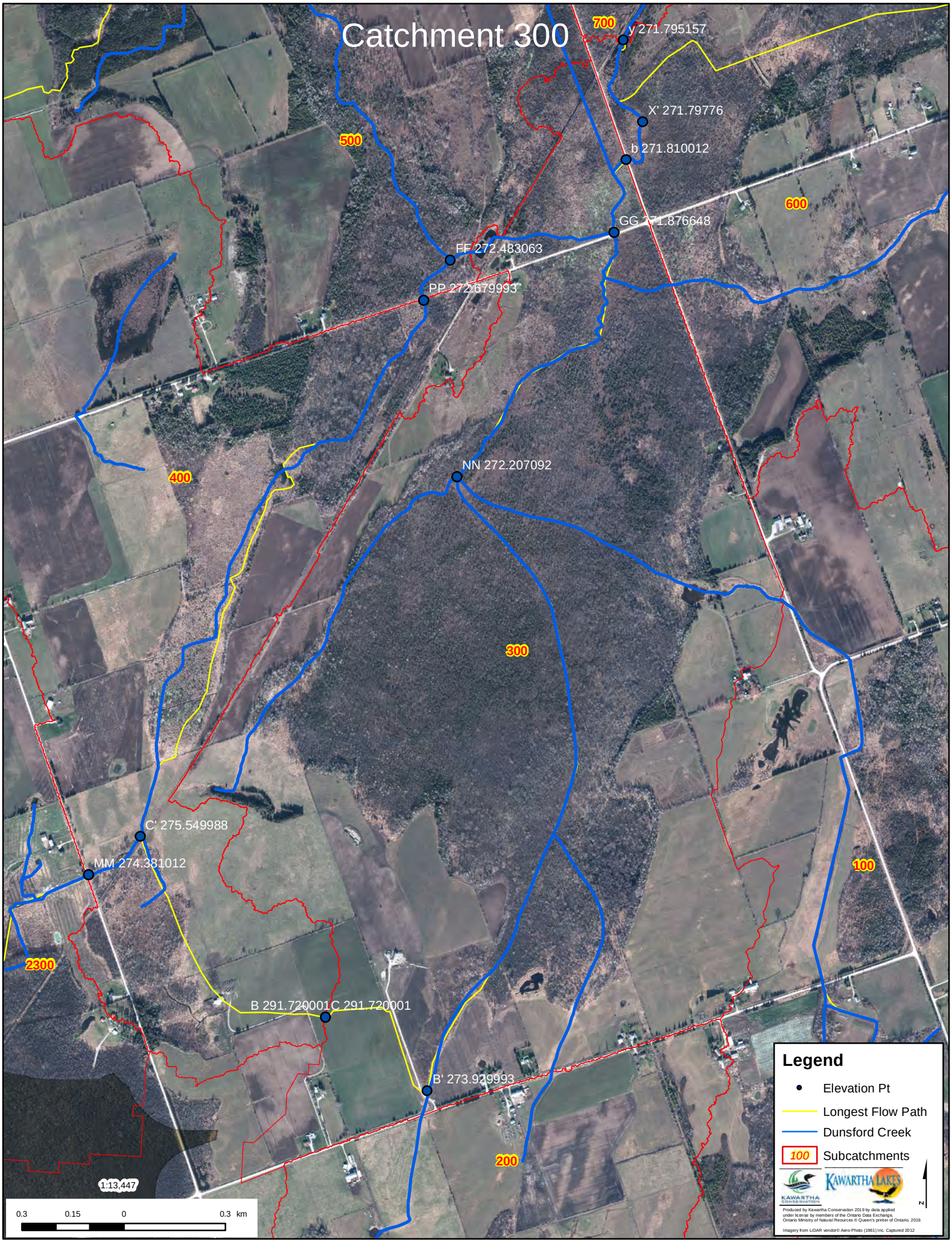
Catchment 300
700
y 271.795157
X' 271.79776
500
b 271.810012
600
GG 271.876648
FF 272.483063
PP 272.679993
NN 272.207092
400
300
C' 275.549988
MM 274.381012
100
2300
B 291.720001C 291.720001
B' 273.929993
200
1:13,447
0.3 0.15 0 0.3 km
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100 Subcatchments
N
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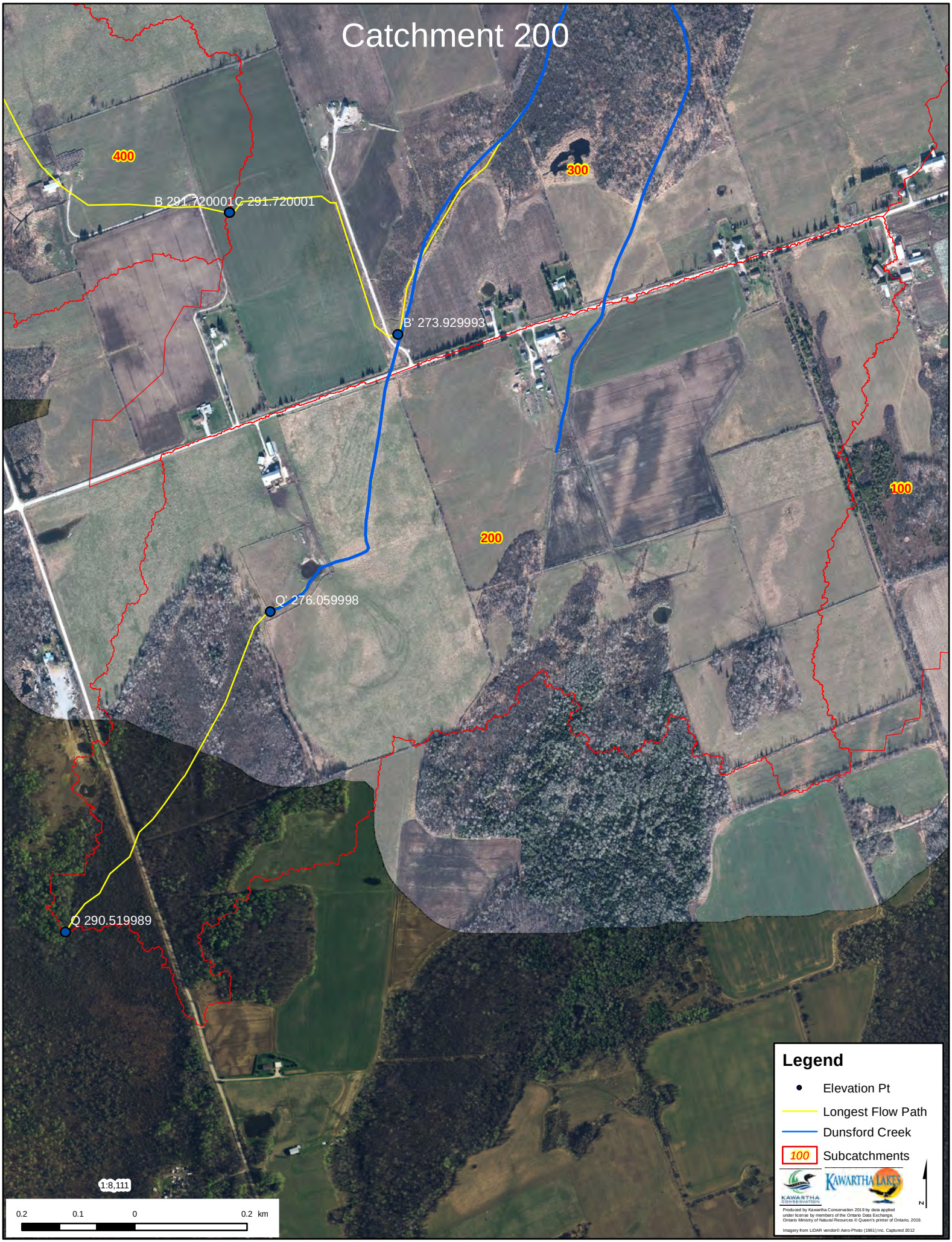
Catchment 200
400
300
100
200
B 291.720001
C 291.720001
B' 273.929993
O' 276.059998
O 290.519989
1:8,111
0.2 0.1 0 0.2 km
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100 Subcatchments
N
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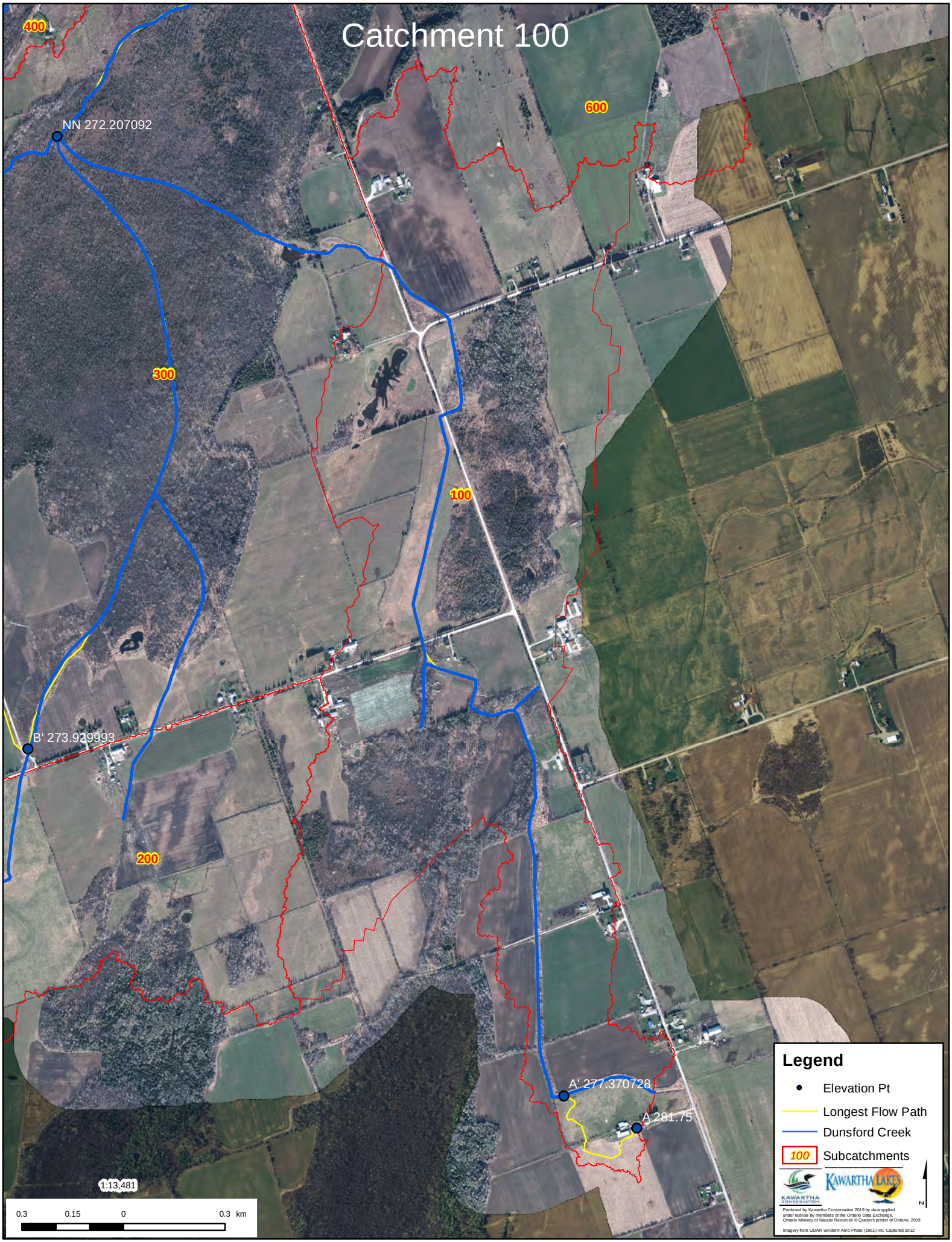
Catchment 100
400
600
300
100
200
NN 272.207092
B' 273.929993
A' 277.370728
A 281.75
1:13,481
0.3 0.15 0 0.3 km
Legend
Elevation Pt
Longest Flow Path
Dunsford Creek
100 Subcatchments
N
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Appendix E
VH Suite Output

```
================================================================================
========================

      V    V   I    SSSSS  U   U    A    L
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\VO Suite 3.0\VO2\voin.dat

  Output  filename: C:\Users\GAL -
Kevin\AppData\Local\Temp\bec36a0b-9f64-4d7f-a130-73c3067dc7e8\Scenario.out

  Summary filename: C:\Users\GAL -
Kevin\AppData\Local\Temp\bec36a0b-9f64-4d7f-a130-73c3067dc7e8\Scenario.sum


DATE: 04/01/2019                                TIME: 02:49:31

USER:


COMMENTS: ____________________________________________________________

--------------------------------------------------------------------------------
------------------------
  ***************************
  ** SIMULATION NUMBER:   0 **
  ***************************


--------------------
|    READ STORM    |    Filename: C:\Users\GAL - Kevin\AppD
|                  |              ata\Local\Temp\
|                  |              bec36a0b-9f64-4d7f-a130-73c3067dc7e8\486ab9ab
| Ptotal= 89.80 mm |    Comments: 100 year SCS 6hour storm   mm/hr
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.00	1.83	7.20	3.50	28.70	5.17	5.40
0.33	3.60	2.00	7.20	3.67	28.70	5.33	5.40
0.50	3.60	2.17	7.20	3.83	10.80	5.50	5.40
0.67	3.60	2.33	10.80	4.00	10.80	5.67	5.40
0.83	5.40	2.50	10.80	4.17	10.80	5.83	3.60
1.00	5.40	2.67	10.80	4.33	7.20	6.00	3.60
1.17	5.40	2.83	86.10	4.50	7.20	6.17	3.60
1.33	5.40	3.00	86.10	4.67	7.20		

1.50	5.40	3.17	86.10	4.83	5.40
1.67	5.40	3.33	28.70	5.00	5.40

CALIB			
NASHYD (0100)	Area (ha)= 197.60	Curve Number (CN)= 67.0	
ID= 1 DT=10.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 2.63		

Unit Hyd Qpeak (cms)= 2.870

PEAK FLOW (cms)= 3.421 (i)
TIME TO PEAK (hrs)= 6.333
RUNOFF VOLUME (mm)= 34.259
TOTAL RAINFALL (mm)= 89.800
RUNOFF COEFFICIENT = 0.381

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ROUTE CHN (****)	
IN= 2---> OUT= 1	Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	277.27	0.1000	
332.34	275.59	0.1000 /0.0500	Main Channel
352.82	273.81	0.0500	Main Channel
365.19	273.82	0.0500	Main Channel
387.54	274.15	0.0500	Main Channel
399.23	275.75	0.0500 /0.1000	Main Channel
500.73	277.20	0.1000	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.18	273.99	.351E+04	0.8	0.24	73.47
0.36	274.17	.976E+04	3.3	0.37	48.89
0.53	274.34	.175E+05	8.3	0.51	35.01
0.71	274.52	.259E+05	15.2	0.63	28.39
0.89	274.70	.349E+05	23.9	0.73	24.39
1.07	274.88	.446E+05	34.3	0.82	21.66
1.25	275.06	.548E+05	46.5	0.91	19.66
1.42	275.23	.658E+05	60.5	0.99	18.11
1.60	275.41	.774E+05	76.4	1.06	16.86
1.78	275.59	.896E+05	94.2	1.13	15.84
1.96	275.77	.106E+06	116.5	1.18	15.12
2.14	275.95	.130E+06	143.5	1.18	15.11
2.32	276.13	.164E+06	175.1	1.15	15.58
2.50	276.31	.207E+06	212.2	1.10	16.22
2.67	276.48	.258E+06	255.6	1.06	16.86
2.85	276.66	.320E+06	305.9	1.02	17.42
3.03	276.84	.390E+06	363.8	1.00	17.87
3.21	277.02	.469E+06	429.9	0.98	18.20
3.39	277.20	.558E+06	504.8	0.97	18.43

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0100)	197.60	3.42	6.33	34.26	0.36	0.37

OUTFLOW: ID= 1 (****)	197.60	3.27	6.83	34.26	0.35	0.36

CALIB NASHYD (0200) ID= 1 DT=10.0 min	Area (ha)= 107.20	Curve Number (CN)= 68.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.87	

Unit Hyd Qpeak (cms)= 4.706

PEAK FLOW (cms)= 4.295 (i)
TIME TO PEAK (hrs)= 4.000
RUNOFF VOLUME (mm)= 35.190
TOTAL RAINFALL (mm)= 89.800
RUNOFF COEFFICIENT = 0.392

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ROUTE CHN (****) IN= 2---> OUT= 1	Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	279.83	0.1000	
204.39	277.60	0.0500	Main Channel
296.57	273.96	0.0500	Main Channel
461.97	273.75	0.0500	Main Channel
485.91	272.71	0.0500 /0.1000	Main Channel
798.40	272.85	0.1000	
877.72	273.64	0.1000	
1006.81	276.74	0.1000	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.21	272.92	.916E+05	3.6	0.08	429.52
0.42	273.13	.237E+06	16.5	0.14	238.88
0.64	273.35	.393E+06	36.9	0.19	177.74
0.85	273.56	.561E+06	64.0	0.23	145.94
1.06	273.77	.739E+06	97.5	0.27	126.27
1.27	273.98	.964E+06	140.8	0.30	114.14
1.48	274.19	.122E+07	202.9	0.34	100.49
1.70	274.41	.149E+07	277.8	0.38	89.31
1.91	274.62	.176E+07	364.6	0.42	80.46
2.12	274.83	.204E+07	462.6	0.46	73.42
2.33	275.04	.232E+07	571.4	0.50	67.71
2.55	275.26	.261E+07	690.7	0.54	63.00
2.76	275.47	.291E+07	820.5	0.57	59.05
2.97	275.68	.321E+07	960.4	0.61	55.69
3.18	275.89	.352E+07	1110.4	0.64	52.79
3.39	276.10	.383E+07	1270.5	0.67	50.26
3.61	276.32	.415E+07	1440.5	0.70	48.03
3.82	276.53	.448E+07	1620.5	0.73	46.05
4.03	276.74	.481E+07	1810.4	0.76	44.28

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0200)	107.20	4.30	4.00	35.19	0.22	0.08

OUTFLOW: ID= 1 (****)	107.20	1.01	6.50	35.17	0.06	0.08

ADD HYD (0020)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (****):	197.60	3.270	6.83	34.26
+ ID2= 2 (****):	107.20	1.015	6.50	35.17
ID = 3 (0020):	304.80	4.277	6.83	34.58

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (****)
IN= 2---> OUT= 1

Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	273.19	0.1000	
89.61	271.91	0.1000 /0.0500	Main Channel
138.71	271.70	0.0500	Main Channel
184.80	271.75	0.0500 /0.1000	Main Channel
266.32	271.80	0.1000	
367.88	271.93	0.1000	
520.40	272.09	0.1000	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.02	271.72	.159E+03	0.0	0.01	******
0.03	271.73	.634E+03	0.0	0.02	694.13
0.05	271.75	.143E+04	0.0	0.03	529.62
0.07	271.77	.306E+04	0.1	0.04	405.42
0.09	271.79	.551E+04	0.3	0.04	365.74
0.11	271.81	.873E+04	0.4	0.05	336.92
0.13	271.83	.124E+05	0.7	0.05	310.09
0.16	271.86	.166E+05	1.0	0.06	288.06
0.18	271.88	.211E+05	1.3	0.06	269.92
0.20	271.90	.262E+05	1.7	0.06	254.75
0.22	271.92	.317E+05	2.2	0.07	239.31
0.24	271.94	.376E+05	2.8	0.07	224.81
0.26	271.96	.439E+05	3.4	0.08	213.43
0.28	271.98	.507E+05	4.1	0.08	203.95
0.30	272.00	.579E+05	4.9	0.08	195.88
0.33	272.03	.656E+05	5.8	0.09	188.88
0.35	272.05	.738E+05	6.7	0.09	182.73
0.37	272.07	.824E+05	7.7	0.09	177.27
0.39	272.09	.915E+05	8.8	0.10	172.36

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0020)	304.80	4.28	6.83	34.58	0.29	0.08
OUTFLOW: ID= 1 (****)	304.80	2.59	8.83	34.56	0.23	0.07

```
| CALIB                |
| NASHYD    (0400)     |   Area     (ha)= 228.10   Curve Number    (CN)= 67.0
|ID= 1 DT=10.0 min     |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=   1.65

     Unit Hyd Qpeak  (cms)=   5.280

     PEAK FLOW       (cms)=   5.620 (i)
     TIME TO PEAK    (hrs)=   5.000
     RUNOFF VOLUME    (mm)=  34.258
     TOTAL RAINFALL   (mm)=  89.800
     RUNOFF COEFFICIENT    =   0.381

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| ROUTE CHN (****)   |
| IN= 2---> OUT= 1   |     Routing time step (min)'= 10.00
----------------------
              <------ DATA FOR SECTION (   1.1) ------>
             Distance      Elevation       Manning
                0.00         276.00        0.1000
               91.20         274.69        0.1000
              174.02         274.10        0.1000
              210.03         273.92        0.1000
              333.58         273.80   0.1000 /0.0500  Main Channel
              368.08         273.64        0.0500     Main Channel
              385.33         273.85   0.0500 /0.1000  Main Channel
              462.42         275.22        0.1000
              531.42         275.33        0.1000

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV       VOLUME     FLOW RATE     VELOCITY    TRAV.TIME
         (m)      (m)      (cu.m.)       (cms)         (m/s)       (min)
        0.08   273.72     .220E+03         0.1          0.07       54.86
        0.16   273.80     .880E+03         0.4          0.11       34.56
        0.25   273.89     .291E+04         1.6          0.13       29.37
        0.34   273.98     .663E+04         4.2          0.15       26.31
        0.43   274.07     .109E+05         8.0          0.17       22.70
        0.52   274.16     .157E+05        13.0          0.19       20.01
        0.61   274.25     .208E+05        19.2          0.21       18.01
        0.70   274.34     .263E+05        26.5          0.23       16.50
        0.79   274.43     .321E+05        34.9          0.25       15.32
        0.88   274.52     .383E+05        44.5          0.27       14.36
        0.97   274.61     .449E+05        55.2          0.28       13.57
        1.06   274.70     .519E+05        67.1          0.30       12.88
        1.15   274.79     .591E+05        80.7          0.32       12.21
        1.24   274.88     .666E+05        95.5          0.33       11.62
        1.33   274.97     .743E+05       111.4          0.35       11.11
        1.42   275.06     .822E+05       128.5          0.36       10.66
        1.51   275.15     .904E+05       146.8          0.38       10.26
        1.60   275.24     .989E+05       165.2          0.39        9.97
        1.69   275.33     .108E+06       183.2          0.39        9.85

                                    <---- hydrograph ---->   <-pipe / channel->
                                AREA    QPEAK    TPEAK   R.V.  MAX DEPTH  MAX VEL
                                (ha)    (cms)    (hrs)   (mm)     (m)       (m/s)
INFLOW : ID= 2 (0400)         228.10     5.62     5.00  34.26     0.37      0.15
OUTFLOW: ID= 1 (****)         228.10     5.32     5.50  34.26     0.37      0.15

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| CALIB            |
| NASHYD    (0500) |   Area     (ha)= 302.30   Curve Number    (CN)= 67.0
|ID= 1 DT=10.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.31

     Unit Hyd Qpeak  (cms)=   8.814

     PEAK FLOW       (cms)=   8.831 (i)
     TIME TO PEAK    (hrs)=   4.667
     RUNOFF VOLUME    (mm)=  34.258
     TOTAL RAINFALL   (mm)=  89.800
     RUNOFF COEFFICIENT   =   0.381

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (2300) |   Area     (ha)= 308.80   Curve Number    (CN)= 64.0
|ID= 1 DT=10.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.85

     Unit Hyd Qpeak  (cms)=   6.375

     PEAK FLOW       (cms)=   6.419 (i)
     TIME TO PEAK    (hrs)=   5.333
     RUNOFF VOLUME    (mm)=  31.585
     TOTAL RAINFALL   (mm)=  89.800
     RUNOFF COEFFICIENT   =   0.352

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| ROUTE CHN (****) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 10.00
--------------------

               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                  0.00         274.69         0.1000
                 82.82         274.10         0.1000
                118.83         273.92         0.1000
                242.38         273.80    0.1000 /0.0500  Main Channel
                276.88         273.64         0.0500      Main Channel
                294.13         273.85    0.0500 /0.1000  Main Channel
                371.22         275.22         0.1000
                440.22         275.33         0.1000

      <---------------------- TRAVEL TIME TABLE ----------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY    TRAV.TIME
         (m)      (m)     (cu.m.)       (cms)         (m/s)       (min)
        0.05   273.69    .907E+03         0.0          0.05      711.92
        0.11   273.75    .363E+04         0.1          0.08      448.48
        0.16   273.80    .816E+04         0.4          0.10      342.25
        0.22   273.86    .175E+05         1.0          0.12      298.74
        0.27   273.91    .342E+05         2.0          0.12      287.79
        0.33   273.97    .560E+05         3.5          0.13      266.60
        0.38   274.02    .797E+05         5.5          0.15      242.26
        0.44   274.08    .105E+06         7.9          0.16      222.10
        0.49   274.13    .132E+06        10.7          0.17      205.22
        0.55   274.19    .160E+06        14.0          0.19      191.05
        0.60   274.24    .190E+06        17.7          0.20      179.33
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0.66	274.30	.221E+06	21.7	0.21	169.47
0.72	274.36	.253E+06	26.2	0.22	161.07
0.77	274.41	.287E+06	31.1	0.23	153.82
0.83	274.47	.321E+06	36.3	0.24	147.48
0.88	274.52	.358E+06	42.0	0.25	141.88
0.94	274.58	.395E+06	48.1	0.26	136.90
0.99	274.63	.434E+06	54.6	0.27	132.43
1.05	274.69	.474E+06	61.5	0.28	128.38

	<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (2300)	308.80	6.42	5.33	31.58	0.40	0.15
OUTFLOW: ID= 1 (****)	308.80	3.08	7.50	31.57	0.31	0.13

ADD HYD (0010)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (****):	308.80	3.083	7.50	31.57
+ ID2= 2 (****):	228.10	5.325	5.50	34.26
ID = 3 (0010):	536.90	7.602	6.00	32.71

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0010)
3 + 2 = 1

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0010):	536.90	7.602	6.00	32.71
+ ID2= 2 (0500):	302.30	8.831	4.67	34.26
ID = 1 (0010):	839.20	15.057	5.17	33.27

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (****)
IN= 2---> OUT= 1

Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	272.10	0.1000	
34.80	271.88	0.0500	Main Channel
68.44	271.83	0.0500	Main Channel
76.43	271.69	0.0500	Main Channel
82.05	271.69	0.0500	Main Channel
110.40	271.81	0.0500 /0.1000	Main Channel
127.77	271.89	0.1000	
150.00	272.05	0.1000	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.02	271.71	.635E+02	0.0	0.05	165.35
0.03	271.72	.166E+03	0.0	0.07	112.65

0.05	271.74	.308E+03	0.1	0.08	89.85
0.07	271.76	.490E+03	0.1	0.10	76.31
0.09	271.78	.710E+03	0.2	0.11	67.08
0.10	271.79	.970E+03	0.3	0.13	60.27
0.12	271.81	.127E+04	0.4	0.14	55.00
0.14	271.83	.161E+04	0.6	0.16	48.44
0.16	271.85	.209E+04	0.7	0.15	49.64
0.18	271.87	.273E+04	0.9	0.15	50.05
0.20	271.89	.353E+04	1.2	0.16	47.38
0.22	271.91	.441E+04	1.7	0.18	42.48
0.24	271.93	.534E+04	2.3	0.20	38.91
0.26	271.95	.633E+04	2.9	0.21	36.19
0.28	271.97	.737E+04	3.6	0.22	34.02
0.30	271.99	.847E+04	4.4	0.24	32.26
0.32	272.01	.962E+04	5.2	0.25	30.78
0.34	272.03	.108E+05	6.1	0.26	29.53
0.36	272.05	.121E+05	7.1	0.27	28.45

**** WARNING: TRAVEL TIME TABLE EXCEEDED

	<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0010)	839.20	15.06	5.17	33.27	0.35	0.26
OUTFLOW: ID= 1 (****)	839.20	14.19	5.67	33.27	0.36	0.27

ADD HYD (0030)		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3	ID1= 1 (****):	304.80	2.593	8.83	34.56
	+ ID2= 2 (****):	839.20	14.187	5.67	33.27
	ID = 3 (0030):	1144.00	15.288	6.00	33.61

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (****)
IN= 2---> OUT= 1

Routing time step (min)'= 5.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	273.19	0.1000	
89.61	271.91	0.1000 /0.0500	Main Channel
138.71	271.70	0.0500	Main Channel
184.80	271.75	0.0500 /0.1000	Main Channel
266.32	271.80	0.1000	
367.88	271.93	0.1000	
520.40	272.09	0.1000	
714.30	273.40	0.1000	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.05	271.75	.365E+03	0.0	0.03	147.14
0.13	271.83	.275E+04	0.5	0.05	89.17
0.20	271.90	.688E+04	1.6	0.06	70.23
0.28	271.98	.124E+05	3.6	0.07	57.38
0.35	272.05	.195E+05	6.4	0.08	50.32

0.43	272.13	.278E+05	10.4	0.09	44.57
0.50	272.20	.366E+05	15.5	0.11	39.50
0.58	272.28	.457E+05	21.4	0.12	35.69
0.66	272.36	.552E+05	28.1	0.13	32.73
0.73	272.43	.649E+05	35.6	0.14	30.37
0.81	272.51	.750E+05	44.0	0.15	28.43
0.88	272.58	.854E+05	53.1	0.16	26.81
0.96	272.66	.961E+05	63.0	0.17	25.43
1.04	272.74	.107E+06	73.7	0.17	24.24
1.11	272.81	.118E+06	85.1	0.18	23.21
1.19	272.89	.130E+06	97.3	0.19	22.29
1.26	272.96	.142E+06	110.3	0.20	21.48
1.34	273.04	.154E+06	124.0	0.20	20.75
1.41	273.11	.167E+06	138.6	0.21	20.09

		<---- hydrograph ---->			<-pipe / channel->	
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0030)	1144.00	15.29	6.00	33.61	0.50	0.11
OUTFLOW: ID= 1 (****)	1144.00	13.96	6.50	33.61	0.48	0.10

CALIB NASHYD (0300) ID= 1 DT=10.0 min	Area (ha)= 315.50	Curve Number (CN)= 54.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 2.03	

Unit Hyd Qpeak (cms)= 5.936

PEAK FLOW (cms)= 4.599 (i)
TIME TO PEAK (hrs)= 5.500
RUNOFF VOLUME (mm)= 23.877
TOTAL RAINFALL (mm)= 89.800
RUNOFF COEFFICIENT = 0.266

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0125)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (****):	1144.00	13.963	6.50	33.61
+ ID2= 2 (0300):	315.50	4.599	5.50	23.88
ID = 3 (0125):	1459.50	18.224	6.25	31.51

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (****)
IN= 2---> OUT= 1

Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
133.75	272.89	0.1000	
157.66	271.71	0.0500 /0.1000	Main Channel
506.36	271.74	0.1000	
524.97	272.90	0.1000	

<-------------------- TRAVEL TIME TABLE ---------------------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.06	271.77	.787E+04	0.6	0.04	211.05
0.12	271.83	.183E+05	2.5	0.07	120.74
0.19	271.90	.288E+05	5.4	0.09	89.62
0.25	271.96	.394E+05	9.0	0.11	73.08
0.31	272.02	.500E+05	13.3	0.13	62.58
0.37	272.08	.607E+05	18.3	0.14	55.23
0.43	272.14	.715E+05	23.9	0.16	49.74
0.50	272.21	.823E+05	30.2	0.18	45.47
0.56	272.27	.932E+05	37.0	0.19	42.03
0.62	272.33	.104E+06	44.3	0.20	39.19
0.68	272.39	.115E+06	52.2	0.22	36.80
0.75	272.46	.126E+06	60.6	0.23	34.76
0.81	272.52	.137E+06	69.5	0.24	32.98
0.87	272.58	.149E+06	78.8	0.25	31.43
0.93	272.64	.160E+06	88.7	0.26	30.06
0.99	272.70	.171E+06	99.1	0.28	28.83
1.06	272.77	.183E+06	109.9	0.29	27.73
1.12	272.83	.194E+06	121.1	0.30	26.73
1.18	272.89	.206E+06	132.8	0.31	25.83

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0125)	1459.50	18.22	6.25	31.51	0.37	0.14
OUTFLOW: ID= 1 (****)	1459.50	16.06	6.83	31.51	0.34	0.14

CALIB NASHYD (0600) ID= 1 DT=10.0 min	Area (ha)= 299.60	Curve Number (CN)= 63.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 1.85	

Unit Hyd Qpeak (cms)= 6.186

PEAK FLOW (cms)= 6.056 (i)
TIME TO PEAK (hrs)= 5.333
RUNOFF VOLUME (mm)= 30.734
TOTAL RAINFALL (mm)= 89.800
RUNOFF COEFFICIENT = 0.342

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0040)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (****):	1459.50	16.060	6.83	31.51
+ ID2= 2 (0600):	299.60	6.056	5.33	30.73
ID = 3 (0040):	1759.10	20.955	6.50	31.37

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| ROUTE CHN (****) |
| IN= 2---> OUT= 1 |

Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	280.66	0.1000	
230.75	272.35	0.0500 /0.1000	Main Channel
454.64	271.34	0.1000	
776.25	271.91	0.1000	
796.25	273.69	0.1000	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.12	271.46	.111E+05	0.2	0.03	******
0.25	271.59	.443E+05	1.1	0.05	681.82
0.37	271.71	.996E+05	3.2	0.06	520.33
0.49	271.83	.177E+06	6.9	0.07	429.52
0.62	271.96	.275E+06	12.8	0.09	359.68
0.74	272.08	.383E+06	21.2	0.10	301.05
0.87	272.21	.498E+06	31.8	0.12	261.00
0.99	272.33	.619E+06	44.5	0.13	231.74
1.11	272.45	.744E+06	60.8	0.15	204.11
1.24	272.58	.871E+06	79.5	0.17	182.72
1.36	272.70	.999E+06	100.2	0.18	166.24
1.48	272.82	.113E+07	122.8	0.20	153.09
1.61	272.95	.126E+07	147.3	0.22	142.33
1.73	273.07	.139E+07	173.7	0.23	133.33
1.86	273.20	.152E+07	201.8	0.24	125.68
1.98	273.32	.166E+07	231.7	0.26	119.08
2.10	273.44	.179E+07	263.2	0.27	113.32
2.23	273.57	.193E+07	296.4	0.28	108.24
2.35	273.69	.206E+07	331.3	0.30	103.73

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0040)	1759.10	20.96	6.50	31.37	0.74	0.10
OUTFLOW: ID= 1 (****)	1759.10	9.68	8.42	31.37	0.55	0.08

CALIB NASHYD (0700) ID= 1 DT=10.0 min	Area (ha)= 181.20	Curve Number (CN)= 60.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 1.89	

Unit Hyd Qpeak (cms)= 3.662

PEAK FLOW (cms)= 3.313 (i)
TIME TO PEAK (hrs)= 5.333
RUNOFF VOLUME (mm)= 28.296
TOTAL RAINFALL (mm)= 89.800
RUNOFF COEFFICIENT = 0.315

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB NASHYD (1000) ID= 1 DT=10.0 min	Area (ha)= 69.40	Curve Number (CN)= 67.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00

U.H. Tp(hrs)= 1.06

Unit Hyd Qpeak (cms)= 2.501

PEAK FLOW (cms)= 2.364 (i)
TIME TO PEAK (hrs)= 4.333
RUNOFF VOLUME (mm)= 34.257
TOTAL RAINFALL (mm)= 89.800
RUNOFF COEFFICIENT = 0.381

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0050)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (1000):	69.40	2.364	4.33	34.26
+ ID2= 2 (****):	1759.10	9.683	8.42	31.37
ID = 3 (0050):	1828.50	9.809	8.33	31.48

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0050)
3 + 2 = 1

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0050):	1828.50	9.809	8.33	31.48
+ ID2= 2 (0700):	181.20	3.313	5.33	28.30
ID = 1 (0050):	2009.70	11.308	7.58	31.19

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB
NASHYD (0800)
ID= 1 DT=10.0 min

Area (ha)= 183.20 Curve Number (CN)= 68.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 1.53

Unit Hyd Qpeak (cms)= 4.573

PEAK FLOW (cms)= 4.910 (i)
TIME TO PEAK (hrs)= 4.833
RUNOFF VOLUME (mm)= 35.193
TOTAL RAINFALL (mm)= 89.800
RUNOFF COEFFICIENT = 0.392

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ROUTE CHN (0009)
IN= 2---> OUT= 1

Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning
8.00	272.30	0.1000

35.00	271.80	0.1000 /0.0500	Main Channel
50.00	271.50	0.0500	Main Channel
80.00	271.80	0.0500 /0.1000	Main Channel
142.00	272.20	0.1000	
150.00	272.10	0.1000	
228.00	273.20	0.1000	
288.00	275.23	0.1000	

<-------------------- TRAVEL TIME TABLE ---------------------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.04	271.54	.150E+03	0.0	0.06	415.02
0.08	271.58	.599E+03	0.0	0.09	261.44
0.11	271.61	.135E+04	0.1	0.12	199.52
0.15	271.65	.240E+04	0.2	0.14	164.70
0.19	271.69	.374E+04	0.4	0.17	141.93
0.23	271.73	.539E+04	0.7	0.19	125.69
0.26	271.76	.734E+04	1.1	0.21	113.41
0.30	271.80	.958E+04	1.5	0.23	103.74
0.35	271.85	.128E+05	2.4	0.27	88.84
0.39	271.89	.166E+05	3.4	0.29	80.63
0.44	271.94	.210E+05	4.7	0.31	75.41
0.48	271.98	.261E+05	6.1	0.33	71.76
0.53	272.03	.318E+05	7.7	0.34	69.01
0.57	272.07	.380E+05	9.5	0.35	66.83
0.62	272.12	.450E+05	11.5	0.36	65.24
0.66	272.16	.528E+05	13.7	0.37	64.35
0.71	272.21	.618E+05	16.2	0.37	63.59
0.75	272.25	.713E+05	19.1	0.38	62.29
0.80	272.30	.812E+05	22.2	0.39	60.90

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0800)	183.20	4.91	4.83	35.19	0.44	0.32
OUTFLOW: ID= 1 (0009)	183.20	3.81	6.00	35.18	0.40	0.30

CALIB NASHYD (0900) ID= 1 DT=10.0 min					
	Area	(ha)=	236.70	Curve Number	(CN)= 64.0
	Ia	(mm)=	5.00	# of Linear Res.	(N)= 3.00
	U.H. Tp	(hrs)=	1.97		

Unit Hyd Qpeak (cms)= 4.589

PEAK FLOW (cms)= 4.693 (i)
TIME TO PEAK (hrs)= 5.500
RUNOFF VOLUME (mm)= 31.585
TOTAL RAINFALL (mm)= 89.800
RUNOFF COEFFICIENT = 0.352

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0070) 1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0009):	183.20	3.811	6.00	35.18
+ ID2= 2 (0900):	236.70	4.693	5.50	31.58

ID = 3 (0070):	419.90	8.430	5.67	33.15

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (****)
IN= 2---> OUT= 1

Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
16.00	272.32	0.1000	
55.00	271.60	0.1000 /0.0500	Main Channel
64.00	270.90	0.0500	Main Channel
129.00	271.30	0.0500 /0.1000	Main Channel
151.00	271.51	0.1000	
193.00	271.75	0.1000	
296.00	272.52	0.1000	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.07	270.97	.364E+03	0.0	0.08	183.39
0.13	271.03	.146E+04	0.2	0.13	115.51
0.20	271.10	.328E+04	0.6	0.18	88.15
0.27	271.17	.582E+04	1.3	0.21	72.77
0.33	271.23	.910E+04	2.4	0.25	62.71
0.40	271.30	.131E+05	3.9	0.28	55.53
0.48	271.38	.186E+05	6.8	0.34	45.54
0.56	271.46	.247E+05	10.3	0.39	39.89
0.64	271.54	.316E+05	14.5	0.43	36.24
0.71	271.61	.394E+05	19.4	0.46	33.82
0.79	271.69	.485E+05	25.2	0.49	32.05
0.87	271.77	.589E+05	31.9	0.51	30.81
0.95	271.85	.705E+05	39.4	0.52	29.81
1.03	271.93	.831E+05	47.8	0.54	28.98
1.11	272.01	.968E+05	57.1	0.55	28.26
1.18	272.08	.112E+06	67.3	0.56	27.63
1.26	272.16	.127E+06	78.4	0.58	27.07
1.34	272.24	.144E+06	90.6	0.59	26.56
1.42	272.32	.162E+06	103.7	0.60	26.09

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0070)	419.90	8.43	5.67	33.15	0.51	0.36
OUTFLOW: ID= 1 (****)	419.90	7.87	6.33	33.15	0.50	0.35

ADD HYD (0060)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (****):	419.90	7.874	6.33	33.15
+ ID2= 2 (0050):	2009.70	11.308	7.58	31.19
ID = 3 (0060):	2429.60	18.624	6.83	31.53

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ROUTE CHN (****) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 10.00
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<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
90.00	276.61	0.1000	
140.00	273.00	0.1000	
152.00	271.10	0.1000 /0.0500	Main Channel
160.00	271.10	0.0500 /0.1000	Main Channel
168.00	271.51	0.1000	
230.00	271.51	0.1000	
252.00	274.18	0.1000	
280.00	276.18	0.1000	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.27	271.37	.253E+04	0.4	0.13	104.52
0.53	271.63	.129E+05	1.8	0.11	120.57
0.80	271.90	.315E+05	5.7	0.15	92.29
1.07	272.17	.510E+05	11.5	0.19	73.61
1.34	272.44	.714E+05	19.1	0.22	62.18
1.60	272.70	.926E+05	28.3	0.25	54.48
1.87	272.97	.115E+06	39.1	0.28	48.92
2.14	273.24	.138E+06	51.1	0.31	44.89
2.41	273.51	.162E+06	64.8	0.33	41.71
2.67	273.77	.188E+06	80.0	0.35	39.11
2.94	274.04	.215E+06	96.9	0.37	36.95
3.21	274.31	.243E+06	115.0	0.39	35.25
3.48	274.58	.273E+06	134.3	0.41	33.89
3.74	274.84	.305E+06	155.4	0.42	32.68
4.01	275.11	.338E+06	178.3	0.44	31.60
4.28	275.38	.373E+06	203.0	0.45	30.62
4.55	275.65	.409E+06	229.5	0.46	29.72
4.81	275.91	.448E+06	258.1	0.48	28.90
5.08	276.18	.487E+06	288.6	0.49	28.14

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0060)	2429.60	18.62	6.83	31.53	1.32	0.22
OUTFLOW: ID= 1 (****)	2429.60	16.43	7.42	31.53	1.24	0.21

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--------------------
| CALIB            |
| NASHYD    (1100) |   Area     (ha)= 203.07   Curve Number    (CN)= 70.0
|ID= 1 DT=10.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.74

     Unit Hyd Qpeak  (cms)=   4.458

     PEAK FLOW       (cms)=   5.222 (i)
     TIME TO PEAK    (hrs)=   5.167
     RUNOFF VOLUME    (mm)=  37.133
     TOTAL RAINFALL   (mm)=  89.800
     RUNOFF COEFFICIENT   =   0.414

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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| ADD HYD   (0080) |
|   1 +  2 =  3    |
--------------------          AREA     QPEAK     TPEAK      R.V.
                              (ha)     (cms)     (hrs)      (mm)
          ID1= 1 (****):   2429.60   16.427      7.42     31.53
        + ID2= 2 (1100):    203.07    5.222      5.17     37.13
          ================================================
          ID = 3 (0080):   2632.67   19.548      6.92     31.96

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| ROUTE CHN (****) |
| IN= 2---> OUT= 1 |      Routing time step (min)'= 10.00
--------------------
                <------ DATA FOR SECTION (   1.1) ------>
                Distance      Elevation        Manning
                   44.00         272.20         0.0700
                   75.00         270.40         0.0700
                   76.00         268.80    0.0700 /0.0500  Main Channel
                   80.00         268.70         0.0500     Main Channel
                   84.00         268.10         0.0500     Main Channel
                   88.00         269.90    0.0500 /0.0700  Main Channel
                  135.00         271.98         0.0700

        <---------------------- TRAVEL TIME TABLE ----------------------->
         DEPTH     ELEV       VOLUME     FLOW RATE     VELOCITY    TRAV.TIME
          (m)       (m)      (cu.m.)       (cms)         (m/s)       (min)
         0.17    268.27     .563E+02         0.0          0.34        20.26
         0.35    268.45     .225E+03         0.3          0.54        12.76
         0.52    268.62     .507E+03         0.9          0.71         9.74
         0.70    268.80     .970E+03         1.6          0.68        10.11
         0.91    269.01     .183E+04         4.4          1.00         6.87
         1.12    269.22     .275E+04         8.4          1.26         5.46
         1.34    269.44     .372E+04        13.4          1.49         4.64
         1.55    269.65     .475E+04        19.3          1.68         4.10
         1.76    269.86     .582E+04        26.2          1.86         3.71
         1.97    270.07     .708E+04        34.7          2.03         3.40
         2.18    270.28     .876E+04        44.9          2.12         3.25
         2.40    270.50     .109E+05        56.8          2.16         3.20
         2.61    270.71     .137E+05        71.3          2.15         3.21
         2.82    270.92     .173E+05        88.8          2.12         3.25
         3.03    271.13     .216E+05       109.9          2.10         3.28
         3.24    271.34     .267E+05       135.0          2.09         3.30
         3.46    271.56     .325E+05       164.4          2.09         3.29
         3.67    271.77     .390E+05       198.6          2.11         3.27
         3.88    271.98     .463E+05       238.0          2.13         3.24

                                        <---- hydrograph ---->   <-pipe / channel->
                                 AREA     QPEAK    TPEAK    R.V.   MAX DEPTH  MAX VEL
                                 (ha)     (cms)    (hrs)    (mm)      (m)       (m/s)
     INFLOW : ID= 2 (0080)    2632.67     19.55     6.92    31.96      1.56      1.69
     OUTFLOW: ID= 1 (****)    2632.67     19.55     7.00    31.96      1.55      1.69
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| CALIB            |
| NASHYD   (1200)  |   Area     (ha)=  30.80   Curve Number    (CN)= 78.0
|ID= 1 DT=10.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
```

---------- U.H. Tp(hrs)= 0.85

Unit Hyd Qpeak (cms)= 1.384

PEAK FLOW (cms)= 1.672 (i)
TIME TO PEAK (hrs)= 4.000
RUNOFF VOLUME (mm)= 45.962
TOTAL RAINFALL (mm)= 89.800
RUNOFF COEFFICIENT = 0.512

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| ADD HYD (0090) |
| 1 + 2 = 3 |

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (****):	2632.67	19.545	7.00	31.96
+ ID2= 2 (1200):	30.80	1.672	4.00	45.96
ID = 3 (0090):	2663.47	19.774	7.00	32.12

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| ROUTE CHN (****) |
| IN= 2---> OUT= 1 |

Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
18.00	268.20	0.0700	
29.00	266.80	0.0700	
50.50	266.10	0.0700	
57.00	264.70	0.0700 /0.0500	Main Channel
60.50	264.60	0.0500	Main Channel
66.00	264.72	0.0500 /0.0700	Main Channel
77.80	267.30	0.0700	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.10	264.70	.416E+03	0.1	0.28	61.42
0.24	264.84	.175E+04	1.1	0.64	26.84
0.37	264.97	.327E+04	2.9	0.90	19.08
0.51	265.11	.497E+04	5.3	1.11	15.51
0.65	265.25	.685E+04	8.5	1.28	13.40
0.78	265.38	.890E+04	12.4	1.43	11.98
0.92	265.52	.111E+05	16.9	1.57	10.95
1.06	265.66	.135E+05	22.2	1.69	10.16
1.19	265.79	.161E+05	28.2	1.80	9.53
1.33	265.93	.189E+05	34.9	1.90	9.01
1.47	266.07	.218E+05	42.4	2.00	8.58
1.61	266.21	.251E+05	49.7	2.04	8.42
1.74	266.34	.290E+05	58.3	2.07	8.30
1.88	266.48	.336E+05	68.3	2.09	8.21
2.02	266.62	.389E+05	79.9	2.11	8.13
2.15	266.75	.449E+05	93.0	2.13	8.05
2.29	266.89	.515E+05	108.5	2.17	7.91
2.43	267.03	.583E+05	126.0	2.22	7.71
2.56	267.16	.654E+05	145.1	2.28	7.51

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
	<---- hydrograph ---->				<-pipe / channel->	
INFLOW : ID= 2 (0090)	2663.47	19.77	7.00	32.12	0.99	1.63
OUTFLOW: ID= 1 (****)	2663.47	19.73	7.08	32.12	0.99	1.63

CALIB NASHYD (1300) ID= 1 DT=10.0 min					
	Area (ha)=	42.90	Curve Number (CN)=	80.0	
	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.53			

Unit Hyd Qpeak (cms)= 3.092

PEAK FLOW (cms)= 3.294 (i)
TIME TO PEAK (hrs)= 3.667
RUNOFF VOLUME (mm)= 48.459
TOTAL RAINFALL (mm)= 89.800
RUNOFF COEFFICIENT = 0.540

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0101)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (****):	2663.47	19.731	7.08	32.12
+ ID2= 2 (1300):	42.90	3.294	3.67	48.46
ID = 3 (0101):	2706.37	19.843	7.08	32.38

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (****)
IN= 2---> OUT= 1

Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	259.27	0.0700	
224.90	256.32	0.0500 /0.0700	Main Channel
234.22	255.44	0.0700	
241.28	255.24	0.0700	
245.63	256.44	0.0700	
278.81	257.64	0.0700	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.10	255.34	.588E+02	0.0	0.11	46.94
0.20	255.44	.235E+03	0.1	0.17	29.57
0.33	255.57	.576E+03	0.5	0.28	17.82
0.46	255.70	.988E+03	1.2	0.37	13.64
0.59	255.83	.147E+04	2.2	0.44	11.35
0.72	255.96	.203E+04	3.4	0.51	9.86
0.85	256.09	.266E+04	5.0	0.57	8.80
0.98	256.22	.336E+04	7.0	0.63	7.99
1.11	256.35	.414E+04	9.4	0.69	7.32

1.24	256.48	.522E+04	12.2	0.71	7.12
1.36	256.60	.679E+04	15.2	0.68	7.45
1.49	256.73	.890E+04	19.6	0.67	7.57
1.62	256.86	.115E+05	25.5	0.67	7.55
1.75	256.99	.147E+05	33.0	0.68	7.42
1.88	257.12	.184E+05	42.3	0.70	7.23
2.01	257.25	.226E+05	53.6	0.72	7.01
2.14	257.38	.273E+05	67.0	0.74	6.79
2.27	257.51	.325E+05	82.7	0.77	6.56
2.40	257.64	.383E+05	100.8	0.80	6.34

		<---- hydrograph ---->			<-pipe / channel->	
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0101)	2706.37	19.84	7.08	32.38	1.50	0.67
OUTFLOW: ID= 1 (****)	2706.37	19.79	7.17	32.38	1.50	0.67

CALIB					
NASHYD (1400)	Area (ha)=	117.70	Curve Number	(CN)=	74.0
ID= 1 DT=10.0 min	Ia (mm)=	5.00	# of Linear Res.	(N)=	3.00
	U.H. Tp(hrs)=	0.97			

Unit Hyd Qpeak (cms)= 4.635

PEAK FLOW (cms)= 5.203 (i)
TIME TO PEAK (hrs)= 4.167
RUNOFF VOLUME (mm)= 41.315
TOTAL RAINFALL (mm)= 89.800
RUNOFF COEFFICIENT = 0.460

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ROUTE CHN (****)	
IN= 2---> OUT= 1	Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	259.27	0.0700	
224.90	256.32	0.0500 /0.0700	Main Channel
234.22	255.44	0.0700	
241.28	255.24	0.0700	
245.63	256.44	0.0700	
278.81	257.64	0.0700	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.10	255.34	.130E+03	0.0	0.25	44.25
0.20	255.44	.521E+03	0.3	0.40	27.88
0.33	255.57	.127E+04	1.3	0.66	16.80
0.46	255.70	.219E+04	2.8	0.87	12.86
0.59	255.83	.326E+04	5.1	1.04	10.70
0.72	255.96	.449E+04	8.0	1.20	9.30
0.85	256.09	.588E+04	11.8	1.34	8.30
0.98	256.22	.743E+04	16.4	1.48	7.53
1.11	256.35	.915E+04	22.1	1.61	6.90
1.24	256.48	.115E+05	28.7	1.66	6.71
1.36	256.60	.150E+05	35.7	1.59	7.02

1.49	256.73	.197E+05	45.9	1.56	7.14
1.62	256.86	.255E+05	59.7	1.57	7.11
1.75	256.99	.325E+05	77.4	1.59	6.99
1.88	257.12	.406E+05	99.3	1.64	6.82
2.01	257.25	.499E+05	125.8	1.69	6.61
2.14	257.38	.604E+05	157.3	1.74	6.40
2.27	257.51	.720E+05	194.1	1.80	6.18
2.40	257.64	.848E+05	236.6	1.87	5.97

		<---- hydrograph ---->			<-pipe / channel->	
		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW :	ID= 2 (1400)	117.70	5.20	4.17	41.32	0.59	1.05
OUTFLOW:	ID= 1 (****)	117.70	5.17	4.33	41.31	0.59	1.05

CALIB NASHYD (1500) ID= 1 DT=10.0 min					
	Area	(ha)=	37.27	Curve Number	(CN)= 74.0
	Ia	(mm)=	5.00	# of Linear Res.	(N)= 3.00
	U.H. Tp	(hrs)=	0.72		

Unit Hyd Qpeak (cms)= 1.977

PEAK FLOW (cms)= 2.012 (i)
TIME TO PEAK (hrs)= 3.833
RUNOFF VOLUME (mm)= 41.310
TOTAL RAINFALL (mm)= 89.800
RUNOFF COEFFICIENT = 0.460

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0121)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (****):	2706.37	19.793	7.17	32.38
+ ID2= 2 (****):	117.70	5.173	4.33	41.31
ID = 3 (0121):	2824.07	20.979	6.92	32.75

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0121)
3 + 2 = 1

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0121):	2824.07	20.979	6.92	32.75
+ ID2= 2 (1500):	37.27	2.012	3.83	41.31
ID = 1 (0121):	2861.34	21.227	6.75	32.87

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (****)
IN= 2---> OUT= 1

Routing time step (min)'= 10.00

<-------- DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	253.10	0.0700	
17.00	252.40	0.0500	Main Channel
29.00	251.60	0.0500	Main Channel
31.00	250.80	0.0500	Main Channel
35.00	251.00	0.0500	Main Channel
39.50	250.90	0.0500 /0.0700	Main Channel
44.00	251.50	0.0700	
56.00	252.50	0.0700	
61.00	253.20	0.0700	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.10	250.90	.294E+02	0.0	0.36	12.18
0.22	251.02	.226E+03	0.4	0.52	8.41
0.33	251.13	.543E+03	1.8	0.86	5.05
0.45	251.25	.895E+03	3.8	1.12	3.88
0.56	251.36	.128E+04	6.6	1.34	3.25
0.68	251.48	.170E+04	9.9	1.52	2.86
0.79	251.59	.217E+04	13.9	1.68	2.59
0.91	251.71	.270E+04	17.6	1.70	2.55
1.03	251.83	.333E+04	22.2	1.75	2.49
1.14	251.94	.405E+04	27.9	1.80	2.42
1.26	252.06	.486E+04	34.7	1.86	2.33
1.37	252.17	.577E+04	42.8	1.93	2.25
1.49	252.29	.678E+04	52.2	2.01	2.17
1.61	252.41	.788E+04	63.0	2.09	2.08
1.72	252.52	.909E+04	77.8	2.23	1.95
1.84	252.64	.104E+05	94.4	2.37	1.84
1.95	252.75	.119E+05	112.7	2.48	1.75
2.07	252.87	.134E+05	132.8	2.59	1.68
2.18	252.98	.151E+05	154.7	2.68	1.62

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0121)	2861.34	21.23	6.75	32.87	1.00	1.74
OUTFLOW: ID= 1 (****)	2861.34	21.23	6.75	32.87	1.00	1.74

CALIB NASHYD (1600) ID= 1 DT=10.0 min	Area (ha)= 8.90	Curve Number (CN)= 74.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.78	

Unit Hyd Qpeak (cms)= 0.436

PEAK FLOW (cms)= 0.455 (i)
TIME TO PEAK (hrs)= 4.000
RUNOFF VOLUME (mm)= 41.312
TOTAL RAINFALL (mm)= 89.800
RUNOFF COEFFICIENT = 0.460

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0110)		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3	ID1= 1 (****):	2861.34	21.226	6.75	32.87
	+ ID2= 2 (1600):	8.90	0.455	4.00	41.31
	ID = 3 (0110):	2870.24	21.298	6.75	32.89

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (****)
IN= 2---> OUT= 1

Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
10.00	249.90	0.1000	
86.00	248.10	0.1000 /0.0350	Main Channel
88.00	246.81	0.0350	Main Channel
107.00	247.20	0.0350	Main Channel
112.00	248.90	0.0350 /0.0600	Main Channel
132.00	247.90	0.0600	
164.00	249.40	0.0600	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.13	246.94	.133E+03	0.2	0.36	14.71
0.26	247.07	.532E+03	1.0	0.57	9.26
0.39	247.20	.120E+04	2.8	0.75	7.07
0.52	247.33	.201E+04	6.5	1.03	5.13
0.64	247.45	.285E+04	11.4	1.28	4.15
0.77	247.58	.371E+04	17.4	1.49	3.55
0.90	247.71	.460E+04	24.4	1.69	3.14
1.03	247.84	.551E+04	32.4	1.87	2.84
1.16	247.97	.648E+04	41.3	2.03	2.61
1.29	248.10	.767E+04	51.3	2.13	2.49
1.43	248.24	.942E+04	64.6	2.18	2.43
1.58	248.39	.117E+05	80.0	2.17	2.45
1.72	248.53	.146E+05	97.9	2.13	2.49
1.87	248.68	.181E+05	118.6	2.08	2.55
2.01	248.82	.222E+05	142.4	2.04	2.59
2.16	248.97	.268E+05	170.6	2.03	2.62
2.30	249.11	.318E+05	203.6	2.03	2.61
2.45	249.26	.373E+05	240.0	2.05	2.59
2.59	249.40	.432E+05	280.2	2.06	2.57

		<---- hydrograph ----> AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	<-pipe / channel-> MAX DEPTH (m)	MAX VEL (m/s)
INFLOW :	ID= 2 (0110)	2870.24	21.30	6.75	32.89	0.85	1.59
OUTFLOW:	ID= 1 (****)	2870.24	21.30	6.83	32.89	0.84	1.59

CALIB
NASHYD (1700)
ID= 1 DT=10.0 min

Area (ha)= 21.80 Curve Number (CN)= 74.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.82

Unit Hyd Qpeak (cms)= 1.015

```
PEAK FLOW        (cms)=   1.081 (i)
TIME TO PEAK     (hrs)=   4.000
RUNOFF VOLUME     (mm)=  41.313
TOTAL RAINFALL    (mm)=  89.800
RUNOFF COEFFICIENT   =   0.460

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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| ADD HYD   (0123) |
|   1 +  2 =  3    |          AREA     QPEAK     TPEAK      R.V.
--------------------          (ha)     (cms)     (hrs)      (mm)
         ID1= 1 (****):   2870.24   21.297      6.83     32.89
       + ID2= 2 (1700):     21.80    1.081      4.00     41.31
         ================================================
         ID = 3 (0123):   2892.04   21.478      6.75     32.95

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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| ROUTE CHN (****) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 10.00
--------------------
              <------ DATA FOR SECTION (   1.1) ------>
             Distance      Elevation        Manning
                0.00         251.28         0.0450
               32.00         250.70         0.0450
               84.00         249.60         0.0450
               91.00         249.10    0.0450 /0.0320  Main Channel
               96.00         248.60         0.0320     Main Channel
              100.00         248.90    0.0320 /0.0450  Main Channel
              112.00         250.45         0.0450

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH      ELEV       VOLUME     FLOW RATE     VELOCITY    TRAV.TIME
        (m)        (m)      (cu.m.)       (cms)         (m/s)       (min)
       0.07     248.68    .889E+01         0.0          0.28        8.17
       0.15     248.75    .356E+02         0.1          0.44        5.14
       0.22     248.82    .800E+02         0.3          0.58        3.93
       0.30     248.90    .142E+03         0.7          0.70        3.24
       0.40     249.00    .253E+03         1.7          0.90        2.50
       0.51     249.11    .390E+03         3.1          1.07        2.12
       0.61     249.21    .555E+03         5.1          1.25        1.81
       0.71     249.31    .752E+03         7.7          1.39        1.63
       0.82     249.42    .980E+03        10.9          1.50        1.50
       0.92     249.52    .124E+04        14.6          1.60        1.41
       1.02     249.62    .153E+04        19.0          1.68        1.35
       1.13     249.73    .189E+04        23.9          1.72        1.32
       1.23     249.83    .233E+04        29.9          1.74        1.30
       1.33     249.93    .284E+04        37.0          1.76        1.28
       1.44     250.04    .344E+04        45.3          1.79        1.26
       1.54     250.14    .412E+04        55.0          1.81        1.25
       1.64     250.24    .487E+04        66.1          1.84        1.23
       1.75     250.35    .571E+04        78.7          1.87        1.21
       1.85     250.45    .662E+04        93.0          1.90        1.19

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK    TPEAK    R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)    (hrs)    (mm)      (m)       (m/s)
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INFLOW : ID= 2 (0123) 2892.04    21.48    6.75  32.95      1.08      1.70
OUTFLOW: ID= 1 (****) 2892.04    21.48    6.83  32.95      1.07      1.70
```

CALIB NASHYD (1800) ID= 1 DT=10.0 min			
	Area (ha)= 3.82	Curve Number (CN)= 78.0	
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.10		

Unit Hyd Qpeak (cms)= 1.459

PEAK FLOW (cms)= 0.431 (i)
TIME TO PEAK (hrs)= 3.167
RUNOFF VOLUME (mm)= 35.071
TOTAL RAINFALL (mm)= 89.800
RUNOFF COEFFICIENT = 0.391

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0130) 1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (****):	2892.04	21.477	6.83	32.95
+ ID2= 2 (1800):	3.82	0.431	3.17	35.07
ID = 3 (0130):	2895.86	21.477	6.83	32.96

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (0124) IN= 2---> OUT= 1

Routing time step (min)'= 5.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	251.01	0.0700	
76.16	250.14	0.0500	Main Channel
84.69	248.40	0.0500 /0.0700	Main Channel
92.28	246.41	0.0700	
100.53	248.07	0.0700	
119.66	248.85	0.0700	
150.39	250.47	0.0700	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.20	246.61	.712E+02	0.0	0.11	62.27
0.40	246.81	.285E+03	0.1	0.17	39.23
0.60	247.01	.641E+03	0.4	0.23	29.94
0.80	247.21	.114E+04	0.8	0.28	24.71
1.00	247.41	.178E+04	1.4	0.32	21.30
1.19	247.60	.256E+04	2.3	0.36	18.86
1.39	247.80	.349E+04	3.4	0.40	17.02
1.59	248.00	.456E+04	4.9	0.44	15.57
1.79	248.20	.584E+04	6.2	0.43	15.75
1.99	248.40	.756E+04	8.0	0.43	15.82
2.22	248.63	.101E+05	11.2	0.45	15.05

2.45	248.86	.133E+05	15.7	0.48	14.19
2.68	249.09	.171E+05	21.8	0.52	13.12
2.91	249.32	.214E+05	29.2	0.56	12.21
3.14	249.55	.262E+05	38.2	0.60	11.44
3.37	249.78	.316E+05	48.9	0.63	10.76
3.60	250.01	.374E+05	61.3	0.67	10.18
3.83	250.24	.439E+05	75.8	0.71	9.67
4.06	250.47	.525E+05	93.1	0.73	9.40

	<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0130)	2895.86	21.48	6.83	32.96	2.67	0.52
OUTFLOW: ID= 1 (0124)	2895.86	21.32	6.92	32.96	2.66	0.52

CALIB NASHYD (1900) ID= 1 DT=10.0 min					
	Area	(ha)=	10.25	Curve Number	(CN)= 80.0
	Ia	(mm)=	5.00	# of Linear Res.	(N)= 3.00
	U.H. Tp	(hrs)=	0.33		

Unit Hyd Qpeak (cms)= 1.186

PEAK FLOW (cms)= 1.019 (i)
TIME TO PEAK (hrs)= 3.333
RUNOFF VOLUME (mm)= 48.296
TOTAL RAINFALL (mm)= 89.800
RUNOFF COEFFICIENT = 0.538

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0150)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0124):	2895.86	21.321	6.92	32.96
+ ID2= 2 (1900):	10.25	1.019	3.33	48.30
ID = 3 (0150):	2906.11	21.332	6.92	33.01

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB NASHYD (2000) ID= 1 DT=10.0 min					
	Area	(ha)=	125.00	Curve Number	(CN)= 67.0
	Ia	(mm)=	5.00	# of Linear Res.	(N)= 3.00
	U.H. Tp	(hrs)=	1.50		

Unit Hyd Qpeak (cms)= 3.183

PEAK FLOW (cms)= 3.308 (i)
TIME TO PEAK (hrs)= 4.833
RUNOFF VOLUME (mm)= 34.258
TOTAL RAINFALL (mm)= 89.800
RUNOFF COEFFICIENT = 0.381

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ROUTE CHN (****) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 10.00
--------------------
                <------ DATA FOR SECTION (   1.1) ------>
                Distance      Elevation       Manning
                    0.00         256.00        0.0700
                   41.00         250.00        0.0500       Main Channel
                  126.00         249.50    0.0500 /0.0700   Main Channel
                  131.00         249.00        0.0700
                  136.00         249.50        0.0700
                  217.00         250.00        0.0700
                  283.00         251.30        0.0700

        <---------------------- TRAVEL TIME TABLE ---------------------->
         DEPTH     ELEV       VOLUME     FLOW RATE     VELOCITY    TRAV.TIME
          (m)       (m)      (cu.m.)       (cms)         (m/s)       (min)
         0.10    249.10     .666E+02        0.0          0.14        77.86
         0.20    249.20     .267E+03        0.1          0.23        49.05
         0.30    249.30     .600E+03        0.3          0.30        37.43
         0.40    249.40     .107E+04        0.6          0.36        30.90
         0.50    249.50     .167E+04        1.0          0.42        26.63
         0.63    249.63     .435E+04        2.0          0.30        36.91
         0.76    249.76     .107E+05        5.9          0.37        30.24
         0.89    249.89     .207E+05       14.0          0.45        24.61
         1.01    250.01     .343E+05       27.9          0.54        20.52
         1.14    250.14     .498E+05       50.9          0.68        16.32
         1.27    250.27     .659E+05       79.4          0.80        13.83
         1.40    250.40     .826E+05      113.3          0.91        12.16
         1.53    250.53     .100E+06      152.3          1.01        10.95
         1.66    250.66     .118E+06      196.3          1.11        10.02
         1.79    250.79     .137E+06      245.3          1.20         9.28
         1.91    250.91     .156E+06      299.3          1.28         8.68
         2.04    251.04     .176E+06      358.1          1.36         8.18
         2.17    251.17     .196E+06      421.8          1.43         7.76
         2.30    251.30     .218E+06      490.5          1.50         7.39

                                        <---- hydrograph ---->   <-pipe / channel->
                                 AREA     QPEAK    TPEAK    R.V.   MAX DEPTH  MAX VEL
                                 (ha)     (cms)    (hrs)    (mm)      (m)       (m/s)
    INFLOW : ID= 2 (2000)      125.00      3.31     4.83    34.26      0.67      0.32
    OUTFLOW: ID= 1 (****)      125.00      3.02     5.50    34.26      0.66      0.32

--------------------
| CALIB            |
| NASHYD    (2100) |   Area     (ha)=  34.30   Curve Number   (CN)= 80.0
|ID= 1 DT=10.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.36

    Unit Hyd Qpeak  (cms)=   3.639

    PEAK FLOW       (cms)=   3.253 (i)
    TIME TO PEAK    (hrs)=   3.333
    RUNOFF VOLUME    (mm)=  48.351
    TOTAL RAINFALL   (mm)=  89.800
    RUNOFF COEFFICIENT   =   0.538

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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--------------------
| ADD HYD    (0160) |
|   1 +  2 =  3     |          AREA     QPEAK     TPEAK      R.V.
--------------------            (ha)     (cms)     (hrs)      (mm)
          ID1= 1 (****):    125.00     3.019      5.50     34.26
        + ID2= 2 (0150):   2906.11    21.332      6.92     33.01
          ================================================
          ID = 3 (0160):   3031.11    23.685      6.67     33.06

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD    (0160) |
|   3 +  2 =  1     |          AREA     QPEAK     TPEAK      R.V.
--------------------            (ha)     (cms)     (hrs)      (mm)
          ID1= 3 (0160):   3031.11    23.685      6.67     33.06
        + ID2= 2 (2100):     34.30     3.253      3.33     48.35
          ================================================
          ID = 1 (0160):   3065.41    23.796      6.67     33.23

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD     (2200)  |   Area     (ha)=  10.21   Curve Number    (CN)= 78.0
|ID= 1 DT=10.0 min   |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.21

     Unit Hyd Qpeak  (cms)=   1.857

     PEAK FLOW       (cms)=   1.205 (i)
     TIME TO PEAK    (hrs)=   3.167
     RUNOFF VOLUME    (mm)=  44.965
     TOTAL RAINFALL   (mm)=  89.800
     RUNOFF COEFFICIENT   =   0.501

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD    (0170) |
|   1 +  2 =  3     |          AREA     QPEAK     TPEAK      R.V.
--------------------            (ha)     (cms)     (hrs)      (mm)
          ID1= 1 (0160):   3065.41    23.796      6.67     33.23
        + ID2= 2 (2200):     10.21     1.205      3.17     44.96
          ================================================
          ID = 3 (0170):   3075.62    23.803      6.67     33.27

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 FINISH
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       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\VO Suite 3.0\VO2\voin.dat

  Output  filename: C:\Users\GAL -
Kevin\AppData\Local\Temp\52a2fbb8-fa04-4871-b666-0c0343464070\Scenario.out

  Summary filename: C:\Users\GAL -
Kevin\AppData\Local\Temp\52a2fbb8-fa04-4871-b666-0c0343464070\Scenario.sum


DATE: 04/01/2019                                TIME: 02:47:54

USER:


COMMENTS: ____________________________________________________________

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  ***************************
  ** SIMULATION NUMBER:   0 **
  ***************************


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|    READ STORM    |    Filename: C:\Users\GAL - Kevin\AppD
|                  |              ata\Local\Temp\
|                  |              52a2fbb8-fa04-4871-b666-0c0343464070\6ac174c3
| Ptotal=193.00 mm |    Comments: Timmins Storm  event   mm/hr
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	15.00	3.17	3.00	6.17	43.00	9.17	13.00
0.33	15.00	3.33	3.00	6.33	43.00	9.33	13.00
0.50	15.00	3.50	3.00	6.50	43.00	9.50	13.00
0.67	15.00	3.67	3.00	6.67	43.00	9.67	13.00
0.83	15.00	3.83	3.00	6.83	43.00	9.83	13.00
1.00	15.00	4.00	3.00	7.00	43.00	10.00	13.00
1.17	20.00	4.17	5.00	7.17	20.00	10.17	13.00
1.33	20.00	4.33	5.00	7.33	20.00	10.33	13.00

1.50	20.00	4.50	5.00	7.50	20.00	10.50	13.00
1.67	20.00	4.67	5.00	7.67	20.00	10.67	13.00
1.83	20.00	4.83	5.00	7.83	20.00	10.83	13.00
2.00	20.00	5.00	5.00	8.00	20.00	11.00	13.00
2.17	10.00	5.17	20.00	8.17	23.00	11.17	8.00
2.33	10.00	5.33	20.00	8.33	23.00	11.33	8.00
2.50	10.00	5.50	20.00	8.50	23.00	11.50	8.00
2.67	10.00	5.67	20.00	8.67	23.00	11.67	8.00
2.83	10.00	5.83	20.00	8.83	23.00	11.83	8.00
3.00	10.00	6.00	20.00	9.00	23.00	12.00	8.00

MODIFY STORM CASE= 1

MODIFYING PARAMETERS
Multiplication Factor= 0.97
Time shift (min) = 0.00

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.167	14.55	3.167	2.91	6.167	41.71	9.17	12.61
0.333	14.55	3.333	2.91	6.333	41.71	9.33	12.61
0.500	14.55	3.500	2.91	6.500	41.71	9.50	12.61
0.667	14.55	3.667	2.91	6.667	41.71	9.67	12.61
0.833	14.55	3.833	2.91	6.833	41.71	9.83	12.61
1.000	14.55	4.000	2.91	7.000	41.71	10.00	12.61
1.167	19.40	4.167	4.85	7.167	19.40	10.17	12.61
1.333	19.40	4.333	4.85	7.333	19.40	10.33	12.61
1.500	19.40	4.500	4.85	7.500	19.40	10.50	12.61
1.667	19.40	4.667	4.85	7.667	19.40	10.67	12.61
1.833	19.40	4.833	4.85	7.833	19.40	10.83	12.61
2.000	19.40	5.000	4.85	8.000	19.40	11.00	12.61
2.167	9.70	5.167	19.40	8.167	22.31	11.17	7.76
2.333	9.70	5.333	19.40	8.333	22.31	11.33	7.76
2.500	9.70	5.500	19.40	8.500	22.31	11.50	7.76
2.667	9.70	5.667	19.40	8.667	22.31	11.67	7.76
2.833	9.70	5.833	19.40	8.833	22.31	11.83	7.76
3.000	9.70	6.000	19.40	9.000	22.31	12.00	7.76

CALIB NASHYD (0100) ID= 1 DT=10.0 min

Area (ha)= 197.60 Curve Number (CN)= 67.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 2.63

Unit Hyd Qpeak (cms)= 2.870

PEAK FLOW (cms)= 7.420 (i)
TIME TO PEAK (hrs)= 10.667
RUNOFF VOLUME (mm)= 108.034
TOTAL RAINFALL (mm)= 187.210
RUNOFF COEFFICIENT = 0.577

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ROUTE CHN (****) IN= 2---> OUT= 1

Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>
Distance Elevation Manning

0.00	277.27	0.1000	
332.34	275.59	0.1000 /0.0500	Main Channel
352.82	273.81	0.0500	Main Channel
365.19	273.82	0.0500	Main Channel
387.54	274.15	0.0500	Main Channel
399.23	275.75	0.0500 /0.1000	Main Channel
500.73	277.20	0.1000	

<-------------------- TRAVEL TIME TABLE ---------------------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.18	273.99	.351E+04	0.8	0.24	73.47
0.36	274.17	.976E+04	3.3	0.37	48.89
0.53	274.34	.175E+05	8.3	0.51	35.01
0.71	274.52	.259E+05	15.2	0.63	28.39
0.89	274.70	.349E+05	23.9	0.73	24.39
1.07	274.88	.446E+05	34.3	0.82	21.66
1.25	275.06	.548E+05	46.5	0.91	19.66
1.42	275.23	.658E+05	60.5	0.99	18.11
1.60	275.41	.774E+05	76.4	1.06	16.86
1.78	275.59	.896E+05	94.2	1.13	15.84
1.96	275.77	.106E+06	116.5	1.18	15.12
2.14	275.95	.130E+06	143.5	1.18	15.11
2.32	276.13	.164E+06	175.1	1.15	15.58
2.50	276.31	.207E+06	212.2	1.10	16.22
2.67	276.48	.258E+06	255.6	1.06	16.86
2.85	276.66	.320E+06	305.9	1.02	17.42
3.03	276.84	.390E+06	363.8	1.00	17.87
3.21	277.02	.469E+06	429.9	0.98	18.20
3.39	277.20	.558E+06	504.8	0.97	18.43

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0100)	197.60	7.42	10.67	108.03	0.50	0.48
OUTFLOW: ID= 1 (****)	197.60	7.36	11.17	108.03	0.50	0.47

CALIB NASHYD (0200) ID= 1 DT=10.0 min	Area (ha)= 107.20	Curve Number (CN)= 68.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.87	

Unit Hyd Qpeak (cms)= 4.706

PEAK FLOW (cms)= 5.975 (i)
TIME TO PEAK (hrs)= 7.500
RUNOFF VOLUME (mm)= 110.020
TOTAL RAINFALL (mm)= 187.210
RUNOFF COEFFICIENT = 0.588

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ROUTE CHN (****) IN= 2---> OUT= 1	Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning
0.00	279.83	0.1000

204.39	277.60	0.0500	Main Channel
296.57	273.96	0.0500	Main Channel
461.97	273.75	0.0500	Main Channel
485.91	272.71	0.0500 /0.1000	Main Channel
798.40	272.85	0.1000	
877.72	273.64	0.1000	
1006.81	276.74	0.1000	

<-------------------- TRAVEL TIME TABLE ---------------------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.21	272.92	.916E+05	3.6	0.08	429.52
0.42	273.13	.237E+06	16.5	0.14	238.88
0.64	273.35	.393E+06	36.9	0.19	177.74
0.85	273.56	.561E+06	64.0	0.23	145.94
1.06	273.77	.739E+06	97.5	0.27	126.27
1.27	273.98	.964E+06	140.8	0.30	114.14
1.48	274.19	.122E+07	202.9	0.34	100.49
1.70	274.41	.149E+07	277.8	0.38	89.31
1.91	274.62	.176E+07	364.6	0.42	80.46
2.12	274.83	.204E+07	462.6	0.46	73.42
2.33	275.04	.232E+07	571.4	0.50	67.71
2.55	275.26	.261E+07	690.7	0.54	63.00
2.76	275.47	.291E+07	820.5	0.57	59.05
2.97	275.68	.321E+07	960.4	0.61	55.69
3.18	275.89	.352E+07	1110.4	0.64	52.79
3.39	276.10	.383E+07	1270.5	0.67	50.26
3.61	276.32	.415E+07	1440.5	0.70	48.03
3.82	276.53	.448E+07	1620.5	0.73	46.05
4.03	276.74	.481E+07	1810.4	0.76	44.28

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0200)	107.20	5.97	7.50	110.02	0.25	0.09
OUTFLOW: ID= 1 (****)	107.20	2.53	11.83	110.00	0.15	0.08

ADD HYD (0020)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (****):	197.60	7.356	11.17	108.03
+ ID2= 2 (****):	107.20	2.533	11.83	110.00
ID = 3 (0020):	304.80	9.864	11.33	108.72

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (****)
IN= 2---> OUT= 1

Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	273.19	0.1000	
89.61	271.91	0.1000 /0.0500	Main Channel
138.71	271.70	0.0500	Main Channel
184.80	271.75	0.0500 /0.1000	Main Channel
266.32	271.80	0.1000	

367.88	271.93	0.1000
520.40	272.09	0.1000

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.02	271.72	.159E+03	0.0	0.01	******
0.03	271.73	.634E+03	0.0	0.02	694.13
0.05	271.75	.143E+04	0.0	0.03	529.62
0.07	271.77	.306E+04	0.1	0.04	405.42
0.09	271.79	.551E+04	0.3	0.04	365.74
0.11	271.81	.873E+04	0.4	0.05	336.92
0.13	271.83	.124E+05	0.7	0.05	310.09
0.16	271.86	.166E+05	1.0	0.06	288.06
0.18	271.88	.211E+05	1.3	0.06	269.92
0.20	271.90	.262E+05	1.7	0.06	254.75
0.22	271.92	.317E+05	2.2	0.07	239.31
0.24	271.94	.376E+05	2.8	0.07	224.81
0.26	271.96	.439E+05	3.4	0.08	213.43
0.28	271.98	.507E+05	4.1	0.08	203.95
0.30	272.00	.579E+05	4.9	0.08	195.88
0.33	272.03	.656E+05	5.8	0.09	188.88
0.35	272.05	.738E+05	6.7	0.09	182.73
0.37	272.07	.824E+05	7.7	0.09	177.27
0.39	272.09	.915E+05	8.8	0.10	172.36

**** WARNING: TRAVEL TIME TABLE EXCEEDED

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0020)	304.80	9.86	11.33	108.72	0.39	0.10
OUTFLOW: ID= 1 (****)	304.80	7.98	12.83	108.70	0.37	0.09

CALIB NASHYD (0400) ID= 1 DT=10.0 min	Area (ha)= 228.10	Curve Number (CN)= 67.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 1.65	

Unit Hyd Qpeak (cms)= 5.280

PEAK FLOW (cms)= 10.190 (i)
TIME TO PEAK (hrs)= 9.333
RUNOFF VOLUME (mm)= 108.033
TOTAL RAINFALL (mm)= 187.210
RUNOFF COEFFICIENT = 0.577

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ROUTE CHN (****) IN= 2---> OUT= 1	Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	276.00	0.1000	
91.20	274.69	0.1000	
174.02	274.10	0.1000	
210.03	273.92	0.1000	
333.58	273.80	0.1000 /0.0500	Main Channel

368.08	273.64	0.0500	Main Channel
385.33	273.85	0.0500 /0.1000	Main Channel
462.42	275.22	0.1000	
531.42	275.33	0.1000	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.08	273.72	.220E+03	0.1	0.07	54.86
0.16	273.80	.880E+03	0.4	0.11	34.56
0.25	273.89	.291E+04	1.6	0.13	29.37
0.34	273.98	.663E+04	4.2	0.15	26.31
0.43	274.07	.109E+05	8.0	0.17	22.70
0.52	274.16	.157E+05	13.0	0.19	20.01
0.61	274.25	.208E+05	19.2	0.21	18.01
0.70	274.34	.263E+05	26.5	0.23	16.50
0.79	274.43	.321E+05	34.9	0.25	15.32
0.88	274.52	.383E+05	44.5	0.27	14.36
0.97	274.61	.449E+05	55.2	0.28	13.57
1.06	274.70	.519E+05	67.1	0.30	12.88
1.15	274.79	.591E+05	80.7	0.32	12.21
1.24	274.88	.666E+05	95.5	0.33	11.62
1.33	274.97	.743E+05	111.4	0.35	11.11
1.42	275.06	.822E+05	128.5	0.36	10.66
1.51	275.15	.904E+05	146.8	0.38	10.26
1.60	275.24	.989E+05	165.2	0.39	9.97
1.69	275.33	.108E+06	183.2	0.39	9.85

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0400)	228.10	10.19	9.33	108.03	0.47	0.18
OUTFLOW: ID= 1 (****)	228.10	10.07	9.67	108.03	0.47	0.18

CALIB NASHYD (0500) ID= 1 DT=10.0 min	Area (ha)= 302.30	Curve Number (CN)= 67.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 1.31	

Unit Hyd Qpeak (cms)= 8.814

PEAK FLOW (cms)= 14.214 (i)
TIME TO PEAK (hrs)= 9.000
RUNOFF VOLUME (mm)= 108.032
TOTAL RAINFALL (mm)= 187.210
RUNOFF COEFFICIENT = 0.577

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB NASHYD (2300) ID= 1 DT=10.0 min	Area (ha)= 308.80	Curve Number (CN)= 64.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 1.85	

Unit Hyd Qpeak (cms)= 6.375

PEAK FLOW (cms)= 12.611 (i)
TIME TO PEAK (hrs)= 9.667

RUNOFF VOLUME (mm)= 102.128
TOTAL RAINFALL (mm)= 187.210
RUNOFF COEFFICIENT = 0.546

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| ROUTE CHN (****) |
| IN= 2---> OUT= 1 |

Routing time step (min)= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	274.69	0.1000	
82.82	274.10	0.1000	
118.83	273.92	0.1000	
242.38	273.80	0.1000 /0.0500	Main Channel
276.88	273.64	0.0500	Main Channel
294.13	273.85	0.0500 /0.1000	Main Channel
371.22	275.22	0.1000	
440.22	275.33	0.1000	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.05	273.69	.907E+03	0.0	0.05	711.92
0.11	273.75	.363E+04	0.1	0.08	448.48
0.16	273.80	.816E+04	0.4	0.10	342.25
0.22	273.86	.175E+05	1.0	0.12	298.74
0.27	273.91	.342E+05	2.0	0.12	287.79
0.33	273.97	.560E+05	3.5	0.13	266.60
0.38	274.02	.797E+05	5.5	0.15	242.26
0.44	274.08	.105E+06	7.9	0.16	222.10
0.49	274.13	.132E+06	10.7	0.17	205.22
0.55	274.19	.160E+06	14.0	0.19	191.05
0.60	274.24	.190E+06	17.7	0.20	179.33
0.66	274.30	.221E+06	21.7	0.21	169.47
0.72	274.36	.253E+06	26.2	0.22	161.07
0.77	274.41	.287E+06	31.1	0.23	153.82
0.83	274.47	.321E+06	36.3	0.24	147.48
0.88	274.52	.358E+06	42.0	0.25	141.88
0.94	274.58	.395E+06	48.1	0.26	136.90
0.99	274.63	.434E+06	54.6	0.27	132.43
1.05	274.69	.474E+06	61.5	0.28	128.38

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (2300)	308.80	12.61	9.67	102.13	0.53	0.18
OUTFLOW: ID= 1 (****)	308.80	8.94	12.00	102.11	0.46	0.17

| ADD HYD (0010) |
| 1 + 2 = 3 |

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (****):	308.80	8.937	12.00	102.11
+ ID2= 2 (****):	228.10	10.073	9.67	108.03
ID = 3 (0010):	536.90	17.699	10.50	104.63

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0010)		AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1		(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0010):		536.90	17.699	10.50	104.63
+ ID2= 2 (0500):		302.30	14.214	9.00	108.03
ID = 1 (0010):		839.20	30.625	9.67	105.85

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (****)	
IN= 2---> OUT= 1	Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	272.10	0.1000	
34.80	271.88	0.0500	Main Channel
68.44	271.83	0.0500	Main Channel
76.43	271.69	0.0500	Main Channel
82.05	271.69	0.0500	Main Channel
110.40	271.81	0.0500 /0.1000	Main Channel
127.77	271.89	0.1000	
150.00	272.05	0.1000	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.02	271.71	.635E+02	0.0	0.05	165.35
0.03	271.72	.166E+03	0.0	0.07	112.65
0.05	271.74	.308E+03	0.1	0.08	89.85
0.07	271.76	.490E+03	0.1	0.10	76.31
0.09	271.78	.710E+03	0.2	0.11	67.08
0.10	271.79	.970E+03	0.3	0.13	60.27
0.12	271.81	.127E+04	0.4	0.14	55.00
0.14	271.83	.161E+04	0.6	0.16	48.44
0.16	271.85	.209E+04	0.7	0.15	49.64
0.18	271.87	.273E+04	0.9	0.15	50.05
0.20	271.89	.353E+04	1.2	0.16	47.38
0.22	271.91	.441E+04	1.7	0.18	42.48
0.24	271.93	.534E+04	2.3	0.20	38.91
0.26	271.95	.633E+04	2.9	0.21	36.19
0.28	271.97	.737E+04	3.6	0.22	34.02
0.30	271.99	.847E+04	4.4	0.24	32.26
0.32	272.01	.962E+04	5.2	0.25	30.78
0.34	272.03	.108E+05	6.1	0.26	29.53
0.36	272.05	.121E+05	7.1	0.27	28.45

**** WARNING: TRAVEL TIME TABLE EXCEEDED

		<---- hydrograph ---->				<-pipe / channel->	
		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW :	ID= 2 (0010)	839.20	30.63	9.67	105.85	0.36	0.27
OUTFLOW:	ID= 1 (****)	839.20	30.10	10.17	105.85	0.36	0.27

ADD HYD (0030)		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3	ID1= 1 (****):	304.80	7.983	12.83	108.70
	+ ID2= 2 (****):	839.20	30.097	10.17	105.85
	ID = 3 (0030):	1144.00	35.796	10.67	106.61

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (****)
IN= 2---> OUT= 1

Routing time step (min)'= 5.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	273.19	0.1000	
89.61	271.91	0.1000 /0.0500	Main Channel
138.71	271.70	0.0500	Main Channel
184.80	271.75	0.0500 /0.1000	Main Channel
266.32	271.80	0.1000	
367.88	271.93	0.1000	
520.40	272.09	0.1000	
714.30	273.40	0.1000	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.05	271.75	.365E+03	0.0	0.03	147.14
0.13	271.83	.275E+04	0.5	0.05	89.17
0.20	271.90	.688E+04	1.6	0.06	70.23
0.28	271.98	.124E+05	3.6	0.07	57.38
0.35	272.05	.195E+05	6.4	0.08	50.32
0.43	272.13	.278E+05	10.4	0.09	44.57
0.50	272.20	.366E+05	15.5	0.11	39.50
0.58	272.28	.457E+05	21.4	0.12	35.69
0.66	272.36	.552E+05	28.1	0.13	32.73
0.73	272.43	.649E+05	35.6	0.14	30.37
0.81	272.51	.750E+05	44.0	0.15	28.43
0.88	272.58	.854E+05	53.1	0.16	26.81
0.96	272.66	.961E+05	63.0	0.17	25.43
1.04	272.74	.107E+06	73.7	0.17	24.24
1.11	272.81	.118E+06	85.1	0.18	23.21
1.19	272.89	.130E+06	97.3	0.19	22.29
1.26	272.96	.142E+06	110.3	0.20	21.48
1.34	273.04	.154E+06	124.0	0.20	20.75
1.41	273.11	.167E+06	138.6	0.21	20.09

		AREA (ha)	<---- hydrograph ----> QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	<-pipe / channel-> MAX DEPTH (m)	MAX VEL (m/s)
INFLOW :	ID= 2 (0030)	1144.00	35.80	10.67	106.61	0.73	0.14
OUTFLOW:	ID= 1 (****)	1144.00	34.96	11.00	106.61	0.72	0.14

**** WARNING: COMPUTATIONS FAILED TO CONVERGE.

CALIB
NASHYD (0300) | Area (ha)= 315.50 Curve Number (CN)= 54.0

|ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00

U.H. Tp(hrs)= 2.03

Unit Hyd Qpeak (cms)= 5.936

PEAK FLOW (cms)= 10.217 (i)
TIME TO PEAK (hrs)= 10.000
RUNOFF VOLUME (mm)= 83.297
TOTAL RAINFALL (mm)= 187.210
RUNOFF COEFFICIENT = 0.445

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| ADD HYD (0125) |
| 1 + 2 = 3 |

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (****):	1144.00	34.960	11.00	106.61
+ ID2= 2 (0300):	315.50	10.217	10.00	83.30
ID = 3 (0125):	1459.50	44.736	11.00	101.57

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| ROUTE CHN (****) |
| IN= 2---> OUT= 1 |

Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
133.75	272.89	0.1000	
157.66	271.71	0.0500 /0.1000	Main Channel
506.36	271.74	0.1000	
524.97	272.90	0.1000	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.06	271.77	.787E+04	0.6	0.04	211.05
0.12	271.83	.183E+05	2.5	0.07	120.74
0.19	271.90	.288E+05	5.4	0.09	89.62
0.25	271.96	.394E+05	9.0	0.11	73.08
0.31	272.02	.500E+05	13.3	0.13	62.58
0.37	272.08	.607E+05	18.3	0.14	55.23
0.43	272.14	.715E+05	23.9	0.16	49.74
0.50	272.21	.823E+05	30.2	0.18	45.47
0.56	272.27	.932E+05	37.0	0.19	42.03
0.62	272.33	.104E+06	44.3	0.20	39.19
0.68	272.39	.115E+06	52.2	0.22	36.80
0.75	272.46	.126E+06	60.6	0.23	34.76
0.81	272.52	.137E+06	69.5	0.24	32.98
0.87	272.58	.149E+06	78.8	0.25	31.43
0.93	272.64	.160E+06	88.7	0.26	30.06
0.99	272.70	.171E+06	99.1	0.28	28.83
1.06	272.77	.183E+06	109.9	0.29	27.73
1.12	272.83	.194E+06	121.1	0.30	26.73
1.18	272.89	.206E+06	132.8	0.31	25.83

<---- hydrograph ----> <-pipe / channel->

	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL

		(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2	(0125)	1459.50	44.74	11.00	101.57	0.62	0.20
OUTFLOW: ID= 1	(****)	1459.50	43.03	11.17	101.57	0.61	0.20

**** WARNING: COMPUTATIONS FAILED TO CONVERGE.

CALIB NASHYD (0600) ID= 1 DT=10.0 min				
	Area	(ha)= 299.60	Curve Number	(CN)= 63.0
	Ia	(mm)= 5.00	# of Linear Res.	(N)= 3.00
	U.H. Tp	(hrs)= 1.85		

Unit Hyd Qpeak (cms)= 6.186

PEAK FLOW (cms)= 12.010 (i)
TIME TO PEAK (hrs)= 9.667
RUNOFF VOLUME (mm)= 100.187
TOTAL RAINFALL (mm)= 187.210
RUNOFF COEFFICIENT = 0.535

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0040)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (****):	1459.50	43.027	11.17	101.57
+ ID2= 2 (0600):	299.60	12.010	9.67	100.19
ID = 3 (0040):	1759.10	53.767	10.92	101.34

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (****)
IN= 2---> OUT= 1

Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	280.66	0.1000	
230.75	272.35	0.0500 /0.1000	Main Channel
454.64	271.34	0.1000	
776.25	271.91	0.1000	
796.25	273.69	0.1000	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.12	271.46	.111E+05	0.2	0.03	******
0.25	271.59	.443E+05	1.1	0.05	681.82
0.37	271.71	.996E+05	3.2	0.06	520.33
0.49	271.83	.177E+06	6.9	0.07	429.52
0.62	271.96	.275E+06	12.8	0.09	359.68
0.74	272.08	.383E+06	21.2	0.10	301.05
0.87	272.21	.498E+06	31.8	0.12	261.00
0.99	272.33	.619E+06	44.5	0.13	231.74
1.11	272.45	.744E+06	60.8	0.15	204.11
1.24	272.58	.871E+06	79.5	0.17	182.72
1.36	272.70	.999E+06	100.2	0.18	166.24

1.48	272.82	.113E+07	122.8	0.20	153.09
1.61	272.95	.126E+07	147.3	0.22	142.33
1.73	273.07	.139E+07	173.7	0.23	133.33
1.86	273.20	.152E+07	201.8	0.24	125.68
1.98	273.32	.166E+07	231.7	0.26	119.08
2.10	273.44	.179E+07	263.2	0.27	113.32
2.23	273.57	.193E+07	296.4	0.28	108.24
2.35	273.69	.206E+07	331.3	0.30	103.73

		<---- hydrograph ---->			<-pipe / channel->	
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0040)	1759.10	53.77	10.92	101.34	1.06	0.14
OUTFLOW: ID= 1 (****)	1759.10	38.72	12.83	101.32	0.93	0.13

CALIB NASHYD (0700) ID= 1 DT=10.0 min					
	Area	(ha)=	181.20	Curve Number	(CN)= 60.0
	Ia	(mm)=	5.00	# of Linear Res.	(N)= 3.00
	U.H. Tp	(hrs)=	1.89		

Unit Hyd Qpeak (cms)= 3.662

PEAK FLOW (cms)= 6.806 (i)
TIME TO PEAK (hrs)= 9.833
RUNOFF VOLUME (mm)= 94.442
TOTAL RAINFALL (mm)= 187.210
RUNOFF COEFFICIENT = 0.504

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB NASHYD (1000) ID= 1 DT=10.0 min					
	Area	(ha)=	69.40	Curve Number	(CN)= 67.0
	Ia	(mm)=	5.00	# of Linear Res.	(N)= 3.00
	U.H. Tp	(hrs)=	1.06		

Unit Hyd Qpeak (cms)= 2.501

PEAK FLOW (cms)= 3.495 (i)
TIME TO PEAK (hrs)= 7.833
RUNOFF VOLUME (mm)= 108.030
TOTAL RAINFALL (mm)= 187.210
RUNOFF COEFFICIENT = 0.577

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0050)
1 + 2 = 3

	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (1000):	69.40	3.495	7.83	108.03
+ ID2= 2 (****):	1759.10	38.721	12.83	101.32
ID = 3 (0050):	1828.50	40.029	12.42	101.57

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ADD HYD   (0050) |
|   3 +  2 =  1    |          AREA     QPEAK     TPEAK      R.V.
--------------------          (ha)     (cms)     (hrs)      (mm)
          ID1= 3 (0050):   1828.50   40.029     12.42    101.57
        + ID2= 2 (0700):    181.20    6.806      9.83     94.44
          ================================================
          ID = 1 (0050):   2009.70   45.082     12.42    100.93

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| CALIB            |
| NASHYD    (0800) |   Area     (ha)= 183.20   Curve Number    (CN)= 68.0
|ID= 1 DT=10.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.53

     Unit Hyd Qpeak  (cms)=   4.573

     PEAK FLOW       (cms)=   8.497 (i)
     TIME TO PEAK    (hrs)=   9.333
     RUNOFF VOLUME    (mm)= 110.029
     TOTAL RAINFALL   (mm)= 187.210
     RUNOFF COEFFICIENT   =   0.588

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| ROUTE CHN (0009) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 10.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   8.00         272.30        0.1000
                  35.00         271.80   0.1000 /0.0500  Main Channel
                  50.00         271.50        0.0500     Main Channel
                  80.00         271.80   0.0500 /0.1000  Main Channel
                 142.00         272.20        0.1000
                 150.00         272.10        0.1000
                 228.00         273.20        0.1000
                 288.00         275.23        0.1000

      <---------------------- TRAVEL TIME TABLE ----------------------->
       DEPTH     ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
         (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        0.04   271.54    .150E+03        0.0         0.06      415.02
        0.08   271.58    .599E+03        0.0         0.09      261.44
        0.11   271.61    .135E+04        0.1         0.12      199.52
        0.15   271.65    .240E+04        0.2         0.14      164.70
        0.19   271.69    .374E+04        0.4         0.17      141.93
        0.23   271.73    .539E+04        0.7         0.19      125.69
        0.26   271.76    .734E+04        1.1         0.21      113.41
        0.30   271.80    .958E+04        1.5         0.23      103.74
        0.35   271.85    .128E+05        2.4         0.27       88.84
        0.39   271.89    .166E+05        3.4         0.29       80.63
        0.44   271.94    .210E+05        4.7         0.31       75.41
        0.48   271.98    .261E+05        6.1         0.33       71.76
        0.53   272.03    .318E+05        7.7         0.34       69.01
        0.57   272.07    .380E+05        9.5         0.35       66.83
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0.62	272.12	.450E+05	11.5	0.36	65.24
0.66	272.16	.528E+05	13.7	0.37	64.35
0.71	272.21	.618E+05	16.2	0.37	63.59
0.75	272.25	.713E+05	19.1	0.38	62.29
0.80	272.30	.812E+05	22.2	0.39	60.90

		<---- hydrograph ---->			<-pipe / channel->	
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0800)	183.20	8.50	9.33	110.03	0.55	0.35
OUTFLOW: ID= 1 (0009)	183.20	7.81	10.17	110.02	0.53	0.34

CALIB			
NASHYD (0900)	Area (ha)= 236.70	Curve Number (CN)= 64.0	
ID= 1 DT=10.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 1.97		

Unit Hyd Qpeak (cms)= 4.589

PEAK FLOW (cms)= 9.453 (i)
TIME TO PEAK (hrs)= 9.833
RUNOFF VOLUME (mm)= 102.128
TOTAL RAINFALL (mm)= 187.210
RUNOFF COEFFICIENT = 0.546

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0070)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0009):	183.20	7.809	10.17	110.02
	+ ID2= 2 (0900):	236.70	9.453	9.83	102.13
	ID = 3 (0070):	419.90	17.231	10.00	105.57

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (****)	
IN= 2---> OUT= 1	Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
16.00	272.32	0.1000	
55.00	271.60	0.1000 /0.0500	Main Channel
64.00	270.90	0.0500	Main Channel
129.00	271.30	0.0500 /0.1000	Main Channel
151.00	271.51	0.1000	
193.00	271.75	0.1000	
296.00	272.52	0.1000	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.07	270.97	.364E+03	0.0	0.08	183.39
0.13	271.03	.146E+04	0.2	0.13	115.51

0.20	271.10	.328E+04	0.6	0.18	88.15
0.27	271.17	.582E+04	1.3	0.21	72.77
0.33	271.23	.910E+04	2.4	0.25	62.71
0.40	271.30	.131E+05	3.9	0.28	55.53
0.48	271.38	.186E+05	6.8	0.34	45.54
0.56	271.46	.247E+05	10.3	0.39	39.89
0.64	271.54	.316E+05	14.5	0.43	36.24
0.71	271.61	.394E+05	19.4	0.46	33.82
0.79	271.69	.485E+05	25.2	0.49	32.05
0.87	271.77	.589E+05	31.9	0.51	30.81
0.95	271.85	.705E+05	39.4	0.52	29.81
1.03	271.93	.831E+05	47.8	0.54	28.98
1.11	272.01	.968E+05	57.1	0.55	28.26
1.18	272.08	.112E+06	67.3	0.56	27.63
1.26	272.16	.127E+06	78.4	0.58	27.07
1.34	272.24	.144E+06	90.6	0.59	26.56
1.42	272.32	.162E+06	103.7	0.60	26.09

		<---- hydrograph ---->			<-pipe / channel->	
		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW :	ID= 2 (0070)	419.90	17.23	10.00	105.57	0.68	0.45
OUTFLOW:	ID= 1 (****)	419.90	16.88	10.50	105.57	0.67	0.44

ADD HYD (0060)		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3	ID1= 1 (****):	419.90	16.880	10.50	105.57
	+ ID2= 2 (0050):	2009.70	45.082	12.42	100.93
	ID = 3 (0060):	2429.60	60.277	11.92	101.73

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (****)
IN= 2---> OUT= 1

Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
90.00	276.61	0.1000	
140.00	273.00	0.1000	
152.00	271.10	0.1000 /0.0500	Main Channel
160.00	271.10	0.0500 /0.1000	Main Channel
168.00	271.51	0.1000	
230.00	271.51	0.1000	
252.00	274.18	0.1000	
280.00	276.18	0.1000	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.27	271.37	.253E+04	0.4	0.13	104.52
0.53	271.63	.129E+05	1.8	0.11	120.57
0.80	271.90	.315E+05	5.7	0.15	92.29
1.07	272.17	.510E+05	11.5	0.19	73.61
1.34	272.44	.714E+05	19.1	0.22	62.18
1.60	272.70	.926E+05	28.3	0.25	54.48

1.87	272.97	.115E+06	39.1	0.28	48.92
2.14	273.24	.138E+06	51.1	0.31	44.89
2.41	273.51	.162E+06	64.8	0.33	41.71
2.67	273.77	.188E+06	80.0	0.35	39.11
2.94	274.04	.215E+06	96.9	0.37	36.95
3.21	274.31	.243E+06	115.0	0.39	35.25
3.48	274.58	.273E+06	134.3	0.41	33.89
3.74	274.84	.305E+06	155.4	0.42	32.68
4.01	275.11	.338E+06	178.3	0.44	31.60
4.28	275.38	.373E+06	203.0	0.45	30.62
4.55	275.65	.409E+06	229.5	0.46	29.72
4.81	275.91	.448E+06	258.1	0.48	28.90
5.08	276.18	.487E+06	288.6	0.49	28.14

		<---- hydrograph ---->			<-pipe / channel->	
		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW :	ID= 2 (0060)	2429.60	60.28	11.92	101.73	2.32	0.32
OUTFLOW:	ID= 1 (****)	2429.60	57.99	12.00	101.73	2.27	0.32

CALIB					
NASHYD (1100)	Area	(ha)=	203.07	Curve Number	(CN)= 70.0
ID= 1 DT=10.0 min	Ia	(mm)=	5.00	# of Linear Res.	(N)= 3.00
	U.H. Tp(hrs)=		1.74		

Unit Hyd Qpeak (cms)= 4.458

PEAK FLOW (cms)= 9.402 (i)
TIME TO PEAK (hrs)= 9.500
RUNOFF VOLUME (mm)= 114.064
TOTAL RAINFALL (mm)= 187.210
RUNOFF COEFFICIENT = 0.609

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0080)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (****):	2429.60	57.990	12.00	101.73
	+ ID2= 2 (1100):	203.07	9.402	9.50	114.06
	ID = 3 (0080):	2632.67	64.899	12.00	102.68

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (****)	
IN= 2---> OUT= 1	Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
44.00	272.20	0.0700	
75.00	270.40	0.0700	
76.00	268.80	0.0700 /0.0500	Main Channel
80.00	268.70	0.0500	Main Channel
84.00	268.10	0.0500	Main Channel

88.00	269.90	0.0500 /0.0700	Main Channel	
135.00	271.98	0.0700		

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.17	268.27	.563E+02	0.0	0.34	20.26
0.35	268.45	.225E+03	0.3	0.54	12.76
0.52	268.62	.507E+03	0.9	0.71	9.74
0.70	268.80	.970E+03	1.6	0.68	10.11
0.91	269.01	.183E+04	4.4	1.00	6.87
1.12	269.22	.275E+04	8.4	1.26	5.46
1.34	269.44	.372E+04	13.4	1.49	4.64
1.55	269.65	.475E+04	19.3	1.68	4.10
1.76	269.86	.582E+04	26.2	1.86	3.71
1.97	270.07	.708E+04	34.7	2.03	3.40
2.18	270.28	.876E+04	44.9	2.12	3.25
2.40	270.50	.109E+05	56.8	2.16	3.20
2.61	270.71	.137E+05	71.3	2.15	3.21
2.82	270.92	.173E+05	88.8	2.12	3.25
3.03	271.13	.216E+05	109.9	2.10	3.28
3.24	271.34	.267E+05	135.0	2.09	3.30
3.46	271.56	.325E+05	164.4	2.09	3.29
3.67	271.77	.390E+05	198.6	2.11	3.27
3.88	271.98	.463E+05	238.0	2.13	3.24

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0080)	2632.67	64.90	12.00	102.68	2.51	2.15
OUTFLOW: ID= 1 (****)	2632.67	64.73	12.00	102.68	2.51	2.15

CALIB NASHYD (1200) ID= 1 DT=10.0 min					
	Area (ha)=	30.80	Curve Number (CN)=	78.0	
	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.85			

Unit Hyd Qpeak (cms)= 1.384

PEAK FLOW (cms)= 2.084 (i)
TIME TO PEAK (hrs)= 7.500
RUNOFF VOLUME (mm)= 130.774
TOTAL RAINFALL (mm)= 187.210
RUNOFF COEFFICIENT = 0.699

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0090)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (****):	2632.67	64.733	12.00	102.68
+ ID2= 2 (1200):	30.80	2.084	7.50	130.77
ID = 3 (0090):	2663.47	65.557	12.00	103.01

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ROUTE CHN (****) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 10.00
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<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
18.00	268.20	0.0700	
29.00	266.80	0.0700	
50.50	266.10	0.0700	
57.00	264.70	0.0700 /0.0500	Main Channel
60.50	264.60	0.0500	Main Channel
66.00	264.72	0.0500 /0.0700	Main Channel
77.80	267.30	0.0700	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.10	264.70	.416E+03	0.1	0.28	61.42
0.24	264.84	.175E+04	1.1	0.64	26.84
0.37	264.97	.327E+04	2.9	0.90	19.08
0.51	265.11	.497E+04	5.3	1.11	15.51
0.65	265.25	.685E+04	8.5	1.28	13.40
0.78	265.38	.890E+04	12.4	1.43	11.98
0.92	265.52	.111E+05	16.9	1.57	10.95
1.06	265.66	.135E+05	22.2	1.69	10.16
1.19	265.79	.161E+05	28.2	1.80	9.53
1.33	265.93	.189E+05	34.9	1.90	9.01
1.47	266.07	.218E+05	42.4	2.00	8.58
1.61	266.21	.251E+05	49.7	2.04	8.42
1.74	266.34	.290E+05	58.3	2.07	8.30
1.88	266.48	.336E+05	68.3	2.09	8.21
2.02	266.62	.389E+05	79.9	2.11	8.13
2.15	266.75	.449E+05	93.0	2.13	8.05
2.29	266.89	.515E+05	108.5	2.17	7.91
2.43	267.03	.583E+05	126.0	2.22	7.71
2.56	267.16	.654E+05	145.1	2.28	7.51

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0090)	2663.47	65.56	12.00	103.01	1.84	2.08
OUTFLOW: ID= 1 (****)	2663.47	65.48	12.08	103.01	1.84	2.08

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--------------------
| CALIB            |
| NASHYD    (1300) |   Area     (ha)=  42.90   Curve Number   (CN)= 80.0
|ID= 1 DT=10.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.53

     Unit Hyd Qpeak  (cms)=   3.092

     PEAK FLOW       (cms)=   3.583 (i)
     TIME TO PEAK    (hrs)=   7.167
     RUNOFF VOLUME    (mm)= 135.035
     TOTAL RAINFALL   (mm)= 187.210
     RUNOFF COEFFICIENT   =   0.721

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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| ADD HYD   (0101) |
|   1 +  2 =  3    |          AREA     QPEAK     TPEAK      R.V.
--------------------          (ha)     (cms)     (hrs)      (mm)
          ID1= 1 (****):   2663.47   65.476     12.08    103.01
        + ID2= 2 (1300):     42.90    3.583      7.17    135.04
          ================================================
          ID = 3 (0101):   2706.37   66.496     11.75    103.51

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ROUTE CHN (****) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 10.00
--------------------
                <------ DATA FOR SECTION (   1.1) ------>
                Distance      Elevation        Manning
                   0.00         259.27         0.0700
                 224.90         256.32    0.0500 /0.0700  Main Channel
                 234.22         255.44         0.0700
                 241.28         255.24         0.0700
                 245.63         256.44         0.0700
                 278.81         257.64         0.0700

       <---------------------- TRAVEL TIME TABLE ---------------------->
        DEPTH     ELEV       VOLUME     FLOW RATE     VELOCITY    TRAV.TIME
         (m)       (m)      (cu.m.)       (cms)         (m/s)       (min)
        0.10    255.34     .588E+02         0.0          0.11        46.94
        0.20    255.44     .235E+03         0.1          0.17        29.57
        0.33    255.57     .576E+03         0.5          0.28        17.82
        0.46    255.70     .988E+03         1.2          0.37        13.64
        0.59    255.83     .147E+04         2.2          0.44        11.35
        0.72    255.96     .203E+04         3.4          0.51         9.86
        0.85    256.09     .266E+04         5.0          0.57         8.80
        0.98    256.22     .336E+04         7.0          0.63         7.99
        1.11    256.35     .414E+04         9.4          0.69         7.32
        1.24    256.48     .522E+04        12.2          0.71         7.12
        1.36    256.60     .679E+04        15.2          0.68         7.45
        1.49    256.73     .890E+04        19.6          0.67         7.57
        1.62    256.86     .115E+05        25.5          0.67         7.55
        1.75    256.99     .147E+05        33.0          0.68         7.42
        1.88    257.12     .184E+05        42.3          0.70         7.23
        2.01    257.25     .226E+05        53.6          0.72         7.01
        2.14    257.38     .273E+05        67.0          0.74         6.79
        2.27    257.51     .325E+05        82.7          0.77         6.56
        2.40    257.64     .383E+05       100.8          0.80         6.34

                                      <---- hydrograph ---->   <-pipe / channel->
                                AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                                (ha)    (cms)   (hrs)   (mm)      (m)       (m/s)
     INFLOW : ID= 2 (0101) 2706.37    66.50   11.75 103.51       2.14       0.74
     OUTFLOW: ID= 1 (****) 2706.37    66.39   12.08 103.51       2.14       0.74

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--------------------
| CALIB            |
| NASHYD   (1400)  |   Area     (ha)= 117.70   Curve Number   (CN)= 74.0
|ID= 1 DT=10.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.97
```

Unit Hyd Qpeak (cms)= 4.635

PEAK FLOW (cms)= 7.020 (i)
TIME TO PEAK (hrs)= 7.667
RUNOFF VOLUME (mm)= 122.299
TOTAL RAINFALL (mm)= 187.210
RUNOFF COEFFICIENT = 0.653

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| ROUTE CHN (****) |
| IN= 2---> OUT= 1 |

Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	259.27	0.0700	
224.90	256.32	0.0500 /0.0700	Main Channel
234.22	255.44	0.0700	
241.28	255.24	0.0700	
245.63	256.44	0.0700	
278.81	257.64	0.0700	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.10	255.34	.130E+03	0.0	0.25	44.25
0.20	255.44	.521E+03	0.3	0.40	27.88
0.33	255.57	.127E+04	1.3	0.66	16.80
0.46	255.70	.219E+04	2.8	0.87	12.86
0.59	255.83	.326E+04	5.1	1.04	10.70
0.72	255.96	.449E+04	8.0	1.20	9.30
0.85	256.09	.588E+04	11.8	1.34	8.30
0.98	256.22	.743E+04	16.4	1.48	7.53
1.11	256.35	.915E+04	22.1	1.61	6.90
1.24	256.48	.115E+05	28.7	1.66	6.71
1.36	256.60	.150E+05	35.7	1.59	7.02
1.49	256.73	.197E+05	45.9	1.56	7.14
1.62	256.86	.255E+05	59.7	1.57	7.11
1.75	256.99	.325E+05	77.4	1.59	6.99
1.88	257.12	.406E+05	99.3	1.64	6.82
2.01	257.25	.499E+05	125.8	1.69	6.61
2.14	257.38	.604E+05	157.3	1.74	6.40
2.27	257.51	.720E+05	194.1	1.80	6.18
2.40	257.64	.848E+05	236.6	1.87	5.97

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (1400)	117.70	7.02	7.67	122.30	0.67	1.14
OUTFLOW: ID= 1 (****)	117.70	7.00	7.83	122.30	0.67	1.14

| CALIB |
| NASHYD (1500) |
| ID= 1 DT=10.0 min |

Area (ha)= 37.27 Curve Number (CN)= 74.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.72

Unit Hyd Qpeak (cms)= 1.977

```
PEAK FLOW        (cms)=    2.518 (i)
TIME TO PEAK     (hrs)=    7.333
RUNOFF VOLUME     (mm)= 122.283
TOTAL RAINFALL    (mm)= 187.210
RUNOFF COEFFICIENT    =   0.653

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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--------------------
| ADD HYD   (0121) |
|   1 +  2 =  3    |          AREA     QPEAK     TPEAK      R.V.
--------------------          (ha)     (cms)     (hrs)      (mm)
         ID1= 1 (****):   2706.37   66.391     12.08    103.51
       + ID2= 2 (****):    117.70    6.997      7.83    122.30
         ================================================
         ID = 3 (0121):   2824.07   69.968     11.75    104.30

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| ADD HYD   (0121) |
|   3 +  2 =  1    |          AREA     QPEAK     TPEAK      R.V.
--------------------          (ha)     (cms)     (hrs)      (mm)
         ID1= 3 (0121):   2824.07   69.968     11.75    104.30
       + ID2= 2 (1500):     37.27    2.518      7.33    122.28
         ================================================
         ID = 1 (0121):   2861.34   70.951     11.75    104.53

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| ROUTE CHN (****) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 10.00
--------------------
              <------ DATA FOR SECTION (   1.1) ------>
             Distance      Elevation       Manning
                0.00         253.10        0.0700
               17.00         252.40        0.0500      Main Channel
               29.00         251.60        0.0500      Main Channel
               31.00         250.80        0.0500      Main Channel
               35.00         251.00        0.0500      Main Channel
               39.50         250.90   0.0500 /0.0700   Main Channel
               44.00         251.50        0.0700
               56.00         252.50        0.0700
               61.00         253.20        0.0700

    <---------------------- TRAVEL TIME TABLE ---------------------->
     DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY    TRAV.TIME
      (m)       (m)     (cu.m.)       (cms)         (m/s)       (min)
     0.10    250.90    .294E+02        0.0          0.36        12.18
     0.22    251.02    .226E+03        0.4          0.52         8.41
     0.33    251.13    .543E+03        1.8          0.86         5.05
     0.45    251.25    .895E+03        3.8          1.12         3.88
     0.56    251.36    .128E+04        6.6          1.34         3.25
     0.68    251.48    .170E+04        9.9          1.52         2.86
     0.79    251.59    .217E+04       13.9          1.68         2.59
     0.91    251.71    .270E+04       17.6          1.70         2.55
     1.03    251.83    .333E+04       22.2          1.75         2.49
```

1.14	251.94	.405E+04	27.9	1.80	2.42
1.26	252.06	.486E+04	34.7	1.86	2.33
1.37	252.17	.577E+04	42.8	1.93	2.25
1.49	252.29	.678E+04	52.2	2.01	2.17
1.61	252.41	.788E+04	63.0	2.09	2.08
1.72	252.52	.909E+04	77.8	2.23	1.95
1.84	252.64	.104E+05	94.4	2.37	1.84
1.95	252.75	.119E+05	112.7	2.48	1.75
2.07	252.87	.134E+05	132.8	2.59	1.68
2.18	252.98	.151E+05	154.7	2.68	1.62

		<---- hydrograph ---->			<-pipe / channel->	
		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW :	ID= 2 (0121)	2861.34	70.95	11.75	104.53	1.67	2.16
OUTFLOW:	ID= 1 (****)	2861.34	70.94	11.75	104.53	1.67	2.16

CALIB					
NASHYD (1600)	Area	(ha)=	8.90	Curve Number	(CN)= 74.0
ID= 1 DT=10.0 min	Ia	(mm)=	5.00	# of Linear Res.	(N)= 3.00
	U.H. Tp(hrs)=		0.78		

Unit Hyd Qpeak (cms)= 0.436

PEAK FLOW (cms)= 0.580 (i)
TIME TO PEAK (hrs)= 7.333
RUNOFF VOLUME (mm)= 122.289
TOTAL RAINFALL (mm)= 187.210
RUNOFF COEFFICIENT = 0.653

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0110)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (****):	2861.34	70.941	11.75	104.53
	+ ID2= 2 (1600):	8.90	0.580	7.33	122.29
	ID = 3 (0110):	2870.24	71.182	11.75	104.59

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (****)	
IN= 2---> OUT= 1	Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
10.00	249.90	0.1000	
86.00	248.10	0.1000 /0.0350	Main Channel
88.00	246.81	0.0350	Main Channel
107.00	247.20	0.0350	Main Channel
112.00	248.90	0.0350 /0.0600	Main Channel
132.00	247.90	0.0600	
164.00	249.40	0.0600	

<-------------------- TRAVEL TIME TABLE ---------------------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.13	246.94	.133E+03	0.2	0.36	14.71
0.26	247.07	.532E+03	1.0	0.57	9.26
0.39	247.20	.120E+04	2.8	0.75	7.07
0.52	247.33	.201E+04	6.5	1.03	5.13
0.64	247.45	.285E+04	11.4	1.28	4.15
0.77	247.58	.371E+04	17.4	1.49	3.55
0.90	247.71	.460E+04	24.4	1.69	3.14
1.03	247.84	.551E+04	32.4	1.87	2.84
1.16	247.97	.648E+04	41.3	2.03	2.61
1.29	248.10	.767E+04	51.3	2.13	2.49
1.43	248.24	.942E+04	64.6	2.18	2.43
1.58	248.39	.117E+05	80.0	2.17	2.45
1.72	248.53	.146E+05	97.9	2.13	2.49
1.87	248.68	.181E+05	118.6	2.08	2.55
2.01	248.82	.222E+05	142.4	2.04	2.59
2.16	248.97	.268E+05	170.6	2.03	2.62
2.30	249.11	.318E+05	203.6	2.03	2.61
2.45	249.26	.373E+05	240.0	2.05	2.59
2.59	249.40	.432E+05	280.2	2.06	2.57

		AREA (ha)	<---- hydrograph ----> QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	<-pipe / channel-> MAX DEPTH (m)	MAX VEL (m/s)
INFLOW :	ID= 2 (0110)	2870.24	71.18	11.75	104.59	1.50	2.17
OUTFLOW:	ID= 1 (****)	2870.24	71.16	11.83	104.59	1.49	2.17

CALIB NASHYD (1700) ID= 1 DT=10.0 min					
	Area (ha)=	21.80	Curve Number (CN)=	74.0	
	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.82			

Unit Hyd Qpeak (cms)= 1.015

PEAK FLOW (cms)= 1.396 (i)
TIME TO PEAK (hrs)= 7.500
RUNOFF VOLUME (mm)= 122.293
TOTAL RAINFALL (mm)= 187.210
RUNOFF COEFFICIENT = 0.653

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0123)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (****):	2870.24	71.155	11.83	104.59
+ ID2= 2 (1700):	21.80	1.396	7.50	122.29
ID = 3 (0123):	2892.04	71.751	11.75	104.72

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (****)

| IN= 2---> OUT= 1 | Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	251.28	0.0450	
32.00	250.70	0.0450	
84.00	249.60	0.0450	
91.00	249.10	0.0450 /0.0320	Main Channel
96.00	248.60	0.0320	Main Channel
100.00	248.90	0.0320 /0.0450	Main Channel
112.00	250.45	0.0450	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.07	248.68	.889E+01	0.0	0.28	8.17
0.15	248.75	.356E+02	0.1	0.44	5.14
0.22	248.82	.800E+02	0.3	0.58	3.93
0.30	248.90	.142E+03	0.7	0.70	3.24
0.40	249.00	.253E+03	1.7	0.90	2.50
0.51	249.11	.390E+03	3.1	1.07	2.12
0.61	249.21	.555E+03	5.1	1.25	1.81
0.71	249.31	.752E+03	7.7	1.39	1.63
0.82	249.42	.980E+03	10.9	1.50	1.50
0.92	249.52	.124E+04	14.6	1.60	1.41
1.02	249.62	.153E+04	19.0	1.68	1.35
1.13	249.73	.189E+04	23.9	1.72	1.32
1.23	249.83	.233E+04	29.9	1.74	1.30
1.33	249.93	.284E+04	37.0	1.76	1.28
1.44	250.04	.344E+04	45.3	1.79	1.26
1.54	250.14	.412E+04	55.0	1.81	1.25
1.64	250.24	.487E+04	66.1	1.84	1.23
1.75	250.35	.571E+04	78.7	1.87	1.21
1.85	250.45	.662E+04	93.0	1.90	1.19

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0123)	2892.04	71.75	11.75	104.72	1.69	1.85
OUTFLOW: ID= 1 (****)	2892.04	71.76	11.83	104.72	1.69	1.85

CALIB NASHYD (1800) ID= 1 DT=10.0 min	Area (ha)= 3.82	Curve Number (CN)= 78.0 Ia (mm)= 5.00	# of Linear Res.(N)= 3.00 U.H. Tp(hrs)= 0.10

Unit Hyd Qpeak (cms)= 1.459

PEAK FLOW (cms)= 0.281 (i)
TIME TO PEAK (hrs)= 7.000
RUNOFF VOLUME (mm)= 99.787
TOTAL RAINFALL (mm)= 187.210
RUNOFF COEFFICIENT = 0.533

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| ADD HYD (0130) |

1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (****):	2892.04	71.756	11.83	104.72
+ ID2= 2 (1800):	3.82	0.281	7.00	99.79
ID = 3 (0130):	2895.86	71.814	11.83	104.71

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN (0124)
IN= 2---> OUT= 1

Routing time step (min)'= 5.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	251.01	0.0700	
76.16	250.14	0.0500	Main Channel
84.69	248.40	0.0500 /0.0700	Main Channel
92.28	246.41	0.0700	
100.53	248.07	0.0700	
119.66	248.85	0.0700	
150.39	250.47	0.0700	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.20	246.61	.712E+02	0.0	0.11	62.27
0.40	246.81	.285E+03	0.1	0.17	39.23
0.60	247.01	.641E+03	0.4	0.23	29.94
0.80	247.21	.114E+04	0.8	0.28	24.71
1.00	247.41	.178E+04	1.4	0.32	21.30
1.19	247.60	.256E+04	2.3	0.36	18.86
1.39	247.80	.349E+04	3.4	0.40	17.02
1.59	248.00	.456E+04	4.9	0.44	15.57
1.79	248.20	.584E+04	6.2	0.43	15.75
1.99	248.40	.756E+04	8.0	0.43	15.82
2.22	248.63	.101E+05	11.2	0.45	15.05
2.45	248.86	.133E+05	15.7	0.48	14.19
2.68	249.09	.171E+05	21.8	0.52	13.12
2.91	249.32	.214E+05	29.2	0.56	12.21
3.14	249.55	.262E+05	38.2	0.60	11.44
3.37	249.78	.316E+05	48.9	0.63	10.76
3.60	250.01	.374E+05	61.3	0.67	10.18
3.83	250.24	.439E+05	75.8	0.71	9.67
4.06	250.47	.525E+05	93.1	0.73	9.40

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0130)	2895.86	71.81	11.83	104.71	3.77	0.70
OUTFLOW: ID= 1 (0124)	2895.86	71.62	11.92	104.71	3.76	0.70

CALIB NASHYD (1900) ID= 1 DT=10.0 min	Area (ha)= 10.25	Curve Number (CN)= 80.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.33	

Unit Hyd Qpeak (cms)= 1.186

```
PEAK FLOW        (cms)=    0.959 (i)
TIME TO PEAK     (hrs)=    7.000
RUNOFF VOLUME     (mm)= 134.579
TOTAL RAINFALL    (mm)= 187.210
RUNOFF COEFFICIENT   =    0.719

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

ADD HYD (0150)		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3	ID1= 1 (0124):	2895.86	71.622	11.92	104.71
	+ ID2= 2 (1900):	10.25	0.959	7.00	134.58
	ID = 3 (0150):	2906.11	71.835	11.92	104.82

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB NASHYD (2000) ID= 1 DT=10.0 min				
	Area (ha)= 125.00	Curve Number (CN)= 67.0		
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00		
	U.H. Tp(hrs)= 1.50			

```
Unit Hyd Qpeak  (cms)=    3.183

PEAK FLOW        (cms)=    5.725 (i)
TIME TO PEAK     (hrs)=    9.167
RUNOFF VOLUME     (mm)= 108.033
TOTAL RAINFALL    (mm)= 187.210
RUNOFF COEFFICIENT   =    0.577

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

ROUTE CHN (****) IN= 2---> OUT= 1	Routing time step (min)'= 10.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	256.00	0.0700	
41.00	250.00	0.0500	Main Channel
126.00	249.50	0.0500 /0.0700	Main Channel
131.00	249.00	0.0700	
136.00	249.50	0.0700	
217.00	250.00	0.0700	
283.00	251.30	0.0700	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.10	249.10	.666E+02	0.0	0.14	77.86
0.20	249.20	.267E+03	0.1	0.23	49.05
0.30	249.30	.600E+03	0.3	0.30	37.43
0.40	249.40	.107E+04	0.6	0.36	30.90
0.50	249.50	.167E+04	1.0	0.42	26.63
0.63	249.63	.435E+04	2.0	0.30	36.91
0.76	249.76	.107E+05	5.9	0.37	30.24

0.89	249.89	.207E+05	14.0	0.45	24.61
1.01	250.01	.343E+05	27.9	0.54	20.52
1.14	250.14	.498E+05	50.9	0.68	16.32
1.27	250.27	.659E+05	79.4	0.80	13.83
1.40	250.40	.826E+05	113.3	0.91	12.16
1.53	250.53	.100E+06	152.3	1.01	10.95
1.66	250.66	.118E+06	196.3	1.11	10.02
1.79	250.79	.137E+06	245.3	1.20	9.28
1.91	250.91	.156E+06	299.3	1.28	8.68
2.04	251.04	.176E+06	358.1	1.36	8.18
2.17	251.17	.196E+06	421.8	1.43	7.76
2.30	251.30	.218E+06	490.5	1.50	7.39

	<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (2000)	125.00	5.72	9.17	108.03	0.75	0.36
OUTFLOW: ID= 1 (****)	125.00	5.64	9.50	108.03	0.75	0.36

CALIB NASHYD (2100) ID= 1 DT=10.0 min	Area (ha)= 34.30	Curve Number (CN)= 80.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.36	

Unit Hyd Qpeak (cms)= 3.639

PEAK FLOW (cms)= 3.163 (i)
TIME TO PEAK (hrs)= 7.000
RUNOFF VOLUME (mm)= 134.734
TOTAL RAINFALL (mm)= 187.210
RUNOFF COEFFICIENT = 0.720

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0160)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (****):	125.00	5.642	9.50	108.03
+ ID2= 2 (0150):	2906.11	71.835	11.92	104.82
ID = 3 (0160):	3031.11	76.138	11.83	104.95

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0160)
3 + 2 = 1

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0160):	3031.11	76.138	11.83	104.95
+ ID2= 2 (2100):	34.30	3.163	7.00	134.73
ID = 1 (0160):	3065.41	76.917	11.58	105.28

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB            |
| NASHYD    (2200) |   Area     (ha)=  10.21   Curve Number    (CN)= 78.0
|ID= 1 DT=10.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.21

     Unit Hyd Qpeak  (cms)=   1.857

     PEAK FLOW       (cms)=   0.947 (i)
     TIME TO PEAK    (hrs)=   7.000
     RUNOFF VOLUME    (mm)= 127.937
     TOTAL RAINFALL   (mm)= 187.210
     RUNOFF COEFFICIENT   =   0.683

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD   (0170) |
|   1 +  2 =  3    |          AREA     QPEAK     TPEAK      R.V.
--------------------          (ha)     (cms)     (hrs)      (mm)
          ID1= 1 (0160):  3065.41   76.917     11.58    105.28
        + ID2= 2 (2200):    10.21    0.947      7.00    127.94
          ================================================
          ID = 3 (0170):  3075.62   77.121     11.58    105.36

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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Appendix F
Sensitivity Analyses - Hydrology

Hydrologic Sensitivity Analyses

The hydrologic model was tested for sensitivity for the input parameters in the list below. Input parameters were modified by varying degrees as outlined below for the Regional Storm event only (Timmins Event). The increase/decrease in peak flows from the base scenario at a number of key nodes was noted to establish a level of confidence in peak flow estimations. This was done to assess flood elevation sensitivity relative to the accuracy of peak flow estimates in the hydraulic modelling. The following parameters were tested for sensitivity:

- Curve Number (CN*) (+/- 20%);
- Initial Abstraction (+/- 50%);
- Model Time Step (+/- 50%);
- Removal of Channel Routing;
- Channel Routing Length (+/- 20%);
- Subcatchment Travel Length (+/- 20%); and
- Model Time Step (DT (+/- 50%).

Curve Number (CN*)
Flows at key nodes were investigated to see the impact of changing the CN* value. Increasing CN* by 20% resulted in an average increase in peak flow of 27% at all key flow nodes during the Timmins storm event. Decreasing CN* by 20% resulted in an average decrease in peak flow of 24% at all key flow nodes during the Timmins storm event. Because there is a significant difference in peak flow values as a result of modifying the CN* value, it is imperative to get an accurate CN* value.

CN* is determined by land use and soil type. Soil type information is extracted from the digitized Victoria County soils map originally produced as a joint venture by the Federal Department of Agriculture and the Ontario Agricultural College. Land use is derived from the City of Kawartha Lakes' Secondary Plan and zoning maps as well as the 2010 Ecological Land Classification (ELC) mapping. Aerial orthophotography was reviewed to confirm land use throughout the watershed. This base data is valid, and therefore any calculated value (such as CN*) based on this data truly represents the land.

Initial abstraction (I_a)
Initial abstraction is a parameter that accounts for losses such as infiltration, evaporation, surface depression storage etc. prior to the occurrence of any runoff. This value is typically very small in comparison to the volume of rainfall for a larger storm event and has a larger effect on smaller storm events. Therefore, it is expected that initial abstraction would have little to no effect on a substantial event such as the Timmins storm.

Increasing Initial Abstraction by 50% resulted in an average decrease in peak flow of 2% at all key flow nodes during the Timmins storm event. Decreasing initial abstraction by 50% resulted in an average increase in peak flow of less than 1% at all key flow nodes during the Timmins storm event. Therefore, changing the initial abstraction does not result in significantly different flows.

Subcatchment Travel Length (TL)
The travel length is used to determine the flow time of concentration for a subcatchment area. A small travel length increases peak flows, as smaller travel lengths also reduce the overland flow gradient which ca also increase peak flow. Flow lengths were delineated automatically using GIS

software, and was revised based aerial topography and engineering judgement (by straightening flow paths or realigning flow paths to channels, municipal drains or swales).

Increasing subcatchment travel length by 20% resulted in an average decrease in peak flow of 3% at all key flow nodes during the Timmins storm event. Decreasing subcatchment travel length by 20% resulted in an average increase in peak flow of 2% at all key flow nodes during the Timmins storm event. Changing the subcatchment travel length is considered to be significant for the study area.

Channel Routing Removed

Channel routing accounts for the storage of flow as it is conveyed along the watercourse and its floodplain. This results in the attenuation of flows through a watercourse. The overall watershed involves a variety of intricate watercourses connecting subcatchments together, and therefore it is expected that removing any channel routing would result in a substantial increase in peak flows. Removal of channel routing assumes that peak flows from catchments occurs at one point, and therefore does not consider the effect of storage and travel time as flow travels between flow nodes.

A scenario was created by removing all channel routing within the model. Removing all channel routing resulted in an average increase in peak flow of 75% at all key flow nodes during the Timmins storm event. Therefore, channel routing has a substantial effect on peak flows throughout the watershed. Eliminating all channel routing would not be considered valid, as the watershed is very long with a number of watercourses between each catchment.

Channel Routing Lengths

Channel routing lengths were varied by +/- 20% to determine the effects storage on peak flows. A smaller channel routing length would result in an increased slope and lower storage volume, therefore resulting in a reduced travel time and peak flow attenuation from node to node. Channel routing lengths were delineated automatically using GIS software, and was revised based aerial topography, known water courses and engineering judgement.

Increasing channel routing lengths by 20% resulted in an average decrease in peak flow of 13% at all key flow nodes during the Timmins storm event. Decreasing channel routing length by 20% resulted in an average increase in peak flow of 14% at all key flow nodes during the Timmins storm event. Therefore, changing the channel routing length results is somewhat significant.

Channel routing lengths can be considered relatively accurate, as watercourses can be visually confirmed via aerial orthophotography or official watercourses. Therefore, there is confidence that acceptable channel routing lengths were applied.

Model Time Step (DT)

The model time step of 10 minutes was modified by changing it by +/- 5 minutes at all subcatchments and channel routing. There was little to no affect on peak flows at all flow nodes during the Timmins Storm Event (less than 0.5%). Therefore, time step has no effect on the regulatory flows.

		Regional Event Peak Flow (m3/s)											
Location	**Hydrologic Flow Node**	**Base**	**Curve Number**		**Initial Abstraction**		**Subcatchment Travel Length**		**Channel Routing**			**Time Step**	
			CN+20%	**CN-20%**	**IA+50%**	**IA-50%**	**TL+20%**	**TL-20%**	**No RC**	**RC+20%**	**RC-20%**	**DT+50%**	**DT-50%**
Top of System, US of Sturgeon	90	65.6	83.66	50.07	64.5	66.3	63.7	67.0	114.0	57.3	74.8	65.6	65.6
DS of Community Centre	101	66.5	84.66	50.06	65.3	67.2	64.4	67.9	116.2	58.0	75.9	66.5	66.5
DS of HWY 36 (W)	121	71.0	89.97	54.06	69.5	71.6	68.6	72.4	124.2	62.0	80.5	70.9	70.9
DS of Cedar Glen Road	110	71.2	90.27	54.24	69.7	71.9	68.8	72.7	124.6	62.2	80.8	71.1	71.1
DS of HWY 36 (E)	123	71.8	90.97	54.68	70.3	71.4	69.3	73.3	125.7	62.8	81.4	71.7	71.7
DS of Herons Landing	130	71.8	91.04	54.71	70.3	72.5	69.3	73.4	125.8	62.8	81.5	71.8	71.8
DS of Herons Landing 2	150	71.8	91.07	54.84	70.5	72.6	69.5	73.5	126.3	62.7	81.3	71.9	71.9

Location	**Hydrologic Flow Node**	**Curve Number**		**Initial Abstraction**		**Subcatchment Travel Length**		**Channel Routing**			**Time Step**	
		CN+20%	**CN-20%**	**IA+50%**	**IA-50%**	**TL+20%**	**TL-20%**	**No RC**	**RC+20**	**RC-20**	**DT+50%**	**DT-50%**
Top of System, US of Sturgeon	90	27.6%	-23.6%	-1.6%	1.2%	-2.9%	2.1%	74%	-13%	14%	0%	0%
DS of Community Centre	101	27.3%	-24.7%	-1.8%	1.1%	-3.2%	2.1%	75%	-13%	14%	0%	0%
DS of HWY 36 (W)	121	26.8%	-23.8%	-2.1%	0.9%	-3.4%	2.1%	75%	-13%	14%	0%	0%
DS of Cedar Glen Road	110	26.8%	-23.8%	-2.1%	1.0%	-3.3%	2.1%	75%	-13%	14%	0%	0%
DS of HWY 36 (E)	123	26.8%	-23.8%	-2.0%	-0.4%	-3.4%	2.2%	75%	-13%	14%	0%	0%
DS of Herons Landing	130	26.8%	-23.8%	-2.0%	1.0%	-3.5%	2.2%	75%	-13%	13%	0%	0%
DS of Herons Landing 2	150	26.8%	-23.7%	-1.8%	1.0%	-3.3%	2.4%	76%	-13%	13%	0%	0%
	Minimum =	*26.8%*	*-24.7%*	*-2.1%*	*-0.4%*	*-3.5%*	*2.1%*	*73.8%*	*-12.7%*	*13.2%*	*-0.1%*	*-0.1%*
	Average =	*27.0%*	*-23.9%*	*-1.9%*	*0.8%*	*-3.3%*	*2.2%*	*75.0%*	*-12.6%*	*13.6%*	*0.0%*	*0.0%*
	Maximum =	*27.6%*	*-23.6%*	*-1.6%*	*1.2%*	*-2.9%*	*2.4%*	*75.8%*	*-12.5%*	*14.1%*	*0.0%*	*0.0%*

Appendix G
Official & Secondary Plan Maps

THIS SCHEDULE REFLECTS A DRAFT CONSOLIDATION AND REFERENCE SHOULD BE HAD TO THE ACTUAL AMENDING BY-LAWS FOR COMPLETE ACCURACY.

THE CORPORATION OF THE TOWNSHIP OF VERULAM SCHEDULE 'A'

TO

ZONING BY-LAW NO. 6-87 AS AMENDED

CONSOLIDATED APRIL 2009

ZONES	SYMBOLS
RESIDENTIAL ZONES	
Rural Residential Zone	RR
Residential Type One Zone	RI
Residential Type Two Zone	R2
Limited Service Residential Zone	LSR
COMMERCIAL ZONES	
General Commercial Zone	CI
Highway Commercial Zone	C2
Recreational Commercial Zone	C3
INDUSTRIAL ZONES	
General Industrial Zone	MI
Extractive Industrial Zone	M2
Disposal Industrial Zone	M3
COMMUNITY FACILITY ZONE	CF
OPEN SPACE ZONE	OS
RURAL ZONES	
General Rural Zone	AI
MOBILE HOME PARK ZONE	MHP

0 2000 4000 FEET
0 500 1000 1500 METRES

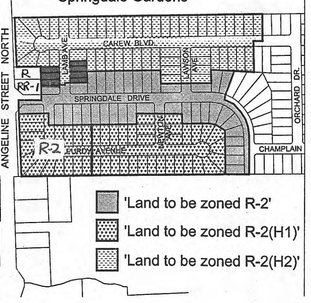
'DUNSFORD' SCHEDULE 'B'

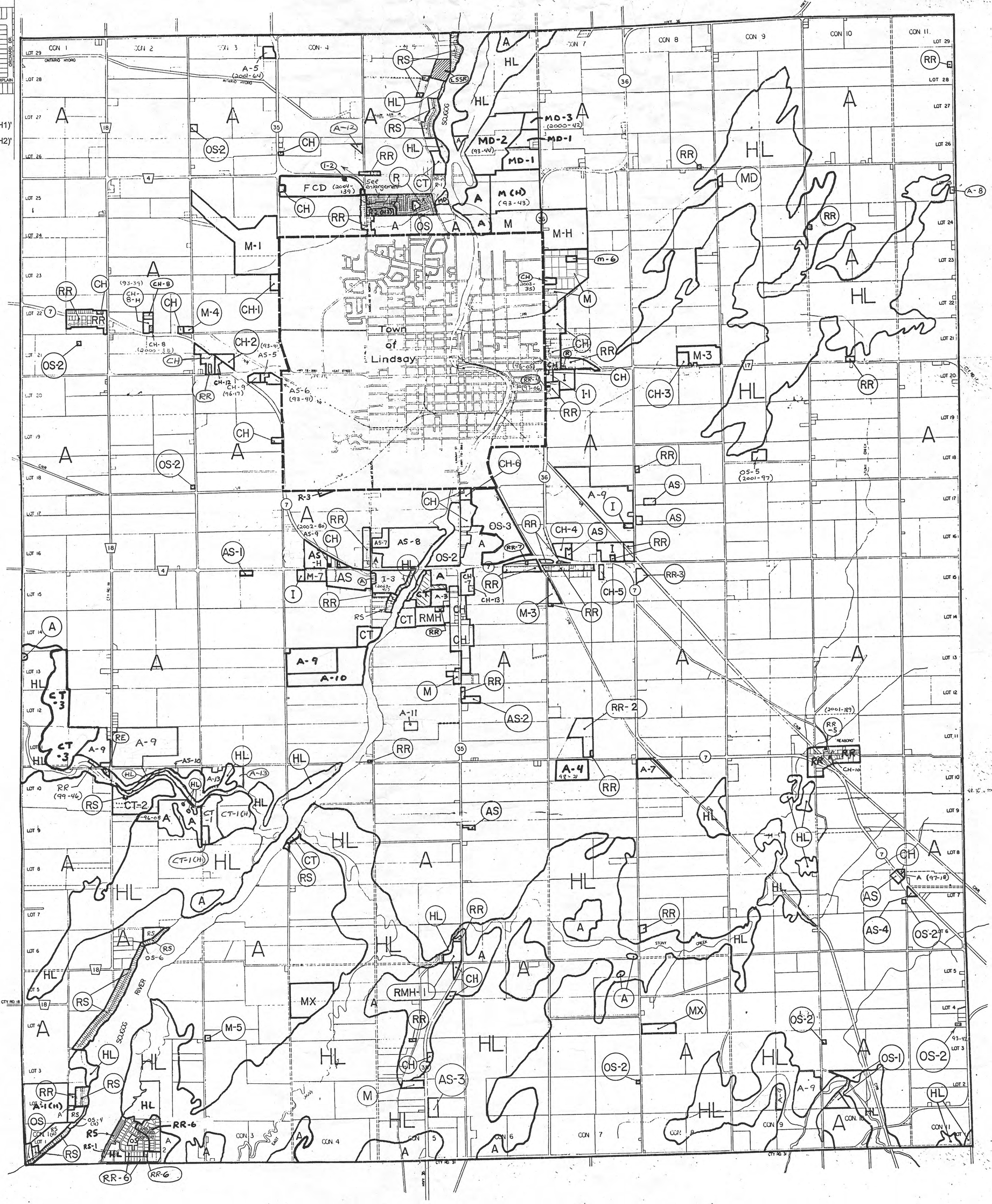
0 500 1000 2000 FT
0 100 250 500 M

'GREENHURST - THURSTONIA' SCHEDULE 'C'

0 500 1000 2000
0 100 250 500 M

'Springdale Gardens'





Schedule "A" Township of Ops Zoning By-Law

THIS SCHEDULE REFLECTS A DRAFT CONSOLIDATION AND REFERENCE SHOULD BE HAD TO THE ACTUAL AMENDING BY-LAWS FOR COMPLETE ACCURACY.

CONSOLIDATED 2012

This is Schedule "A" to By-Law No. 93-30
Passed the 20th day of September, 1993

Sharon McCrae
Reeve

Sandra Richardson
Clerk

LEGEND

Town of Lindsay Boundary	
Zone Boundary	
Provincial Highway	
County Road	
Township Road	

ZONE	SYMBOL
Estate Residential	RE
Rural Residential	RR
Shoreline Residential	RS
Residential	R
Mobile Home Residential	RMH
Institutional	I
Highway Commercial	CH
Tourist Commercial	CT
General Industrial	M
Extractive Industrial	MX
Disposal Industrial	MD
Open Space	OS
Agricultural	A
Agricultural Support	AS
Hazard Land	HZ
Future Community Development	FCD
Lands not subject to By-law	

LIMITED SERVICE SHORELINE RESIDENTIAL LSSR

Number	Revision	Revised By	Date
2	CHANGES	JMITCHELL	AUG 17/93
1	MINOR CHANGES	JMITCHELL	JUNE 25/93

Drawn By: JMITCHELL
Checked By:
Date: JUNE 7,1993
Scale: 1000 0 2000 4000FT

LEHMAN & Associates
113 Collier Street, Barrie, Ontario, L4M 1H2, (705) 737-4512
50 Yorkville Avenue, Suite 200, Toronto, Ontario, M4W 1L4, (416) 975-1556

THIS SCHEDULE REFLECTS A DRAFT CONSOLIDATION AND REFERENCE SHOULD BE HAD TO THE ACTUAL AMENDING BY-LAWS FOR COMPLETE ACCURACY.

THE CORPORATION OF THE TOWNSHIP OF FENELON

SCHEDULE 'A'

TO

ZONING BY-LAW NO. 12-95

AS AMENDED

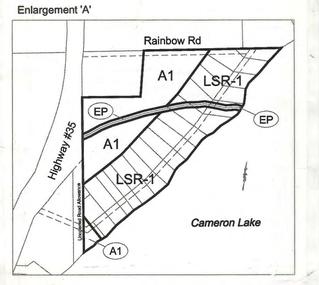
CONSOLIDATED JANUARY 2014

0 1000 3000 5000 FEET
0 500 1000 1500 METRES

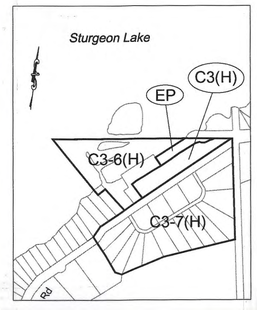
LEGEND

Symbol	Zone
EP	ENVIRONMENTAL PROTECTION
AP	AGGREGATE PROTECTION
CF	COMMUNITY FACILITY
AI	AGRICULTURAL
A2	RURAL GENERAL
HR	HAMLET RESIDENTIAL
RRI	RURAL RESIDENTIAL TYPE ONE
RR2	RURAL RESIDENTIAL TYPE TWO
RR3	RURAL RESIDENTIAL TYPE THREE
RM	RESIDENTIAL MOBILE HOME PARK
LSR	LIMITED SERVICE RESIDENTIAL
CI	GENERAL COMMERCIAL
C2	HIGHWAY COMMERCIAL
C3	TOURIST COMMERCIAL
C4	CAMPGROUND COMMERCIAL
MI	RESTRICTED INDUSTRIAL
M2	GENERAL INDUSTRIAL
M3	EXTRACTIVE INDUSTRIAL
M4	DISPOSAL INDUSTRIAL
(H)	REFER TO SECTION 3.8.1
	REFER TO SECTION 3.18.1.4
	ZONE BOUNDARY

Enlargement 'A'



Enlargement B



AS AMENDED IN ACCORDANCE WITH THE DECISION OF THE ONTARIO MUNICPAL BOARD. (FILE NO. R950145) AUGUST 23, 1995

THE CORPORATION OF THE TOWNSHIP OF EMILY

SCHEDULE 'A'

TO

ZONING BY-LAW NO. 1996-30

AS AMENDED

CONSOLIDATION JULY 2012

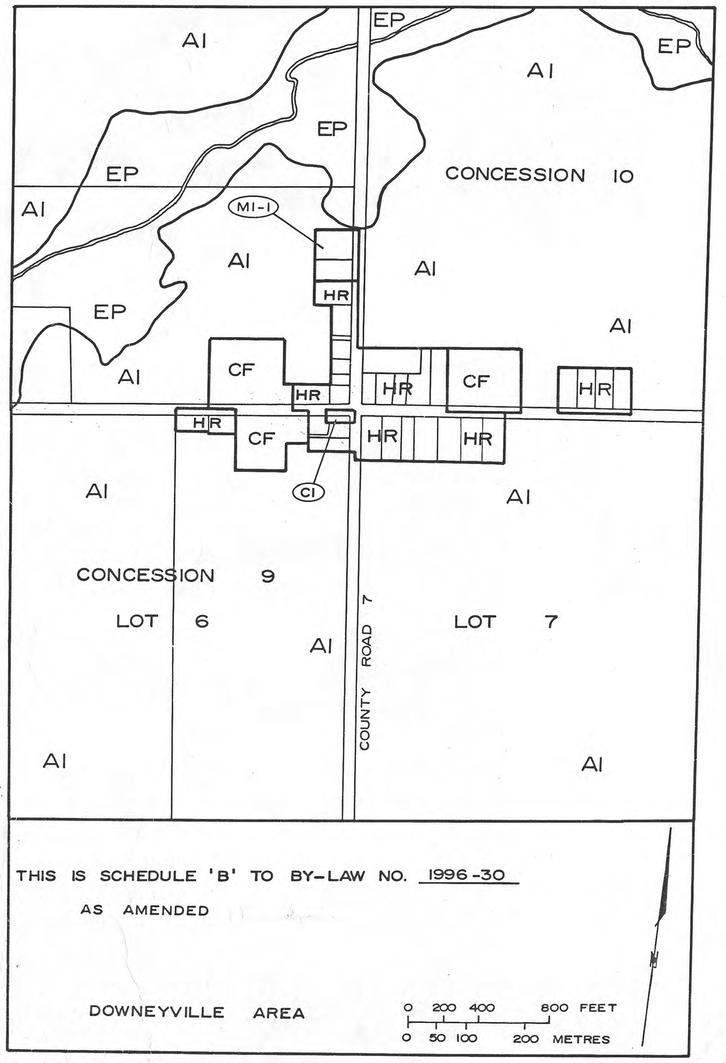
THIS SCHEDULE REFLECTS A DRAFT CONSOLIDATION AND REFERENCE SHOULD BE HAD TO THE ACTUAL AMENDING BY-LAWS FOR COMPLETE ACCURACY.

0 1000 3000 5000 FEET
0 500 1000 1500 METRES

ZONES

EP ——— ENVIRONMENTAL PROTECTION ZONE
CF ——— COMMUNITY FACILITY ZONE
A1 ——— AGRICULTURAL ZONE
A2 ——— RURAL GENERAL ZONE

HR ——— HAMLET RESIDENTIAL ZONE
RR1 ——— RURAL RESIDENTIAL TYPE ONE ZONE
RR2 ——— RURAL RESIDENTIAL TYPE TWO ZONE
RR3 ——— RURAL RESIDENTIAL TYPE THREE ZONE
LSR ——— LIMITED SERVICE RESIDENTIAL ZONE
C1 ——— GENERAL COMMERCIAL ZONE
C2 ——— HIGHWAY COMMERCIAL ZONE
C3 ——— RECREATION COMMERCIAL ZONE
C4 ——— CAMPGROUND COMMERCIAL ZONE
M1 ——— RESTRICTED INDUSTRIAL ZONE
M2 ——— GENERAL INDUSTRIAL ZONE
M3 ——— EXTRACTIVE INDUSTRIAL ZONE
M4 ——— DISPOSAL INDUSTRIAL ZONE
▨ ——— REFER TO SECTION 3.18.1.4
——— ZONE BOUNDARY
(H) ——— REFER TO SECTION 3.8



THIS IS SCHEDULE 'B' TO BY-LAW NO. 1996-30

AS AMENDED

DOWNEYVILLE AREA

0 200 400 800 FEET
0 50 100 200 METRES

Appendix H
Cross-Section Photo Inventory

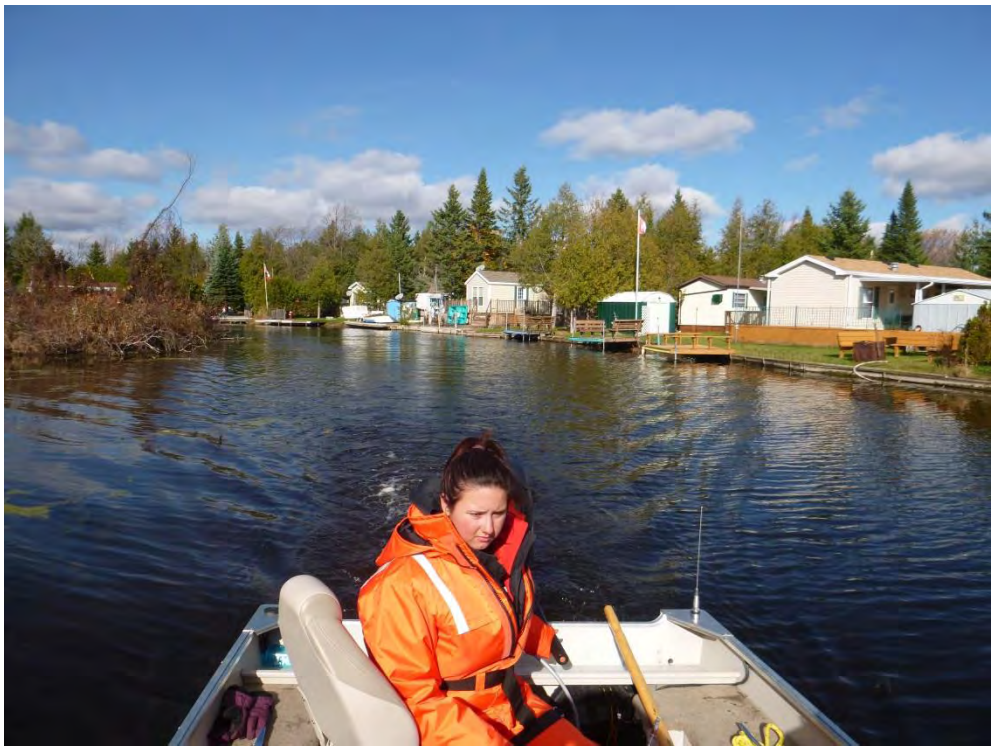
Downstream

Upstream

Downstream

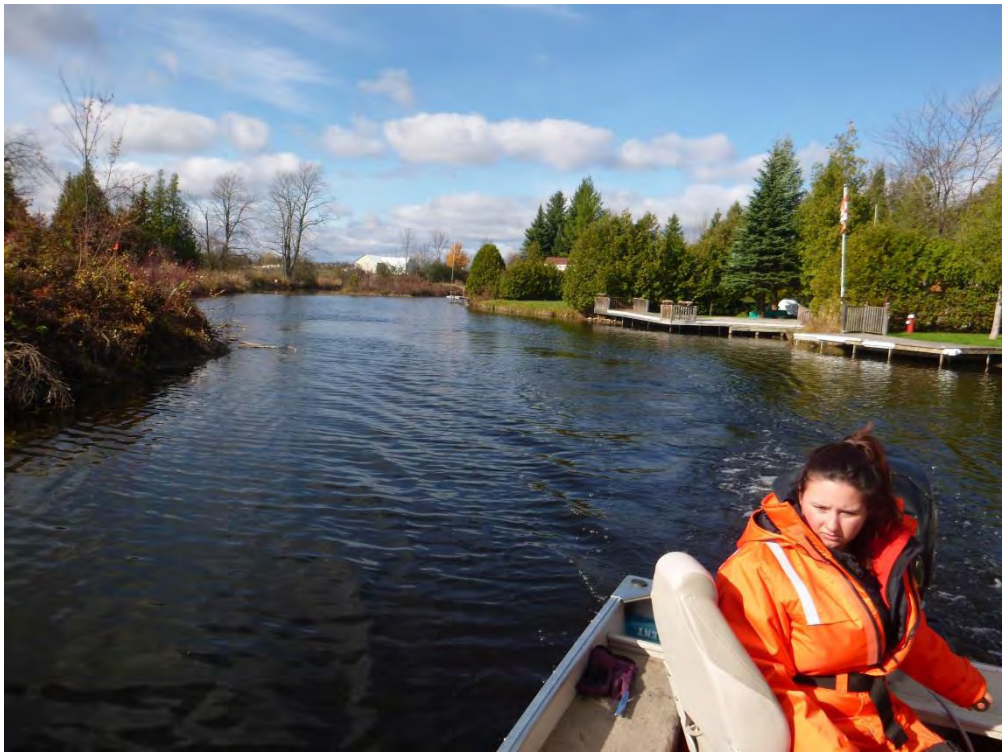
Upstream

Downstream



Upstream

Downstream

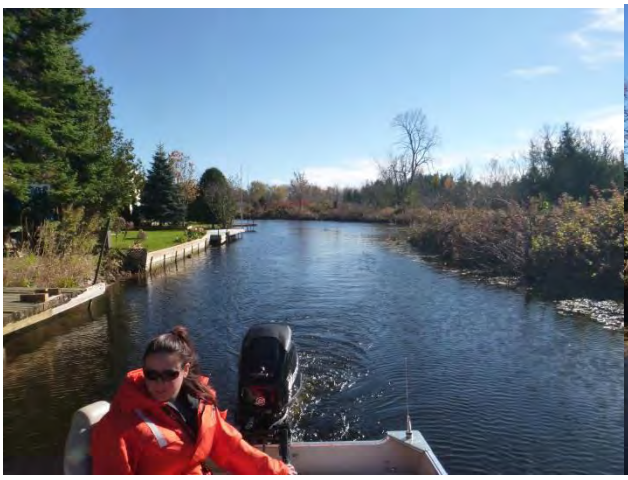


Upstream

Downstream

Upstream

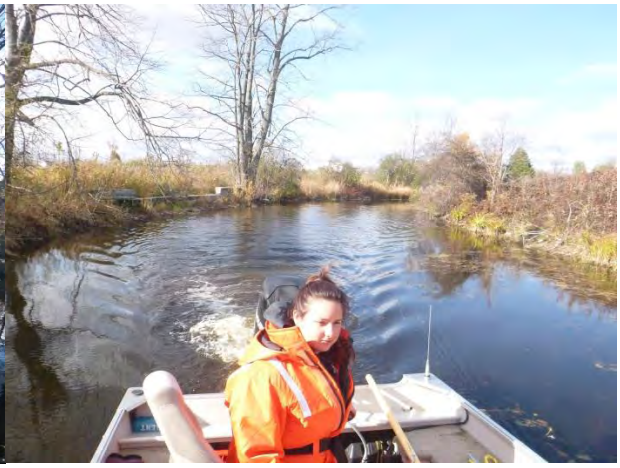
466, 487, 504



Downstream East Side

Upstream East Side

Downstream West Side



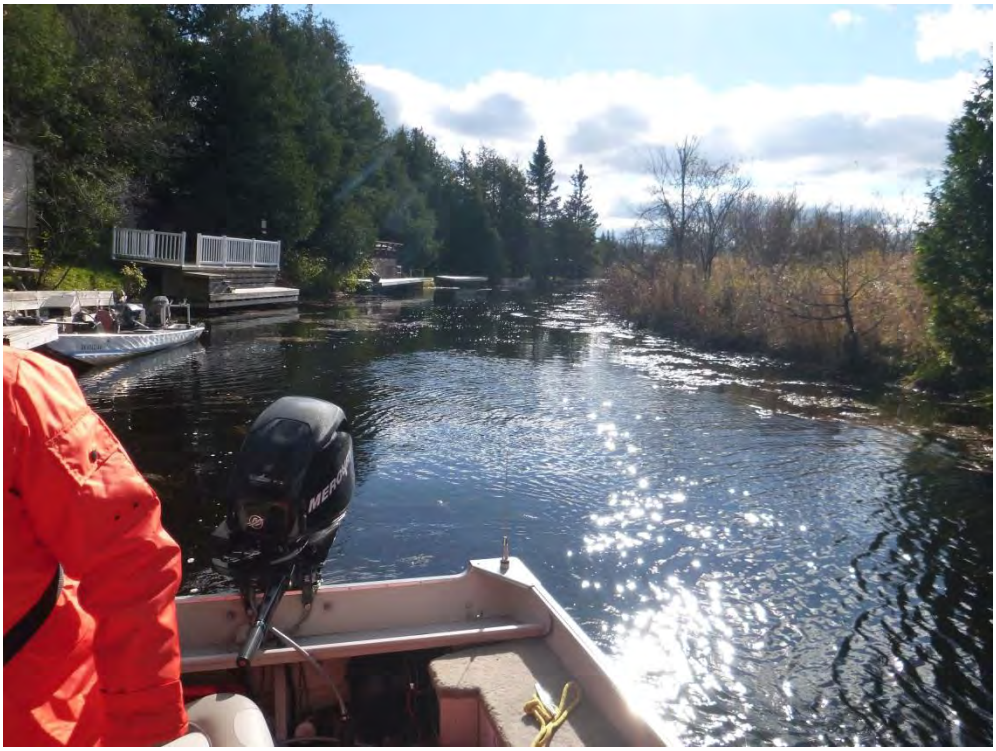
Upstream Westside

Downstream

Upstream

Downstream

Upstream



Downstream

Upstream

Downstream

Upstream

755, 760

Downstream

Upstream

767, 774

Downstream

Upstrteam

Downstream

Upstream

883, 889

Downstream

Upstream

902, 935

Downstream

Upstream

Downstream

Upstream

970

Downstream

Upstream

Downstream

Upstream

1048

Downstream

Upstream

1111

Downstream

Upstream

1147

Downstream

Upstream

1162

Downstream

Upstream

1186, 1202

Downstream

Upstream

1222

Downstream

Upstream

1233, 1240

Downstream

Upstream

1259, 1269

Downstream

Upstream

1320, 1330

Downstream

Upstream

1395

Downstream

Upstream

1458

Downstream

Upstream

1497, 1508

Downstream

Upstream

1519, 1524

Downstream

Upstream

1534

Downstream

Upstream

1590

Downstream

Upstream

1699, 1767

Downstream

Upstream

1801, 1815, 1823

Downstream

Upstream

1843, 1851

Downstream

Upstream

1944

Downstream

Upstream

1997

Downstream

Upstream

2262

Downstream

Upstream

2570

Downstream

Upstream

2886, 2900

Downstream

Upstream

2915, 2930

Downstream

Upstream

2985, 2997, 3007

Downstream

Middle

Upstream

3127

Downstream

Upstream

3233

Downstream

Upstream

3289

Downstream

Upstream

3445, 3483, 3492

Downstream

Upstream

3510, 3533

Downstream

Upstream

Appendix I
Structure Photo Inventory Record

Dunsford Creek

Structure Photo Inventory

April 2017

KAWARTHA CONSERVATION

KAWARTHA LAKES

List of Figures

Structure 1 : Heron's Landing - South Crossing 4

Structure 2: Heron's Landing North Crossing 5

Structure 3: Culvert under Hwy 36 D/S Online Pond.....6

Structure 4: Culvert Under Cedar Glen Road.....7

Structure 5: Culvert Under Hwy 36 U/S of Online Pond.....8

Structure 6: Dunsford Community Centre Crossing.....9

Structure 7: Dunsford Culvert.....10

Structure 1: Heron's Landing South Crossing

HecRas #: 763

Upstream Invert Elevation: 247.638 m

Downstream Invert Elevation: 247.011 m

Structure Length: 3.035 m

Span: 13.43 m

Rise: 1.28 m

Bridge/Shape: Pedestrian Bridge

Material: Steel and Concrete

Bottom Material: Concrete Pad

Upstream facing Downstream

Downstream facing Upstream

Looking Upstream under Bridge

Structure 2: Heron's Landing North Crossing

HecRas #: 891

Upstream Invert Elevation: 247.439 m

Downstream Invert Elevation: 247.444 m

Structure Length: 4.649 m

Span: 5.2 m

Rise: 1.97 m

Culvert Type/Shape: Bridge

Material: Concrete/Wood/Railway Ties

Bottom Material: Open Bottom

Upstream facing Downstream

Downstream facing Upstream

Upstream end of Culvert

Structure 3: Culvert Under Hwy 36 (E)

HecRas #: 1249

Upstream Invert Elevation: 250.343 m

Downstream Invert Elevation: 250.127 m

Structure Length: 16.276 m

Span: 6.85 m

Rise: 1.95 m

Culvert Type/Shape: Box (Rectangular)

Material: Concrete

Bottom Material: Open Bottom

Upstream facing Downstream

Upstream end of Culvert

Downstream facing Upstream

Structure 4: Culvert under Cedar Glen Road

HecRas #: 1513

Upstream Invert Elevation: 253.342 m

Downstream Invert Elevation: 253.247 m

Structure Length: 9.575 m

Span: 4.00 m

Rise: 2.1 m

Culvert Type/Shape: Pipe Arch

Material: Corrugated Galvanized Steel/Concrete

Bottom Material: Open Bottom/Bedrock

Upstream facing Downstream

Downstream facing Upstream

Upstream end of Culvert

Structure 5: Culvert Under Hwy 36 U/S (W)

HecRas #: 1834

Upstream Invert Elevation: 256.448 m

Downstream Invert Elevation: 256.37 m

Structure Length: 16.66m

Span: 6.0m

Rise: 2.5 m

Culvert Type/Shape: Box (Rectangular)

Material: Concrete

Bottom Material: Open Bottom

Upstream Facing Downstream

Downstream facing Upstream

Upstream end of Culvert

Structure 6: Dunsford Community Centre Crossing

HecRas #: 2906

Upstream Invert Elevation A: 267.311 m
Downstream Invert Elevation A: 267.303 m

Upstream Invert Elevation B: 267.337 m
Downstream Invert Elevation B: 267.309 m

Upstream Invert Elevation C: 267.38 m
Downstream Invert Elevation C: 267.363 m

Structure Length A: 11.543 m
Structure Length B: 9.885 m
Structure Length C: 9.28 m

Span A: 0.86 m
Rise A: 0.84 m

Span B: 0.90 m
Rise B: 0.83 m

Span C: 0.90 m
Rise C: 0.77 m

Culvert Type/Shape: Corrugated Metal/Circular

Material: Corrugated Galvanized Steel

Bottom Material: Same as Tops and Sides

Downstream facing Upstream

Upstream facing Downstream

Upstream end of Culverts

Structure 7: Culvert under Sturgeon Raod

HecRas #: 3503

Upstream Invert Elevation: 269.247 m

Downstream Invert Elevation: 269.132 m

Structure Length: 15.709 m

BOX DIMENSIONS
Span: 4.9 m
Rise: 1.53 m

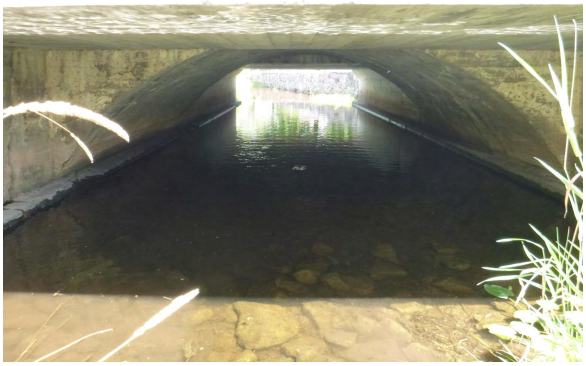
Culvert Type/Shape: Arch with box extensions

Material: Concrete

Bottom Material: Open Bottom

Upstream Facing Downstream

Downstream facing Upstream



Upstream end of Culvert

Appendix J
Sensitivity Analyses - Hydraulic

Hydraulic Sensitivity Analyses

The hydraulic model was tested for sensitivity to input parameters in the list below. Input parameters were modified by varying degrees as outlined below for the Regional Storm event only (Timmins Event). The increase/decrease in flood elevation from the base scenario were noted to establish a level of confidence in flood elevation estimations. The following parameters were tested for sensitivity:

- Manning roughness coefficient (+/- 20%)
- Peak Regulatory Flow (+/- 30%)
- Downstream Boundary Condition (+/- 1.0 m)

Manning roughness coefficient
Flood elevations throughout the project reach were investigated to determine the impact of changing the Manning roughness coefficient. The Manning's number indicates the friction factor in a cross section. The higher the number, the rougher is the surface against which water flows. For instance, a smooth concrete pipe has a manning's n of 0.013 whereas a forest has a Manning's n value of 0.1.

By increasing the Manning's n by 20%, the flow is being subject to a watercourse with greater friction forces acting upon it. It was found that the average increase in the regional water surface elevation throughout the 83 cross section was 5 cm, and the highest was 20 cm, at cross section 2570.

By decreasing the Manning's n by 20%, the flow is being subject to a watercourse with lower friction forces acting upon it. It was found that the average decrease in the regional water surface elevation throughout the 83 cross section was 5 cm, and the greatest was 31 cm, at cross section 1997.9.

Due to a minimal affect on the average, overall flood elevation throughout the study reach, it can be determined that the Manning roughness coefficients are acceptable.

Peak Regulatory Flow
Flood elevations throughout the project reach were investigated to determine the impact of changing the regional (Timmins Storm) peak flows. This was completed to account for uncertainty and assumptions as per the hydrologic modelling. From the hydrology sensitivity analysis, regional peak flow varied by up to 27%, therefore peak flows within the hydraulic model were varied by +/-30%.

By increasing the peak flows, it was found that the average increase in regional flood elevation throughout the 83 cross sections was 19 cm, with the highest greatest of 79 cm at cross section 1147. Cross section 1147 has a relatively narrow cross section, with limited floodplain access. Therefore, increases in flood elevations are significant due to an entrenched channel.

By decreasing the peak flows, it was found that the average decrease in regional flood elevation throughout the 83 cross sections was 24 cm, with the greatest decrease of 65 cm at cross section 1233.

Cross section 1233 is located immediately downstream of the Highway 36 bridge crossing. During the base scenario, Timmins flood elevation is immediately above an ineffective flow area

(associated with the bridge). As flows are reduced, the flood elevation decreases below the ineffective flow area, causing flood elevations to decrease significantly.

While the flood elevations are somewhat sensitive to the peak flow rate, the variability of 30% in peak flow is also significant. Therefore, with lower assumptions on variability of peak flow, the flood elevations are considered reasonable.

Downstream Boundary Condition

The Dunsford Creek flows into the Emily Creek, a tributary to Sturgeon Lake. Due to the lack of known water levels immediately at the confluence of Dunsford Creek and Emily Creek, a downstream boundary condition was based on the Sturgeon Lake normal operating level of 247.76 m, as a flow gauge is located approximately 10.5 km north easterly in Bobcaygeon.

Due to the uncertainty of the starting water elevation, a sensitivity analysis was completed by varying the starting water level by +/- 1.0m. For most of the cross sections, the regional flood elevation remained unchanged. When increasing the downstream boundary condition to 248.76m, only the 10 downstream cross sections had a change in flood elevations, with an average of 32 cm through these sections. The limit of this backwater effect ends at cross section 755.

The most downstream cross section (181) has a channel invert of 246.59 m. Therefore, when decreasing the downstream boundary condition to 246.76 m. The most downstream cross section's flood elevation decreased by 16 cm with the remainder unchanged.

Due to the limited effects on flood elevations throughout the entire watershed, the starting water elevation is considered acceptable for the study area.

HEC-RAS Cross Section		Regional Flood Elevation (m)						Delta (from Base)					
		Discharge		Downstream Boundary Condition		Manning n		Discharge		Downstream Boundary Condition		Manning n	
	Base (m)	+30%	-30%	+1.0m	-1.0m	+20%	-20%	+30%	-30%	+1.0m	-1.0m	+20%	-20%
3532	272.00	272.18	271.83	272.00	272.00	272.01	272.00	0.18	-0.17	0.00	0.00	0.01	0.00
3510	271.56	271.69	271.32	271.56	271.56	271.56	271.56	0.13	-0.24	0.00	0.00	0.00	0.00
3492	271.35	271.59	271.07	271.35	271.35	271.48	271.21	0.24	-0.28	0.00	0.00	0.13	-0.14
3483	271.35	271.58	271.07	271.35	271.35	271.47	271.21	0.23	-0.28	0.00	0.00	0.12	-0.14
3446	271.33	271.56	271.06	271.33	271.33	271.46	271.19	0.23	-0.27	0.00	0.00	0.13	-0.14
3445	271.30	271.54	271.01	271.30	271.30	271.43	271.15	0.24	-0.29	0.00	0.00	0.13	-0.15
3289	271.05	271.29	270.73	271.05	271.05	271.17	270.89	0.24	-0.32	0.00	0.00	0.12	-0.16
3233	270.90	271.13	270.60	270.90	270.90	271.01	270.75	0.23	-0.30	0.00	0.00	0.11	-0.15
3127	270.40	270.58	270.21	270.40	270.40	270.51	270.34	0.18	-0.19	0.00	0.00	0.11	-0.06
3007	270.35	270.51	270.17	270.35	270.35	270.38	270.34	0.16	-0.18	0.00	0.00	0.03	-0.01
2985	270.34	270.49	270.17	270.34	270.34	270.36	270.33	0.15	-0.17	0.00	0.00	0.02	-0.01
2930	270.31	270.45	270.14	270.31	270.31	270.31	270.31	0.14	-0.17	0.00	0.00	0.00	0.00
2915	270.28	270.40	270.13	270.28	270.28	270.28	270.28	0.12	-0.15	0.00	0.00	0.00	0.00
2900	269.60	269.82	269.34	269.60	269.60	269.57	269.57	0.22	-0.26	0.00	0.00	-0.03	-0.03
2886	269.08	269.31	268.80	269.08	269.08	269.20	269.08	0.23	-0.28	0.00	0.00	0.12	0.00
2571	267.43	267.67	267.07	267.43	267.43	267.58	267.36	0.24	-0.36	0.00	0.00	0.15	-0.07
2570	266.39	266.60	266.22	266.39	266.39	266.59	266.24	0.21	-0.17	0.00	0.00	0.20	-0.15
2264	266.05	266.20	265.78	266.05	266.05	266.05	266.05	0.15	-0.27	0.00	0.00	0.00	0.00
2263.7	265.76	265.87	265.56	265.76	265.76	265.83	265.63	0.11	-0.20	0.00	0.00	0.07	-0.13
2263.4	265.36	265.54	265.18	265.36	265.36	265.47	265.36	0.18	-0.18	0.00	0.00	0.11	0.00
2263	264.89	265.07	264.66	264.89	264.89	264.89	264.89	0.18	-0.23	0.00	0.00	0.00	0.00
2262	263.04	263.29	262.79	263.04	263.04	263.11	262.99	0.25	-0.25	0.00	0.00	0.07	-0.05
1998	262.59	262.88	262.22	262.59	262.59	262.70	262.59	0.29	-0.37	0.00	0.00	0.11	0.00
1997.9	262.43	262.80	262.03	262.43	262.43	262.58	262.12	0.37	-0.40	0.00	0.00	0.15	-0.31
1997.8	261.95	262.29	261.69	261.95	261.95	261.95	261.95	0.34	-0.26	0.00	0.00	0.00	0.00
1997.7	261.85	262.07	261.37	261.85	261.85	261.85	261.85	0.22	-0.48	0.00	0.00	0.00	0.00
1997	260.12	260.36	259.70	260.12	260.12	260.12	260.12	0.24	-0.42	0.00	0.00	0.00	0.00
1944	260.12	260.36	259.64	260.12	260.12	260.12	260.12	0.24	-0.48	0.00	0.00	0.00	0.00
1851	260.12	260.36	259.64	260.12	260.12	260.12	260.12	0.24	-0.48	0.00	0.00	0.00	0.00
1818	260.10	260.34	259.62	260.10	260.10	260.10	260.10	0.24	-0.48	0.00	0.00	0.00	0.00
1816.1	258.07	258.20	257.77	258.07	258.07	258.07	258.07	0.13	-0.30	0.00	0.00	0.00	0.00
1815	257.94	258.03	257.77	257.94	257.94	257.94	257.94	0.09	-0.17	0.00	0.00	0.00	0.00
1767	257.39	257.51	257.17	257.39	257.39	257.46	257.23	0.12	-0.22	0.00	0.00	0.07	-0.16
1699	256.91	257.06	256.88	256.91	256.91	257.03	256.91	0.15	-0.03	0.00	0.00	0.12	0.00
1590	256.36	256.46	256.04	256.36	256.36	256.36	256.36	0.10	-0.32	0.00	0.00	0.00	0.00
1534	256.13	256.21	256.04	256.13	256.13	256.13	256.13	0.08	-0.09	0.00	0.00	0.00	0.00
1499	256.13	256.21	256.04	256.13	256.13	256.13	256.13	0.08	-0.09	0.00	0.00	0.00	0.00
1498	255.30	255.44	255.07	255.30	255.30	255.30	255.30	0.14	-0.23	0.00	0.00	0.00	0.00
1458	253.97	254.15	253.88	253.97	253.97	254.01	253.93	0.18	-0.09	0.00	0.00	0.04	-0.04
1395	253.97	254.15	253.88	253.97	253.97	254.01	253.93	0.18	-0.09	0.00	0.00	0.04	-0.04
1242	253.97	254.15	253.88	253.97	253.97	254.01	253.93	0.18	-0.09	0.00	0.00	0.04	-0.04
1241.8	253.97	254.14	253.88	253.97	253.97	254.00	253.93	0.17	-0.09	0.00	0.00	0.03	-0.04
1241.6	253.95	254.12	253.87	253.95	253.95	253.99	253.92	0.17	-0.08	0.00	0.00	0.04	-0.03
1241.3	253.90	254.05	253.85	253.90	253.90	253.92	253.87	0.15	-0.05	0.00	0.00	0.02	-0.03
1241	253.87	253.99	253.84	253.87	253.87	253.87	253.87	0.12	-0.03	0.00	0.00	0.00	0.00
1240.9	253.87	253.99	253.84	253.87	253.87	253.87	253.87	0.12	-0.03	0.00	0.00	0.00	0.00
1240.7	253.87	253.99	253.84	253.87	253.87	253.87	253.87	0.12	-0.03	0.00	0.00	0.00	0.00
1240.6	253.87	253.99	253.84	253.87	253.87	253.87	253.87	0.12	-0.03	0.00	0.00	0.00	0.00
1233	253.55	253.80	252.90	253.55	253.55	253.59	253.53	0.25	-0.65	0.00	0.00	0.04	-0.02
1186	253.55	253.80	252.90	253.55	253.55	253.58	253.53	0.25	-0.65	0.00	0.00	0.03	-0.02
1162	253.40	253.62	252.75	253.40	253.40	253.43	253.38	0.22	-0.65	0.00	0.00	0.03	-0.02
1147	252.35	253.14	252.07	252.35	252.35	252.35	252.35	0.79	-0.28	0.00	0.00	0.00	0.00
1111	251.91	252.11	251.69	251.91	251.91	251.91	251.91	0.20	-0.22	0.00	0.00	0.00	0.00
1048	251.10	251.25	250.95	251.10	251.10	251.15	251.10	0.15	-0.15	0.00	0.00	0.05	0.00
978	250.89	251.02	250.73	250.89	250.89	250.91	250.87	0.13	-0.16	0.00	0.00	0.02	-0.02
970	250.69	250.84	250.54	250.69	250.69	250.69	250.69	0.15	-0.15	0.00	0.00	0.00	0.00
935	250.62	250.83	250.33	250.62	250.62	250.66	250.58	0.21	-0.29	0.00	0.00	0.04	-0.04
902	250.22	250.45	250.07	250.22	250.22	250.25	250.22	0.23	-0.15	0.00	0.00	0.03	0.00
893	250.22	250.45	250.07	250.22	250.22	250.25	250.22	0.23	-0.15	0.00	0.00	0.03	0.00
889	250.13	250.45	249.95	250.13	250.13	250.21	250.13	0.32	-0.18	0.00	0.00	0.08	0.00
883	250.05	250.19	249.87	250.05	250.05	250.08	250.02	0.14	-0.18	0.00	0.00	0.03	-0.03
839	250.05	250.19	249.87	250.05	250.05	250.08	250.02	0.14	-0.18	0.00	0.00	0.03	-0.03
774	249.97	250.10	249.81	249.97	249.97	249.98	249.97	0.13	-0.16	0.00	0.00	0.01	0.00
761	249.92	249.96	249.78	249.92	249.92	249.92	249.92	0.04	-0.14	0.00	0.00	0.00	0.00
760	249.44	249.59	249.08	249.44	249.44	249.44	249.44	0.15	-0.36	0.00	0.00	0.00	0.00
755	249.39	249.52	249.06	249.39	249.39	249.40	249.39	0.13	-0.33	0.00	0.00	0.01	0.00
704	249.24	249.44	248.90	249.29	249.24	249.37	249.10	0.20	-0.34	0.05	0.00	0.13	-0.14
657	249.1	249.28	248.76	249.17	249.10	249.24	248.89	0.18	-0.34	0.07	0.00	0.14	-0.21
606	248.88	249.09	248.62	248.98	248.88	249.01	248.71	0.21	-0.26	0.10	0.00	0.13	-0.17
551	248.76	248.96	248.51	248.93	248.76	248.89	248.65	0.20	-0.25	0.17	0.00	0.13	-0.11
504	248.76	248.96	248.49	248.93	248.76	248.86	248.65	0.20	-0.27	0.17	0.00	0.10	-0.11
487	248.7	248.95	248.42	248.92	248.71	248.82	248.58	0.25	-0.28	0.22	0.01	0.12	-0.12
466	248.6	248.85	248.30	248.88	248.60	248.74	248.41	0.25	-0.30	0.28	0.00	0.14	-0.19
437	248.38	248.52	248.18	248.82	248.38	248.53	248.20	0.14	-0.20	0.44	0.00	0.15	-0.18
247	248.11	248.28	247.95	248.80	248.12	248.17	248.05	0.17	-0.16	0.69	0.01	0.06	-0.06
181	247.76	247.76	247.76	248.76	247.60	247.76	247.76	0.00	0.00	1.00	-0.16	0.00	0.00

Appendix K
HEC – RAS Output

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)
Main Channel	3532	100Yr-SCS-	19.77	268.91	271.28		271.29	0.000055	0.34	109.21	86.68
Main Channel	3510	100Yr-SCS-	19.77	268.99	271.11	270.28	271.22	0.001387	1.57	20.29	50.82
Main Channel	3503	Sturgeon Road	Culvert								
Main Channel	3492	100Yr-SCS-	19.77	269	270.55	270.02	270.62	0.001677	1.31	18.72	61.4
Main Channel	3483	100Yr-SCS-	19.77	268.87	270.55		270.57	0.000523	0.83	35.78	59.15
Main Channel	3446	100Yr-SCS-	19.77	269.02	270.55		270.56	0.000354	0.66	45.11	52.98
Main Channel	3445	100Yr-SCS-	19.77	268.97	270.49		270.55	0.002208	1.67	26.18	45.62
Main Channel	3289	100Yr-SCS-	19.77	268.85	270.19		270.26	0.001676	1.34	26.39	41.8
Main Channel	3233	100Yr-SCS-	19.77	268.58	270.08		270.15	0.002156	1.57	23.75	34.87
Main Channel	3127	100Yr-SCS-	19.77	268.25	269.83		269.92	0.002515	1.72	23.51	32.71
Main Channel	3007	100Yr-SCS-	19.77	267.88	269.82		269.83	0.000214	0.53	44.71	47.75
Main Channel	2985	100Yr-SCS-	19.77	267.52	269.82		269.83	0.000125	0.52	55.5	43.61
Main Channel	2930	100Yr-SCS-	19.77	267.13	269.81		269.82	0.000125	0.55	57.49	43.16
Main Channel	2915	100Yr-SCS-	19.77	267.29	269.81	268.15	269.82	0.000133	0.56	53.09	41.85
Main Channel	2906	Community Ce	Culvert								
Main Channel	2900	100Yr-SCS-	19.77	267.27	268.74	268.12	268.82	0.00138	1.31	17.56	25.17
Main Channel	2886	100Yr-SCS-	19.84	267.33	268.35	268.35	268.65	0.010695	2.53	9.36	18.72
Main Channel	2571	100Yr-SCS-	19.84	265.5	266.53	266.53	266.88	0.01006	2.72	9.05	15.3
Main Channel	2570	100Yr-SCS-	19.84	264.62	265.71		265.87	0.004056	1.81	12.65	16.36
Main Channel	2264	100Yr-SCS-	19.84	264.42	265.33		265.57	0.007998	2.2	9.66	14.22
Main Channel	2263.7	100Yr-SCS-	19.84	264.26	265.21	265.12	265.35	0.007155	1.79	14.28	28.91
Main Channel	2263.4	100Yr-SCS-	19.84	263.99	264.83	264.83	265.04	0.0129	2.4	12.68	30.08
Main Channel	2263	100Yr-SCS-	19.84	263.18	264.1	264.1	264.41	0.010321	2.58	9.34	16.74
Main Channel	2262	100Yr-SCS-	19.84	261	262.15		262.23	0.002603	1.23	16.11	19.65
Main Channel	1998	100Yr-SCS-	19.84	260.92	261.73	261.73	262.04	0.018992	2.8	8.96	15.28
Main Channel	1997.9	100Yr-SCS-	19.84	260.34	261.47	261.28	261.68	0.006897	2.42	12.12	15.7
Main Channel	1997.8	100Yr-SCS-	19.84	260.15	261.14	261.14	261.47	0.012807	3.06	9.99	15.31
Main Channel	1997.7	100Yr-SCS-	19.84	259.94	260.93	260.87	261.19	0.009798	2.29	9.25	14.35
Main Channel	1997	100Yr-SCS-	19.84	258.18	259.14	259.14	259.48	0.010872	2.7	8.91	17.58
Main Channel	1944	100Yr-SCS-	19.84	257.14	258.34		258.45	0.004006	1.49	13.36	17.51
Main Channel	1851	100Yr-SCS-	19.84	256.46	258.26	257.48	258.31	0.000689	1.04	28.42	70.22
Main Channel	1818	100Yr-SCS-	19.84	256.5	258.23	257.44	258.29	0.001042	1.17	17.65	26.65
Main Channel	1816.5	Cty Rd 36 (W)	Culvert								

Main Channel	1816.1	100Yr-SCS-	19.84	256.21	257.63	257.2	257.71	0.002118	1.34	17.37	29.44
Main Channel	1815	100Yr-SCS-	21.23	256.27	257.46	257.46	257.66	0.008647	2.41	14.97	41.36
Main Channel	1767	100Yr-SCS-	21.23	255.81	256.81	256.67	256.93	0.007016	1.57	13.53	25.08
Main Channel	1699	100Yr-SCS-	21.23	255.24	256.24	256.13	256.42	0.008394	1.9	11.21	18.56
Main Channel	1590	100Yr-SCS-	21.23	254.34	255.77	255.35	255.88	0.003113	1.48	14.36	15.7
Main Channel	1534	100Yr-SCS-	21.23	253.4	255.84		255.84	0.000041	0.3	137.26	181.79
Main Channel	1499	100Yr-SCS-	21.23	253.39	255.84	254.49	255.84	0.000047	0.32	151.49	213.57
Main Channel	1498.5	Cedar Glen Rd	Culvert								
Main Channel	1498	100Yr-SCS-	21.3	253.25	254.47	254.47	254.86	0.013979	2.76	7.7	9.86
Main Channel	1458	100Yr-SCS-	21.3	252.6	253.28	253.28	253.52	0.015364	2.2	9.91	21.13
Main Channel	1395	100Yr-SCS-	21.3	251.76	253.04		253.08	0.00096	0.92	24.8	26.7
Main Channel	1242	100Yr-SCS-	21.3	252.19	253.01		253.07	0.002177	1.02	21.06	32.11
Main Channel	1241.8	100Yr-SCS-	21.3	252.22	252.99		253.04	0.002482	1.04	20.92	34.49
Main Channel	1241.6	100Yr-SCS-	21.3	252.26	252.95		253.01	0.002848	1.08	19.88	34.32
Main Channel	1241.3	100Yr-SCS-	21.3	252.24	252.71	252.71	252.9	0.016482	1.96	10.94	28.45
Main Channel	1241	100Yr-SCS-	21.3	250.96	252.2	252	252.43	0.006915	2.13	10.02	11.26
Main Channel	1240.9	100Yr-SCS-	21.3	250.99	252.21	251.94	252.35	0.00483	1.65	12.92	16.85
Main Channel	1240.7	100Yr-SCS-	21.3	250.78	252.18		252.22	0.001292	0.93	22.95	26.4
Main Channel	1240.6	100Yr-SCS-	21.3	250.34	252.17	251.39	252.21	0.000998	0.87	24.51	169.06
Main Channel	1237.34	Cty Rd 36 (E)	Culvert								
Main Channel	1233	100Yr-SCS-	21.3	250.29	251.98	251.67	252.13	0.004217	1.72	12.4	26.79
Main Channel	1186	100Yr-SCS-	21.48	250.49	251.91	251.52	251.96	0.001725	1.28	23.37	28.03
Main Channel	1162	100Yr-SCS-	21.48	250.32	251.75		251.9	0.003849	2.02	13.87	15.39
Main Channel	1147	100Yr-SCS-	21.48	249.79	251.29	251.29	251.78	0.013269	3.16	7.29	7.86
Main Channel	1111	100Yr-SCS-	21.48	249.81	251.03	250.9	251.34	0.008054	2.48	9.1	10.85
Main Channel	1048	100Yr-SCS-	21.48	249.35	250.53	250.53	250.78	0.010055	2.75	12.23	27.42
Main Channel	978	100Yr-SCS-	21.48	248.99	250.37		250.45	0.002726	1.67	25.4	50
Main Channel	970	100Yr-SCS-	21.48	248.72	250.2	250.2	250.41	0.007427	2.41	16.29	40.44
Main Channel	935	100Yr-SCS-	21.48	248.52	249.75		249.88	0.004794	2.07	18.68	53.94
Main Channel	902	100Yr-SCS-	21.48	248	249.7		249.79	0.001734	1.38	16.82	21.22
Main Channel	893	100Yr-SCS-	21.48	247.44	249.69	248.83	249.77	0.001396	1.29	19.75	31.17
Main Channel	891	Heron's Landing	Bridge								
Main Channel	889	100Yr-SCS-	21.48	247.44	249.47	249.13	249.73	0.007865	2.3	10.27	22.35
Main Channel	883	100Yr-SCS-	21.48	247.44	249.5	249.12	249.65	0.003721	1.76	15.38	40.91
Main Channel	839	100Yr-SCS-	21.48	247.67	249.55		249.57	0.000415	0.65	41.13	59.28

Main Channel	774	100Yr-SCS-	21.48	247.33	249.52		249.54	0.000395	0.74	42.66	64.35
Main Channel	761	100Yr-SCS-	21.48	247.64	249.51	248.71	249.54	0.000546	0.8	37.65	58.27
Main Channel	760.5	Heron's Landir	Bridge								
Main Channel	760	100Yr-SCS-	21.48	247.01	248.7	248.26	248.86	0.004161	1.81	11.9	11.29
Main Channel	755	100Yr-SCS-	21.33	247.16	248.44	248.44	248.77	0.014165	2.58	8.27	12.1
Main Channel	704	100Yr-SCS-	21.33	247.07	248.26		248.32	0.001669	1.12	19.1	20
Main Channel	657	100Yr-SCS-	21.33	246.41	248.19	247.46	248.25	0.001305	1.14	18.75	16.13
Main Channel	606	100Yr-SCS-	21.33	246.22	248.11	247.38	248.18	0.001426	1.17	18.27	15.82
Main Channel	551	100Yr-SCS-	21.33	246.33	248.05	247.29	248.11	0.001191	1.09	19.72	17.49
Main Channel	504	100Yr-SCS-	21.33	246.66	248.01		248.05	0.001047	0.83	25.79	29.29
Main Channel	487	100Yr-SCS-	21.33	246.3	247.98		248.03	0.001262	0.95	22.39	23.62
Main Channel	466	100Yr-SCS-	21.33	246.46	247.91		247.99	0.002962	1.23	17.36	23.99
Main Channel	437	100Yr-SCS-	21.33	246.44	247.87	247.31	247.92	0.001317	1.02	20.88	20.66
Main Channel	247	100Yr-SCS-	21.33	245.81	247.8		247.81	0.000299	0.44	49.36	60.1
Main Channel	181	100Yr-SCS-	21.33	246.59	247.76	247.12	247.78	0.000616	0.6	35.53	45.46

Froude # Chl
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Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)
Main Channel	3532	Regional-Timmins	65.56	268.91	272		272.02	0.00017	0.72	182.84	115.57
Main Channel	3510	Regional-Timmins	65.56	268.99	271.56	271.56	271.84	0.003642	2.94	52.21	83.42
Main Channel	3503 Sturgeon Road		Culvert								
Main Channel	3492	Regional-Timmins	65.56	269	271.35	270.71	271.4	0.000876	1.32	95.39	97.68
Main Channel	3483	Regional-Timmins	65.56	268.87	271.35		271.39	0.000548	1.13	101.55	97.42
Main Channel	3446	Regional-Timmins	65.56	269.02	271.33		271.37	0.000634	1.19	101.25	92.99
Main Channel	3445	Regional-Timmins	65.56	268.97	271.3		271.36	0.001484	1.83	76.39	79.57
Main Channel	3289	Regional-Timmins	65.56	268.85	271.05		271.13	0.001448	1.77	73.11	64.06
Main Channel	3233	Regional-Timmins	65.56	268.58	270.9		271.03	0.002548	2.34	57.66	51.54
Main Channel	3127	Regional-Timmins	65.56	268.25	270.4		270.66	0.005731	3.23	44.52	42.74
Main Channel	3007	Regional-Timmins	65.56	267.88	270.35		270.41	0.00071	1.18	71.64	54.32
Main Channel	2985	Regional-Timmins	65.56	267.52	270.34		270.4	0.000548	1.27	81.92	53.26
Main Channel	2930	Regional-Timmins	65.56	267.13	270.31		270.37	0.000581	1.35	80.55	50.26
Main Channel	2915	Regional-Timmins	65.56	267.29	270.28	268.96	270.35	0.000653	1.41	75.24	51.64
Main Channel	2906 Community Centre		Culvert								
Main Channel	2900	Regional-Timmins	65.56	267.27	269.6	268.9	269.75	0.00173	2.03	51.45	45.07
Main Channel	2886	Regional-Timmins	66.5	267.33	269.08	269.08	269.53	0.008403	3.44	29.14	35.25
Main Channel	2571	Regional-Timmins	66.5	265.5	267.43	267.36	267.99	0.008127	3.78	25.38	20.57
Main Channel	2570	Regional-Timmins	66.5	264.62	266.39	266.24	266.89	0.006916	3.35	27.3	33.14
Main Channel	2264	Regional-Timmins	66.5	264.42	266.05	266.05	266.5	0.007504	3.26	29.49	35.06
Main Channel	2263.7	Regional-Timmins	66.5	264.26	265.76	265.63	266.09	0.008295	2.88	31.7	35.74
Main Channel	2263.4	Regional-Timmins	66.5	263.99	265.36	265.36	265.76	0.012955	3.59	31.75	42.66
Main Channel	2263	Regional-Timmins	66.5	263.18	264.89	264.89	265.31	0.007426	3.39	31.78	39.73
Main Channel	2262	Regional-Timmins	66.5	261	263.04		263.22	0.00244	1.87	37.43	34.18
Main Channel	1998	Regional-Timmins	66.5	260.92	262.59	262.59	263.06	0.009891	3.64	29.1	36.17
Main Channel	1997.9	Regional-Timmins	66.5	260.34	262.43	262.12	262.8	0.006144	3.53	37.45	43.32
Main Channel	1997.8	Regional-Timmins	66.5	260.15	261.95	261.95	262.59	0.012296	4.57	25.55	34.61
Main Channel	1997.7	Regional-Timmins	66.5	259.94	261.85	261.85	262.27	0.005988	3.06	31.82	52.54
Main Channel	1997	Regional-Timmins	66.5	258.18	259.96	259.96	260.38	0.007164	3.41	34.21	67.56
Main Channel	1944	Regional-Timmins	66.5	257.14	260.11		260.15	0.000383	0.99	106.34	101.23
Main Channel	1851	Regional-Timmins	66.5	256.46	260.12	258.37	260.13	0.00005	0.46	251.78	155.54
Main Channel	1818	Regional-Timmins	66.5	256.5	260.1	258.56	260.12	0.000167	0.81	175.39	228.76
Main Channel	1816.5 Cty Rd 36 (W)		Culvert								

Main Channel	1816.1	Regional-Timmins	66.5	256.21	258.07	258.07	258.34	0.005047	2.6	41.87	80.72
Main Channel	1815	Regional-Timmins	70.95	256.27	257.94	257.94	258.18	0.008654	3.17	45.9	94.73
Main Channel	1767	Regional-Timmins	70.95	255.81	257.39	257.23	257.67	0.006545	2.38	32.47	79.72
Main Channel	1699	Regional-Timmins	70.95	255.24	256.91	256.91	257.24	0.006663	2.67	34.73	64.99
Main Channel	1590	Regional-Timmins	70.95	254.34	256.36	256.36	256.59	0.004499	2.34	49.66	116.87
Main Channel	1534	Regional-Timmins	70.95	253.4	256.13		256.14	0.000179	0.68	191	190.51
Main Channel	1499	Regional-Timmins	70.95	253.39	256.13	255.1	256.13	0.000204	0.74	216.88	236.03
Main Channel	1498.5	Cedar Glen Road	Culvert								
Main Channel	1498	Regional-Timmins	71.18	253.25	255.3	255.3	255.62	0.008296	2.83	37.76	138.88
Main Channel	1458	Regional-Timmins	71.18	252.6	253.89	253.89	254.4	0.01133	3.22	23.95	25.3
Main Channel	1395	Regional-Timmins	71.18	251.76	253.97		254.08	0.001171	1.54	59	53.63
Main Channel	1242	Regional-Timmins	71.18	252.19	253.97		254.06	0.001168	1.35	57.66	46.48
Main Channel	1241.8	Regional-Timmins	71.18	252.22	253.97		254.05	0.001085	1.28	61.74	50.56
Main Channel	1241.6	Regional-Timmins	71.18	252.26	253.95		254.03	0.001089	1.28	59.58	47.1
Main Channel	1241.3	Regional-Timmins	71.18	252.24	253.9		254.01	0.001558	1.51	50.19	37.39
Main Channel	1241	Regional-Timmins	71.18	250.96	253.73	252.97	253.96	0.002643	2.11	34.17	83.59
Main Channel	1240.9	Regional-Timmins	71.18	250.99	253.84	252.7	253.9	0.000631	1.19	78.61	158.2
Main Channel	1240.7	Regional-Timmins	71.18	250.78	253.87		253.88	0.000116	0.54	193.89	140.16
Main Channel	1240.6	Regional-Timmins	71.18	250.34	253.87	252.13	253.87	0.000015	0.21	465.7	260.59
Main Channel	1237.34	Cty Rd 36 (E)	Culvert								
Main Channel	1233	Regional-Timmins	71.18	250.29	253.55	252.48	253.69	0.00127	1.81	48.61	90.88
Main Channel	1186	Regional-Timmins	71.75	250.49	253.55	252.03	253.61	0.000584	1.33	73.35	33.11
Main Channel	1162	Regional-Timmins	71.75	250.32	253.4		253.58	0.001809	2.41	50.65	36.98
Main Channel	1147	Regional-Timmins	71.75	249.79	252.35	252.35	253.43	0.014277	4.9	17.57	13.19
Main Channel	1111	Regional-Timmins	71.75	249.81	251.91	251.91	252.4	0.007359	3.5	28.85	32.35
Main Channel	1048	Regional-Timmins	71.75	249.35	251.1	251.1	251.38	0.009101	3.51	38.98	61.72
Main Channel	978	Regional-Timmins	71.75	248.99	250.89		250.99	0.003125	2.26	70.81	108.34
Main Channel	970	Regional-Timmins	71.75	248.72	250.69	250.69	250.95	0.008001	3.24	46.32	95.59
Main Channel	935	Regional-Timmins	71.75	248.52	250.62		250.68	0.001752	1.82	84.2	129.46
Main Channel	902	Regional-Timmins	71.75	248	250.18	250.05	250.56	0.005217	2.96	33.31	49.16
Main Channel	893	Regional-Timmins	71.75	247.44	250.22	250.04	250.45	0.003371	2.44	46.08	68.65
Main Channel	891	Heron's Landing	Bridge								
Main Channel	889	Regional-Timmins	71.75	247.44	250.13	250.13	250.44	0.006728	2.96	37.4	59.58
Main Channel	883	Regional-Timmins	71.81	247.44	249.95	249.95	250.34	0.00766	3.19	36.62	49.11
Main Channel	839	Regional-Timmins	71.81	247.67	250.05		250.11	0.000977	1.24	84.23	99.9

Main Channel	774	Regional-Timmins	71.81	247.33	249.97		250.04	0.001074	1.45	84.4	115.75
Main Channel	761	Regional-Timmins	71.81	247.64	249.92	249.41	250.02	0.001801	1.72	67.68	99.93
Main Channel	760.5	Heron's Landing	Bridge								
Main Channel	760	Regional-Timmins	71.81	247.01	249.44	249.44	249.79	0.005749	2.85	34.85	51.95
Main Channel	755	Regional-Timmins	71.84	247.16	249.39	249.39	249.66	0.005069	2.55	42.36	82.74
Main Channel	704	Regional-Timmins	71.84	247.07	249.24		249.36	0.001427	1.64	53.61	47.39
Main Channel	657	Regional-Timmins	71.84	246.41	249.1	248.29	249.28	0.001914	1.98	49.69	58.63
Main Channel	606	Regional-Timmins	71.84	246.22	248.88	248.26	249.15	0.002946	2.32	32.57	44.87
Main Channel	551	Regional-Timmins	71.84	246.33	248.74	248.11	248.99	0.002834	2.24	34.45	41.52
Main Channel	504	Regional-Timmins	71.84	246.66	248.76		248.84	0.001575	1.33	59.33	67.11
Main Channel	487	Regional-Timmins	71.84	246.3	248.7		248.81	0.001918	1.52	60.35	121.16
Main Channel	466	Regional-Timmins	71.84	246.46	248.6		248.75	0.003555	1.79	48.48	91.97
Main Channel	437	Regional-Timmins	71.84	246.44	248.38	247.94	248.64	0.003826	2.25	33.05	53.36
Main Channel	247	Regional-Timmins	71.84	245.81	248.11		248.16	0.001403	1.02	72.62	91.31
Main Channel	181	Regional-Timmins	71.84	246.59	247.76	247.6	247.97	0.006993	2.02	35.53	45.46

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HEC-RAS Cross Section	Regional Flood Elevation (m)	100 Year Flood Elevation (m)
3532	272.00	271.28
3510	271.56	271.11
3503 Sturgeon Road	0.00	0.00
3492	271.35	270.55
3483	271.35	270.55
3446	271.33	270.55
3445	271.30	270.49
3289	271.05	270.19
3233	270.90	270.08
3127	270.40	269.83
3007	270.35	269.82
2985	270.34	269.82
2930	270.31	269.81
2915	270.28	269.81
2906 Community Centre	0.00	0.00
2900	269.60	268.74
2886	269.08	268.35
2571	267.43	266.53
2570	266.39	265.71
2264	266.05	265.33
2263.7	265.76	265.21
2263.4	265.36	264.83
2263	264.89	264.10
2262	263.04	262.15
1998	262.59	261.73
1997.9	262.43	261.47
1997.8	261.95	261.14
1997.7	261.85	260.93
1997	259.96	259.14
1944	260.11	258.34
1851	260.12	258.26
1818	260.10	258.23
1816.5 Cty Rd 36 (W)	0.00	0.00
1816.1	258.07	257.63
1815	257.94	257.46
1767	257.39	256.81
1699	256.91	256.24
1590	256.36	255.77
1534	256.13	255.84
1499	256.13	255.84
1498.5 Cedar Glen Road	0.00	0.00
1498	255.30	254.47
1458	253.89	253.28
1395	253.97	253.04
1242	253.97	253.01
1241.8	253.97	252.99

1241.6	253.95	252.95
1241.3	253.90	252.71
1241	253.73	252.20
1240.9	253.84	252.21
1240.7	253.87	252.18
1240.6	253.87	252.17
1237.34 Cty Rd 36 (E)	0.00	0.00
1233	253.55	251.98
1186	253.55	251.91
1162	253.40	251.75
1147	252.35	251.29
1111	251.91	251.03
1048	251.10	250.53
978	250.89	250.37
970	250.69	250.20
935	250.62	249.75
902	250.18	249.70
893	250.22	249.69
891 Heron's Landing	0.00	0.00
889	250.13	249.47
883	249.95	249.50
839	250.05	249.55
774	249.97	249.52
761	249.92	249.51
760.5 Heron's Landing	0.00	0.00
760	249.44	248.70
755	249.39	248.44
704	249.24	248.26
657	249.10	248.19
606	248.88	248.11
551	248.74	248.05
504	248.76	248.01
487	248.70	247.98
466	248.60	247.91
437	248.38	247.87
247	248.11	247.80
181	247.76	247.76