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Technical Memorandum

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Subject: **Jock River Flood Risk Mapping from Richmond Road to Ashton Station Road**

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Executive Summary

This report provides a summary of the analytical methods used and underlying assumptions applied in the preparation of flood plain mapping for the Jock River from Richmond Road to Ashton Station Road. The project has been completed in accordance with the technical guidelines set out under the Canada-Ontario Flood Damage Reduction Program (FDRP) (MNR, 1986), and the technical guide for the flood hazard delineation in Ontario (MNR, 2002) as laid out by the Ontario Ministry of Natural Resources. The 1:100 year flood lines delineated here are suitable for use in the RVCA's regulation limits mapping (as per Ontario Regulation 174/06) and in municipal land use planning and development approval processes under the Planning Act.

Contents

1. Introduction

Since about 2007, the Rideau Valley Conservation Authority (RVCA) has been doing flood plain mapping in-house using internal staff and resources. The focus initially was on the rivers and inland lakes, located mostly in the upper watershed and outside the City of Ottawa. In 2012, the City of Ottawa and three conservation authorities (Mississippi, Rideau and South Nation) initiated a collaborative flood risk mapping program within the boundary of the City. Under this program, the RVCA has completed twelve projects and is working on two more. As most of the areas are mapped inside the city, the focus has now once again shifted to the upper watershed; it is anticipated that four to six projects will be done during the next few years. The upper reach of the Jock River (commonly known as Upper Jock) is one of them.

There have been several flood studies done on the Jock River over the years, but all of them focused on the lower end of the river; no study was done on the Upper Jock River (upstream of Ashton Station Road).

The most recent engineered flood risk mapping of the Jock River extends from the Rideau River to Ashton Station Road, the southwestern boundary of the City of Ottawa (PSR/JFSA 2004a, 2004b, 2005). Information from this study, when found useful, is used in the present study. Flood studies on several other tributaries are also available: van Gaal Drain (JFSA 2010); Kings Creek (RVCA, 2017a); Flowing Creek (RVCA, 2017b); Hobbs Drain (RVCA, 2017c); and Nichols Creek (RVCA, 2018a). Summary of available information has recently been compiled by RVCA in a series of subwatershed and catchment reports (RVCA, 2016a, 2016b, 2016c).

This report provides a summary of the analytical methods used and underlying assumptions applied in the preparation of flood plain mapping for the Upper Jock River from Ashton Station Road to Richmond Road (Figures 1 and 2). The project has been done in accordance with the technical guidelines set out under the Canada-Ontario Flood Damage Reduction Program (FDRP) (MNR, 1986), and the technical guide for the flood hazard delineation in Ontario (MNR, 2002) as laid out by the Ontario Ministry of Natural Resources. It also conforms to the ‘generic regulation’ guidelines of Conservation Ontario (2005). The 1:100 year flood lines delineated here are suitable for use in the

RVCA's regulation limits mapping (as per Ontario Regulation 174/06) and in municipal land use planning and development approval processes under the Planning Act.

2. Study Area

A 17 km reach of the Upper Jock River has been mapped (Figures 2 and 17), although 21 km has been modeled in HEC-RAS. The study area is rural with some isolated settlements (Figure 4). Only 8.9% of the area is currently developed (residential, commercial, institutional, streets, and recreational), and is slated to rise to 14.4% in the foreseeable future. About 20% is agricultural and about 23% is forest. Wetlands cover about 40% of the watershed area.

The following streams were modeled and mapped:

- Upper Jock River (17 km)

3. Data Used

LIDAR: High quality topography is the key to high quality flood risk mapping. Digital Elevation Models (DEM) were derived from the 2015 LIDAR data procured by the RVCA in association with the City of Ottawa. In a small part of the watershed, the 2012 LIDAR provided by the City was used. For the areas not covered by LIDAR, the 2014 MNR DRAPE DEM was used. The 2012 data set has a density of about 4 to 5 points per square meter, and an estimated consolidated vertical accuracy (CVA) of 20 cm (Airborne Imagery, 2013). The corresponding values for the 2015 data set are 4 to 10 points per square meter and 20-25 cm respectively (Airborne Imagery, 2015). The spatial extent of these two data sets is shown in Figure C.3 in Appendix C. The City also provided 0.25 m contour lines that were derived from LIDAR data. However, we only used the LIDAR points directly for this study, and the contour lines were never used.

The accuracy of the LIDAR data was checked in the field by RVCA staff in July 2019. The true elevations of on-the-ground features that are identifiable on the mapping were determined using RVCA's survey grade GPS equipment (Trimble R10) and were compared with the elevations indicated by the LIDAR spot heights, to determine that any differences between mapped and true elevations were within the accuracy prescribed by the FDRP standards.

In total, 243 spot heights were verified (see Table C.1 and Figure C.1 in Appendix C). As described in the FDRP guidelines (MNR 1986), the spot height checks are considered satisfactory when 90% of the data points are within 0.33 m of the field measurement. As shown in Table C.1, this criterion has been adequately met[1]. On average, the spot heights are within 4.3 cm (Table C.1).

Watercourses: A GIS-based watercourse layer was obtained from the City of Ottawa. It was a flow network generated by the City using their LiDAR topography, augmented by culvert and bridge overrides to ensure hydraulic connectivity. This layer was modified by RVCA's GIS staff using the DRAPE 2014 imagery (Fugro, 2015) and following the procedures outlined by the MNR (2011). The resultant watercourses were integrated into a jurisdiction-wide dataset maintained by RVCA's GIS department.

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[1] FDRP (1986) Manual also specifies criteria for checking contour crossings. However, in this study we used only LIDAR spot heights, not contour lines. Therefore, we did not check the accuracy of contour lines supplied by the City of Ottawa.

Catchment Delineation: Catchments were derived using the ArcHydro and Spatial Analyst extensions in ESRI's ArcMap. The 2014 MNR DRAPE DEM was augmented by the RVCA watercourse layer. The augmentation involved 'burning down' the watercourses into the surface and then filling the areas back up, along with all other depressions, to form a cohesive surface devoid of localized sinks. This hydrologically-corrected DEM ensures hydraulic connectivity throughout the analysis surface. The subcatchments of the Upper Jock River were generated off this surface via pour points placed at key stream confluences and road crossings.

Drape Imagery: The Drape imagery was collected during a period from 28 April through 7 June 2014 with a horizontal accuracy of ±0.5 metre (Fugro, 2015). This high-quality colored photo clearly shows the rivers, creeks, land use, houses, buildings, roads, infrastructure, vegetation, and other details.

Land use: RVCA's GIS Department has created the land cover dataset for the Jock River subwatershed (RVCA, 2016a). Vector data originally obtained during approximately the early to late 1990s by the Ministry of Natural Resources and Forests (MNRF) were used to produce a pre-classification of the area. This pre-classification provided a historical overview of the spatial distribution of transportation, settled areas, aggregate sites, evaluated and unevaluated wetlands, wooded areas, and water. Updates to this land cover vector data were based on 20cm ortho-imagery acquired through the Digital Raster Acquisition Project for the East (DRAPE), a program lead by the MNRF in 2008 and 2014. DRAPE imagery was also used to incorporate crop, pasture, and meadow/thicket as additional land cover classes. The most recent rendition, used in this project, contains 36 categories based on 2014 information (see Table 1).

They further refined the data based on information related to planning and regulations programs. Locations where land uses had changed (e.g., for the forest cover replaced with agriculture) were identified by visual inspection of the DRAPE 2014 imagery (Fugro, 2015) and recent observations by RVCA staff. RVCA's planning staff procured Official Plans for the Township of Beckwith (2012). Areas earmarked for future development are: Anand, Ashton, Beckwith Industrial, Franktown, Gillies Corner and Greater Blacks Corner (Figure 4 and Table 1). These areas resulted in six extra categories of land use for a total of 39 (see Table 1 and Figure 4). These changes were used for hydrologic parameter estimation.

Imperviousness: A GIS data layer showing the impervious surfaces was derived from the above-mentioned land cover layer. It identified and combined various impervious surfaces such as roads, parking lots, buildings, etc. (Figure 5). Designs for areas of future development were used to estimate CN values and % imperviousness (Table 4). The imperviousness varied in the range from 2% to 17% for the subcatchments, with an average of 6.9% for the entire Upper Jock catchment (Table 3a). This data set was used in the hydrologic analysis.

Soil classification: A soils classification layer was obtained from MNRF's LIO (Land Information Ontario) database, details of which are documented in a report by MNR (2012). Soil is classified into four categories (A, B, C and D) based on infiltration capacity.

Group A soils have a high infiltration rate (low runoff potential) when thoroughly wet; these consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B soils have a moderate infiltration rate and consist chiefly of moderately deep or deep, moderately well drained, or well drained soils that have moderately fine texture to moderately coarse texture; these soils have a moderate rate of water transmission.

Group C soils have a slow infiltration rate and consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture; these soils have a slow rate of water transmission.

Group D soils have a very slow infiltration rate (high runoff potential) and consist chiefly of clays that have high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material; these soils have a very slow rate of water transmission.

This report (MNR, 2012) describes the infiltration rate in qualitative terms without giving numerical values. However, it appears to be based on the SCS's original classification. USDA-SCS (1986) gives specific range of infiltration or transmission rate

(Group A: greater than 0.30 inch/hour; Group B: 0.15-0.30 inch/hour; Group C: 0.05-0.15 inch/hour; Group D: 0-0.05 inch/hour). This soil information was used in hydrological parameter estimation.

As shown in Table 2 and Figure 3, Soil Group B is predominant (52%) in the Upper Jock catchment, followed by Group D (40%). Thus, the soil in this area has a moderate to low infiltration rate. It consists chiefly of moderately drained soils. The soil texture spans from fine to course with a moderate to low rate of water transmission.

Soil Permeability: A GIS-based data layer showing the soil permeability was obtained from the Ontario Geological Survey (2010). Four categories of soil permeability were identified: high, low-medium, variable, and low. These categories roughly coincided with the soil groups (A, B, C and D). This information was not directly used in the present analysis but was only used for corroborating soil classification data.

4. Hydrological Computations

4.1 Overall Methodology

In the absence of any streamflow measurement – a common situation in many small catchments – we have used a single-event hydrological model to estimate flood flows at key locations along the Upper Jock River. This approach is sometimes referred to as the 'return period design storm' method and is one of the acceptable flow estimation procedures discussed in the provincial guidelines (MNR, 1986, 2002). In this method, a synthetic design storm (hyetograph) of specified return period is fed into a rainfall-runoff model to generate the corresponding peak flow, which is generally assumed to have the same return period. This procedure is quite popular and is regularly used in studies related to drainage, stormwater, flooding, and so on. This method is also accepted by FEMA (2009), although they call it simply 'rainfall-runoff modeling'.

For small catchments of this size, floods generated by summer storms are expected to be larger compared to spring freshet and should therefore be used in flood risk mapping. Past studies in this area support this notion[2].

Suitable data for calibrating the SWMHYMO model was not available. Therefore, we have estimated the flood quantiles based on theoretical (or synthetic) storms and uncalibrated hydrologic modeling as the best available methodology at the present time. As described later in the report, lack of data also prevented calibration of the hydraulic model.

Synthetic storms of various types and durations were first used to estimate the 1:100 year flood flows. Based largely on engineering judgement, one of the storms was selected as suitable for the flood mapping purposes within the Upper Jock basin. The selected storm was then used to estimate the flood quantiles for various return periods (2, 5, 10, 20, 50, 100, 200, 350 and 500 years).

[2] For example, the 1:100 year summer and spring floods of Flowing Creek (with an area of 49.5 km^2) were estimated at 51 and 46 cms respectively by PRS/JFSA (2005) during a larger mapping study on the Jock watershed; it was recommended that the summer flows be used for flood mapping. MVCA (2015) analyzed snowmelt events using the Ottawa Airport data and concluded that 'if a location on a river has a response time somewhat longer than 12 hours, it would be expected that snow melt would govern" (as opposed to summer rainfall). Within the Upper Jock area, catchments response time is much lower (5-7 hours) in wetland-free areas; therefore, summer rainfall is expected to produce larger runoff than spring snowmelt. Wetlands increase the response time to 12-22 hour range.

4.2 SWMHYMO Model

We have used version 4.02 of SWMHYMO model (JFSA 2000) for estimating the summer floods. This model is used widely in Ontario for both urban and rural catchments.

As shown in Figures 2 and 7, the Upper Jock River basin has been divided into five catchments, and flood quantiles have been estimated at four nodes and five catchment outlets along the river and its tributaries (Figure 13). A schematic of the SWMHYMO model is shown in Figure 8, where both the catchments and channel segments used for flow routing are included.

The Upper Jock catchment is within the municipalities of Ottawa, Beckwith, and Montague. Pertinent Official Plans (Township of Beckwith, 2012) indicate a good amount of land use change in this area (about 5.5% of catchment area) in the foreseeable future. This is concentrated in six community development areas (see Figures 4, 5 and 6, Tables 1 and 4). We have used this information for the hydrologic analysis. The hydrologic analysis therefore is based on the future condition as required by the provincial guideline (MNR, 2002).

It is noted that there is no existing stormwater pond in this catchment and no information about ponds associated with future development is available. Therefore, the question of incorporating ponds in hydrologic modeling did not arise.

Among the available runoff-generating modules in SWMHYMO model, two commands (CALIB NASHYD and CALIB STANDHYD) are usually considered for calculating runoff from rural and urban catchments respectively. In case of the Upper Jock River, all five catchments are rural (imperviousness less than 20%). Therefore, only CALIB NASHYD command was used.

The CALIB NASHYD command, used for rural areas with imperviousness less than 20%, requires the following input:

$AREA$ = area of the catchment (hectares),

DWF = dry weather flow component (m^3/s),

CN or $CN*$ = original or conjugate (modified) curve number,

IA = initial abstraction (mm),

DT = computational time step (minutes),

N = number of lineal reservoirs, and

T_p = time to peak (hour).

Table 3a lists the parameters for all five catchments within the Upper Jock basin. The dry weather flow or base flow was assumed to be zero (DWF = 0.0). A five-minute time step was used (DT = 5.0 minute). The number of linear reservoirs was set at three (N = 3). These are typical values that hydrologists use in the absence of more site-specific information.

Two parameters (curve number and time to peak) are very important in SWMHYMO modeling and therefore require elaborate discussion.

Curve Number Method: The curve number (CN) method of estimating runoff was first introduced by US Department of Agriculture's Soil Conservation Service (USDA-SCS 1986) and is widely used in North America and elsewhere. This method is used in the SWMHYMO model too. The curve number (CN) was calculated based on land use and soil type (Tables 1 and 2). Equivalent land use and associated CN from TR-55 were first selected for each of the 39 land cover and 4 soils types found in this region (Table 4). For each elemental area with a particular land cover-soil combination, the appropriate CN value was chosen; these CN values were then area-averaged over the whole catchment to find the aggregate CN for the catchment. CN values varied from 77 to 86 for different sub-catchments, with an average value of 81.9 for the entire Upper Jock catchment (Table 3a).

Both the original SCS curve number method and its 'conjugate' or modified version can be used in SWMHYMO. For this study, we have used the modified method – commonly known as the $CN*$ method, because this method was used for most of the subwatersheds in the greater Jock River Basin in the past. For parameter estimation and calculation procedures, we have closely followed the original SCS manual (USDA-SCS, 1986) and a recent, comprehensive state-of-the-art review done by a task committee (Hawkins et al., 2009).

The first step is estimating the CN value based on land use and soil type as given in the SCS manual (USDA-SCS, 1986). We have used the following information:

- 2012 soil classification by LIO/OMAFRA/MNR (MNR, 2012)

- 2014 land cover data compiled by RVCA staff.

Both data sets were available in digital format. Tables 1, 2a and 4 summarize parameters related to the estimation of CN and $CN*$. This process was automated in the GIS system.

Once CN was estimated, then the initial abstraction (IA) in mm was calculated as:

$$IA = 0.2S$$

where the soil storage capacity (S) in mm is related to CN and by the relation:

$$CN = \frac{25400}{254 + S}$$

The 'conjugate' or modified curve number $CN*$ was calculated using the following equation:

$$CN* = \frac{100}{1.879(\frac{100}{CN} - 1)^{1.15} + 1}$$

The corresponding soil storage capacity ($S*$) in mm was related to $CN*$ by the relation:

$$CN* = \frac{25400}{254 + S*}$$

And the corresponding initial abstraction ($IA*$) in mm was calculated as:

$$IA* = 0.05S*$$

The above equations were taken from Hawkins et al. (2009; page 35, 9 and 34 respectively).

While the original CN was estimated based on the assumption of an initial abstraction equal to 20% of the soil moisture capacity, later research revealed that the initial abstraction equal to 5% of the soil moisture capacity may be more appropriate, the new curve number was called $CN*$, and the relationship between CN and $CN*$ was established. At present, both the original and the modified methods are widely used, with more and more practitioners preferring the latter. However, given that they can be readily converted to each other, one has the option to use any of them.

In this study, we have used the modified CN method, which means we have used the $CN*$ and $IA*$ combination as input to the hydrologic model. Parameters for the original CN method, namely CN and associated (IA), were calculated and presented in Table 3a for information only but were not used in the hydrologic calculations.

Time to Peak: The time of concentration (T_c) of a watershed is defined as the time required for water to move from the most remote part of the watershed to its outlet. Many methods are available, mostly empirical and developed for specific conditions, to estimate T_c. Here, we have used the 'velocity method' originally introduced by Soil Conservation Service (USDA-SCS, 1986) and later elaborated by Natural Resources Conservation Service (USDA-NRCS, 2010). This method has a sound physical basis[3], i.e., the movement of water over the land and along the channel, although estimating parameters – as the case frequently is in hydrology – is at best an approximation.

The time to peak (T_p) is defined as the time between rainfall event and the corresponding peak flow. It is related to the time of concentration as (USDA-CSC 1986, page 15-3):

[3] The SCS velocity method is generally considered to have a sound physical basis and is often used as a yardstick to evaluate other methods (see, for instance, McCuen et al. 1984; Grimaldi et al. 2012 and Sharifi and Hosseini 2011). Grimaldi et al. found that as much as 500% variation is quite common when using different methods to estimate time of concentration. They also made an interesting remark: "Indeed, it a paradox that advanced hydraulic models, such as 2-D flood propagation models for hydraulic risk mapping based on very expensive topographic and remote sensing data, are actually limited by design hydrographs based on anachronistic parameters, such as Tc." This is consistent with the commonly observed fact that hydraulic calculations are much more accurate than hydrologic calculations. Also, from the practitioner's point of view, "as a general rule, methods that compute individual travel times for various types of flow segments (for example, overland flows and channelized flows), and then sum the individual travel times to estimate the total travel time, are thought to be the most reliable" (Bentley Systems 2007b).

$$T_p = 0.6T_c$$

Both T_c and T_p were calculated using the method detailed in the USDA-NRCS (2010) manual. The time to peak (T_p) was an input to SWMHYMO model (Table 3a). It varied from 5.6 to 7.1 hours the three catchments that are wetland-free. For the other two catchments with significant wetlands, the times to peak were 12.4 to 22.1 hours.

All estimated parameters necessary for the SWMHYMO modeling of the Upper Jock River catchments are listed in Tables 3a.

Channel Routing: The ROUTE CHANNEL command of the SWMHYMO model was used for routing the flow along rivers and streams[4]. The model requires channel length, slope, roughness, and a typical channel cross-section. Channel length and slope are given in Table 3b. Figure 8 shows how the channels fit within the overall model structure. Typical cross-section for each channel was based on the characteristic main channel and adjacent floodplains where applicable. Manning's roughness coefficients for the main channel and floodplain were also assigned based on land use and expected flow conditions. Care was taken to ensure that parameter values used in SWMHYMO were consistent with those used in HEC-RAS model.

4.3 Selection of Design Storm

A wide variety of design (or synthetic) storms are available. However, a particular storm is generally selected for flood mapping purposes after appropriate scrutiny. For this study, synthetic storms of two types (Chicago and SCS Type II) and four durations (3, 6, 12 and 24 hours) were considered for hydrologic modeling (Table 5). These storms are routinely used in Canada for both stormwater management and flood risk studies. Recent studies in neighboring conservation authorities (SNCA 2014; MVCA 2015) as well as within the RVCA (RVCA 2016, 2017a, 2017b, 2017c, 2017d, 2018a, 2018b, 2018c)

[4] We considered the option of modeling the Goodwood Marsh as a reservoir in the SWMHYMO model. However, field observations indicated that there is a significant drop of water level (about 2 m) along the marsh. This made it inappropriate to treat it as a level-pool reservoir. Modeling it as a very wide channel was deemed to be more appropriate.

confirm the suitability of these storms for the purposes of floodplain mapping in small basins.

The following synthetic storms were considered:

- 3 hour SCS Type II storm
- 6 hour SCS Type II storm
- 12 hour SCS Type II storm
- 24 hour SCS Type II storm
- 3 hour Chicago storm
- 6 hour Chicago storm
- 12 hour Chicago storm
- 24 hour Chicago storm

Hyetographs corresponding to these storms were generated from the most recent IDF curve at Ottawa Airport (Station ID 6106000), obtained from Environment Canada[5]. This IDF curve was based on the most recent analysis using 39 years of data from 1967 to 2007 (with 2001 and 2005 data missing)[6]. Generally, the curve for a certain return period follows an equation like:

$$I = \frac{a}{(b+t)^c}$$

where,

I = rainfall intensity (mm/hour), and

a, b, c = constants.

From the EC IDF curve (Figure 9), equations were fitted via the STORM software and constants determined for all return periods (Figure 10). These equations were then used to generate rainfall hyetographs, for which we used the STORMS 2010 utility software (version 3.0.1) from JFSA (2011). Figure 11 shows the storm hyetographs.

[5] Information on IDF curve was obtained from Environment Canada's website [http://climate.weather.gc.ca/prods_servs/engineering_e.html].

[6] City of Ottawa's Sewer Design Guidelines (2012) contain an old IDF curve based on 1961-1990 data, which yields somewhat smaller storm depths than the more recent IDF curve (based on 1967-2007 data). We have opted to use the most recent IDF curve because it reflects recent climatic conditions, is based on more data (39 years as opposed to 31 years), and is slightly conservative (produces bigger storms). The FDRP Manual (MNR 1986) also recommends the use of most recent IDF information.

Hyetographs were input to SWMHYMO model, where they drive the rainfall-runoff computation. This procedure was followed for all Chicago storms and the SCS 24 hour storm. For all other SCS storms (3, 6, 12 hour durations), the distribution was taken from the City of Ottawa Sewer Guidelines (2012; page 5.18).

Using the eight synthetic storms, the 1:100 year flows were computed for all sub-catchments and at key locations along the stream (Table 6), which were then scrutinized to select an appropriate storm for the purposes of flood mapping. This step is somewhat subjective and requires engineering judgement. As expected, the longer duration storms produced higher flows; usually the flow corresponding to a 3 hour storm was about 50-56% of that produced by a 24 hour storm. The SCS storms produced slightly higher flows (by about 5-10%) compared to Chicago storms. The estimated flows from various storms were thus within the typical variation associated with hydrologic computation; no storm produced extremely high or low flows. This appears to endorse the notion that all storms considered here and associated flows were within the realm of hydrological plausibility. No storm stood out as an outlier or as unrealistic. In the selection of a storm for flood mapping purposes, we wanted to be as close as possible to reality with a slight degree of conservatism. Considering all, we selected the 24 hour SCS Type II storm as the most suitable for Upper Jock River flood mapping[7]. As can be seen in Table 6 and Figure 12, it produced the higher flows, but only marginally so (1-10% higher than those produced by the Chicago storm). This selection was consistent with our philosophy of being as close as possible to reality, with only a slight degree of conservatism to account for the uncertainty.

4.4 Estimated Flood Quantiles

After the 24 hour SCS Type II storm was selected for the flood mapping purposes, the SWMHYMO model was run for all events with return periods from 2 to 500 years (Table 7). Input and output files of the SWMHYMO model are included in

[7] The hydrological analyses done here and the results obtained therefrom are considered suitable for the purposes of floodplain mapping of the Upper Jock River only, and for no other purpose. It should be emphasized that the methodology, storms considered and selected, modeling, and the estimated flood quantiles may not be suitable for any other purpose, including land drainage, stormwater management and infrastructure design. Any subsequent use of the data, model and other information contained in this report should be made only after independent verification and scrutiny by qualified engineers/hydrologists.

Appendix D. Estimated flood quantiles at key locations were tabulated (Table 9 and Figures 13 and 14). Flood flows from this table were then used in the hydraulic modeling; thus, this table is the link between hydrologic and hydraulic computations.

The flows calculated by PSR/JFSA (2004, 2005) may be used for comparison. The 1:100 spring flow was estimated at 54 cms and 20 cms by two methods (area prorating and 10-day melt modeling). The 1:100 year summer flow was estimated at 21 cms by hydrologic modeling. The wide spread of flow estimation is interesting and shows the difficulties of hydrologic modeling in the absence of measured data. Our estimate of 40 cms differs from their various estimates but falls within the spread. Several issues can be thought of as contributing to this disparity. First, it can partly be attributed to the use of different IDF curves; we used the latest IDF curve which translates into a 10-15% higher rainfall. Another reason is the details of land use and soil information used; ours were much more detailed than theirs. They have also used smaller basin areas (about 5% lower than ours), lower CN values (62 vs. 75), and lower time of concentration values (4-11 hours vs. 5-22 hours). Further, the Goodwood Marsh had been modelled as a reservoir, but surveys carried out by RVCA in spring of 2016, 2017 and summer of 2019 demonstrated that the water level within the marsh was not a level pool. The difference in water elevations between the upstream (at Richmond Rd) and downstream (at Cemetery Side Rd.) varied by 2.6m to 2.9m. Owing to these findings, the Goodwood Marsh has been modelled as a series of reaches with wide floodplains to capture the topography and high Manning's "n" to simulate the abundant vegetation. All these factors contributed to the difference in flow estimates. However, at the end, based on the more detailed and better quality of the data we used, we concluded that our estimate of flood quantiles is more appropriate for flood mapping purposes.

4.5 Comparison with Other Methods

In order to assess the reasonableness of the flood quantiles computed here (with SCS Type II 24 hour storm), a comparison was made to those computed at other small catchments elsewhere (Figures 15 and 16). Besides comparing the data points to each other, three lines were drawn to provide the context. They are:

- Area pro-rating: based on Jock River at Moodie Drive; 1:100 year spring flood of 196 cms based on measured data (PSR/JFSA 2004a)
- 1:100 year floods computed by the Index Flood Method (MNR, 1986)
- Creager envelope curve with a coefficient of 30 (Watt et al. 1989)

Figures 15 and 16 show that, in general, the Upper Jock River flows are in the same range as other catchments within the RVCA (taken from PSR/JFSA 2005; JFSA 2009; RVCA 2016, 2017a, 2017b, 2017c, 2017d, 2018a, 2018b, 2018c) and from adjacent conservation authorities (SNCA, 2014; MVCA, 2015). One notable exception is Bilberry Creek, which is fully urbanized with soils mostly composed of clay with a low infiltration rate and shows higher flows. Some of the urban catchments within the Jock watershed also have higher flows comparable to those in Bilberry basin.

We note that all of the estimated floods within the Upper Jock River basin are higher than those given by the Index Flood Method, which was based on measured streamflow data and was prescribed by MNR (1986) for estimating floods in the absence of better information. The only exception were the two wetland-rich catchments where the flows were lower than Index Flood Line. All data points are below the Creager envelope curve, which is the upper-most limit of extreme flood flows in Canada. On the balance, we found that the estimated Upper Jock flows are congruent with other information and are within the confines of pertinent estimation methods.

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5. Hydraulic Computations

5.1 HEC-RAS Model

Following standard procedures (MNR, 1986; USACE, 1990, 2010a, 2010b), a steady-state hydraulic model of the Upper Jock River was built. The HEC-RAS software (version 4.1.0) developed by the US Army Corps of Engineers (USACE, 2010) was used. It uses the same back water calculation procedure as HEC-2 (USACE, 1990), which has been the industry standard since the 1970s, but with improved data processing and graphical capabilities. About 21 km of Upper Jock River was included in the HEC-RAS model.

Cross-Sections: The cross-sections used in the modeling were generated from the latest topography (2012 and 2015 LIDAR) using GIS tools. While the above-water part of the cross-sections generated from LIDAR is accurate, the under-water portion of the channel is sometimes not adequate. In such cases, the under-water portion of the cross-section was adjusted from field observation. Since the LIDAR were flown during low flow conditions, the adjustment required for under-water channel was usually in the range of 0-100 cm. Small correction was usually required for the shallower reaches downstream of the wetland, and larger corrections within the wetland. The probable impact of such adjustments on 1:100 year flood level is expected to be insignificant. Therefore, the cross-sectional data was considered adequate for the purposes of flood mapping.

In the wetland-dominated regions, where about 80% of the wetlands were observed to be under water during the summer of 2019, the accuracy of LIDAR topography was somewhat doubtful. Extensive field observation and engineering judgement were used to estimate the cross-sections (main channel as well as the flood plain). Admittedly this is an approximation, but it is the best we could do with available information.

In total, 90 cross-sections were used in our HEC-RAS model. Figure 17 shows a schematic of the HEC-RAS model. Drawing UJ-1 in Appendix F shows the cross-sections in greater detail, along with the computed Regulatory Flood Levels (RFLs) and flood risk limits.

The location and alignment of river cross-sections within the model were based on engineering judgment as related to the expected flow conditions during high flood events. After the first iteration of flood line was plotted, the probable streamflow lines along the actively conveying waterbody were drawn, taking into consideration the presence of local topography, islands, roads, and bridges. This offered an overall view of the regional flow pattern in plan view. Ineffective flow areas were then identified on this plan and were entered into the model. This afforded a wholistic and more realistic identification of ineffective flow areas than would be possible when single cross-sections are considered in isolation.

We applied the blocked obstruction command to model buildings and non-conveying portion of channels. Usually, these portions are either depressions or ditches in the floodplain. Cross-section 3700 has such a ditch, which was blocked off. Cross-section 6500 has a depression, which was modeled as an ineffective flow area.

The HEC-RAS Manual does not prescribe much guidance on the spacing and number of cross-sections necessary for adequate modeling, rather leaving it to the judgement of the engineer. However, it refers to Samuels equation for estimating the number of cross-sections under unsteady flow conditions. The number of cross-section we used adequately met this criterion.

We also followed the HEC-RAS Manual for the placement of cross-section near road crossings.

Channel Roughness: Based on our best understanding of the expected channel, flow and vegetation conditions, the Manning's roughness coefficient was estimated to be 0.045 in the main channel and 0.05-0.1 for the overbank areas (Table B.1 in Appendix B). These values were consistent with standard values, such as those recommended by Chow (1959).

Bridges/Culverts: Within the study area there are eight road crossings (Table 11a). As-built drawings were obtained from the municipalities. Moreover, field survey by RVCA technicians during the Fall of 2019 were used for determining bridge/culvert dimensions.

In modeling bridges and culverts in HEC-RAS, we meticulously followed the guidance provided by USACE (2010a, Chapter 5 and 6). In HEC-RAS model, each bridge structure requires both the low flow and high flow methods to be selected, where a flow is defined as a high flow when the water surface touches the low chord of the bridge (USACE, 2010a, page 5-18). The modeling of each crossing is described below.

- Richmond Road Culvert (XS 23650): Modeled as a box culvert as per guidance provided in USACE (2010b, page 6-49).
- Beckwith 9 Line Bridge (XS 11180): As a bridge without piers, it has been modeled using the energy method for low flow.
- Cemetery Side Road Bridge (XS 10175): As a bridge without piers, it has been modeled using the energy method for low flow.
- 552 Beckwith 9 Line Culverts A and B (XS 7490): Modeled as twin culverts. However, the culverts were completely submerged on both the upstream and downstream sides. Furthermore, the road was overtopped, which was modeled using the energy/standard step method[8], as per the guidance document (USACE 2010a, page 5-29).
- 500 Beckwith 9 Line Bridge (XS 6745): It is a bridge with a pier. As the bridge deck was overtopped during high flows, it was modeled using the pressure/weir method.
- 442 Beckwith 9 Line Bridge (XS 6275): It is a bridge with a pier. While low flows passed through the bridge opening, high flows overtopped the adjacent roadways. Therefore, the flow through the bridge opening was modeled using the energy method to be on the conservative side.
- Ashton Station Bridge (XS 4350): As a bridge without piers, it has been modeled using the energy method for low flow.
- McCafferey Trail Bridge (XS 2150): It is a bridge with a pier. The flow was through the bridge opening. It has been modeled using the energy method. The flow was subcritical upstream of the bridge, critical at the downstream edge of the bridge and subcritical again further downstream. Under this kind of condition, called Class B low

[8] The road top was not modeled as a weir because doing so in the presence of high tail water condition will induce unacceptable error. Therefore, it is simpler to solve it as an open channel flow using energy/standard step method (USACE, 2010a, page 5-29).

flow, the momentum equation fails to converge and the HEC-RAS model defaults to the energy method (USACE 2010a, p.5-17).

<u>Inline Structures</u>: The only inline structure within the study area is the Ashton Station Dam (see Table 11b, Figure 20, and Appendix E).

The physical dimensions of the Ashton Station Dam were measured by RVCA staff in August 2019. Supplemental measurements were available from the drawings provided by the City of Ottawa. The dam consisted of two sluice gates and five weir sections, as shown in Figure 20. The dam was modeled as 'fully open' during flood events.

Weir Sections: There are five weir sections of the Ashton Station Dam. Three of them are at a higher elevation of 127.75 m and have a combined width of 10.89 m. The length of them along the flow direction is 0.92 m, thereby making them broad-crested weirs.

The other two weirs are at a lower elevation of 127.30 m and have a combined width of 3.90 m. The length of them along the flow direction is 1.15 m, thereby making them broad-crested weirs.

Broad-crested weirs can be modeled in HEC-RAS, and the following formula is used to compute discharge (USACE, 2010a, equation 8-6, page 8-10):

$$Q = CLH^{\frac{3}{2}},$$

where,

Q is the discharge (m^3/s),

C is the weir coefficient ($m^{1/2}$/s),

L is the length (or width) of the weir crest (m), and

H is the upstream energy head above the weir crest (m).

In this equation, obviously the computational accuracy is dependent on the weir coefficient. The HEC-RAS Manual (Table 8-1) gives a range of this coefficient from 1.43 to 1.71 $m^{1/2}$/s, but without specific guidance on how to choose the appropriate value.

In order to be more realistic in choosing an appropriate weir coefficient, we used the information provided by Bos (1989, chapter 4), whereby the flow coefficients can be calculated as a function of weir geometry.

The broad-crested weir formula as given by Bos (1989, equation 4-1, p. 121) is

$$Q = C_d C_v \frac{2}{3} \sqrt{g \frac{2}{3}} b_c h_1^{1.5} ,$$

where,

Q is the discharge (m^3/s),

C_d is the coefficient of discharge (dimensionless),

C_v is the coefficient of velocity (dimensionless),

g is the acceleration due to gravity (9.81 m/s^2),

b_c is the width of the weir (m), and

h_1 is the height of upstream water level above the weir crest (m).

The discharge coefficient C_d may be calculated by the formula[9] below (Bos 1989, equation 4-2, p.122)

$$C_d = 0.93 + 0.10 \frac{H}{L} ,$$

where,

H is the upstream energy head above sill level (m), and

L the length of the weir in the direction of flow(m).

The coefficient of velocity, C_v, is a function of the ratio of approach wetted flow area to weir flow area, the discharge coefficient C_d, and the velocity distribution coefficient (Bos, 1989, Figure 1.1.2, Page 30). Based on the configuration of Ashton Dam, C_d was estimated at 0.96 and C_v at 1.02.

[9] This equation for C_d is only applicable when flow is broad-crested in nature. The flow nature is obtained by the ratio of H/L. For 0.08 < H/L < 0.7, the flow is broad-crested (Bos 1989, page 40 and 128). It is also so when 0.1 < h_1/L < 0.4 according to Lakshmana Rao (1975, page 329). As H and h_1 are often nearly equal they can be treated as the same. Once H/L exceeds the upper limit of 0.7 it is in the narrow-crested flow regime (Bos, 1989, page 39), and is classified as short-crested. Lakshmana Rao (1975) defines the upper limit of the narrow-crested regime as 1.5 (or 1.9) (page 330), however, no such upper limit has been defined by Bos (1989). Thus, C_d for water levels beyond the broad-crested regime were taken from Bos (1989, Figure 6.2, p.176). Equations for derivation of discharge and velocity coefficients remain the same.

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Now, by equating the weir flow formulas of HEC-RAS and Bos (1989) as described above, and assuming coincidental the upstream water level and energy head, one could write

$$CLh^{\frac{3}{2}} = C_d C_v \, \frac{2}{3} \sqrt{g \, \frac{2}{3}} b_c h_1^{1.5} \, .$$

With, L=b_c and h = h_1, this reduces to

$$C = C_d C_v \, \frac{2}{3} \sqrt{g \, \frac{2}{3}} \, .$$

Now, with the calculated values of C_d and C_v as 0.96 and 1.02 respectively, the value of C comes out to be 1.66 and 1.69 8 $m^{1/2}/s$ for the upper and lower weir sections respectively. This value was used in the HEC-RAS weir formula.

Sluice Gates: There are two sluice gates of identical dimensions in the Ashton Dam. Each of the sluice gates is 1.06 m in height and 0.76 m in width. The depth of the sluice gate in the direction of flow tapers from 2.6 m at its bottom sill level to 1.53 m at its obvert. The sluice gates are modeled as ‘fully open’ during flood events.

In HEC-RAS there are four flow regimes through the sluice gate: weir flow, free flow, transition flow and orifice flow (USACE 2010a, chapter 8).

In the case of Ashton Dam, flows for every return period, from the 2 year to the 500 year, are in the ‘free flow’ flow regime. Free flow through sluice gates can be estimated by the following equation (Bos, 1989, equation 8-8, p. 275; USACE, 2010a, equation 8-4, page 8-9).

$$Q = C_e A \sqrt{2 g y_1} \, ,$$

where,

C_e is the discharge coefficient (dimensionless); it is a function of y_1/h. It was estimated to be 0.53 (Chow 1959 Figure 17-38, page 509; Bos 1989, figure 8.4, page 275),

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A is the area of the sluice gate opening (m^2),

g the acceleration due to gravity(m/s^2),

y_1 is the upstream water level above sluice sill level (m), and

h is the height (m) of the spillway gate.

Flood Quantiles: The estimated design flows from the hydrologic analysis (discussed above), with return periods ranging from 2 to 500 years (Table 8), were used in the HEC-RAS model. Table 9 shows the flows that were input to the HEC-RAS model.

For each channel reach, flows at both upstream and downstream ends were estimated from the SWMHYMO model (Table 8) and are listed in Table 9[10]. As is the usual practice, the higher of these two flows – almost always the downstream one – was used for the hydraulic calculation in the HEC-RAS model. However, an exception was noticed for the reaches between M4 and M5 of the Upper Jock River. Here the SWMHYMO-generated 2-year flow at Node N5 (or M5) was slightly lower than the flow at node N4 (or M4). For the HEC-RAS model we have taken the greater of the two for all individual events[11] (Table 9).

Downstream Boundary Condition: Known or estimated water levels are usually used as downstream boundary conditions in HEC-RAS models. In this case, flood mapping and associated HEC-RAS modeling downstream of Ashton Station Road were available (PRS/JFSA 2004b, 2005). Although the current mapping was done for the area upstream of this road, the HEC-RAS model was extended about 3 km downstream. The

[10] In Table 9 and Figures 13 and 14, flows at locations M1, M4 and M5 are the same as those at N1, N4 and N5 – taken directly from Table 8; however, flows at M2 and M3 are interpolated (area prorated) between M1 and M4. This interpolation was necessary because of the way the Goodwood Marsh was modeled in the SWMHYMO.

[11] This can be explained by the difference in response times of the various components between low (2 year) and high flows (5 year and up). Referring to Figure 12, the 2 year peak at N4 occurs before the peak at N5. This changes as the return period increases, for the 100 year the peak at N4 now is after the peak at N5. This difference is caused by the ability of channel C4 to route N4. Channel C4 is the single longest reach in the study. As expected, it does a better job in attenuating the 2 year vs 100 year. For higher flows (5 year and up) as C4 reacts sooner, the addition with the UJ3 hydrograph is a larger positive.

flood levels calculated at the downstream end by PRS/JFSA (2005) were used as the starting water level (Table 10). Recognizing the differences between the two studies, the downstream end was selected very far downstream on purpose, so that the effect of the downstream boundary condition (an approximation) does not affect the hydraulics upstream of Ashton Station Road. It was verified that even a ±1.0 m variation in the boundary condition do not propagate upstream of the road and thus have no affect on the mapping upstream of it.

Once the model was set up, the computed profiles and other parameters were scrutinized to assess the reasonableness of model outputs. Special attention was given to the computed water level and energy profiles near road crossings. Adjustments of model parameters – mainly the channel resistance and contraction and expansion coefficients – were made as necessary.

Suitable data to calibrate or validate the HEC-RAS model was not available. Therefore, no calibration was done[12]. However, we exercised professional judgement and tried to be slightly on the conservative side. Our approach of slight conservatism (a combination of hydrologic and hydraulic computations) is also congruent with the current notion of the Precautionary Principle, which applies when there exist considerable scientific uncertainties about causality, magnitude, probability, and consequences of different course of action (UNESCO 2005). The Precautionary Principle is also a key policy of Environment Canada[13].

[12] Given the constraints, this HEC-RAS model is the best we could build for the limited purpose of floodplain mapping at this time. We recognize that this model may not be suitable for other purposes. Further model improvement/adjustment/modification may be necessary for other purposes; it all depends on the purpose of the modeling and the features and phenomena a model is meant to capture. We therefore caution against using this model for other purposes without first confirming its suitability by qualified hydrologists/engineers.

[13] Canada's environmental policy is also guided by the precautionary principle and is reflected in the Federal Sustainable Development Act (2008), which states that the Minister of Environment must "develop a Federal Sustainable Development Strategy based on the precautionary principle". The precautionary principle states that: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation". In other words, the absence of complete scientific evidence to take precautions does not mean that precautions should not be taken – especially when there is a possibility of irreversible damage (Environment Canada, 2010).

5.2 Computed Water Surface Profiles

The HEC-RAS model was run with the design floods. The 1:100 year computed water surface elevations and other parameters are shown in Table 13. Typical water surface profiles and all cross-sections are included in Appendix B.

Computed water surface elevations for various flood events with return periods ranging from 2 to 500 years are presented in Tables 14 and 15. It should be pointed out that the model has been built for the expected conditions prevailing during intense rainfall-generated flood events in the summer. Caution should be used when applying this model to simulate water surface profiles for events of other magnitude and during other seasons of the year.

Computed head losses across road crossings are listed in Table 12.

In cold climate areas like Ontario, spring floods may also be accompanied by ice jams. Here we have only analyzed the summer floods, not the spring floods. We are unaware of any ice-related flooding that caused significant concern in this area.

5.3 Sensitivity Analysis

Flood quantiles have the highest degree of uncertainty in our computation and is most likely to affect the water surface profile. Therefore, we decided to test the sensitivity of water surface profile to a wide variation in flow.

The sensitivity analysis was conducted to determine how much the computed water surface elevations will vary with changes in the value used for the 1:100 year discharge. Six flow conditions were tested:

- 1:100 year flow increased by 10%
- 1:100 year flow increased by 25%
- 1:100 year flow increased by 50%
- 1:100 year flows decreased by 10%
- 1:100 year flow decreased by 25%
- 1:100 year flow decreased by 50%

Figures 18 and 19 show the computed water surface profiles and the differences in computed water levels for each condition. Figure 18 indicates that the computed water surface elevations are less sensitive to the discharge value in the steeper portions of the reach and more sensitive upstream of road crossings. The sensitivity analysis indicates that the computed water level can vary by about 0.05-0.20 m for a 25% variation in flow along most of the river reach, which is typical in the hydrologic estimation of design flow. For a 50% increase in flow, the water level, on average, can go up by about 0.15-0.45 m.

The sensitivity analysis provides an indication of the potential implications of inaccuracies in flow estimation, and changes in the expected flood flows that might result from urbanization and climate change.

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6. Selection of Regulatory Flood Levels

As per Section 3 of the Provincial Policy Statement under the Planning Act (MMAH, 2014, 2020), the regulatory flood in Zone 2, which includes the RVCA, is the 1:100 year flood. Depending on the local hydraulic conditions, the computed water surface elevation, the energy grade or a value in between is generally taken as the Regulatory Flood Level (RFL). Engineering judgment is applied to recommend an appropriate value for the regulatory flood level at each cross-section, using the model outputs and considering hydraulic characteristics of the river reach, and the inherent limitations of numerical modeling.

When the stream velocity is relatively low and varies only gradually over relatively long river reaches, the water surface can generally be taken as the RFL.

However, near bridges, culverts and other water control structures and on steeper reaches where streamflow velocities are higher, and may change more abruptly, the computed water surface elevation may be substantially lower than the energy grade level, with the possibility that the water level may rise to the energy grade near obstacles and irregularities in the channel profile or cross-section which may not be represented in the hydraulic model. In such cases, the regulatory flood level is generally based on the computed energy grade as a conservative approach, given that the model-generated water surface elevation is less likely to be a true representation of flood risk in such situations.

Another possible situation arises when the computed water surface profile is undulating, with downstream water levels occasionally higher than upstream levels. When this occurs, it is more often an artifact from the simplifying assumptions of the modeling scheme than a reliable prediction of the actual differences in streamflow velocity and depth (and hence energy grade) from one cross-section to the next. Accordingly, the regulatory flood level at the upstream cross-section is taken to be equivalent to the downstream water surface elevation in these situations.

In all cases, the RFL is always between the computed water level and energy grade line. Hence, for the sake of simplicity and consistency, the energy grade elevation is often used as the RFL as a standard practice in delineating flood hazard areas.

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For the present study, the regulatory flood levels were set equal to the computed energy grade and are tabulated in Table 13, along with the computed water surface elevations and energy grades at each cross-section in the model.

7. Flood Line Delineation

7.1 General

Once the RFLs are established, the plotting of 1:100 year flood lines or flood risk limits is a relatively straightforward matter. Given the topographical information in the form of LIDAR spot heights, the inundated area below the RFLs can be easily delineated manually or by using automated computer programs. In the present case, it was done manually with a focus on areas with complex topography, infrastructure, and overbank flow paths. The raw LIDAR spot heights were extensively used in the plotting the flood risk limit.

Field surveys were conducted by RVCA staff in August of 2019 to verify hydraulic connectivity through culvert openings and flood prone areas (Table 17). This information was used to plot the areas flooded through road openings. It is noted that these culverts were not on the Jock River and were therefore not used in its HEC-RAS modeling. These culverts were only used for identifying openings through which flood water would propagate and therefore for facilitating flood line plotting.

The record of site-specific information associated with RVCA's regulatory approval process since 2010 was checked (Table 16). It was found that no site-specific work affects the flood risk lines.

Drawings UJ-1 and UJ-2 in Appendix F depict the delineated floodplain.

7.2 Buildings in the Floodplain

Presence of existing buildings within the floodplain and associated variation in the way a building could be exposed to flood risk required special attention. Recently, RVCA has consolidated a few rules for drawing flood lines in the vicinity of buildings (Appendix A), which have been followed in this study. Due to the limitations of the data and methodology used in the current mapping done at a large scale, and the small degree of (inevitable) subjectivity in drawing flood lines around buildings at a smaller scale, RVCA recommends that, should the need arise for accurate flood line delineation near buildings, site-specific information be taken into account when dealing with flood risk at these locations. It is the practice of RVCA to refine flood lines when more accurate information becomes available.

7.3 Islands in the Floodplain

Presence of small islands, especially those associated with septic beds, within the floodplain also requires special attention. Recently, RVCA has decided to show small islands with an area less than 1000 m^2 as flood risk area (Appendix A) This guidance was followed during this study.

7.4 Spill Sections

One spill section was identified during this study (see Drawing UJ-1). It was minor in nature and had water depth in the order of 25-50 cm. During exceptionally large flood events, water is expected to spill over to the Kings Creek watershed.

Because of the minor nature of the spill and the flows escaping therethrough, no adjustment was made to the flow values. In other words, the current HEC-RAS modeling uses an assumption that all flow is retained in the creek, i.e., no water escapes the creek. Therefore, the floodplain delineated here is conservative.

7.5 Flood Mapping Data in GIS

The regulatory flood lines and cross-sections have been incorporated as separate layers in RVCA's Geographical Information System (GIS). In this system, one can view the flood lines, cross-sections, design flow, water level, energy grade, RFL, and other computed parameters. The flood lines can be overlain on the aerial photography or any other base mapping layers that are in the system and at any scale that suits the user's need.

The regulatory flood line layer is maintained and updated as required according to the established procedures of the RVCA (RVCA 2005).

Drawings UJ-1 and UJ-2 show the flood risk limits as delineated in this study. At all cross-section locations, the RFL is indicated. The general surroundings and landmarks are also included for easy referencing.

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8. Project Deliverables

The key information or knowledge products generated from this project are:

1) The Flood Mapping Report (this Technical Memorandum) – which summarizes the analytical methods that were used and the underlying assumptions
2) SWMHYMO model files
3) HEC-RAS model files
4) The flood risk limit lines in GIS format (shape files) – identifying the extent of lands which are considered to be vulnerable to flooding during a regulatory flood event (1:100 year flood)
5) The position and orientation of cross-sections used in the HEC-RAS model, in GIS format (shape files) – which, when used in conjunction with the HEC-RAS model output files, informs the user as to the estimated 1:100 year water surface elevation and the regulatory flood level for any location in the study area

A "documentation folder" containing working notes and relevant background information accumulated during the study process is maintained by the water resources engineering unit within RVCA's Watershed Science and Engineering Services department.

9. Closure

The hydrotechnical and cartographic procedures used in this study generally conform to present day standards for flood hazard delineation, as set out in the MNR's Natural Hazards Technical Guide (MNR, 2002). The resulting 1:100 year flood lines are suitable for use in the RVCA's regulation limits mapping (as per Ontario Regulation 174/06) and in municipal land use planning and development approval processes under the Planning Act.

[redacted]

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Table 1 Land cover breakdown in Upper Jock River Watershed

	Catchment >>	UJ1		UJ2		UJ3		TA1		TB1		Entire Watershed	
	Land use description	Area (km^2)	%	Area (km^2)	%	Area (km^2)	%	Area (km^2)	%	Area (km^2)	%	Area (km^2)	%
1	Aggregate Site	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Aggregate Site-Pit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Aggregate Site-Quarry	0.07	0.36	0.19	0.51	0.25	1.37	0.11	1.09	0.09	0.67	0.72	0.72
4	Crop and Pasture	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Crop and Pasture-Cultivated	3.15	15.35	5.21	13.76	7.09	39.13	1.16	11.60	1.70	12.19	18.31	18.22
6	Crop and Pasture-Fallow	0.24	1.16	0.55	1.47	0.35	1.91	0.16	1.56	0.30	2.17	1.60	1.59
7	Evaluated Wetland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Evaluated Wetland-Bog	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	Evaluated Wetland-Fen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	Evaluated Wetland-Marsh	0.22	1.07	0.35	0.93	0.31	1.72	0.00	0.00	0.00	0.00	0.88	0.88
11	Evaluated Wetland-Open Water	0.05	0.25	0.21	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.26
12	Evaluated Wetland-Swamp	2.20	10.76	16.58	43.81	1.07	5.90	0.27	2.68	0.73	5.23	20.85	20.76
13	Meadow/Thicket	0.82	4.02	0.89	2.35	0.40	2.22	0.38	3.74	1.41	10.06	3.90	3.88
14	Settlement	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	Settlement-Impervious	0.00	0.00	0.04	0.10	0.20	1.09	0.00	0.00	0.00	0.00	0.24	0.24
16	Settlement-Pervious	0.10	0.51	0.08	0.21	0.36	1.98	0.01	0.11	0.02	0.13	0.57	0.57
17	Settlement-Pervious Homestead	0.64	3.14	0.91	2.40	0.69	3.79	0.26	2.59	0.26	1.87	2.76	2.75
18	Settlement-Residential	0.00	0.01	0.26	0.68	0.44	2.44	0.00	0.03	0.02	0.11	0.72	0.72
19	Transportation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Transportation-Rail	0.10	0.51	0.03	0.07	0.06	0.34	0.04	0.36	0.07	0.49	0.30	0.30
21	Transportation-Road	0.39	1.90	0.51	1.35	0.70	3.89	0.12	1.21	0.10	0.74	1.83	1.82
22	Unevaluated Wetland	5.41	26.41	3.72	9.83	1.77	9.79	3.76	37.45	2.19	15.66	16.85	16.78
23	Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	Water-Buffer around wetland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	Water-Lake	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	Water-Pond	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.47	0.01	0.10	0.06	0.06
27	Water-River	0.00	0.00	0.02	0.05	0.06	0.32	0.00	0.00	0.00	0.00	0.08	0.08
28	Wooded Area	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	Wooded Area-Fallow	0.06	0.28	0.06	0.15	0.04	0.25	0.02	0.17	0.00	0.00	0.18	0.18
30	Wooded Area-Hedgerow	0.03	0.15	0.06	0.16	0.15	0.83	0.03	0.29	0.05	0.37	0.32	0.32
31	Wooded Area-Island	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
32	Wooded Area-Plantation	0.10	0.51	0.37	0.97	0.02	0.13	0.03	0.30	0.00	0.00	0.53	0.52
33	Wooded Area-Treed	5.44	26.53	6.81	18.00	2.94	16.22	3.65	36.34	2.61	18.71	21.45	21.35
34	Anand	0.00	0.00	0.00	0.00	0.11	0.58	0.00	0.00	0.00	0.00	0.11	0.11
35	Ashton	0.00	0.00	0.00	0.00	0.96	5.30	0.00	0.00	0.00	0.00	0.96	0.96
36	Beckwith Industrial	0.00	0.00	0.00	0.00	0.14	0.78	0.00	0.00	0.00	0.00	0.14	0.14
37	Franktown	1.09	5.32	1.00	2.65	0.00	0.00	0.00	0.00	0.00	0.00	2.09	2.08
38	Gillies Corners	0.36	1.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.36
39	Greater Blacks Corners	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.40	31.50	4.40	4.38
	Total	20.48	100	37.84	100	18.11	100	10.04	100	13.97	100	100.44	100

1 Development areas represents the areas of Balcks Corner, Ashton, Franktown and Gillies Corner projected for a 20 year planning horizon until 2029 (Township of Beckwith,Office Consolidation-Official Plan, November 2012)

2 Unless otherwise stated land cover values are based on RVCA in-house work which represnts conditions of spring 2014

Table 2 Hydrological Soil Groups in Upper Jock Basin

		Soil Group area (km^2)				as percent (%) of catchment area			
Catchment	Area (km^2)	A	B	C	D	A	B	C	D
UJ1	20.48	0.08	11.16	0.20	9.05	0.39	54.46	0.97	44.18
UJ2	37.84	0.61	16.62	1.58	19.03	1.61	43.94	4.17	50.29
UJ3	18.11	1.31	7.75	2.87	6.19	7.21	42.77	15.86	34.16
TA	10.04	0.00	6.01	0.00	4.04	0.00	59.79	0.00	40.21
TB	13.97	0.56	11.18	0.07	2.16	3.98	80.06	0.48	15.48
Entire Upper Jock	100.44	2.55	52.71	4.72	40.46	2.54	52.48	4.69	40.29

Note: Based on MNRF's LIO (Land Information System) database and documentation by MNR (2012)

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Table 3a Hydrologic parameters for rural catchments (Upper Jock River)

Catchment	Area (km^2)	Imperviousness [1] (%)	CN [1]	IA [3] (mm)	CN* [2]	IA* [3] (mm)	Tc [4] (hr)	T_{lag} [5] (hr)
UJ1	20.48	5.7	81.0	11.94	73.8	4.51	20.60	12.36
UJ2	37.84	3.4	85.3	8.76	80.1	3.16	36.90	22.14
UJ3	18.11	10.3	80.2	12.58	72.6	4.79	9.37	5.62
TA1	10.04	2.1	80.1	12.66	72.5	4.83	11.81	7.08
TB1	13.97	16.8	77.5	14.73	68.8	5.75	11.57	6.94
Entire Upper Jock Watershed	100.44	6.9	81.9	11.32	75.1	5.90	---	---

1) Calculated from land cover and TR-55 Curve Number tables (Urban Hydrology for Small Watersheds by USDA-SCS, 1986)

2) Calculated based on equation $CN^*=100/(1.879((100/CN)-1)^{1.15}+1)$ (Curve Number Hydrology by Hawkins et al., 2009)

3) Calculated based $IA=((25400/CN_{\lambda})-254)*\lambda$, where $\lambda=0.2$ for CN and $\lambda=0.05$ for CN* (Curve Number Hydrology by Hawkins et al., 2009)

4) Calculated based on the velocity method (National engineering handbook Chapter 15 by USDA-NRCS, 2010)

5) Calculated based on $T_{lag} = 0.6 \times Tc$ (HEC-HMS Technical Reference Manual by USACE, 2000)

6) Hydrologic calculations used CN* and IA*, not CN and IA. The latter are included for information purposes only.

Table 3b Estimated channel parameters

Channel	Length (m) [1]	Slope (%) [2]	Manning's "n" [3]		
			LOB	Channel	ROB
C1	3496	0.0590	0.070	0.050	0.070
C2	4708	0.0180	0.070	0.050	0.070
C3	2255	0.0430	0.070	0.050	0.070
C4	5183	0.0670	0.035	0.045	0.035
C1+C2+C3+C4	15642	0.0470	0.058	0.048	0.058

1) Length of HEC-RAS centerline flowpath for the 100-yr event, within associated routing catchment.

2) Slope = Rise/Run, where Rise was the difference in minimum channel elevations of HEC-RAS cross-sections closest to channel ends.

3) Obtained by averaging the HEC-RAS values within each channel, which themselves were determined from site visits and DRAPE (2014) photography using roughness coefficients outlined by Chow (1959).

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Table 4 Curve number for different landuse and soil groups

	RVCA Land Classes	Assigned Curve Number (CN) Hydrologic Soil Group				%Impervious
		A	B	C	D	
1	Aggregate Site	81	88	91	93	nva**
2	Aggregate Site-Pit	81	88	91	93	nva**
3	Aggregate Site-Quarry	81	88	91	93	nva**
4	Crop and Pasture	64	75	82	85	nva**
5	Crop and Pasture-Cultivated	64	75	82	85	nva**
6	Crop and Pasture-Fallow	76	85	90	93	nva**
7	Evaluated Wetland	98	98	98	98	nva**
8	Evaluated Wetland-Bog	98	98	98	98	nva**
9	Evaluated Wetland-Fen	98	98	98	98	nva**
10	Evaluated Wetland-Marsh	98	98	98	98	nva**
11	Evaluated Wetland-Open Water	98	98	98	98	nva**
12	Evaluated Wetland-Swamp	98	98	98	98	nva**
13	Meadow/Thicket	60	71	81	89	nva**
14	Settlement	77	85	90	92	65
15	Settlement-Impervious	89	92	94	95	85
16	Settlement-Pervious	39	61	74	80	12
17	Settlement-Pervious Homestead	46	65	77	82	20
18	Settlement-Residential	77	85	90	92	65
19	Transportation	98	98	98	98	100
20	Transportation-Rail	98	98	98	98	100
21	Transportation-Road	98	98	98	98	100
22	Unevaluated Wetland	98	98	98	98	nva**
23	Water	98	98	98	98	nva**
24	Water-Buffer around wetland	98	98	98	98	nva**
25	Water-Lake	98	98	98	98	nva**
26	Water-Pond	98	98	98	98	nva**
27	Water-River	98	98	98	98	nva**
28	Wooded Area	30	55	70	77	nva**
29	Wooded Area-Fallow	49	69	79	84	nva**
30	Wooded Area-Hedgerow	45	66	77	83	nva**
31	Wooded Area-Island	30	55	70	77	nva**
32	Wooded Area-Plantation	45	66	77	83	nva**
33	Wooded Area-Treed	30	55	70	77	nva**
34	Beckwith Industrial Park*	81	88	91	93	72
35	Ashton*	61	75	83	87	38
36	Anand Subdivision*	61	75	83	87	38
37	Blacks Corners*	67	78	85	89	48
38	Franktown*	61	75	83	87	38
39	Gilles Corners*	61	75	83	87	38

1) Values adopted from United States Depart of Agriculture (1986) : Urban Hydrology of Small Watershed, Technical Release 55, 210-VI-TR-55, Second Ed., June 1986.
2) Unless otherwise stated land cover areas are based on RVCA in-house work which represent conditions of spring 2014
3) *Represent the community developement areas as outlined within the Beckwith Official Plan (2015) and known proposed developments as of November 2019.
4) **nva - no value assigned

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Table 5 Characteristics of design storms

	Duration (hour)	Total volume (mm)	Peak intensity (mm/hr)	Time step (minutes)	Source of hyetograph shape
Chicago 3 hour	3	74.43	168.71	10	Generated by STORMS software
Chicago 6 hour	6	88.42	168.71	10	Generated by STORMS software
Chicago 12 hour	12	104.44	168.71	10	Generated by STORMS software
Chicago 24 hour	24	123.02	168.71	10	Generated by STORMS software
SCS 3 hour	3	74.47	80.87	30	City of Ottawa Sewer Design Guidelines 2012
SCS 6 hour	6	88.43	85.25	30	City of Ottawa Sewer Design Guidelines 2012
SCS 12 hour	12	104.44	89.40	30	City of Ottawa Sewer Design Guidelines 2012
SCS 24 hour	24	123.01	93.49	30	Generated by STORMS software

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Table 6 SWMHYMO-generated peak flows generated by various storms

Storm	3H Chicago	6H Chicago	12H Chicago	24H Chicago	3H SCS	6H SCS	12H SCS	24H SCS
Return Period	100 year	100 year	100 year	100 year	100 year	100 year	100 year	100 year
Flow	(cms)	(cms)	(cms)	(cms)	(cms)	(cms)	(cms)	(cms)
Catchments								
UJ1	7.66	10.09	12.76	14.74	7.68	10.13	12.96	15.58
UJ2	9.87	12.77	16.15	19.68	9.88	12.79	16.22	20.02
UJ3	14.09	18.13	20.92	22.94	14.16	18.49	22.42	24.94
TA1	6.22	8.10	9.72	10.65	6.24	8.20	10.21	11.49
TB1	7.75	10.21	12.33	13.56	7.77	10.34	12.99	14.70
Nodes								
N1	7.66	10.09	12.76	14.74	7.68	10.13	12.96	15.58
N2	10.13	13.21	16.56	19.00	10.14	13.26	16.80	19.99
N3	10.28	13.36	16.58	18.75	10.30	13.45	17.00	20.04
N4	17.58	22.92	29.28	36.18	17.60	22.94	29.39	36.79
N5	17.38	23.12	30.33	39.33	17.40	23.12	30.25	39.52

Table 7 SCS Type II 24 hour design storms for different return periods

Return Period	Total volume	Peak intensity	Time step	hyetograph generated by
(year)	(mm)	(mm/hr)	(minutes)	
2	50.48	38.08	30	STORMS software
5	70.01	53.21	30	STORMS software
10	82.57	62.75	30	STORMS software
20	95.07	72.25	30	STORMS software
50	110.92	84.3	30	STORMS software
100	123.01	93.49	30	STORMS software
200	134.57	102.27	30	STORMS software
350	144.20	109.59	30	STORMS software
500	150.84	114.64	30	STORMS software

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Table 8 SWMHYMO-generated peak flows for SCS Type II 24 hour design storms

Storm	24 hour SCS Type II								
Return Period	2 year	5 year	10 year	20 year	50 year	100 year	200 year	350year	500 year
Flow	(cms)	(cms)	(cms)	(cms)	(cms)	(cms)	(cms)	(cms)	(cms)
Catchments									
UJ1	3.53	6.37	8.38	10.50	13.34	15.58	17.79	19.67	20.98
UJ2	5.10	8.77	11.29	13.89	17.33	20.02	22.63	24.85	26.39
UJ3	5.40	9.93	13.18	16.62	21.25	24.94	28.57	31.67	33.84
TA1	2.50	4.59	6.08	7.67	9.80	11.49	13.16	14.58	15.58
TB1	3.00	5.65	7.57	9.64	12.45	14.70	16.93	18.84	20.18
Nodes									
N1	3.53	6.37	8.38	10.50	13.34	15.58	17.79	19.67	20.98
N2	4.77	8.50	11.08	13.75	17.26	19.99	22.63	24.86	26.40
N3	4.71	8.19	10.62	13.23	17.02	20.04	23.00	25.54	27.31
N4	9.12	15.59	20.26	25.09	31.62	36.79	41.84	46.13	49.13
N5	8.87	15.74	20.71	26.16	33.46	39.52	45.48	50.65	54.21

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Table 9 Estimated flows for hydraulic modeling (HEC-RAS)

				Return Period (year)	2	5	10	20	50	**100**	200	350	500
Stream	Node	Hydrologic Node	Nearest Cross Section	Distance from Ashton Station Bridge (m)	Flow (cms)								
Upper Jock River	M5	N5	9900	4925	8.87 <u>*9.12*</u>	15.74	20.71	26.16	33.46	**39.52**	45.48	50.65	54.21
Upper Jock River	M4	N4	13300	7486	9.12	15.59	20.26	25.09	31.62	**36.79**	41.84	46.13	49.13
Upper Jock River	M3	PRN3	19500	12194	8.02	13.82	17.99	22.31	28.14	**32.77**	37.28	41.12	43.80
Upper Jock River	M2	PRN2	23400	15494	6.14	10.73	14.02	17.45	22.06	**25.71**	29.29	32.33	34.45
Upper Jock River	M1	N1	25400	17309	3.53	6.37	8.38	10.50	13.34	**15.58**	17.79	19.67	20.98

Note: Cells with two values identify reaches where upstream flows were greater than downstream flows in the hydrologic (SWMHYMO) model. As attenuation would not occur immediately, the underlined values representing upstream flows were used throughout the reach in the HEC-RAS model to remain conservative.

Table 10 Downstream Boundary Condition

Return Period (years)	Water Level (m) at Cross Section 18698 of PSR/JFSA 2005	Source
2	118.15	PSR/JFSA 2005
5	118.20	PSR/JFSA 2005
10	118.27	PSR/JFSA 2005
20	118.32	PSR/JFSA 2005
50	118.35	PSR/JFSA 2005
100	118.39	PSR/JFSA 2005
200	118.43	Extrapolated
350	118.46	Extrapolated
500	118.49	Extrapolated

Source:

1) PSR/JFSA (2005), Jock River Flood Risk Mapping (within the City of Ottawa), Hydraulics Report 2005.

Table 11.a Road Crossings in Upper Jock Watershed

Stream	Location	Bridge or Culvert	Chainage (from Ashton Station Road) (m)	Bounding Cross Sections	Width (m)	Height (m)	Length (m)	Upstream Invert (m)	Downstream Invert (m)	Upstream Obvert (m)	Downstream Obvert (m)	Source(s)
Jock River	McCafferey Trail Bridge	B	-	2100 & 2200	6.10	-	15.40	120.27	120.27	121.05	121.05	• RVCA Survey (25th September 2019) • City of Ottawa Drawings (2013).: General Arrangement, contract no-ISD11-7100, dwg no - 02, McCormic Rankin Corporation , Feb 2013. • City of Ottawa Drawings (2013).: CRPF Deck Strengthening, contract no ISD11-7100, dwg no - 06, McCormic Rankin Corporation , Feb 2013.
Jock River	Ashton Station Bridge	B	0	4300 & 4360	11.28	-	15.24	125.31	125.10	132.09	132.12	• RVCA Survey (1st August 2019 - Page 1) • City of Ottawa Drawings: Contract# 538 R. M. Kostuch Associates Ltd. June 1975 • City of Ottawa Rehabilitation Review Drawings: Contract# ISD17-7067. McIntosh Perry. February 2018
Jock River	442 Beckwith 9 Line	B	1953	6250 & 6300	5.00	-	13.60	-	-	-	-	• RVCA Survey (25th September 2019)
Jock River	500 Beckwith 9 line	B	2331	6740 & 6750	5.00	-	12.50	-	-	-	-	• RVCA Survey (25th September 2019)
Jock River	562 Beckwith 9 Line (B)	C	2953	7480 & 7500	2.40	1.80	6.80	128.47	128.47	130.27	130.27	• RVCA Survey (25th September 2019)
Jock River	562 Beckwith 9 Line (A)	C	2953	7480 & 7500	2.40	1.80	6.80	128.48	128.46	130.28	130.26	• RVCA Survey (25th September 2019)
Jock River	Cemetery Side Road	B	8421	10160 & 10180	10.41	-	13.00	128.25	128.05	132.17	132.31	• RVCA Survey (1st August 2019 - Page 2) • Drawing 1: Site Plan: Project# 18-12156, Tender Set, Jock River Bridge, County of Lanark. Totten Sims Hubicki Associates. 20th May 1993 • Drawing 2: General Arrangement : Project# 18-12156, Tender Set, Jock River Bridge, County of Lanark. Totten Sims Hubicki Associates. Mar 1993
Jock River	Beckwith 9 Line	B	9205	11170 & 11200	10.40	-	13.00	129.09	128.93	132.34	132.33	• RVCA Survey (1st August 2019 - Page 3 & 4)
Jock River	Richmond Road	C	18917	23610 & 23690	4.87	1.52	23.78	132.37	132.36	133.88	133.88	• RVCA Survey (1st August 2019 - Page 2) • LiDAR • Drawing - Rigid Frame Culvert, Open Footings (16'x5'x78' Skewed) - Lanark County

• From DRAPE imagery as well as GPS coordinates from RVCA Survey 2019
• Herewidth 'Width' denotes the physical dimension 'Deck Width' for bridges and 'Span' for culverts.
• Herewidth 'height' denotes the physical dimension 'Rise' for culverts.
• Herewidth 'length' denotes the physical dimension 'Opening Width' for bridges.

Table 11.b Inline Structures (Dams) on Upper Jock River

Stream	Location	Structure Description	Chainage (m)	Bounding Cross Sections	Width (m)	Height (m)	Length (m)	Weir Coefficient	Upstream Invert (m)	Downstream Invert (m)	Upstream Obvert (m)	Downstream Obvert (m)	Source(s)
Jock River	Ashton Station Road Dam	Weir - Sluice Gates	0	4360 & 4445	2.07	1.06	0.76	0.53	125.48	125.48	126.55	126.55	• RVCA Survey (1st August 2019) • City of Ottawa Drawings: Contract# 538 R. M. Kostuch Associates Ltd. June 1975 • City of Ottawa Rehabilitation Review Drawings: Contract# ISD17-7067. McIntosh Perry. February 2017
Jock River	Ashton Station Road Dam	Low Weir	0	4360 & 4445	1.15	-	3.9 (Combined)	1.69	127.30	127.30	-	-	• RVCA Survey (1st August 2019) • City of Ottawa Drawings: Contract# 538 R. M. Kostuch Associates Ltd. June 1975 • City of Ottawa Rehabilitation Review Drawings: Contract# ISD17-7067. McIntosh Perry. February 2017
Jock River	Ashton Station Road Dam	High Weir	0	4360 & 4445	0.92	-	10.89 (Combined)	1.66	127.75	127.75	-	-	• RVCA Survey (1st August 2019) • City of Ottawa Drawings: Contract# 538 R. M. Kostuch Associates Ltd. June 1975 • City of Ottawa Rehabilitation Review Drawings: Contract# ISD17-7067. McIntosh Perry. February 2017

- From DRAPE imagery as well as GPS coordinates from RVCA Survey 2019
- It should be noted here that "us/ds Invert" is synonymous with Dam Sill, Spillway Crest, Dam Invert etc.
- In this Table, 'width' denotes the physical dimension parallel to the direction of flow.
- In this Table, 'length' denotes the physical dimension perpendicular to the direction of flow.
- Coefficients of contraction and expansion modeled as 0.3 and 0.5 respectively.

Table 12 Calculated head loss at road crossings (during 1:100 Year flood)

Stream	Location	Chainage (m)	Bounding Cross Sections	Upstream Energy Grade (m)	Downstream Energy Grade (m)	Head Loss (cm)	Road Overtopped
Upper Jock River	McCafferey Trail Bridge	-	2100 & 2200	120.35	119.91	44	No
Upper Jock River	Ashton Station Bridge	0	4300 & 4360	127.37	127.28	9	No
Upper Jock River	442 Beckwith 9 Line	1953	6250 & 6300	129.89	129.62	27	Yes
Upper Jock River	500 Beckwith 9 Line	2331	6740 & 6750	130.44	130.00	44	Yes
Upper Jock River	562 Beckwith 9 Line	2953	7480 & 7500	130.61	130.60	1	Yes
Upper Jock River	Cemetery Side Road	5193	10160 & 10180	131.07	130.99	8	No
Upper Jock River	Beckwith 9 Line	5978	11170 & 11200	131.41	131.20	21	Yes
Upper Jock River	Richmond Road	15690	23610 & 23690	134.33	133.70	63	No

Table 13 Regulatory Flood Levels for 100 Year Flood Event

River	Reach	Xsec ID #	Q (total) (cms)	Computed WSEL (m)	EGL (m)	RFL (m)
Upper Jock River	Reach1	2000	39.52	118.39	118.41	-
	Reach1	2050	39.52	119.44	119.74	-
	Reach1	2100	39.52	119.60	119.91	-
	Reach1	2150	McCafferey Trail Bridge			
	Reach1	2200	39.52	120.28	120.35	-
	Reach1	2300	39.52	120.33	120.38	-
	Reach1	2400	39.52	121.04	121.30	-
	Reach1	2500	39.52	121.80	121.82	-
	Reach1	2600	39.52	121.95	121.97	-
	Reach1	2700	39.52	122.13	122.14	-
	Reach1	2800	39.52	122.22	122.24	-
	Reach1	2900	39.52	122.33	122.35	-
	Reach1	3000	39.52	122.34	122.52	-
	Reach1	3050	39.52	122.72	122.74	-
	Reach1	3100	39.52	122.81	122.84	-
	Reach1	3200	39.52	123.03	123.06	-
	Reach1	3300	39.52	123.37	123.69	-
	Reach1	3400	39.52	123.73	123.95	-
	Reach1	3500	39.52	123.91	124.04	-
	Reach1	3600	39.52	124.00	124.12	-
	Reach1	3700	39.52	124.54	124.56	-
	Reach1	3800	39.52	124.72	124.74	-
	Reach1	3900	39.52	124.94	124.97	-
	Reach1	4000	39.52	125.40	125.52	-
	Reach1	4100	39.52	126.14	126.31	-
	Reach1	4200	39.52	126.55	126.79	-
	Reach1	4250	39.52	126.94	127.19	-
	Reach1	4300	39.52	127.20	127.28	-
	Reach1	4350	Ashton Station Bridge			
	Reach1	4360	39.52	127.26	127.37	127.37
	Reach1	4400	Ashton Station Dam			
	Reach1	4445	39.52	128.82	128.84	128.84
	Reach1	4450	39.52	128.82	128.84	128.84
	Reach1	4600	39.52	128.85	128.89	128.89
	Reach1	4700	39.52	128.92	129.26	129.26
	Reach1	5400	39.52	129.46	129.46	129.46
	Reach1	5440	39.52	129.56	129.57	129.57
	Reach1	6100	39.52	129.60	129.60	129.60
	Reach1	6200	39.52	129.60	129.61	129.61
	Reach1	6250	39.52	129.61	129.62	129.62
	Reach1	6275	442 Beckwith 9 line			
	Reach1	6300	39.52	129.87	129.89	129.89
	Reach1	6350	39.52	129.89	129.90	129.90
	Reach1	6500	39.52	129.91	129.92	129.92
	Reach1	6720	39.52	129.96	129.98	129.98
	Reach1	6740	39.52	129.97	130.00	130.00
	Reach1	6745	500 Beckwith 9 Line			
	Reach1	6750	39.52	130.42	130.44	130.44
	Reach1	6760	39.52	130.43	130.45	130.45
	Reach1	6765	39.52	130.48	130.48	130.48
	Reach1	7450	39.52	130.56	130.59	130.59

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River	Reach	Xsec ID #	Q (total) (cms)	Computed WSEL (m)	EGL (m)	RFL (m)
Upper Jock River	Reach1	7480	39.52	130.60	130.60	130.60
	Reach1	7490	562 Beckwith 9 Line			
	Reach1	7500	39.52	130.61	130.61	130.61
	Reach1	7520	39.52	130.61	130.61	130.61
	Reach1	8000	39.52	130.64	130.64	130.64
	Reach1	8400	39.52	130.67	130.67	130.67
	Reach1	9000	39.52	130.69	130.69	130.69
	Reach1	9900	39.52	130.75	130.77	130.77
	Reach1	10000	36.79	130.86	130.87	130.87
	Reach1	10150	36.79	130.93	130.96	130.96
	Reach1	10160	36.79	130.93	130.99	130.99
	Reach1	10175	Cemetery Side Road			
	Reach1	10180	36.79	131.04	131.07	131.07
	Reach1	10200	36.79	131.05	131.10	131.10
	Reach1	10500	36.79	131.14	131.14	131.14
	Reach1	10800	36.79	131.15	131.15	131.15
	Reach1	11150	36.79	131.18	131.19	131.19
	Reach1	11170	36.79	131.18	131.20	131.20
	Reach1	11180	Beckwith 9 Line			
	Reach1	11200	36.79	131.41	131.41	131.41
	Reach1	11250	36.79	131.41	131.41	131.41
	Reach1	11600	36.79	131.41	131.41	131.41
	Reach1	12000	36.79	131.41	131.41	131.41
	Reach1	12500	36.79	131.41	131.41	131.41
	Reach1	13300	36.79	131.42	131.42	131.42
	Reach1	14000	36.79	131.42	131.42	131.42
	Reach1	14750	32.77	131.44	131.44	131.44
	Reach1	15800	32.77	131.45	131.45	131.45
	Reach1	16800	32.77	131.49	131.49	131.49
	Reach1	17700	32.77	131.57	131.57	131.57
	Reach1	18800	32.77	131.73	131.73	131.73
	Reach1	19500	32.77	131.81	131.81	131.81
	Reach1	20750	25.71	131.91	131.91	131.91
	Reach1	21800	25.71	132.29	132.30	132.30
	Reach1	22500	25.71	132.90	132.90	132.90
	Reach1	23400	25.71	133.22	133.24	133.24
	Reach1	23600	15.58	133.58	133.60	133.60
	Reach1	23610	15.58	133.55	133.70	133.70
	Reach1	23650	Richmond Road			
	Reach1	23690	15.58	134.30	134.33	134.33
	Reach1	23700	15.58	134.33	134.34	134.34
	Reach1	23800	15.58	134.42	134.44	134.44
	Reach1	23900	15.58	134.64	134.66	134.66
	Reach1	24100	15.58	134.95	134.98	134.98
	Reach1	24200	15.58	135.22	135.23	135.23
	Reach1	24500	15.58	135.40	135.40	135.40
	Reach1	24900	15.58	135.54	135.54	135.54
	Reach1	25400	15.58	135.66	135.66	135.66

Table 14 Flows and computed water levels for the 2, 5, 10, and 20 year flood events

River	Reach	Xsec ID	Flow (m^3/s) and Computed WSEL (m) for Different Flood Events							
			Q2	WL2	Q5	WL5	Q10	WL10	Q20	WL20
Upper Jock	Reach1	2000	9.12	118.15	15.74	118.20	20.71	118.27	26.16	118.32
	Reach1	2050	9.12	118.91	15.74	119.09	20.71	119.21	26.16	119.29
	Reach1	2100	9.12	119.16	15.74	119.33	20.71	119.41	26.16	119.47
	Reach1	2150	McCafferey Trail Bridge							
	Reach1	2200	9.12	119.35	15.74	119.60	20.71	119.76	26.16	119.93
	Reach1	2300	9.12	119.38	15.74	119.62	20.71	119.78	26.16	119.95
	Reach1	2400	9.12	120.71	15.74	120.82	20.71	120.87	26.16	120.87
	Reach1	2500	9.12	121.27	15.74	121.45	20.71	121.54	26.16	121.64
	Reach1	2600	9.12	121.45	15.74	121.63	20.71	121.70	26.16	121.78
	Reach1	2700	9.12	121.61	15.74	121.80	20.71	121.86	26.16	121.95
	Reach1	2800	9.12	121.69	15.74	121.87	20.71	121.95	26.16	122.04
	Reach1	2900	9.12	121.80	15.74	121.97	20.71	122.06	26.16	122.15
	Reach1	3000	9.12	121.86	15.74	122.01	20.71	122.08	26.16	122.15
	Reach1	3050	9.12	122.11	15.74	122.33	20.71	122.47	26.16	122.57
	Reach1	3100	9.12	122.20	15.74	122.43	20.71	122.58	26.16	122.66
	Reach1	3200	9.12	122.50	15.74	122.68	20.71	122.79	26.16	122.87
	Reach1	3300	9.12	123.02	15.74	123.09	20.71	123.09	26.16	123.15
	Reach1	3400	9.12	123.25	15.74	123.35	20.71	123.48	26.16	123.58
	Reach1	3500	9.12	123.46	15.74	123.55	20.71	123.64	26.16	123.73
	Reach1	3600	9.12	123.50	15.74	123.62	20.71	123.72	26.16	123.82
	Reach1	3700	9.12	124.00	15.74	124.16	20.71	124.25	26.16	124.34
	Reach1	3800	9.12	124.30	15.74	124.41	20.71	124.48	26.16	124.56
	Reach1	3900	9.12	124.44	15.74	124.59	20.71	124.68	26.16	124.77
	Reach1	4000	9.12	124.92	15.74	125.06	20.71	125.18	26.16	125.25
	Reach1	4100	9.12	125.72	15.74	125.89	20.71	125.97	26.16	126.07
	Reach1	4200	9.12	125.95	15.74	126.13	20.71	126.24	26.16	126.34
	Reach1	4250	9.12	126.22	15.74	126.43	20.71	126.56	26.16	126.68
	Reach1	4300	9.12	126.30	15.74	126.55	20.71	126.71	26.16	126.87
	Reach1	4350	Ashton Station Bridge							
	Reach1	4360	9.12	126.36	15.74	126.61	20.71	126.77	26.16	126.93
	Reach1	4400	Ashton Station Dam							
	Reach1	4445	9.12	127.85	15.74	128.14	20.71	128.31	26.16	128.48
	Reach1	4450	9.12	127.85	15.74	128.14	20.71	128.31	26.16	128.48
	Reach1	4600	9.12	127.85	15.74	128.15	20.71	128.32	26.16	128.49
	Reach1	4700	9.12	127.94	15.74	128.24	20.71	128.43	26.16	128.60
	Reach1	5400	9.12	128.61	15.74	128.83	20.71	128.97	26.16	129.12
	Reach1	5440	9.12	128.80	15.74	129.01	20.71	129.13	26.16	129.26
	Reach1	6100	9.12	128.90	15.74	129.08	20.71	129.19	26.16	129.32
	Reach1	6200	9.12	128.93	15.74	129.10	20.71	129.20	26.16	129.32
	Reach1	6250	9.12	128.94	15.74	129.10	20.71	129.21	26.16	129.33
	Reach1	6275	442 Beckwith 9 line							
	Reach1	6300	9.12	129.00	15.74	129.21	20.71	129.36	26.16	129.51
	Reach1	6350	9.12	129.00	15.74	129.22	20.71	129.36	26.16	129.52
	Reach1	6500	9.12	129.04	15.74	129.26	20.71	129.40	26.16	129.56
	Reach1	6720	9.12	129.19	15.74	129.39	20.71	129.52	26.16	129.65
	Reach1	6740	9.12	129.26	15.74	129.41	20.71	129.52	26.16	129.62
	Reach1	6745	500 Beckwith 9 Line							
	Reach1	6750	9.12	129.39	15.74	129.63	20.71	129.81	26.16	129.98
	Reach1	6760	9.12	129.42	15.74	129.69	20.71	129.87	26.16	130.06
	Reach1	6765	9.12	129.56	15.74	129.79	20.71	129.95	26.16	130.13
	Reach1	7450	9.12	129.80	15.74	129.99	20.71	130.11	26.16	130.26
	Reach1	7480	9.12	129.81	15.74	130.01	20.71	130.14	26.16	130.29
	Reach1	7490	562 Beckwith 9 Line							
	Reach1	7500	9.12	129.81	15.74	130.01	20.71	130.14	26.16	130.29
	Reach1	7520	9.12	129.81	15.74	130.01	20.71	130.14	26.16	130.29
	Reach1	8000	9.12	129.94	15.74	130.09	20.71	130.20	26.16	130.34
	Reach1	8400	9.12	130.04	15.74	130.18	20.71	130.27	26.16	130.39
	Reach1	9000	9.12	130.12	15.74	130.25	20.71	130.32	26.16	130.42
	Reach1	9900	9.12	130.32	15.74	130.43	20.71	130.49	26.16	130.55
	Reach1	10000	9.12	130.37	15.59	130.50	20.26	130.58	25.09	130.66
	Reach1	10150	9.12	130.39	15.59	130.55	20.26	130.64	25.09	130.72

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River	Reach	Xsec ID	Flow (m^3/s) and Computed WSEL (m) for Different Flood Events							
			Q2	WL2	Q5	WL5	Q10	WL10	Q20	WL20
Upper Jock	Reach1	10160	9.12	130.40	15.59	130.55	20.26	130.64	25.09	130.73
	Reach1	10175	Cemetery Side Road							
	Reach1	10180	9.12	130.41	15.59	130.59	20.26	130.69	25.09	130.80
	Reach1	10200	9.12	130.41	15.59	130.58	20.26	130.69	25.09	130.80
	Reach1	10500	9.12	130.51	15.59	130.68	20.26	130.79	25.09	130.89
	Reach1	10800	9.12	130.53	15.59	130.70	20.26	130.81	25.09	130.91
	Reach1	11150	9.12	130.55	15.59	130.73	20.26	130.84	25.09	130.94
	Reach1	11170	9.12	130.55	15.59	130.73	20.26	130.83	25.09	130.94
	Reach1	11180	Beckwith 9 Line							
	Reach1	11200	9.12	130.58	15.59	130.79	20.26	130.93	25.09	131.06
	Reach1	11250	9.12	130.61	15.59	130.83	20.26	130.97	25.09	131.10
	Reach1	11600	9.12	130.66	15.59	130.87	20.26	131.01	25.09	131.15
	Reach1	12000	9.12	130.68	15.59	130.89	20.26	131.02	25.09	131.15
	Reach1	12500	9.12	130.71	15.59	130.90	20.26	131.03	25.09	131.16
	Reach1	13300	9.12	130.77	15.59	130.92	20.26	131.04	25.09	131.17
	Reach1	14000	9.12	130.88	15.59	131.00	20.26	131.09	25.09	131.20
	Reach1	14750	8.02	130.94	13.82	131.05	17.99	131.13	22.31	131.23
	Reach1	15800	8.02	130.98	13.82	131.09	17.99	131.17	22.31	131.26
	Reach1	16800	8.02	131.11	13.82	131.21	17.99	131.26	22.31	131.33
	Reach1	17700	8.02	131.32	13.82	131.39	17.99	131.43	22.31	131.46
	Reach1	18800	8.02	131.45	13.82	131.54	17.99	131.60	22.31	131.64
	Reach1	19500	8.02	131.50	13.82	131.60	17.99	131.66	22.31	131.71
	Reach1	20750	6.14	131.58	10.73	131.69	14.02	131.75	17.45	131.80
	Reach1	21800	6.14	131.98	10.73	132.14	14.02	132.17	17.45	132.19
	Reach1	22500	6.14	132.61	10.73	132.71	14.02	132.76	17.45	132.81
	Reach1	23400	6.14	132.88	10.73	132.99	14.02	133.05	17.45	133.11
	Reach1	23600	3.53	133.30	6.37	133.39	8.38	133.44	10.50	133.49
	Reach1	23610	3.53	133.31	6.37	133.39	8.38	133.43	10.50	133.47
	Reach1	23650	Richmond Road							
	Reach1	23690	3.53	133.39	6.37	133.60	8.38	133.75	10.50	133.91
	Reach1	23700	3.53	133.41	6.37	133.63	8.38	133.78	10.50	133.94
	Reach1	23800	3.53	133.97	6.37	134.05	8.38	134.07	10.50	134.14
	Reach1	23900	3.53	134.27	6.37	134.39	8.38	134.46	10.50	134.52
	Reach1	24100	3.53	134.56	6.37	134.69	8.38	134.76	10.50	134.83
	Reach1	24200	3.53	134.89	6.37	135.00	8.38	135.06	10.50	135.11
	Reach1	24500	3.53	135.04	6.37	135.17	8.38	135.23	10.50	135.29
	Reach1	24900	3.53	135.21	6.37	135.33	8.38	135.38	10.50	135.44
	Reach1	25400	3.53	135.39	6.37	135.47	8.38	135.52	10.50	135.56

Table 15 Flows and computed water levels for the 50, 100, 200, 350, and 500 year flood events

River	Reach	Xsec ID	Flow (m^3/s) and Computed WSEL (m) for Different Flood Events									
			Q50	WL50	Q100	WL100	Q200	WL200	Q350	WL350	Q500	WL500
Upper Jock	Reach1	2000	33.46	118.35	39.52	118.39	45.48	118.43	50.65	118.46	54.21	118.49
	Reach1	2050	33.46	119.38	39.52	119.44	45.48	119.51	50.65	119.56	54.21	119.59
	Reach1	2100	33.46	119.53	39.52	119.60	45.48	119.67	50.65	119.72	54.21	119.75
	Reach1	2150	McCafferey Trail Bridge									
	Reach1	2200	33.46	120.13	39.52	120.28	45.48	120.42	50.65	120.56	54.21	120.68
	Reach1	2300	33.46	120.17	39.52	120.33	45.48	120.48	50.65	120.62	54.21	120.71
	Reach1	2400	33.46	120.97	39.52	121.04	45.48	121.09	50.65	121.13	54.21	121.17
	Reach1	2500	33.46	121.73	39.52	121.80	45.48	121.86	50.65	121.91	54.21	121.95
	Reach1	2600	33.46	121.88	39.52	121.95	45.48	122.01	50.65	122.06	54.21	122.09
	Reach1	2700	33.46	122.05	39.52	122.13	45.48	122.19	50.65	122.25	54.21	122.29
	Reach1	2800	33.46	122.14	39.52	122.22	45.48	122.29	50.65	122.34	54.21	122.38
	Reach1	2900	33.46	122.25	39.52	122.33	45.48	122.39	50.65	122.45	54.21	122.48
	Reach1	3000	33.46	122.16	39.52	122.34	45.48	122.44	50.65	122.50	54.21	122.53
	Reach1	3050	33.46	122.69	39.52	122.72	45.48	122.75	50.65	122.81	54.21	122.83
	Reach1	3100	33.46	122.77	39.52	122.81	45.48	122.85	50.65	122.91	54.21	122.93
	Reach1	3200	33.46	122.97	39.52	123.03	45.48	123.08	50.65	123.13	54.21	123.16
	Reach1	3300	33.46	123.28	39.52	123.37	45.48	123.40	50.65	123.49	54.21	123.55
	Reach1	3400	33.46	123.66	39.52	123.73	45.48	123.83	50.65	123.89	54.21	123.91
	Reach1	3500	33.46	123.83	39.52	123.91	45.48	123.98	50.65	124.04	54.21	124.08
	Reach1	3600	33.46	123.92	39.52	124.00	45.48	124.07	50.65	124.13	54.21	124.17
	Reach1	3700	33.46	124.45	39.52	124.54	45.48	124.62	50.65	124.69	54.21	124.73
	Reach1	3800	33.46	124.65	39.52	124.72	45.48	124.80	50.65	124.86	54.21	124.90
	Reach1	3900	33.46	124.86	39.52	124.94	45.48	125.00	50.65	125.06	54.21	125.10
	Reach1	4000	33.46	125.30	39.52	125.40	45.48	125.47	50.65	125.53	54.21	125.48
	Reach1	4100	33.46	126.10	39.52	126.14	45.48	126.19	50.65	126.23	54.21	126.31
	Reach1	4200	33.46	126.46	39.52	126.55	45.48	126.63	50.65	126.69	54.21	126.72
	Reach1	4250	33.46	126.83	39.52	126.94	45.48	127.04	50.65	127.12	54.21	127.17
	Reach1	4300	33.46	127.06	39.52	127.20	45.48	127.33	50.65	127.44	54.21	127.51
	Reach1	4350	Ashton Station Bridge									
	Reach1	4360	33.46	127.12	39.52	127.26	45.48	127.39	50.65	127.50	54.21	127.57
	Reach1	4400	Ashton Station Dam									
	Reach1	4445	33.46	128.67	39.52	128.82	45.48	128.96	50.65	129.08	54.21	129.15
	Reach1	4450	33.46	128.67	39.52	128.82	45.48	128.97	50.65	129.08	54.21	129.16
	Reach1	4600	33.46	128.69	39.52	128.85	45.48	128.99	50.65	129.11	54.21	129.18
	Reach1	4700	33.46	128.79	39.52	128.92	45.48	129.05	50.65	129.15	54.21	129.21
	Reach1	5400	33.46	129.31	39.52	129.46	45.48	129.60	50.65	129.71	54.21	129.78
	Reach1	5440	33.46	129.43	39.52	129.56	45.48	129.69	50.65	129.79	54.21	129.86
	Reach1	6100	33.46	129.47	39.52	129.60	45.48	129.72	50.65	129.82	54.21	129.89
	Reach1	6200	33.46	129.48	39.52	129.60	45.48	129.72	50.65	129.83	54.21	129.90
	Reach1	6250	33.46	129.47	39.52	129.61	45.48	129.73	50.65	129.83	54.21	129.90
	Reach1	6275	442 Beckwith 9 line									
	Reach1	6300	33.46	129.72	39.52	129.87	45.48	130.00	50.65	130.11	54.21	130.19
	Reach1	6350	33.46	129.73	39.52	129.89	45.48	130.00	50.65	130.11	54.21	130.19
	Reach1	6500	33.46	129.76	39.52	129.91	45.48	130.00	50.65	130.11	54.21	130.20
	Reach1	6720	33.46	129.83	39.52	129.96	45.48	130.05	50.65	130.14	54.21	130.22
	Reach1	6740	33.46	129.84	39.52	129.97	45.48	130.06	50.65	130.15	54.21	130.23
	Reach1	6745	500 Beckwith 9 Line									
	Reach1	6750	33.46	130.36	39.52	130.42	45.48	130.48	50.65	130.54	54.21	130.60
	Reach1	6760	33.46	130.36	39.52	130.43	45.48	130.49	50.65	130.55	54.21	130.61
	Reach1	6765	33.46	130.41	39.52	130.48	45.48	130.55	50.65	130.61	54.21	130.67
	Reach1	7450	33.46	130.48	39.52	130.56	45.48	130.62	50.65	130.68	54.21	130.73
	Reach1	7480	33.46	130.51	39.52	130.60	45.48	130.67	50.65	130.74	54.21	130.79
	Reach1	7490	562 Beckwith 9 Line									
	Reach1	7500	33.46	130.52	39.52	130.61	45.48	130.67	50.65	130.74	54.21	130.79
	Reach1	7520	33.46	130.52	39.52	130.61	45.48	130.67	50.65	130.74	54.21	130.79
	Reach1	8000	33.46	130.55	39.52	130.64	45.48	130.70	50.65	130.77	54.21	130.82
	Reach1	8400	33.46	130.57	39.52	130.67	45.48	130.73	50.65	130.80	54.21	130.85
	Reach1	9000	33.46	130.60	39.52	130.69	45.48	130.75	50.65	130.82	54.21	130.87
	Reach1	9900	33.46	130.67	39.52	130.75	45.48	130.81	50.65	130.87	54.21	130.92
	Reach1	10000	31.62	130.77	36.79	130.86	41.84	130.92	46.13	130.98	49.13	131.03
	Reach1	10150	31.62	130.84	36.79	130.93	41.84	131.00	46.13	131.06	49.13	131.11
	Reach1	10160	31.62	130.85	36.79	130.93	41.84	131.00	46.13	131.05	49.13	131.10
	Reach1	10175	Cemetery Side Road									
	Reach1	10180	31.62	130.94	36.79	131.04	41.84	131.13	46.13	131.21	49.13	131.26
	Reach1	10200	31.62	130.94	36.79	131.05	41.84	131.14	46.13	131.22	49.13	131.28
	Reach1	10500	31.62	131.04	36.79	131.14	41.84	131.23	46.13	131.31	49.13	131.37
	Reach1	10800	31.62	131.05	36.79	131.15	41.84	131.25	46.13	131.33	49.13	131.38
	Reach1	11150	31.62	131.08	36.79	131.18	41.84	131.27	46.13	131.34	49.13	131.40

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River	Reach	Xsec ID	Flow (m^3/s) and Computed WSEL (m) for Different Flood Events									
			Q50	WL50	Q100	WL100	Q200	WL200	Q350	WL350	Q500	WL500
Upper Jock	Reach1	11170	31.62	131.07	36.79	131.18	41.84	131.27	46.13	131.34	49.13	131.40
	Reach1	11180	Beckwith 9 Line									
	Reach1	11200	31.62	131.24	36.79	131.41	41.84	131.53	46.13	131.62	49.13	131.69
	Reach1	11250	31.62	131.28	36.79	131.41	41.84	131.53	46.13	131.62	49.13	131.69
	Reach1	11600	31.62	131.32	36.79	131.41	41.84	131.53	46.13	131.62	49.13	131.69
	Reach1	12000	31.62	131.33	36.79	131.41	41.84	131.53	46.13	131.62	49.13	131.70
	Reach1	12500	31.62	131.33	36.79	131.41	41.84	131.54	46.13	131.63	49.13	131.70
	Reach1	13300	31.62	131.34	36.79	131.42	41.84	131.54	46.13	131.63	49.13	131.70
	Reach1	14000	31.62	131.36	36.79	131.42	41.84	131.54	46.13	131.63	49.13	131.70
	Reach1	14750	28.14	131.37	32.77	131.44	37.28	131.55	41.12	131.64	43.80	131.71
	Reach1	15800	28.14	131.39	32.77	131.45	37.28	131.56	41.12	131.65	43.80	131.72
	Reach1	16800	28.14	131.43	32.77	131.49	37.28	131.59	41.12	131.67	43.80	131.73
	Reach1	17700	28.14	131.53	32.77	131.57	37.28	131.64	41.12	131.71	43.80	131.76
	Reach1	18800	28.14	131.69	32.77	131.73	37.28	131.78	41.12	131.82	43.80	131.86
	Reach1	19500	28.14	131.77	32.77	131.81	37.28	131.85	41.12	131.90	43.80	131.93
	Reach1	20750	22.06	131.86	25.71	131.91	29.29	131.96	32.33	131.99	34.45	132.02
	Reach1	21800	22.06	132.25	25.71	132.29	29.29	132.32	32.33	132.35	34.45	132.36
	Reach1	22500	22.06	132.86	25.71	132.90	29.29	132.93	32.33	132.95	34.45	132.97
	Reach1	23400	22.06	133.18	25.71	133.22	29.29	133.27	32.33	133.30	34.45	133.32
	Reach1	23600	13.34	133.54	15.58	133.58	17.79	133.62	19.67	133.65	20.98	133.67
	Reach1	23610	13.34	133.52	15.58	133.55	17.79	133.58	19.67	133.60	20.98	133.61
	Reach1	23650	Richmond Road									
	Reach1	23690	13.34	134.12	15.58	134.30	17.79	134.52	19.67	134.65	20.98	134.65
	Reach1	23700	13.34	134.15	15.58	134.33	17.79	134.54	19.67	134.65	20.98	134.65
	Reach1	23800	13.34	134.28	15.58	134.42	17.79	134.60	19.67	134.64	20.98	134.64
	Reach1	23900	13.34	134.58	15.58	134.64	17.79	134.74	19.67	134.78	20.98	134.79
	Reach1	24100	13.34	134.90	15.58	134.95	17.79	135.01	19.67	135.05	20.98	135.08
	Reach1	24200	13.34	135.18	15.58	135.22	17.79	135.27	19.67	135.31	20.98	135.33
	Reach1	24500	13.34	135.35	15.58	135.40	17.79	135.44	19.67	135.47	20.98	135.49
	Reach1	24900	13.34	135.50	15.58	135.54	17.79	135.58	19.67	135.61	20.98	135.63
	Reach1	25400	13.34	135.62	15.58	135.66	17.79	135.69	19.67	135.72	20.98	135.74

Table 16 List of RVCA Regulation Permit Files (November 2019 to 2009)

RVCA File #	Location	Year of Application	Flood Line Change Required?	Brief Description
RV5-6419	Richmond Rd	2019	No	Intall Subdivision Road, Ditches, Placement Of Fill, Entrace To Severed Lot
RV5-5719	254 Franktown Cemetery Rd	2019	No	Construct New Garage Within Adjacent Lands Of Psw (Outside Of Min. 30 M Setback)
RV5-3019	442 9Th Line Beckwith	2019	No	Cleanout Of Mcewen Municipal Drain And Restoration Of Bank Slopes
RV5-2719	622 9Th Line Beckwith	2019	No	Maintenance Clean Out Of Municipal Drain
RV5-2619	562 9Th Line Beckwith	2019	No	Maintenance Clean Out Of Municipal Drain
RV5-3216	Richmond Rd	2016	No	Construct A New Home & Septic System
RV5-2419	113 Old Mill Rd	2019	No	Alterwater. - Shoreline Stabilization
RV5-1619	2001 Derry Side Rd	2019	No	Construction Of A New 30' X 25' Steel Shed On Concrete Footings
18-BEC-SEV-0027	Derry Side Road / County Road 17	2018	No	Consent
18-BEC-SEV-0026	1131 7Th Line Road	2018	No	Consent
18-BEC-SEV-0025	1131 7Th Line Road	2018	No	Consent
18-BEC-SEV-0003	166 Franktown Cemetery Rd	2018	No	Consent
17-BEC-SUB-0017	Derry Side Road (1009)	2018	No	Subdivision
RV5-0617	Powel St	2017	No	Development - Structure - Construction Of A Single Famility Dwelling & Septic System
17-BEC-SEV-0003	6 Kidd Road	2017	No	Consent
RV5-2117	Ashton Station Rd	2017	No	Replacement Of Nw & Sw Retaining Walls
RV5-3216	Richmond Rd	2016	No	Development - Structure - Construct A New Home & Septic System
RV5-2916	Crooked Side Road	2016	No	Alteration To An Existing Watercourse - Removal Of Vegetative Swale Without Permit
RV5-1716	Richmond Road	2016	No	Development - Structure - New Single Family Residential With Septic System
RV5-1216	166 Franktown Cemetery Rd	2016	No	New 32' X 52' Garage Near House
RV5-0616	Glenashton Road	2016	No	Construct A New Single Family Residence With 2 Auxilary Buildings
16-BEC-SPC-0016	County Road 10 (Richmond Rd)	2016	No	Single Family Dwelling
RV5-2715	Franktown Cemetery Road	2015	No	Construct New House And Septic System
RV5-1715	113 Old Mill Rd	2015	No	Development - Grading - Replacement Septic System To Service An Existing Holding Tank
RV5-1615	10047 Highway 15	2015	No	Development - Structure - Construct New Residence
RV5-2814	Highway 15	2014	No	Construction/Reconstruction - New House Construction
RV5-1014	Line Road 9	2014	No	Road Reconstruction Project - Culvert Replacements
RV5-0414	166 Franktown Cemetery Rd	2014	No	Construction/Reconstruction - Construct A Single Family Dwelling And Septic System
RV5-0214	500 9Th Line	2014	No	Alteration To An Existing Watercourse - Retroactive Permit For Drain Clean-Out
RV5-2413	Richmond Rd	2013	No	Construct New Dwelling And Septic
RV5-0313	795 Glenashton Road	2013	No	Alterations, Additions, And/Or Renovations To A Building - Construct A New 650 Sq Foot Auxiliary Building
RV5-0113	Richmond Road	2013	No	Construction/Reconstruction - To Construct A Single Family Dwelling
RV5-4912	9271 Cavanagh Rd	2012	No	Construct Waste Transfer Station -Comments Field From Old Database: Steel B
RV5-4812	127 Mockingbird	2012	No	Construct A 16 X 18 Shed - Pour Concrete Slab - Comments Field From Old Database: Shed
RV5-2612	Kidd Side Rd	2012	No	Driveway Rehabilitation
RV5-2512V	1319 9Th Line	2012	No	4.75Km Trail Through Goodwood Marsh - Comments Field From Old Database: Violati

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Table 16 List of RVCA Regulation Permit Files (November 2019 to 2009)

RVCA File #	Location	Year of Application	Flood Line Change Required?	Brief Description
RV5-2112T	Ashton Statio	2012	No	Replace 2 Culverts Immediately Adjacent - Comments Field From Old Database: 2 Culve
RV5-1812	110 Hummingbird L	2012	No	Construct 20 X 28 Square Foot Steel Garage - Comments Field From Old Database: Aux Bui
RV5-3111T	Richmond Rd	2011	No	Bridge, Culvert, Road Crossing, Major Works - Install Culvert For New Driveway - Related Severance Application 11-Bec-Sev -Comments Field From Old Database: Culvert
RV5-3111T	Richmond Rd	2011	No	Install Culvert For New Driveway - Related Severance Application 11-Bec-Sev -Comments Field From Old Database: Culvert
RV5-0611V	Hwy 7	2011	No	Wetland Interference - Out of Bounds
RV5-0211T	Franktown Cem	2011	No	Construct Dwelling And Septic System On Franktown Cemetery Rd -Comments Field From Old Database: Cond
RV5-2410	622 9Th Line	2010	No	Bridge, Culvert, Road Crossing, Major Works - Replace Culvert On Farm Retroactive Review & Fee - Refer To Dfo -Comments Field From Old Database: Vio
RV5-2410	622 9Th Line	2010	No	Replace Culvert On Farm Retroactive Review & Fee - Refer To Dfo -Comments Field From Old Database: Vio
RV5-2609T	1873 9Th Line Rd	2009	No	Bridge, Culvert, Road Crossing, Major Works - Relocate Watercourse To Accommodate Country Lane Estates Subdivision
RV5-2609T	1873 9Th Line Rd	2009	No	Relocate Watercourse To Accommodate Country Lane Estates Subdivision
RV5-2409V	Hwy 7	2009	No	Violation
RV5-0509T	Maple Creek E	2009	No	Construction New (Residential) - Construction Of New Residence - Glen Looking After File At This Point
RV5-0509T	Maple Creek E	2009	No	Construction Of New Residence - Glen Looking After File At This Point

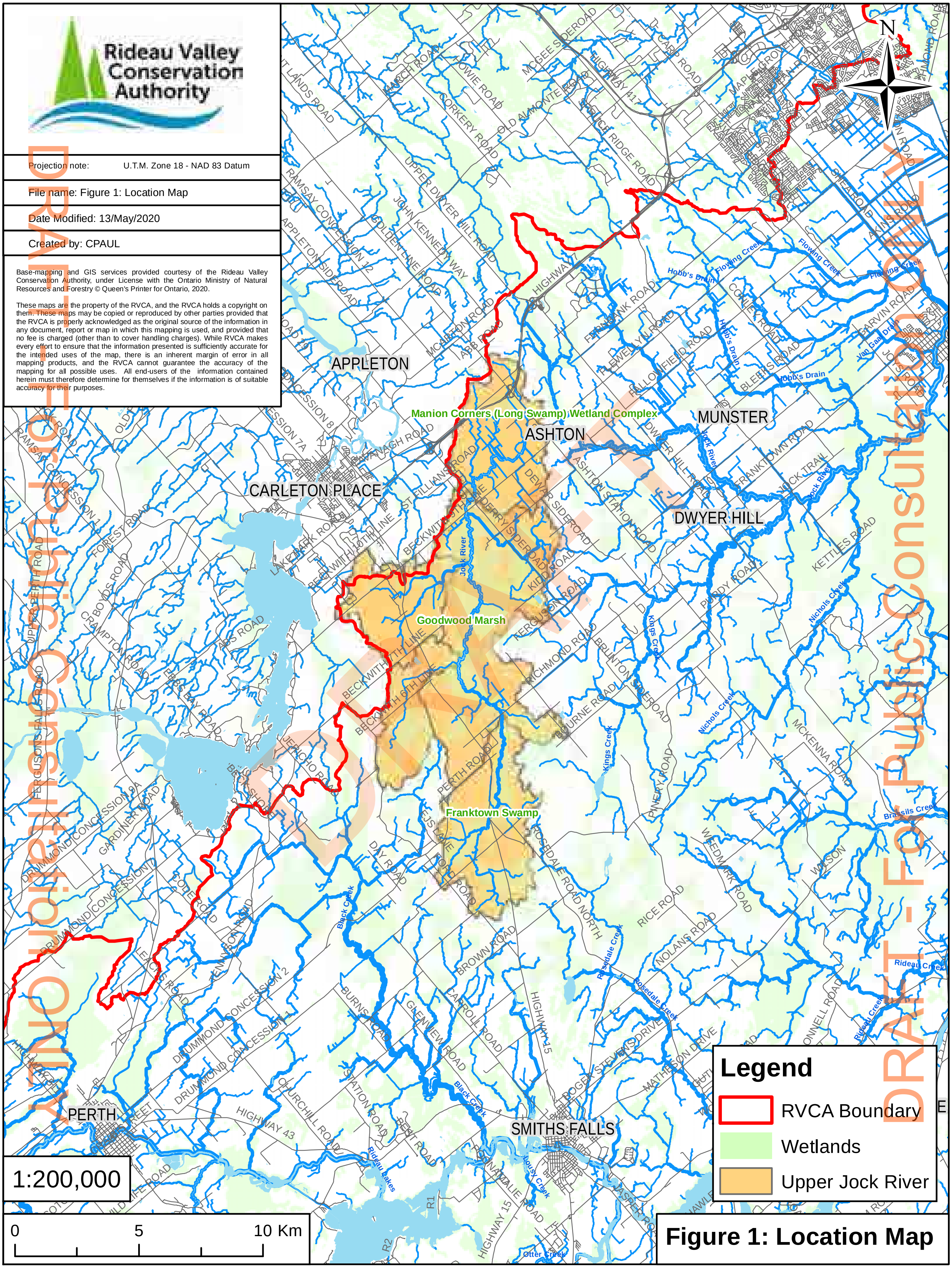
Table 17.: Culvert Data from Field Surveys

Serial No.:	Given Name*	Location	Draining to Watercourse	Downstream Invert (m)	Upstream Invert (m)	Downstream Obvert (m)	Upstream Obvert (m)	Shape	Survey Date.:
1	BO-HWY015-RD-0001	Intersection of Highway 15 and Jock River	Jock River	136.00	136.31	137.98	138.18	Box	1st August 2019
2	CL-KIDDRD-RD-A001	875 m SW from the intersection of Derry Side Road and Kidd Rd.	Jock River	131.70	132.17	132.22	132.17	Circular	1st August 2019
3	CL-KIDDRD-RD-A002	876 m SW from the intersection of Derry Side Road and Kidd Rd.	Jock River	131.63	132.05	132.19	132.05	Circular	1st August 2019
4	CL-DERRYS-RD-0001	460 m SE from the intersection of Derry Side Road and Glenashton Station Road	Jock River	131.32	131.35	132.10	132.19	Circular	1st August / 12th December
5	CL-DERRYS-RD-0002	461 m SE from the intersection of Derry Side Road and Glenashton Station Road	Jock River	131.36	131.32	132.11	132.12	Circular	1st August / 12th December
6	CL-GLNASH-RD-0001	300 m SW from the intersection of Derry Side Road and Glenashton Road.	Jock River	130.22	130.20	131.05	131.04	Circular	1st August 2019
7	CL-GLNASH-RD-454A	140 m SW from the intersection of Derry Side Road and Glenashton Road.	Jock River	130.45	130.44	130.98	131.01	Circular	13th August 2019
8	CL-GLNASH-RD-454B	140 m SW from the intersection of Derry Side Road and Glenashton Road.	Jock River	130.44	130.41	130.99	131.00	Circular	13th August 2019
9	CL-BEC9LN-RD-A001	50 m SW from the intersection of Cemetery Side Road and Beckwith 9 Line.	Jock River	129.51	129.69	130.40	130.72	Circular	13th August 2019
10	CL-BEC9LN-RD-A002	50 m SW from the intersection of Cemetery Side Road and Beckwith 9 Line.	Jock River	129.59	129.70	130.39	130.77	Circular	13th August 2019
11	CL-BEC9LN-RD-B001	140 m SW from the intersection of Cemetery Side Road and Beckwith 9 Line.	Jock River	129.37	129.58	130.32	130.33	Circular	13th August 2019
12	CL-HEMLCK-RD-0202	On Hemlock Drive	Jock River	129.84	129.80	130.35	130.20	Circular	13th August 2019
13	CL-BEC9LN-RD-0307	600 m NE from the intersection of Jock Ridge Drive and Beckwith 9 Line	Jock River	130.02	129.87	130.80	130.77	Circular	13th August 2019
14	CL-BEC9LN-RD-268A	680 m NE from the intersection of Campbell Side Road and Beckwith 9 Line	Jock River	128.89	128.87	129.64	129.76	Circular	13th August 2019
15	CL-BEC9LN-RD-268B	680 m NE from the intersection of Campbell Side Road and Beckwith 9 Line	Jock River	128.78	128.93	129.65	129.75	Circular	13th August 2019
16	BO-FOSTER-RD-0054	Intersection of Ashton Station Road and Foster Road.	Jock River	131.15	131.83	132.77	132.95	Box	13th August 2019
17	CL-FOSTER-RD-0051	200 m SW from the intersection of Ashton Station Road and Foster Road.	Jock River	131.18	131.35	132.11	132.22	Circular	13th August 2019
18	CL-ASHCRK-RD-0188	On Ashton Creek Crescent	Jock River	130.95	131.19	131.54	131.64	Circular	13th August 2019
19	CL-ASHCRK-RD-194A	On Ashton Creek Crescent	Jock River	129.54	129.68	130.40	130.33	Circular	13th August 2019
20	CL-ASHCRK-RD-194B	On Ashton Creek Crescent	Jock River	129.50	129.59	130.34	130.38	Circular	13th August 2019
21	CL-ASHCRK-RD-194C	On Ashton Creek Crescent	Jock River	129.44	129.54	130.30	130.34	Circular	13th August 2019
22	CL-ASHCRK-RD-0301	On Ashton Creek Crescent	Jock River	130.17	130.25	130.88	130.95	Circular	13th August 2019
23	CL-ASHCRK-RD-0301	On Ashton Creek Crescent	Jock River	129.94	130.11	130.88	130.95	Circular	13th August 2019
24	CL-BEC9LN-RD-0376	1.1 km NE from the intersection of Campbell Side Road and Beckwith 9 Line	Jock River	129.11	129.44	129.695	130.025	Circular	13th August 2019
25	CL-FRKCEM-RD-0041	At the intersection of Franktown Cemetery and Richmond Road	Jock River	133.026	133.071	133.646	133.621	Circular	1st December 2019
26	CL-RICHRD-DW-1913	On the driveway of 1913 Richmond Road	Jock River	133.084	133.002	133.474	133.512	Circular	1st December 2019
29	CL-GLNASH-DW-0885	On the driveway of 885 Glen Ashton Road	Jock River	130.97	131.03	131.39	131.44	Circular	1st December 2019

30	CL-DERRYS-RD-A001	The intersection of Derry Side Rd and Glen Ashton Road	Jock River	130.595	130.519	131.285	131.339	Circular	1st December 2019
31	CL-DERRYS-DW-2130	On the driveway of 2130 Derry Side Road	Jock River	130.86	130.87	131.32	131.33	Circular	1st December 2019
32	CL-DERRYS-RD-B001	The intersection of Derry Side Rd and Glen Ashton Road	Jock River	130.58	130.84	131.23	131.27	Circular	1st December 2019
33	CL-CEMSDR-RD-A001	50 m N of the intersection of Beckwith 9 Line and Cemetery Side Rd	Jock River	129.856	130.037	130.356	130.537	Circular	1st December 2019
34	CL-DEERLN-RD-A001	45m E from the intersection of Deer Lane and Cemetery Side Rd	Jock River	130.409	130.659	130.749	130.889	Circular	1st December 2019
35	CL-DEERLN-DW-0137	On the driveway of 137 Deer Lane	Jock River	130.895	130.938	131.195	131.238	Circular	1st December 2019
36	CL-DERRYS-RD-C001	30m S of the intersection of Beckwith 9 Line and Derry Side Road	Jock River	129.95	130.01	130.45	130.51	Circular	1st December 2019
37	CL-BEC9LN-RD-D001	75m SW of CL-BEC9LN-DW-1168 on Beckwith 9 Line Road	Jock River	130.05	130.104	130.65	130.704	Circular	1st December 2019
38	CL-BEC9LN-DW-1168	On the driveway of 1168 Beckwith 9 Line Road	Jock River	130.32	130.3	130.63	130.65	Circular	1st December 2019
39	CL-BEC9LN-RD-E001	180M NE of CL-BEC9LN-DW-1168 on Beckwith 9 Line Road	Jock River	131.043	131.154	131.583	131.654	Circular	1st December 2019
40	CL-HEMLCK-RD-A001	250m NE from the intersection of Hemlock and Cemetery Side Road	Jock River	129.793	129.917	130.443	130.457	Circular	1st December 2019
41	CL-HEMLCK-DW-0124	On the driveway of 124 Hemlock Drive	Jock River	130.339	130.464	130.779	130.864	Circular	1st December 2019
42	CL-HEMLCK-DW-PARK	On the driveway of Unmarked Public Property	Jock River	130.226	130.366	130.606	130.786	Circular	1st December 2019
43	CL-HEMLCK-DW-0151	On the driveway of 151 Hemlock Drive	Jock River	130.079	130.19	130.559	130.69	Circular	1st December 2019

Field measurements are the work of RVCA surveys (2019)

*In the absence of official names a random naming system was adopted and later organised.



Projection note: U.T.M. Zone 18 - NAD 83 Datum

File name: Figure 1: Location Map

Date Modified: 13/May/2020

Created by: CPAUL

Figure 1: Location Map

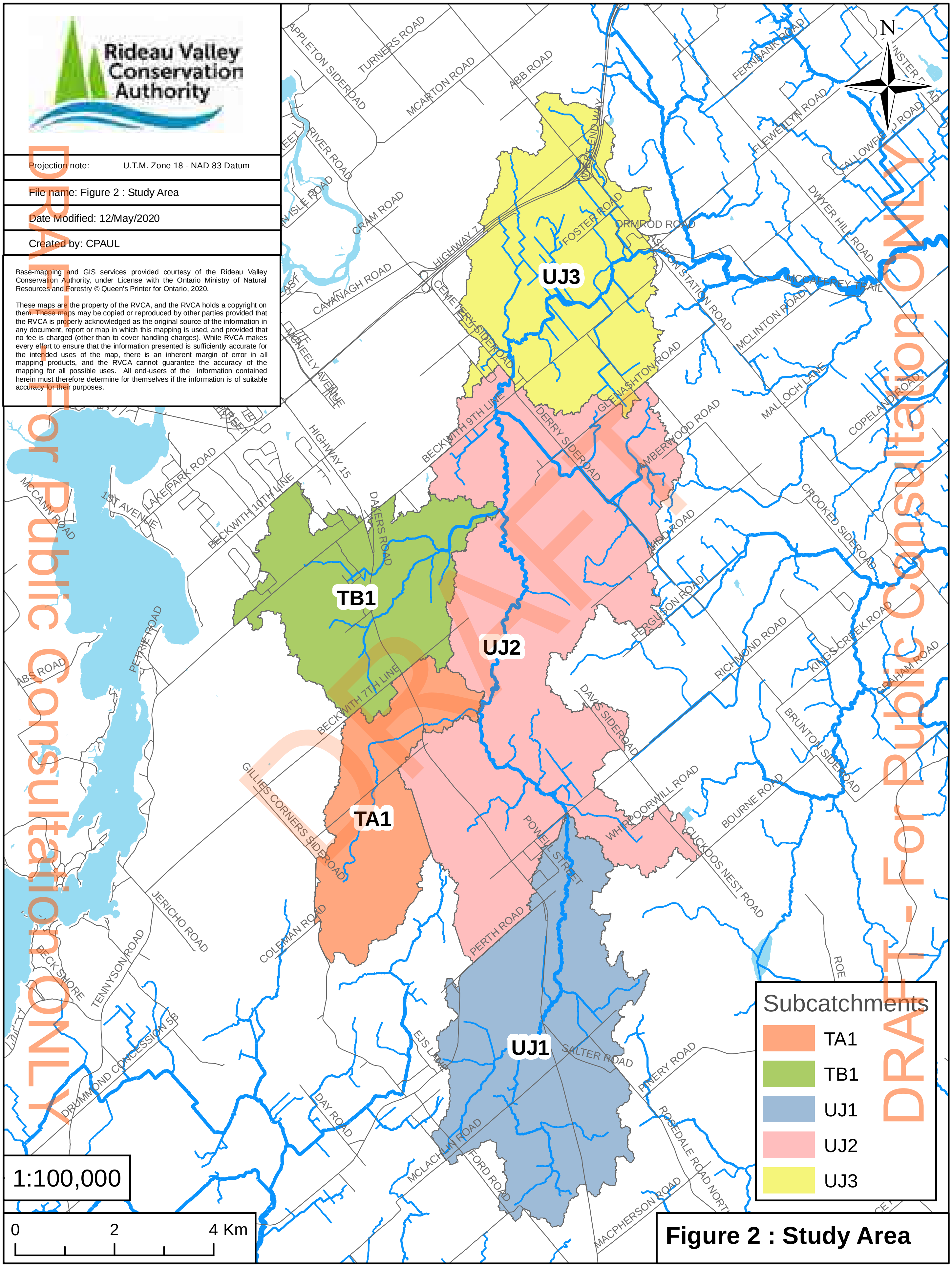
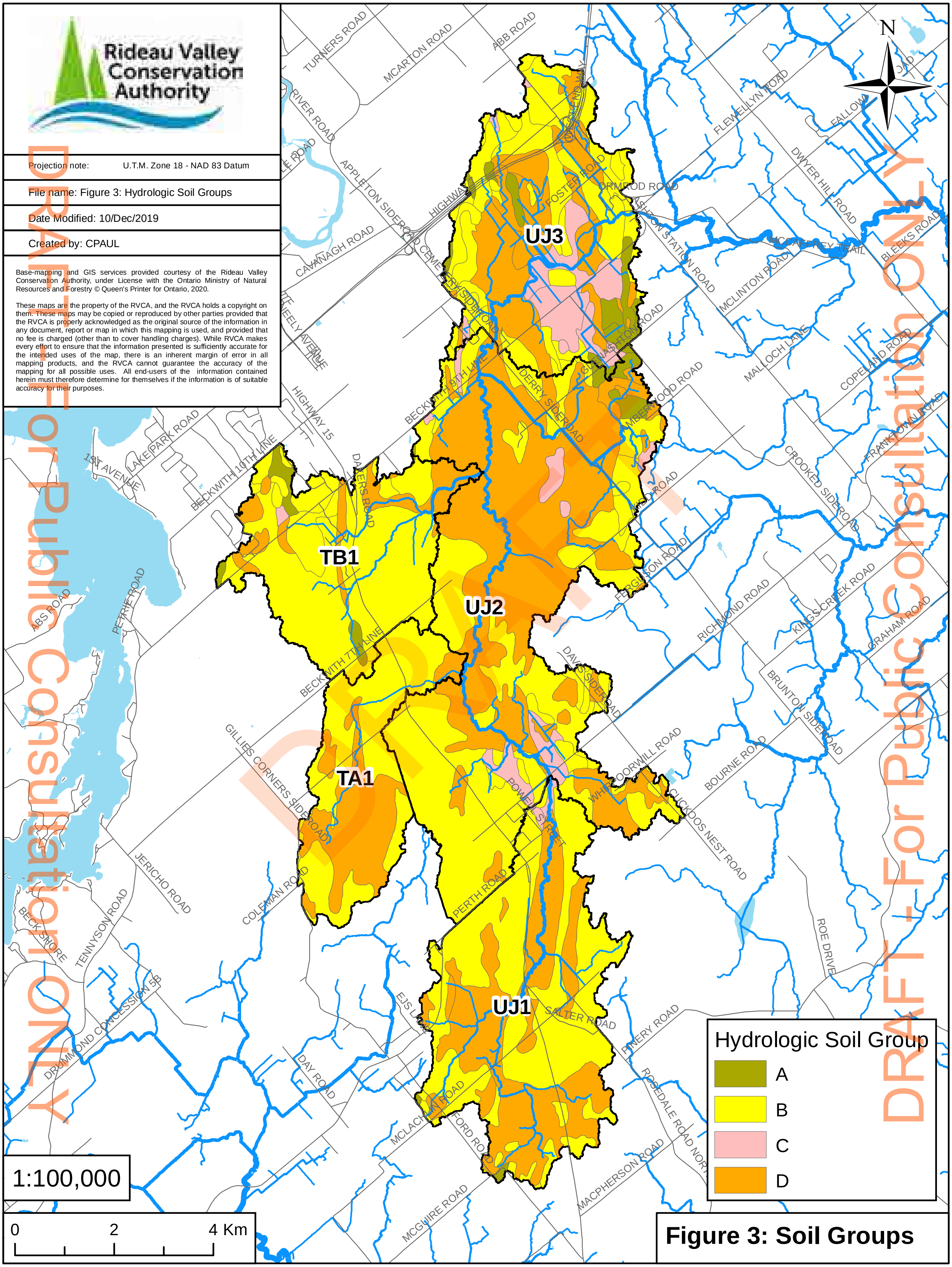


Figure 2 : Study Area



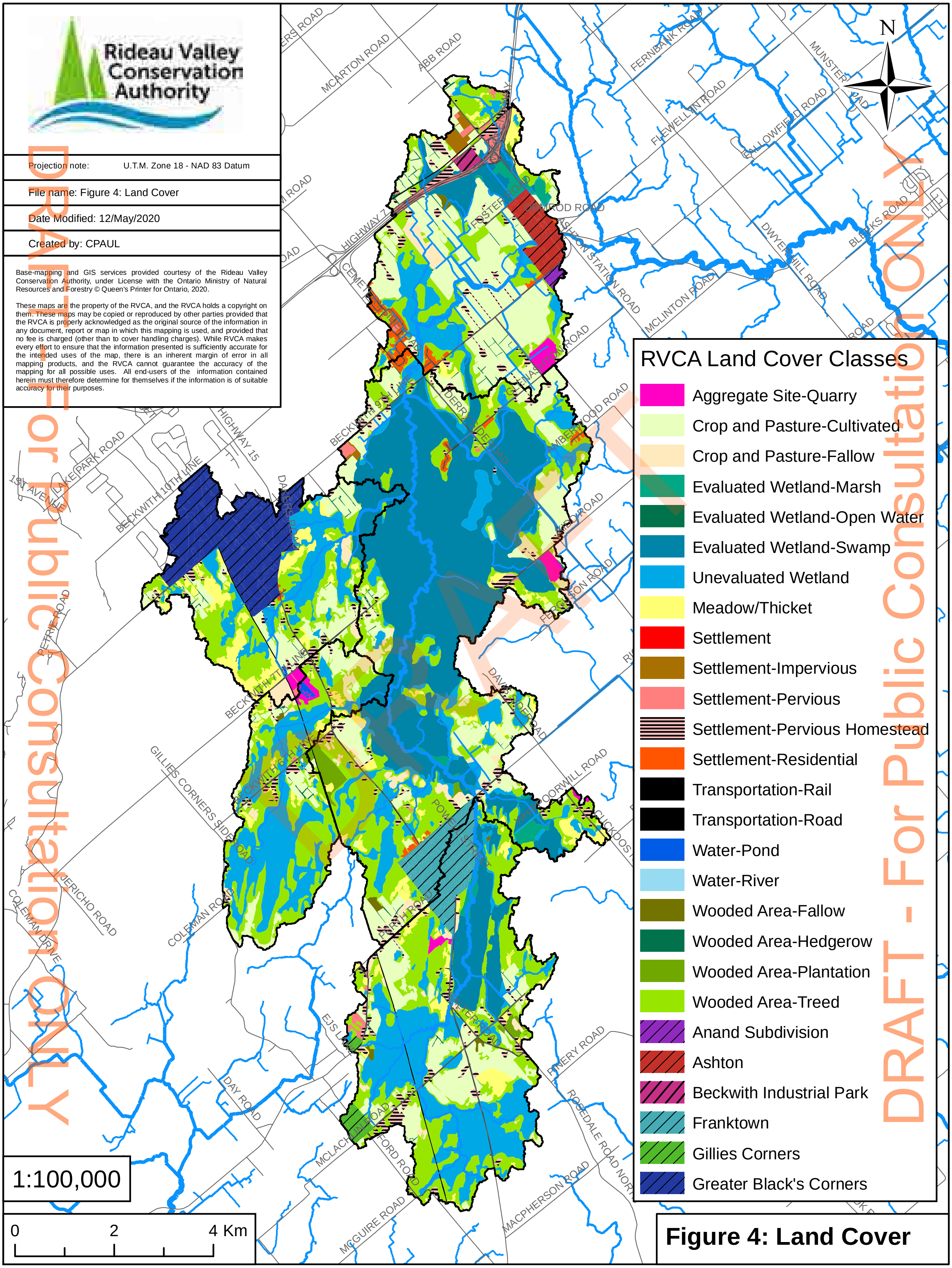
Projection note: U.T.M. Zone 18 - NAD 83 Datum

File name: Figure 3: Hydrologic Soil Groups

Date Modified: 10/Dec/2019

Created by: CPAUL

Figure 3: Soil Groups


Rideau Valley Conservation Authority
Projection note: U.T.M. Zone 18 - NAD 83 Datum
File name: Figure 4: Land Cover
Date Modified: 12/May/2020
Created by: CPAUL
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N
RVCA Land Cover Classes
Aggregate Site-Quarry
Crop and Pasture-Cultivated
Crop and Pasture-Fallow
Evaluated Wetland-Marsh
Evaluated Wetland-Open Water
Evaluated Wetland-Swamp
Unevaluated Wetland
Meadow/Thicket
Settlement
Settlement-Impervious
Settlement-Pervious
Settlement-Pervious Homestead
Settlement-Residential
Transportation-Rail
Transportation-Road
Water-Pond
Water-River
Wooded Area-Fallow
Wooded Area-Hedgerow
Wooded Area-Plantation
Wooded Area-Treed
Anand Subdivision
Ashton
Beckwith Industrial Park
Franktown
Gillies Corners
Greater Black's Corners
1:100,000
0
2
4 Km
MCARTON ROAD
ABB ROAD
FERNBANK ROAD
MUNSTER ROAD
FLEWELLYN ROAD
FALLOWFIELD ROAD
HIGHWAY 7
FOSTER ROAD
ASHTON STATION ROAD
MCLINTON ROAD
DWYER HILL ROAD
BLEEKS ROAD
LAKE PARK ROAD
HIGHWAY 15
BECKWITH 10TH LINE
PETRIE ROAD
GILLIES CORNERS SIDEROAD
JERICHO ROAD
COLEMAN DRIVE
COLEMAN ROAD
DAY ROAD
MCLACHLIN ROAD
MCGUIRE ROAD
MACPHERSON ROAD
ROSEDALE ROAD NORTH
PINERY ROAD
FERGUSON ROAD
DOORWILL ROAD
Figure 4: Land Cover

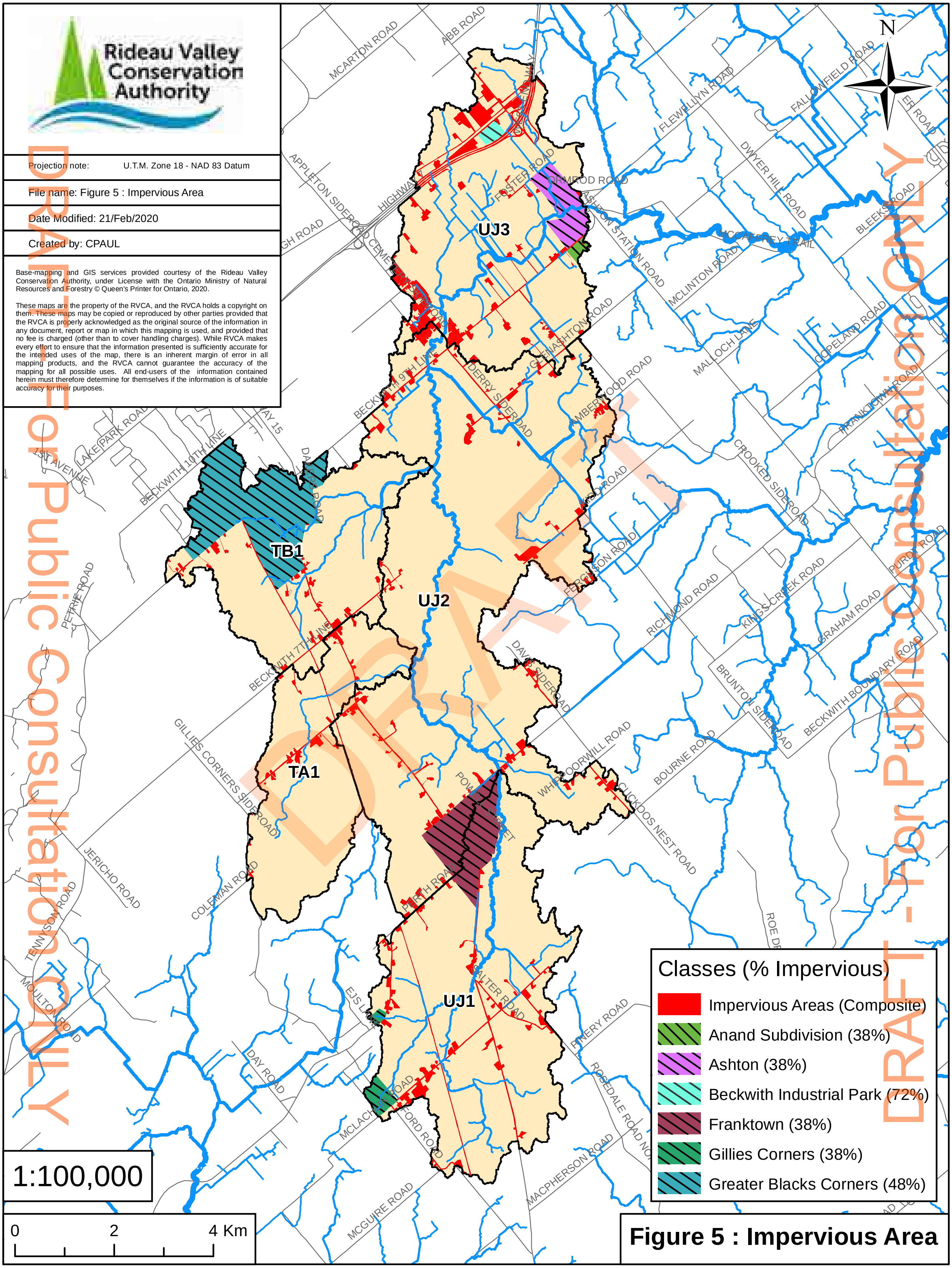
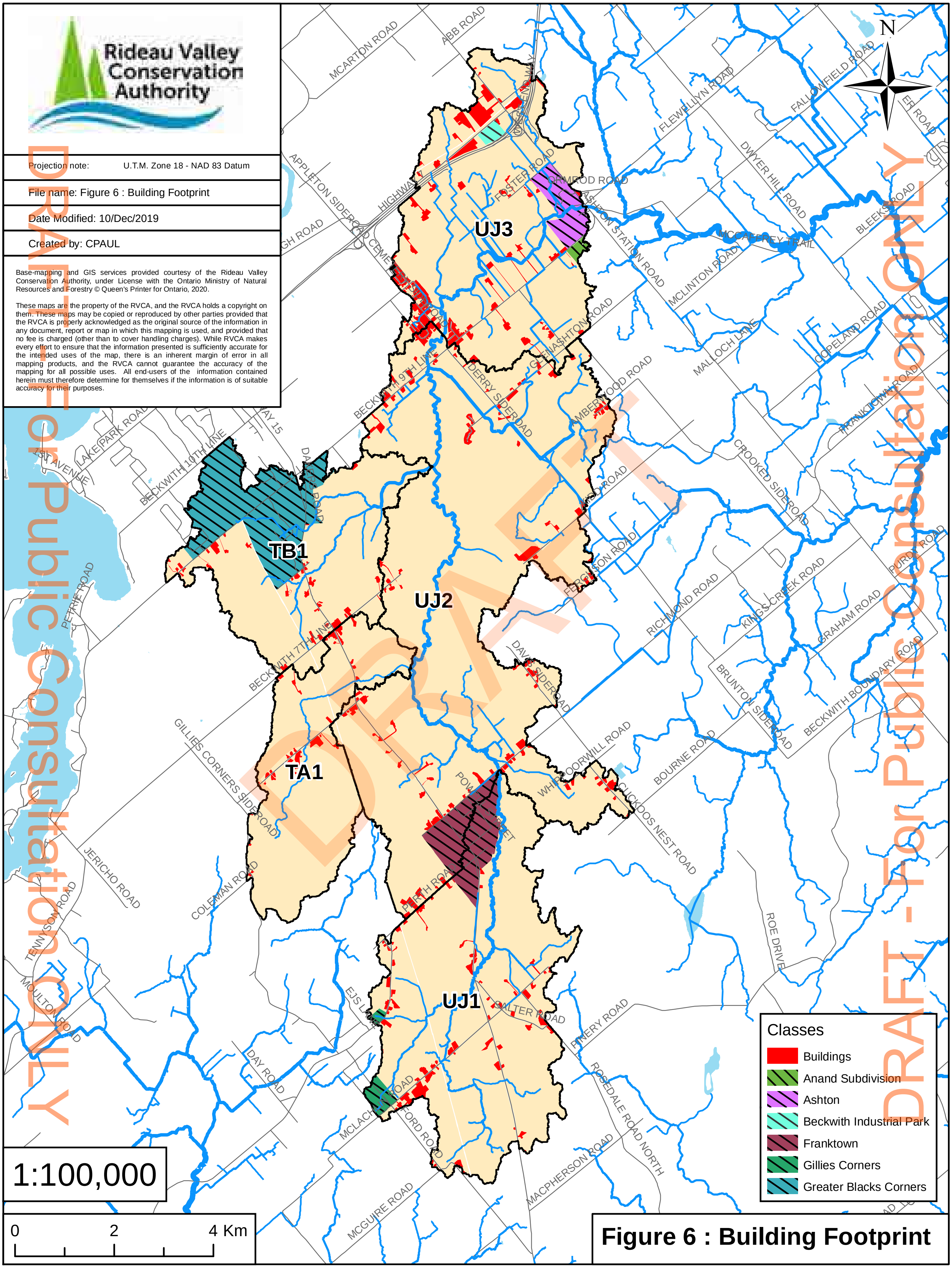


Figure 5 : Impervious Area



Projection note: U.T.M. Zone 18 - NAD 83 Datum

File name: Figure 6 : Building Footprint

Date Modified: 10/Dec/2019

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Figure 6 : Building Footprint

Projection note: U.T.M. Zone 18 - NAD 83 Datum

File name: Figure 7: SWMHYMO Schematic

Date Modified: 12/May/2020

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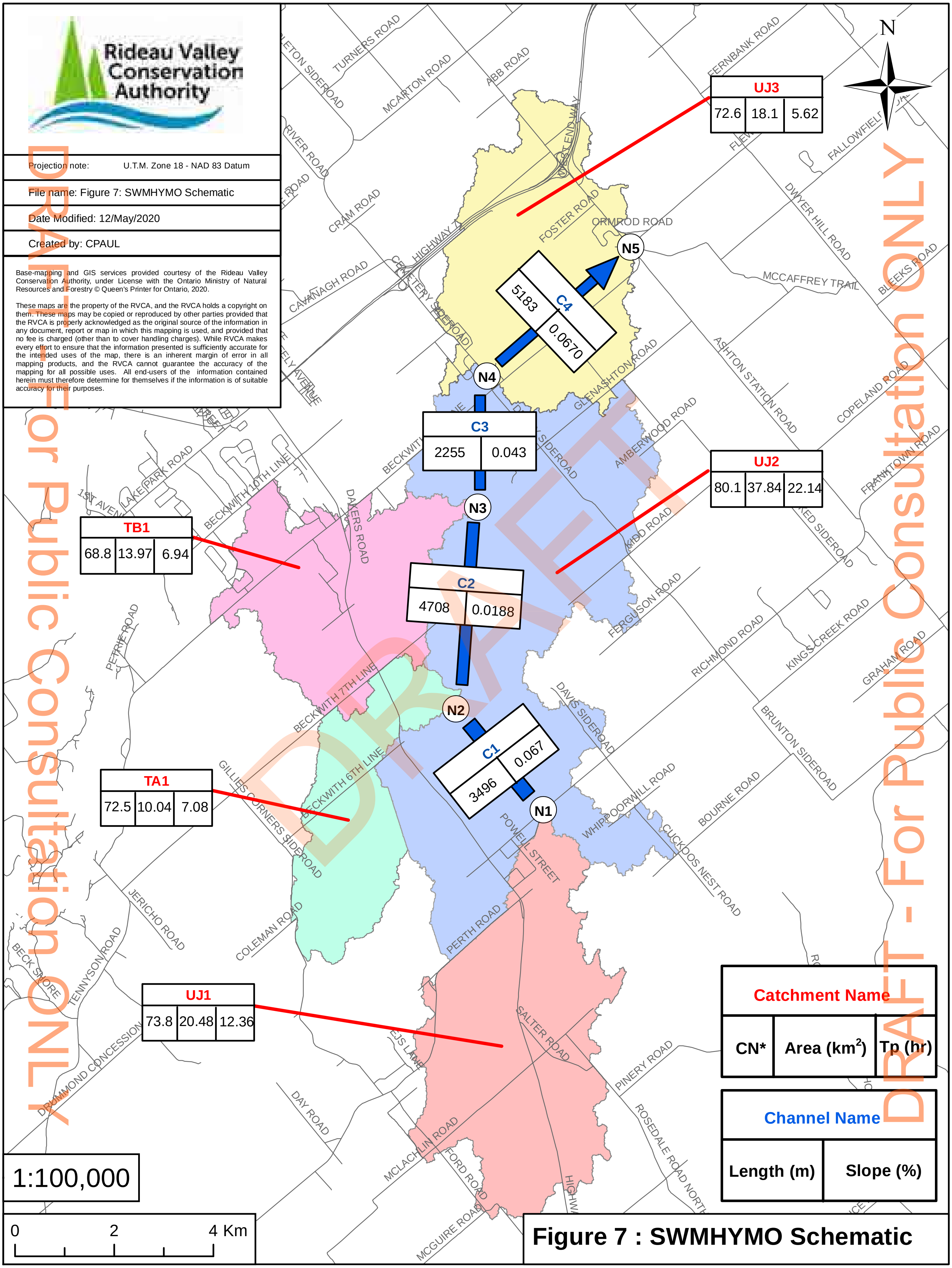

Figure 7 : SWMHYMO Schematic

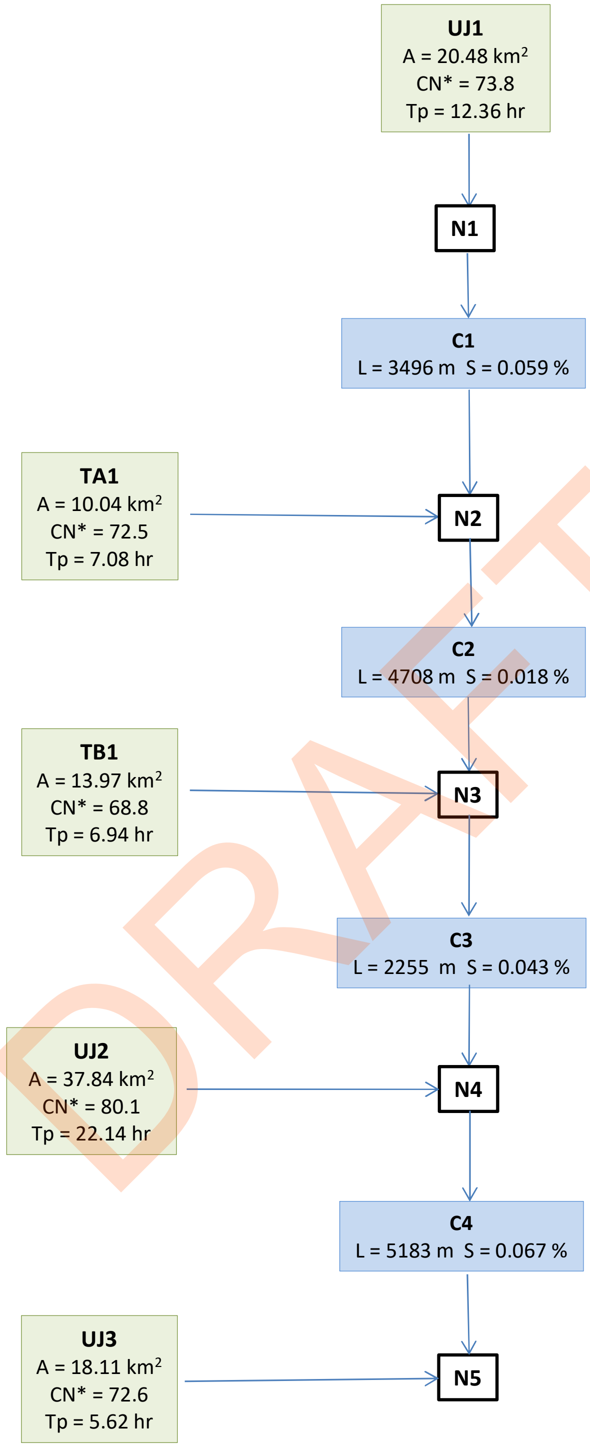

Figure 8 SWMHYMO Flow Chart

Figure 9   IDF curve for Ottawa Airport based on 1967-2007 data

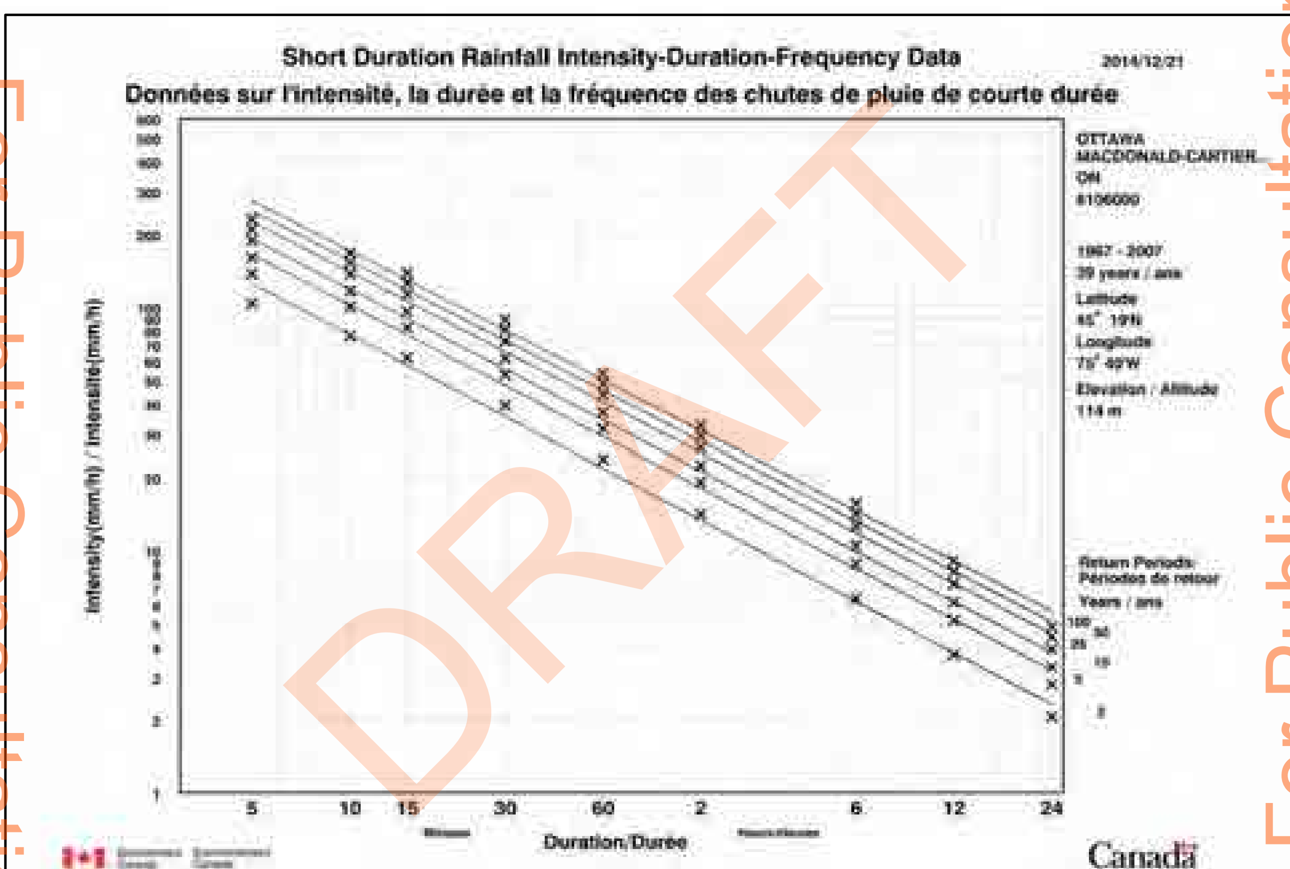

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Figure 10   Fitted IDF curves for Ottawa Airport generated by STORMS software

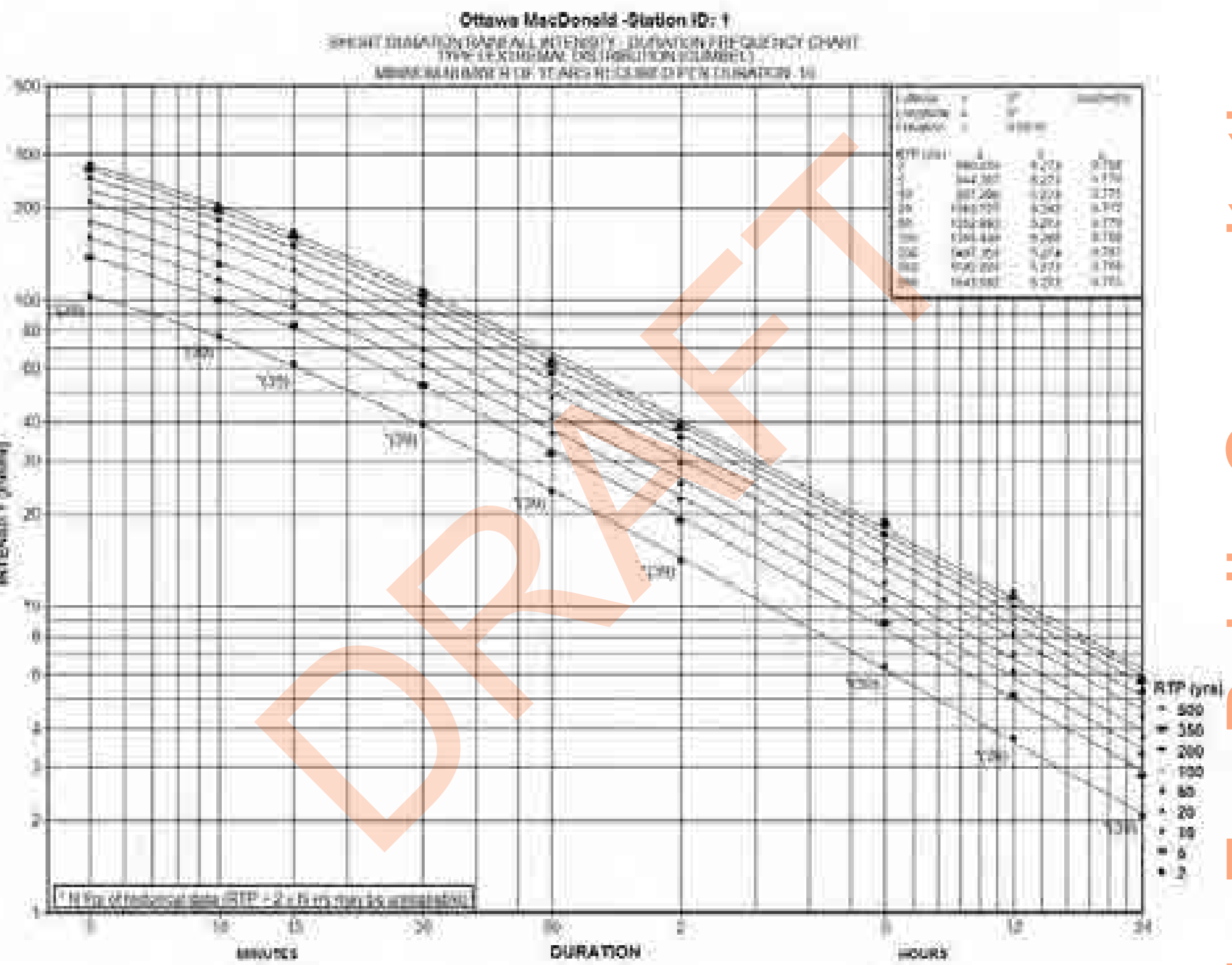


Figure 11 Hyetographs of various design storms

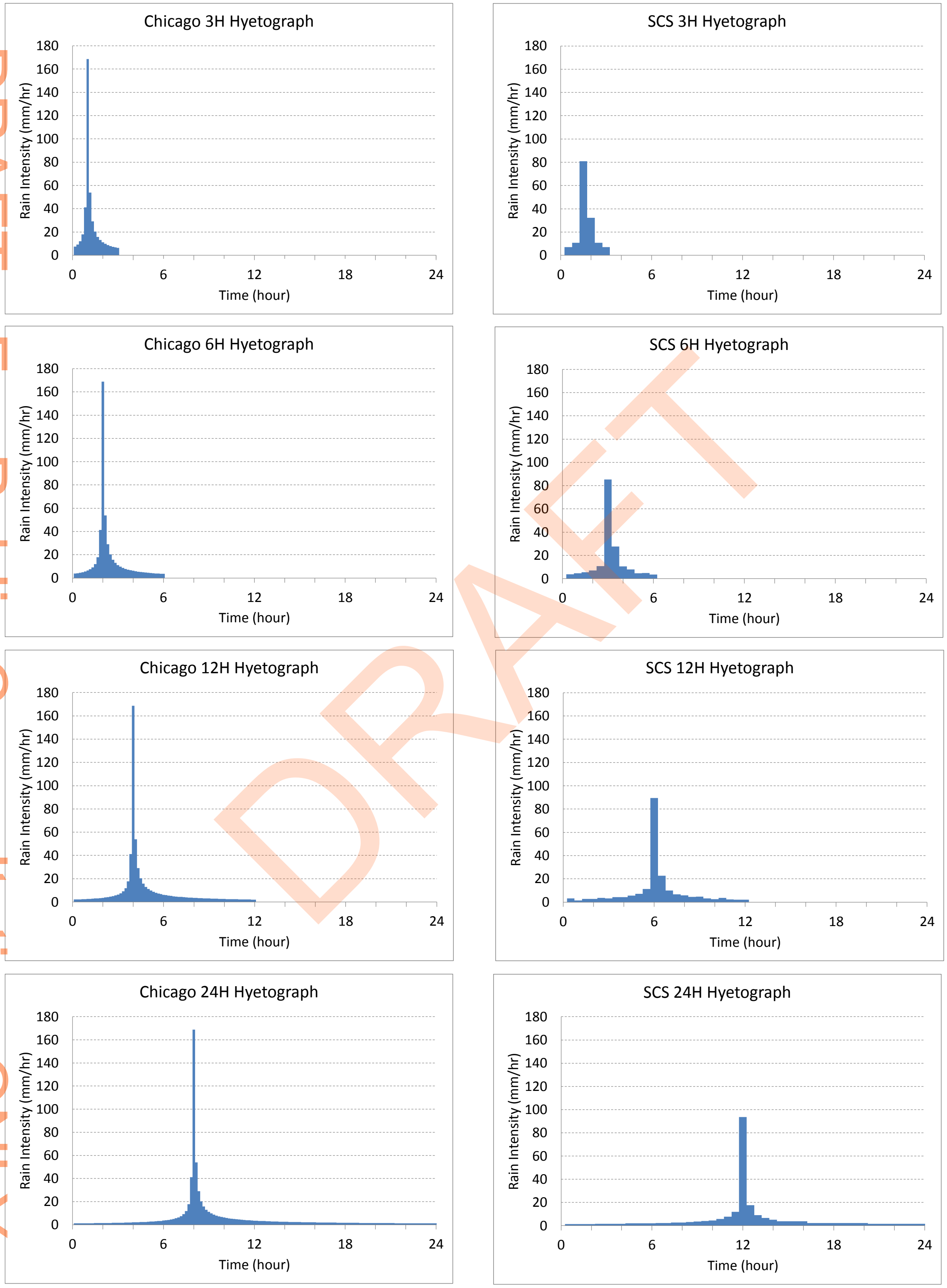
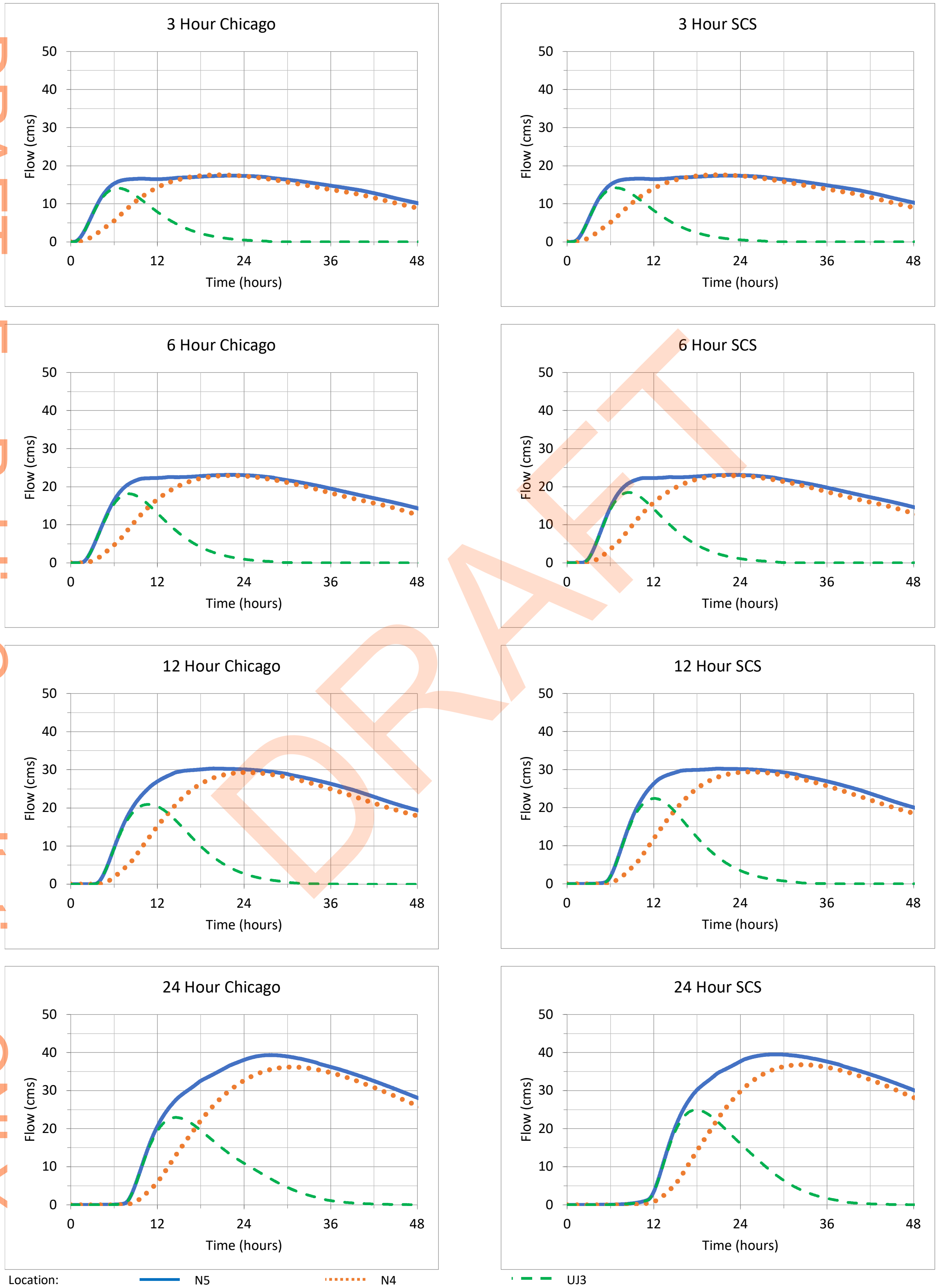


Figure 12 SWMHYMO generated 100 Year flows.

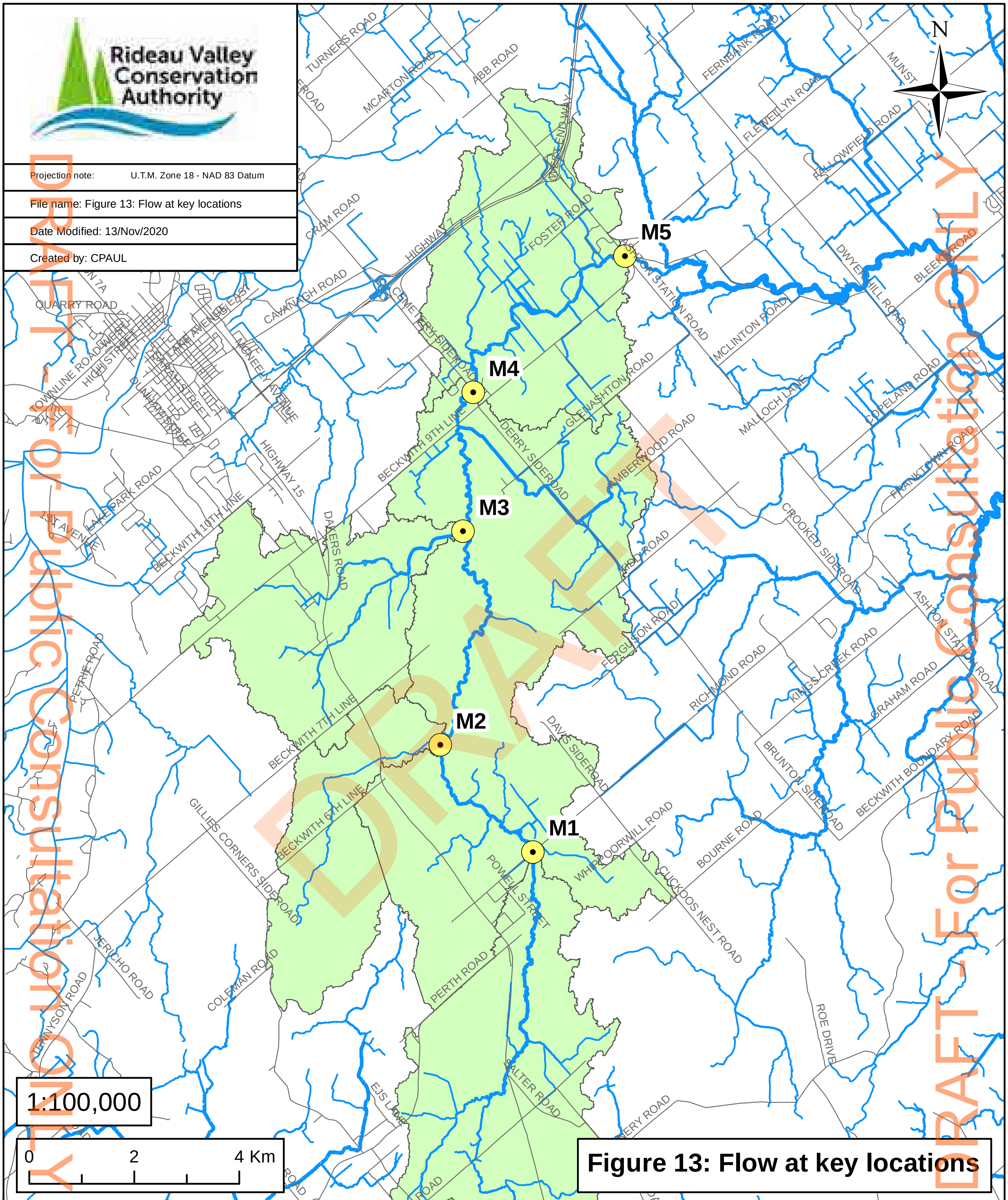


Projection note: U.T.M. Zone 18 - NAD 83 Datum

File name: Figure 13: Flow at key locations

Date Modified: 13/Nov/2020

Created by: CPAUL

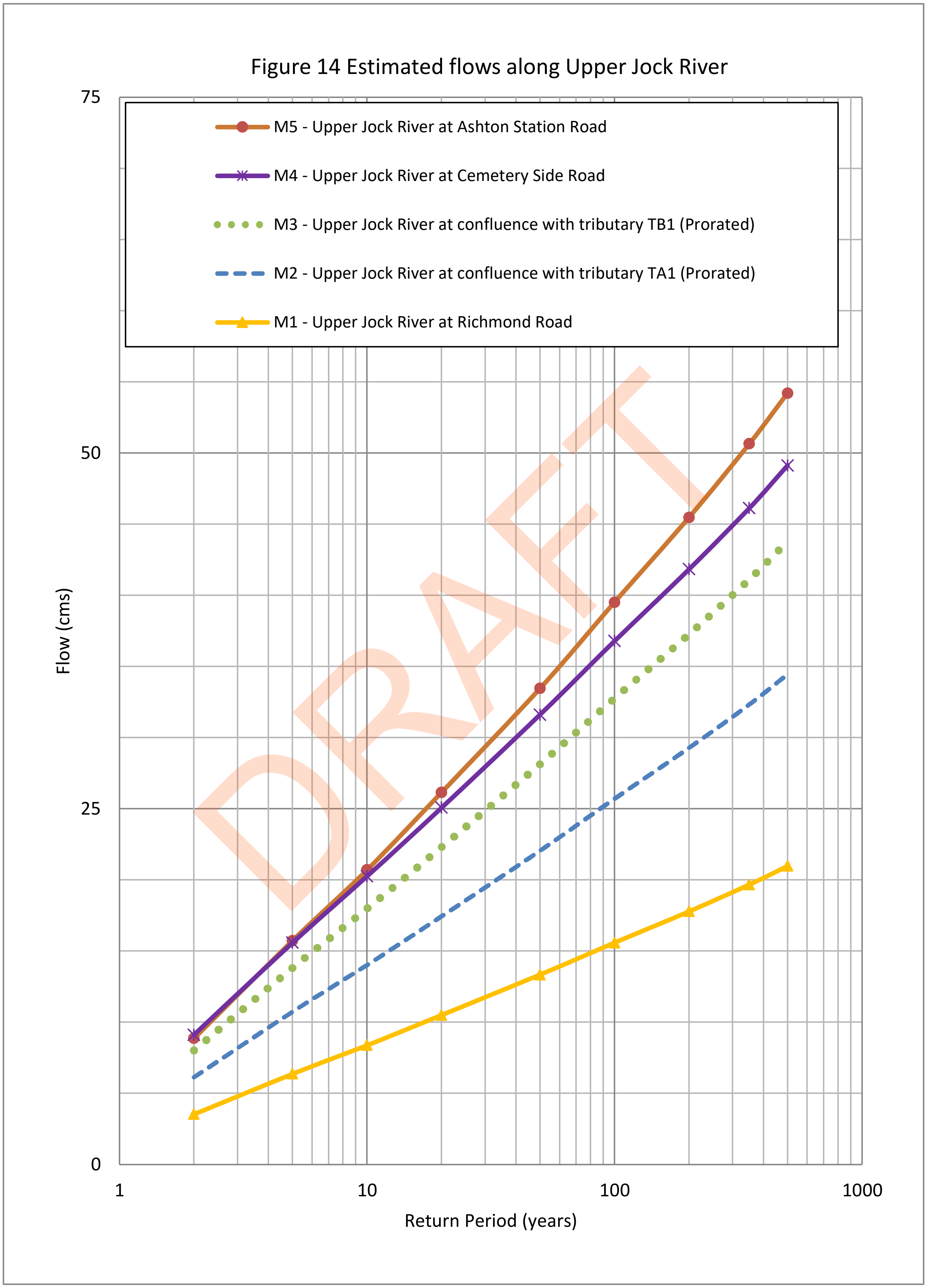


1:100,000

0 2 4 Km

Figure 13: Flow at key locations

Return Period (year)	2	5	10	20	50	100	200	350	500
Nodes	Flow (cms)								
M1	3.53	6.37	8.38	10.50	13.34	15.58	17.79	19.67	20.98
M2	6.14	10.73	14.02	17.45	22.06	25.71	29.29	32.33	34.45
M3	8.02	13.82	17.99	22.31	28.14	32.77	37.28	41.12	43.80
M4	9.12	15.59	20.26	25.09	31.62	36.79	41.84	46.13	49.13
M5	8.87	15.74	20.71	26.16	33.46	39.52	45.48	50.65	54.21



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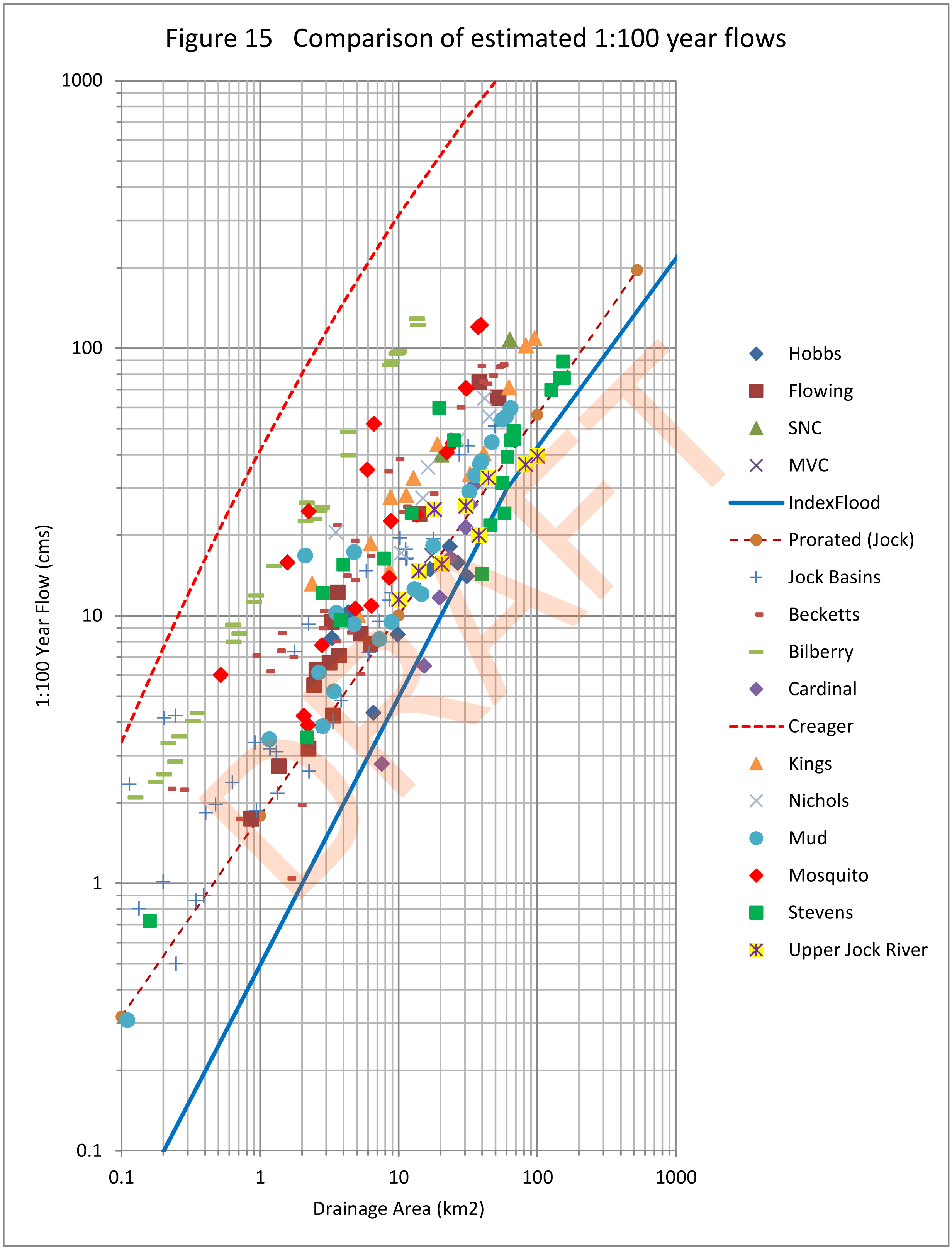

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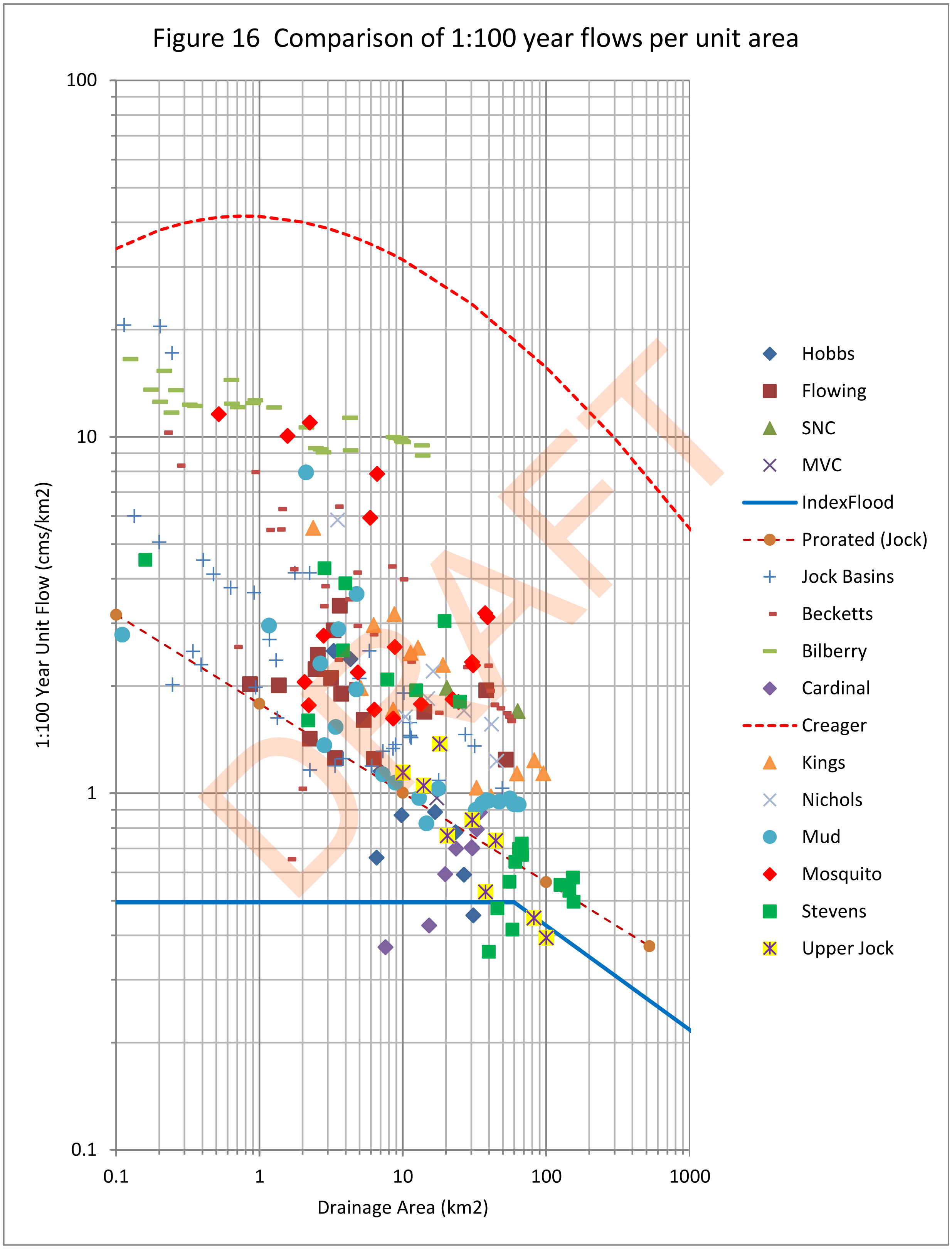


Figure 16 Comparison of 1:100 year flows per unit area
100
10
1
0.1
1:100 Year Unit Flow (cms/km2)
0.1
1
10
100
1000
Drainage Area (km2)
Hobbs
Flowing
SNC
MVC
IndexFlood
Prorated (Jock)
Jock Basins
Becketts
Bilberry
Cardinal
Creager
Kings
Nichols
Mud
Mosquito
Stevens
Upper Jock
DRAFT

Rideau Valley Conservation Authority

Projection note: U.T.M. Zone 18 - NAD 83 Datum

File name: Figure 17.a : HEC-RAS Schematic

Date Modified: 13/Jul/2021

Created by: CPAUL

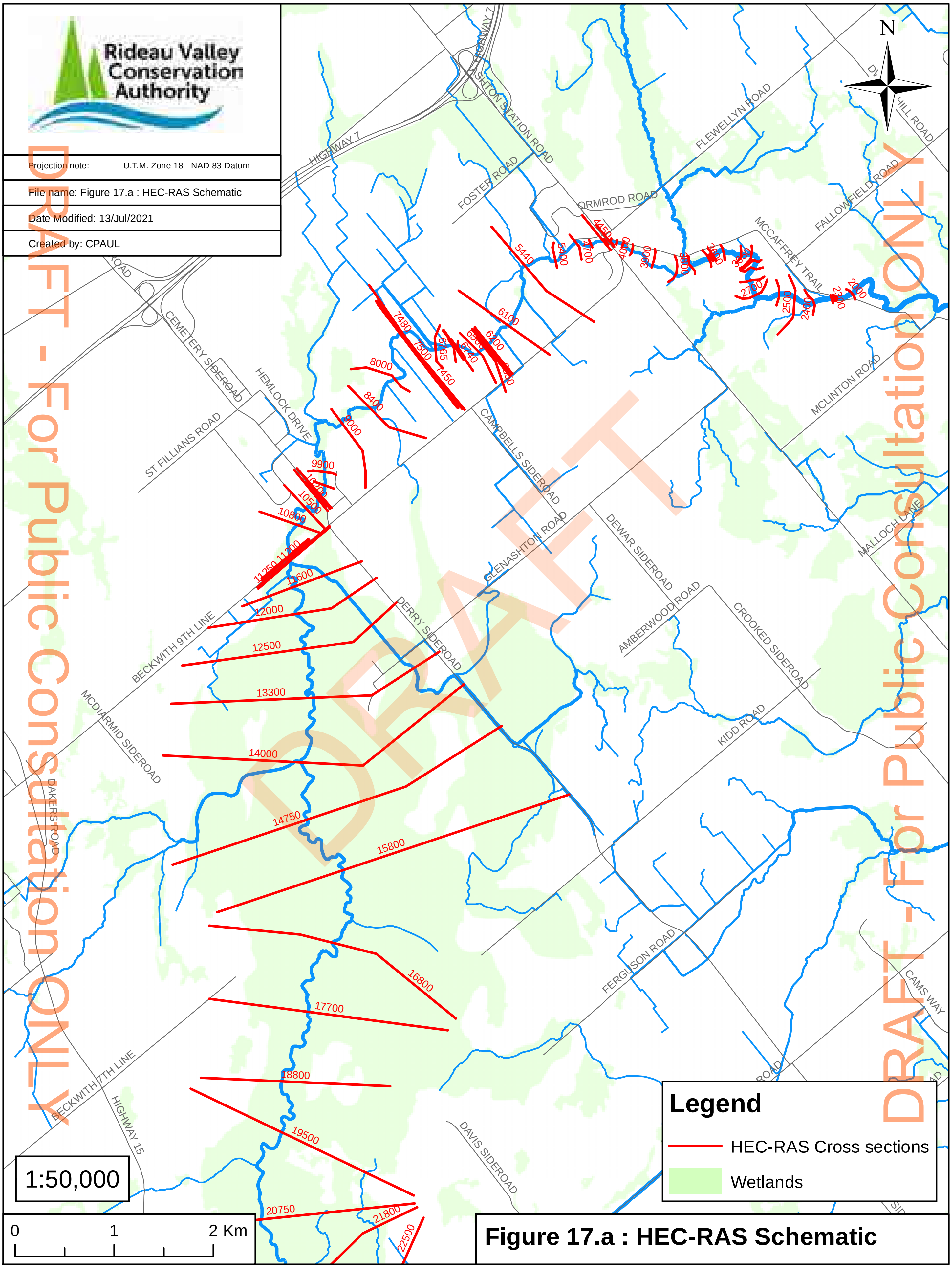


Figure 17.a : HEC-RAS Schematic

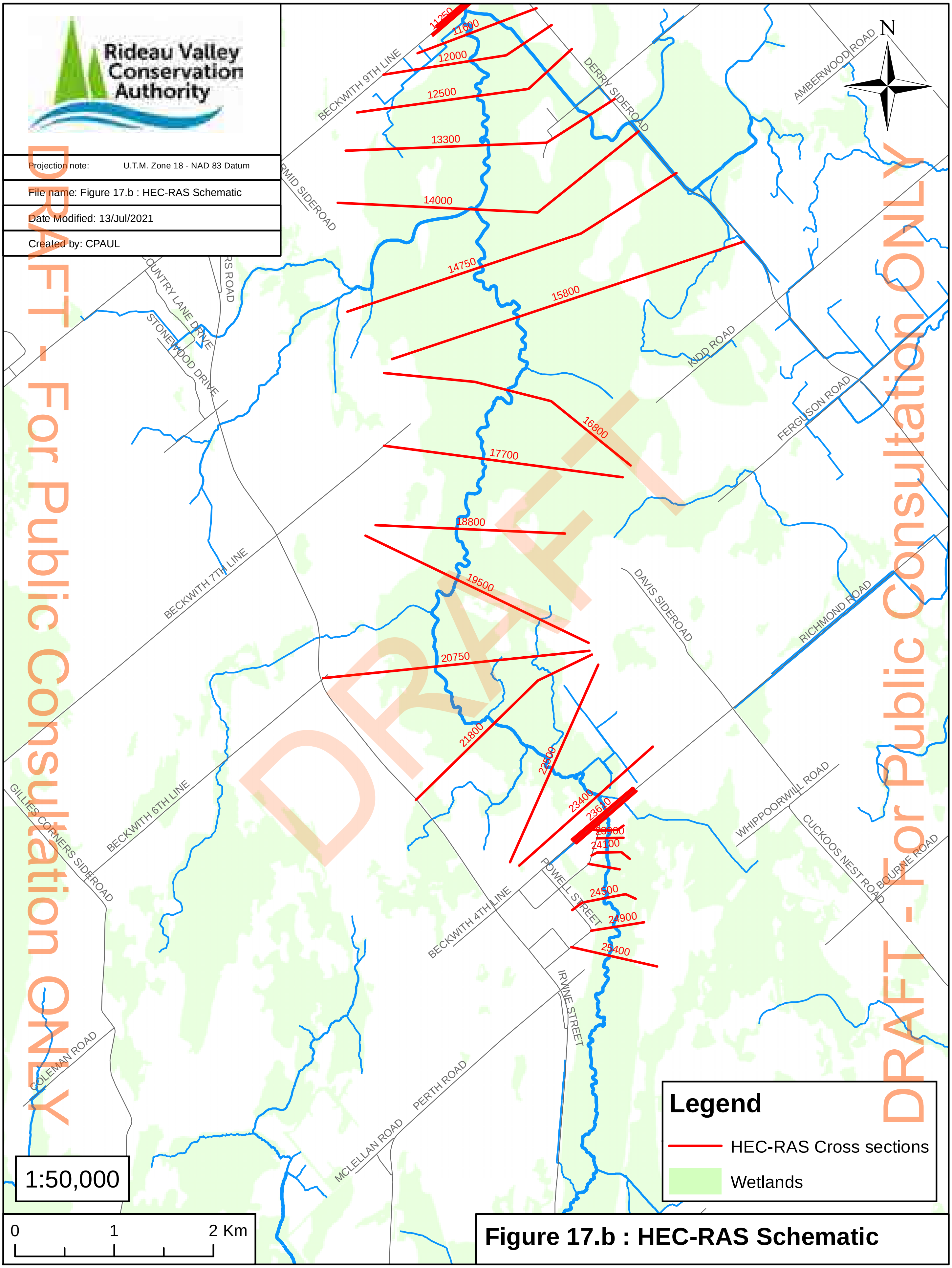
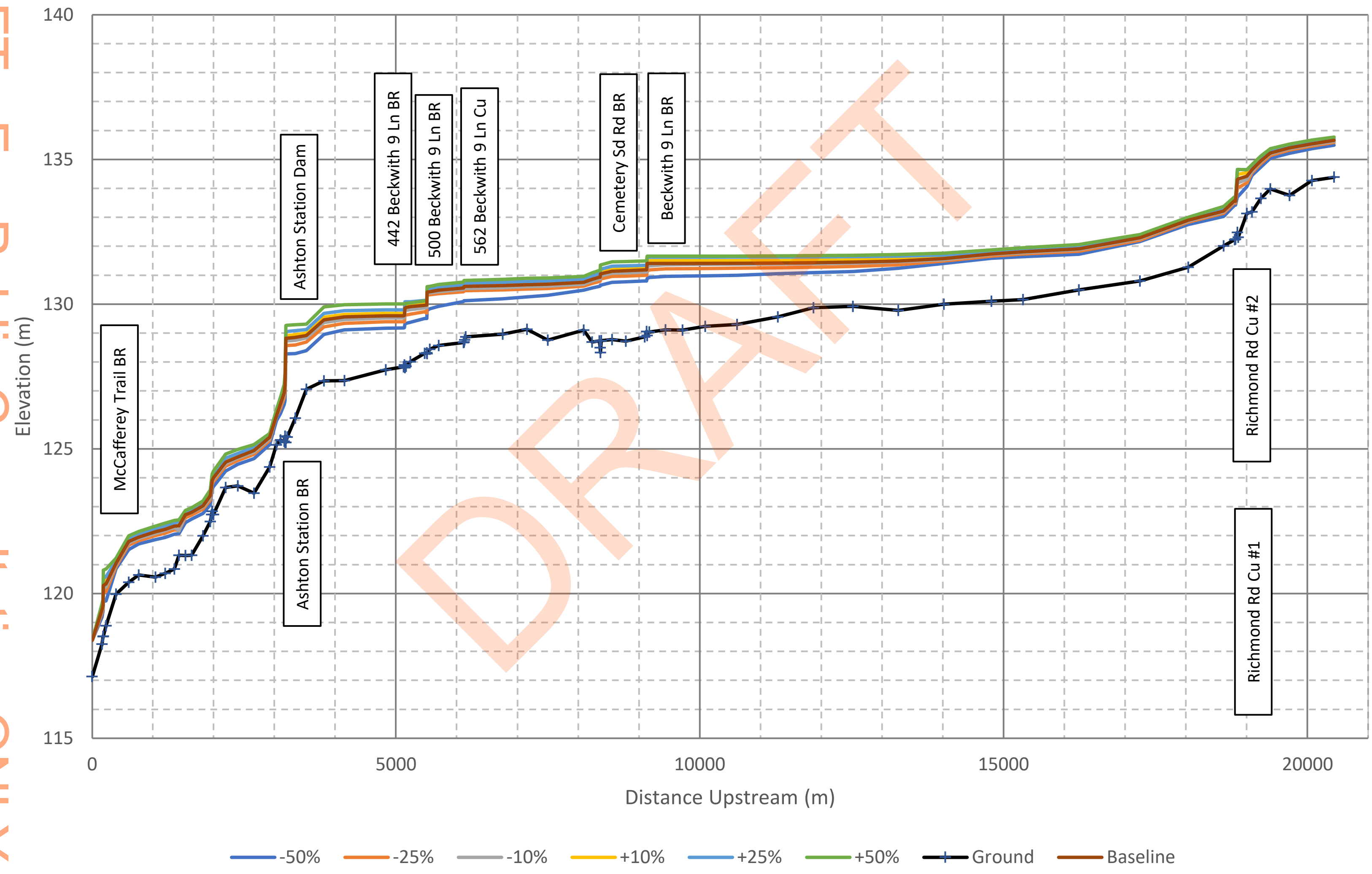


Figure 17.b : HEC-RAS Schematic

Figure 18 Sensitivity analysis of computed water level.



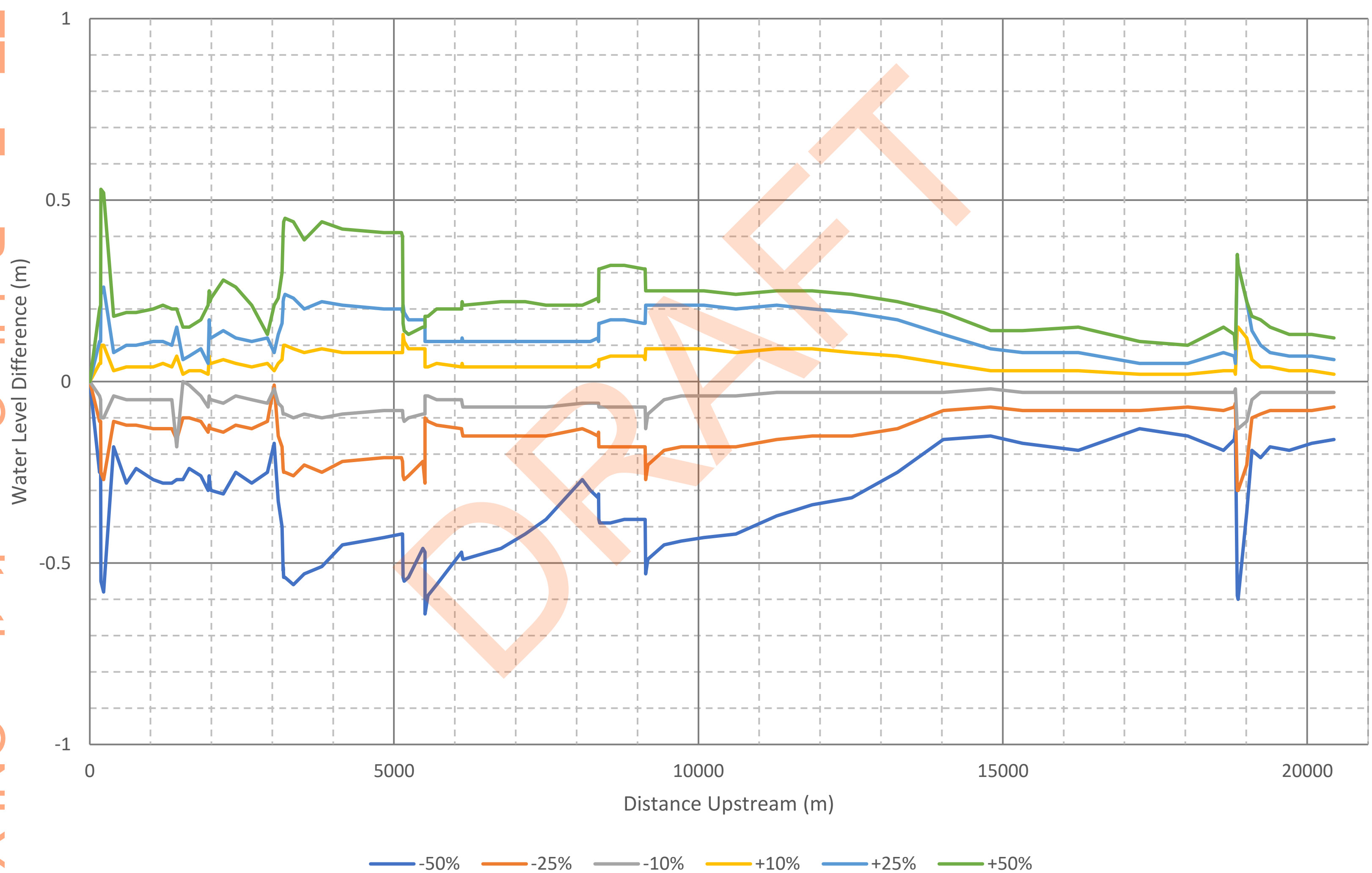


Figure 19 Sensitivity analysis of computed water level.

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Figure 20 Ashton Station Dam

Appendix A

Buildings and Islands in Floodplain – RVCA Policy

Ferdous Ahmed

From: Ewan Hardie
Sent: Wednesday, June 29, 2016 10:35 AM
To: Ferdous Ahmed
Subject: Buildings in the Floodplain Guidelines

Hi Ferdous,
As discussed at recent meetings please consider the following guidelines when undertaking floodplain mapping projects

Effective June 13th 2016, when plotting floodlines RVCA staff will use the following guidelines in order to apply a conservative approach to the delineation of the regulatory floodplain, specifically in areas that have buildings that are in the floodplain or affected by the floodplain:

1. Include any buildings in the floodplain that have any part of the footprint touching the floodplain. This is done to be conservative based on the lack of knowledge on the conditions around the buildings: soil conditions, window wells, walk out doors, building egress are all not known at the time of a floodplain mapping study so it is wise to adopt a conservative approach and include building footprints in the floodplain.
2. With regards to dry islands in and around buildings, islands will be removed if they did not meet the minimum mapping unit acceptable for the data. An envelope of 2 metres around building footprints is to be considered. If the floodplain comes close to or is in this 2m building envelope the entire envelope should be included in the floodplain. This approach is also consistent with the above approach (building footprints) in that the lack of knowledge of the conditions around the building forces the uses of a conservative approach, which is to remove the islands
3. In cases where a building has been included in the floodplain (because of the above criteria), the adjacent building will need to be included in the floodplain as well because of a lack of data in between the buildings and/or the 2m building envelope rule.
4. In the case of townhome or connected type buildings and the floodplain touching the foundations, the building footprint should be included up to the next visible unit partition where the elevation changes

Thanks

Ewan Hardie

Director
Watershed Science and Engineering Services
Rideau Valley Conservation Authority
ewan.hardie@rvca.ca
Tel: 613 692-3571 ext 1130
Fax: 613 692-0334

Rideau Valley Conservation Authority
3889 Rideau Valley Drive, Manotick, ON
K4M 1A5
www.rvca.ca

Ferdous Ahmed

From: Ewan Hardie
Sent: Thursday, July 6, 2017 5:12 PM
To: Ferdous Ahmed
Cc: Brian Stratton
Subject: Floodplain delineation guidance

Good Afternoon Ferdous,

As discussed here is the documentation of the guidance that was given to RVCA staff when it comes to plotting floodlines using LiDAR data for this most recent project.

Guidance:

When delineating the regulatory flood water levels, RVCA staff will follow a precautionary principle to include island areas in the floodplain that are up to 1000 square metres.

Ewan Hardie

Director
Watershed Science and Engineering Services
Rideau Valley Conservation Authority
ewan.hardie@rvca.ca
Tel: 613 692-3571 ext 1130
Fax: 613 692-0334

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3889 Rideau Valley Drive, Manotick, ON
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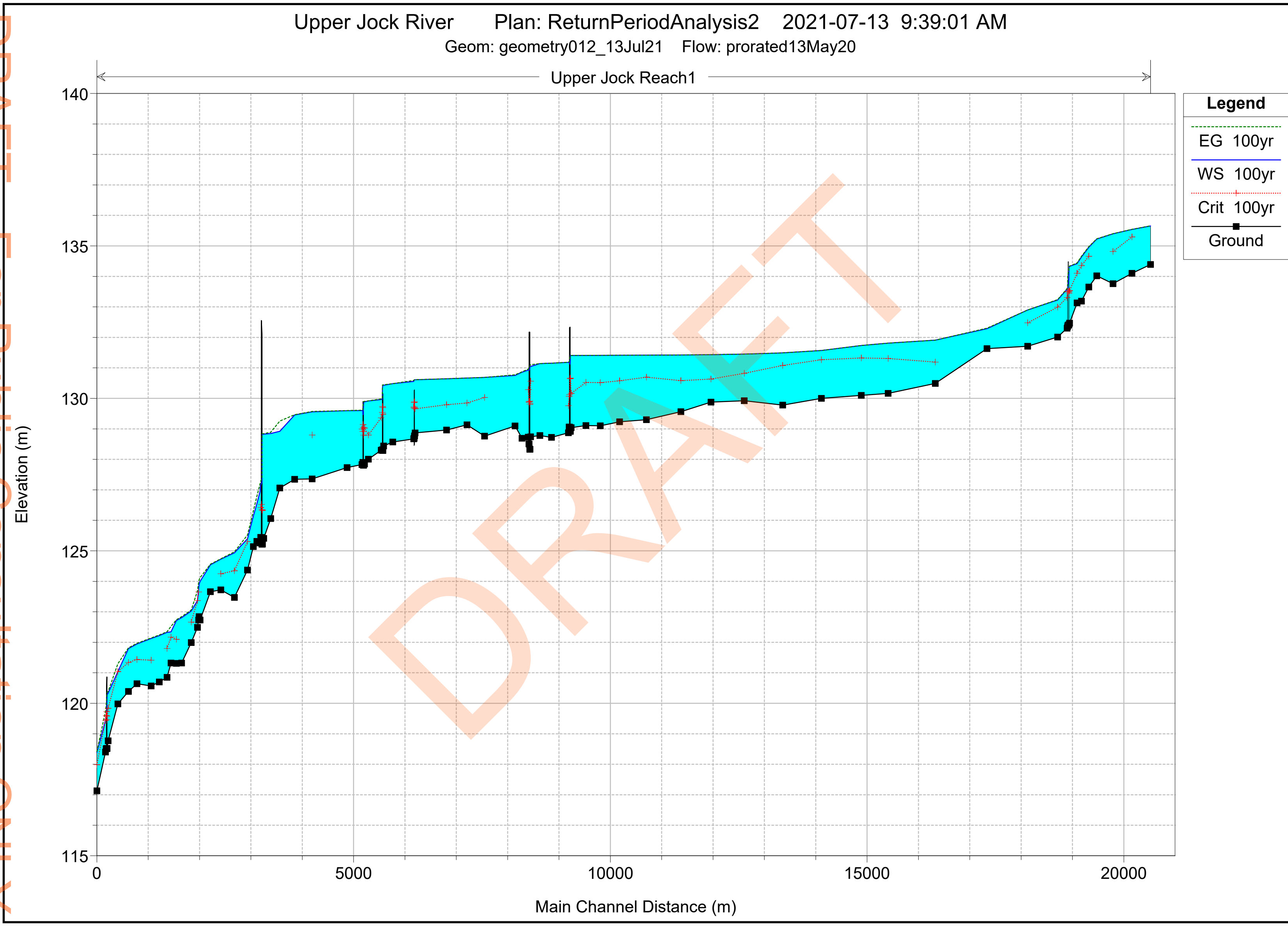
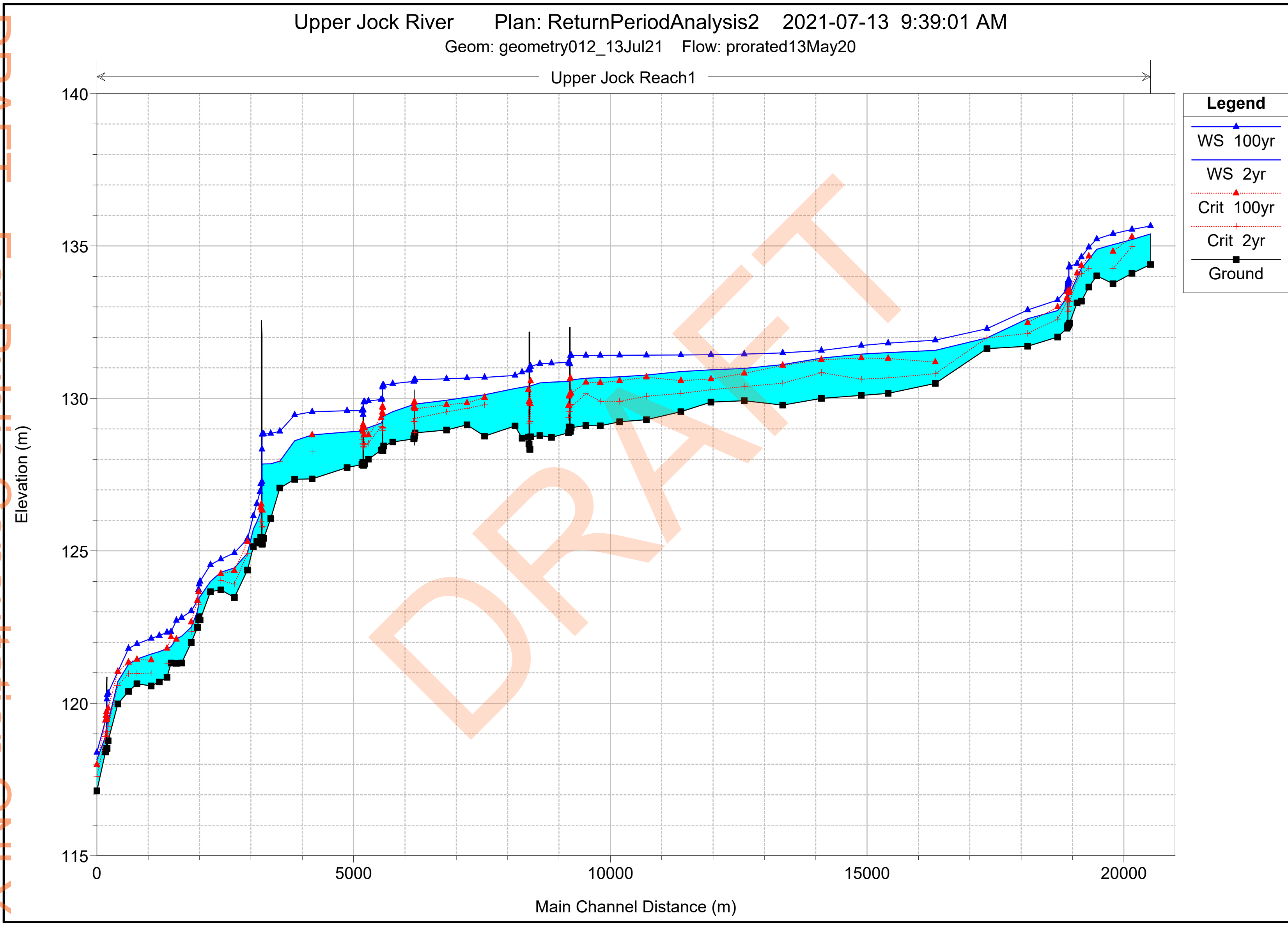
Appendix B

HEC-RAS Profiles and Cross-Sections



Upper Jock River Plan: ReturnPeriodAnalysis2 2021-07-13 9:39:01 AM
Geom: geometry012_13Jul21 Flow: prorated13May20
Upper Jock Reach1
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Elevation (m)
Main Channel Distance (m)
140
135
130
125
120
115
0
5000
10000
15000
20000
DRAFT



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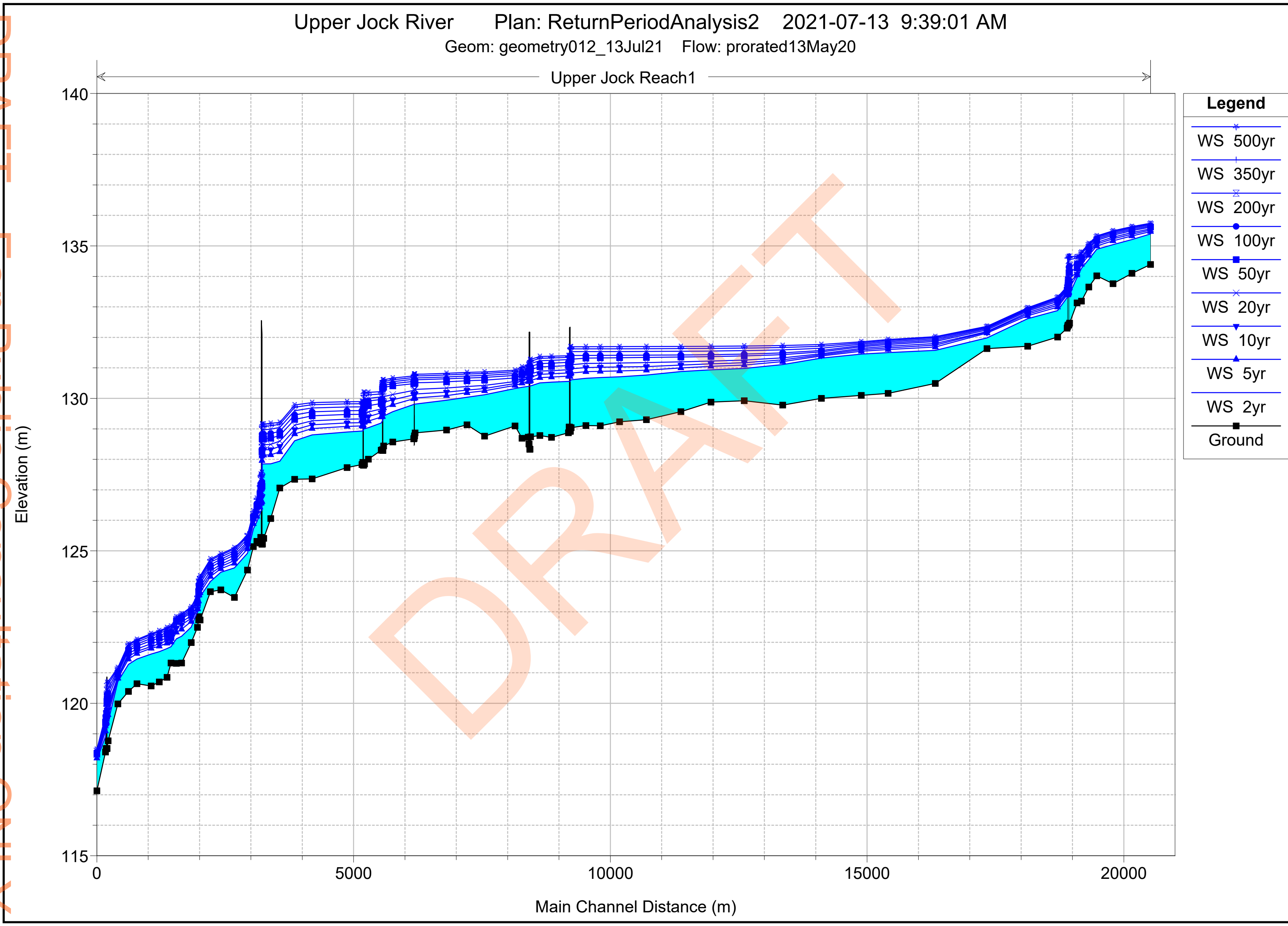
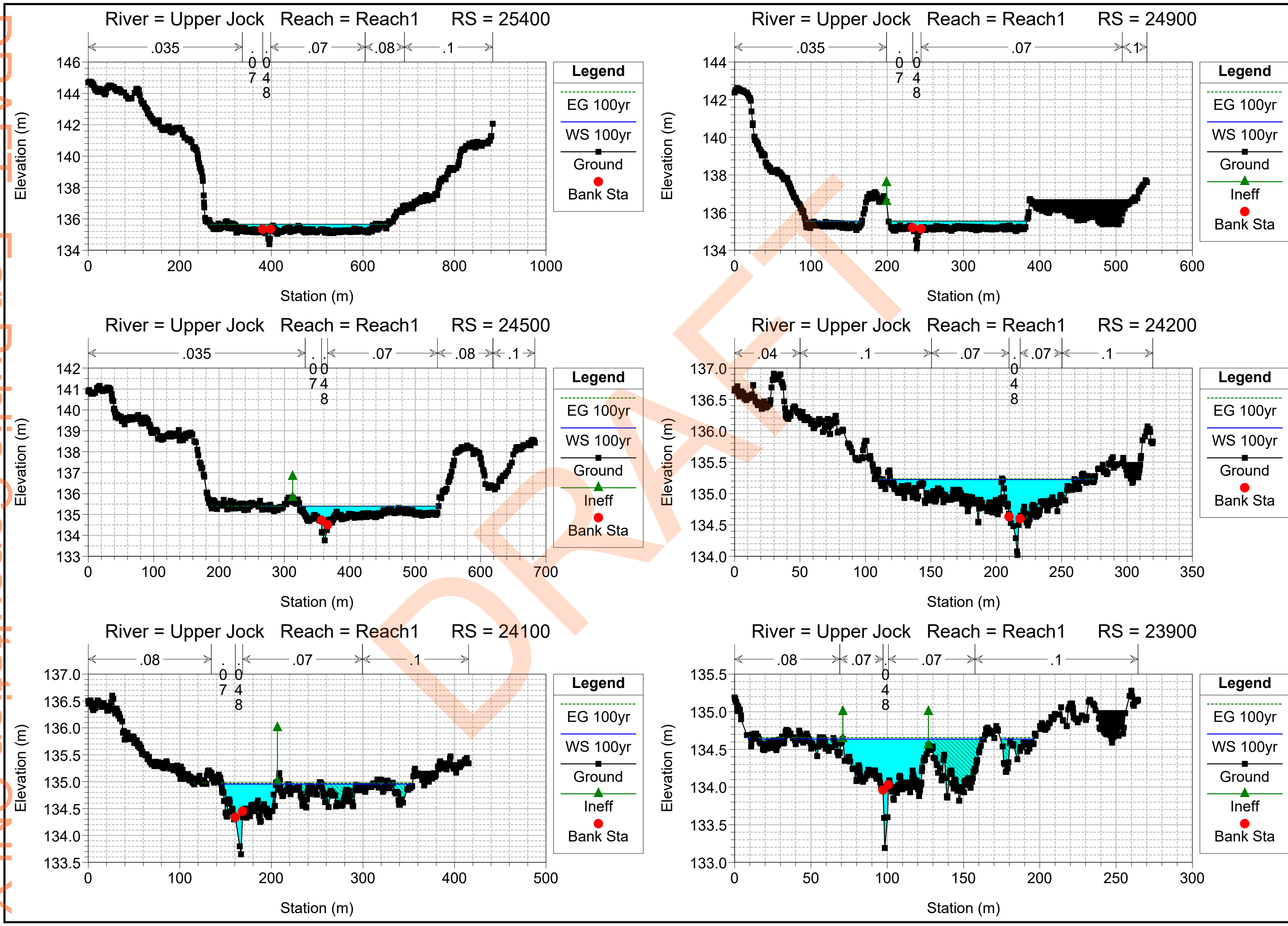
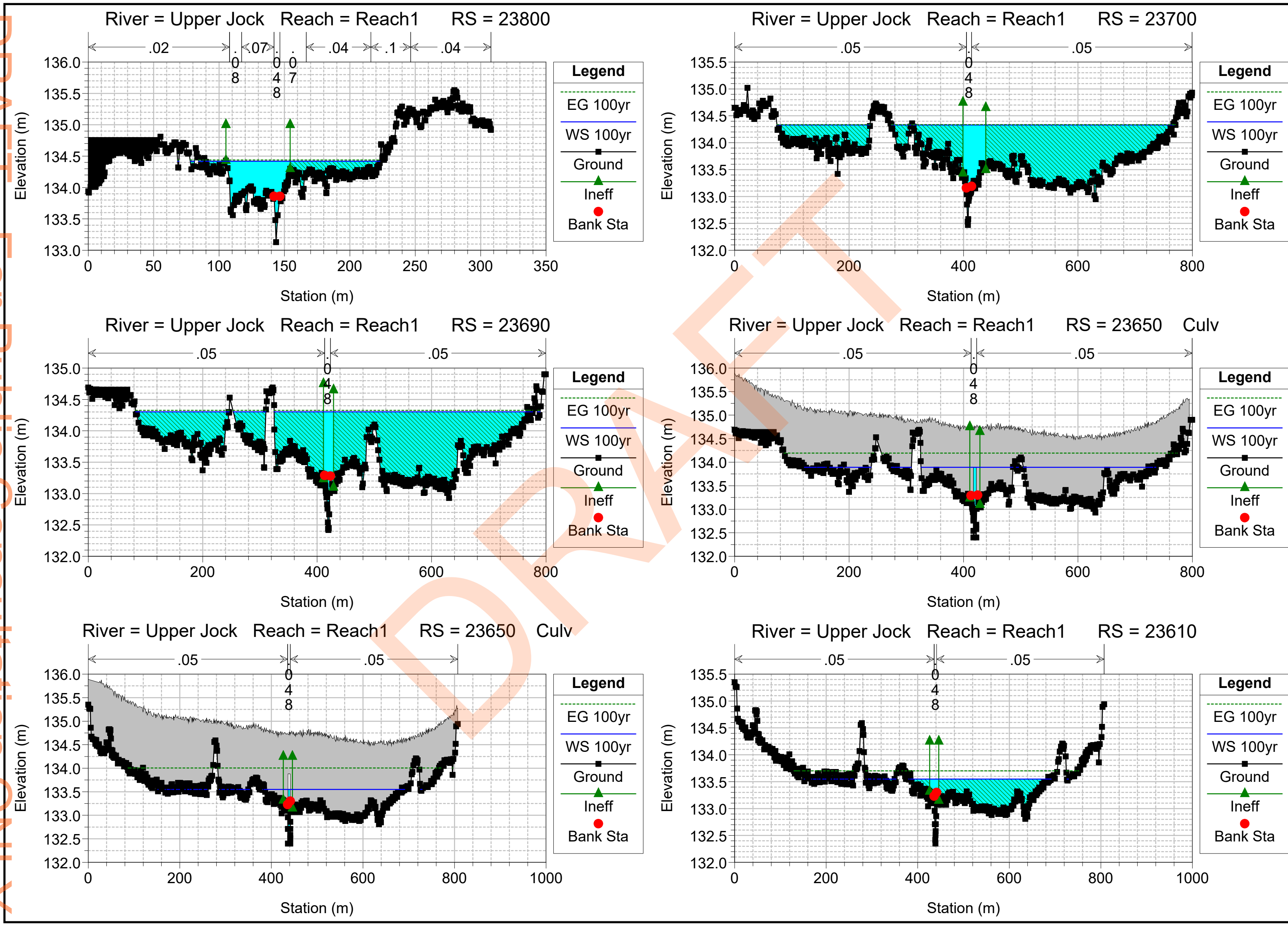


Upper Jock River Plan: ReturnPeriodAnalysis2 2021-07-13 9:39:01 AM
Geom: geometry012_13Jul21 Flow: prorated13May20
Upper Jock Reach1
Legend
WS 500yr
WS 350yr
WS 200yr
WS 100yr
WS 50yr
WS 20yr
WS 10yr
WS 5yr
WS 2yr
Ground
Elevation (m)
140
135
130
125
120
115
0
5000
10000
15000
20000
Main Channel Distance (m)
DRAFT


River = Upper Jock Reach = Reach1 RS = 25400
.035 .07 .08 .1
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Bank Sta
River = Upper Jock Reach = Reach1 RS = 24900
.035 .07 .1
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
River = Upper Jock Reach = Reach1 RS = 24500
.035 .07 .08 .1
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
River = Upper Jock Reach = Reach1 RS = 24200
.04 .1 .07 .07 .1
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Bank Sta
River = Upper Jock Reach = Reach1 RS = 24100
.08 .07 .1
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
River = Upper Jock Reach = Reach1 RS = 23900
.08 .07 .07 .1
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta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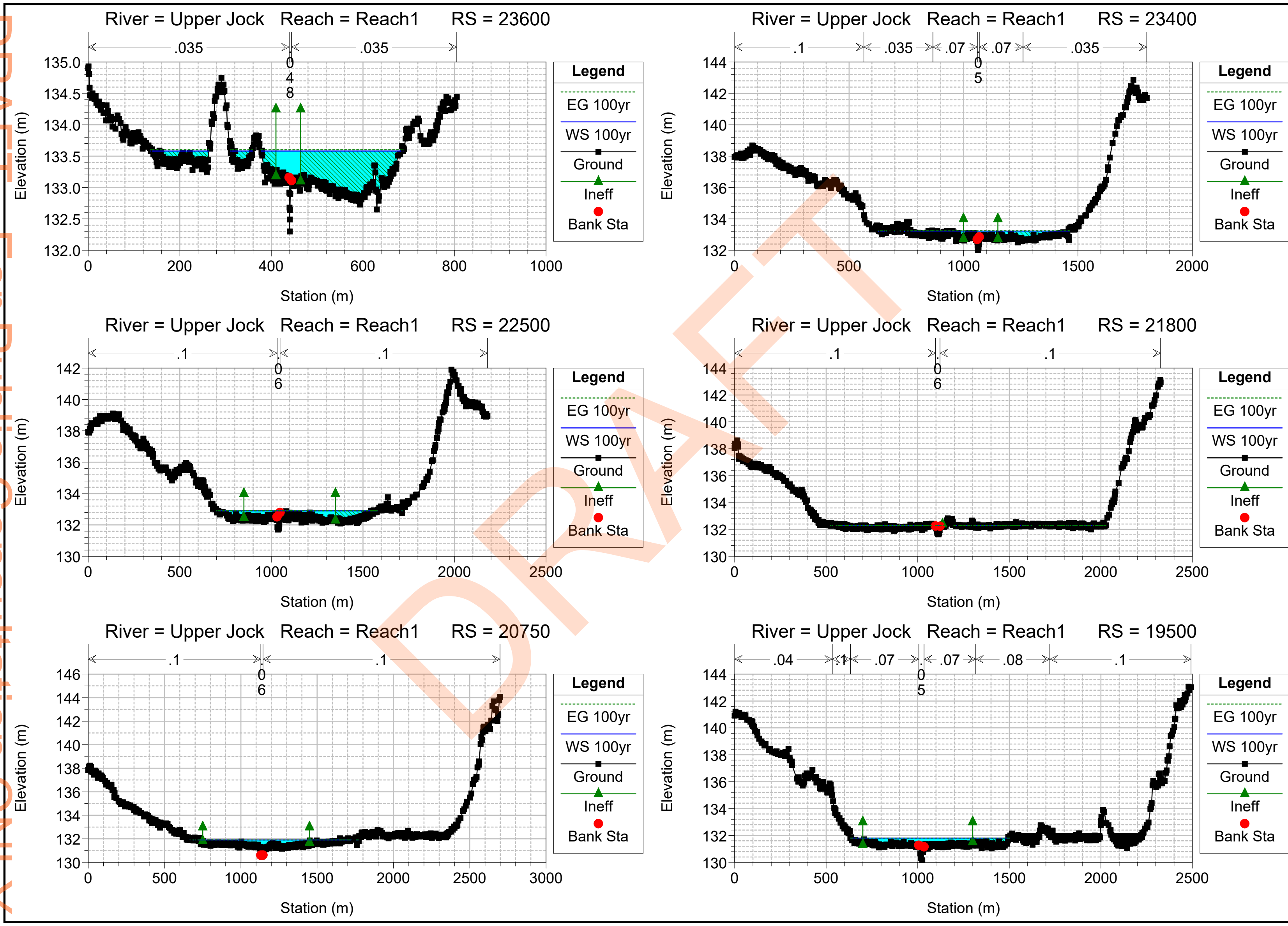
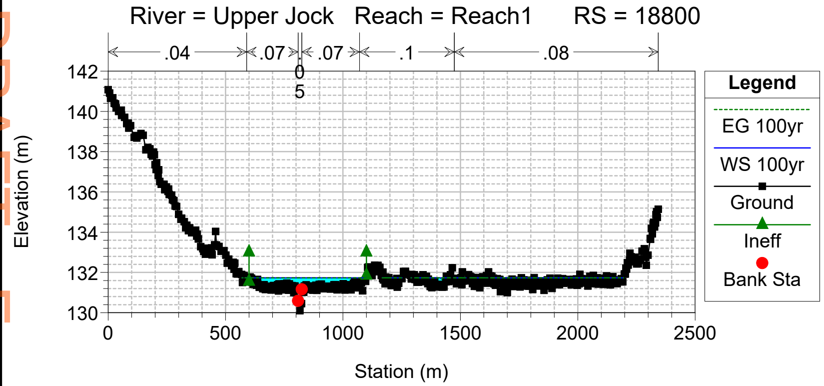
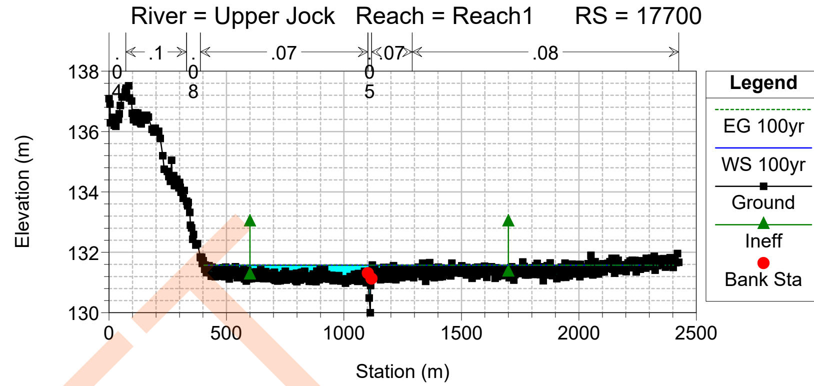
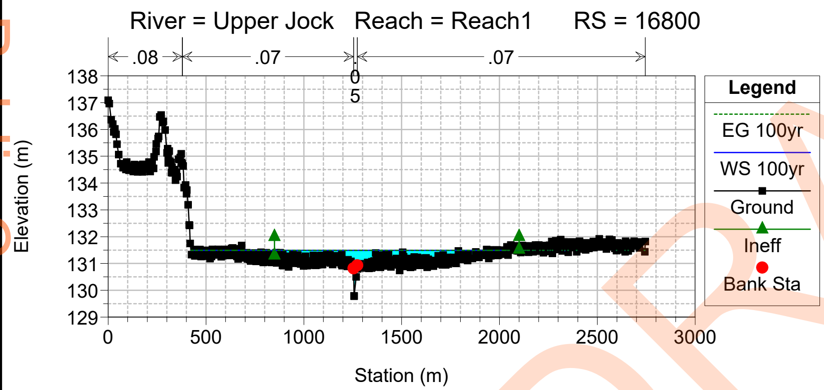
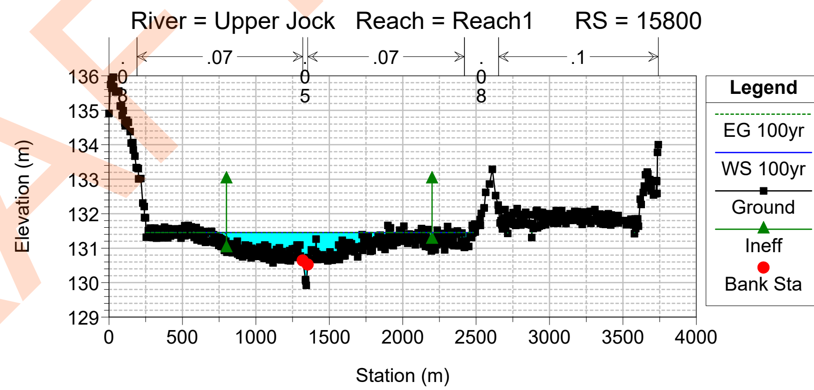
River = Upper Jock Reach = Reach1 RS = 23700
River = Upper Jock Reach = Reach1 RS = 23690
River = Upper Jock Reach = Reach1 RS = 23650 Culv
River = Upper Jock Reach = Reach1 RS = 23650 Culv
River = Upper Jock Reach = Reach1 RS = 23610
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta

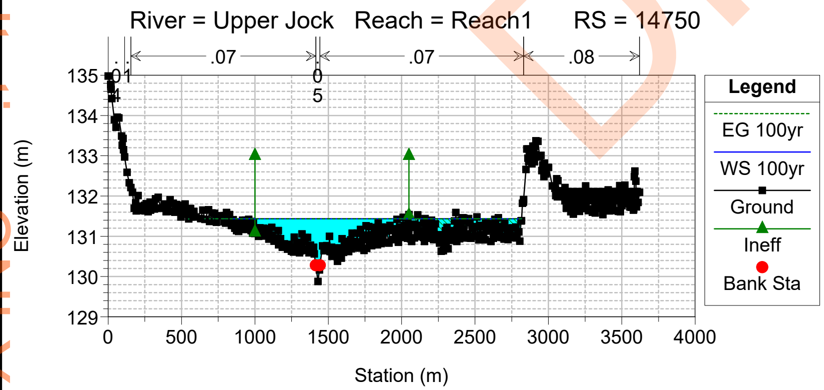

River = Upper Jock Reach = Reach1 RS = 23600
.035
.035
048
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
River = Upper Jock Reach = Reach1 RS = 23400
.1
.035
.07
.07
.035
05
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
River = Upper Jock Reach = Reach1 RS = 22500
.1
.1
06
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
River = Upper Jock Reach = Reach1 RS = 21800
.1
.1
06
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
River = Upper Jock Reach = Reach1 RS = 20750
.1
.1
06
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
River = Upper Jock Reach = Reach1 RS = 19500
.04
.1
.07
.07
.08
.1
05
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta

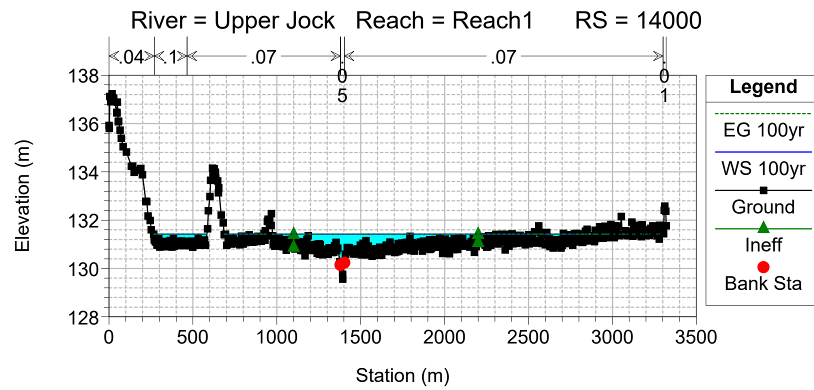

River = Upper Jock Reach = Reach1 RS = 18800
.04
.07
.07
.1
.08
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta

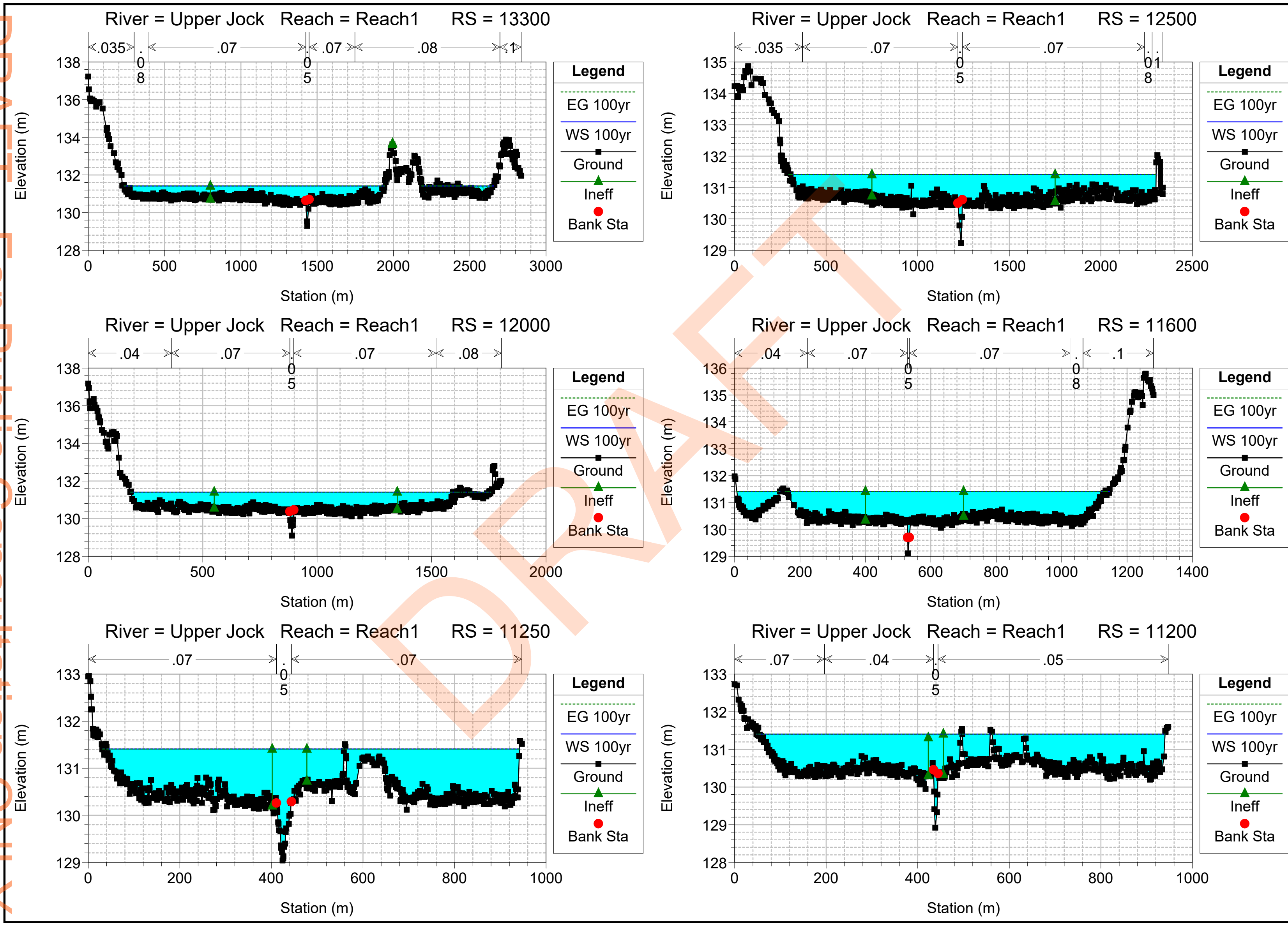

River = Upper Jock Reach = Reach1 RS = 17700
.1
.07
.07
.08
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta

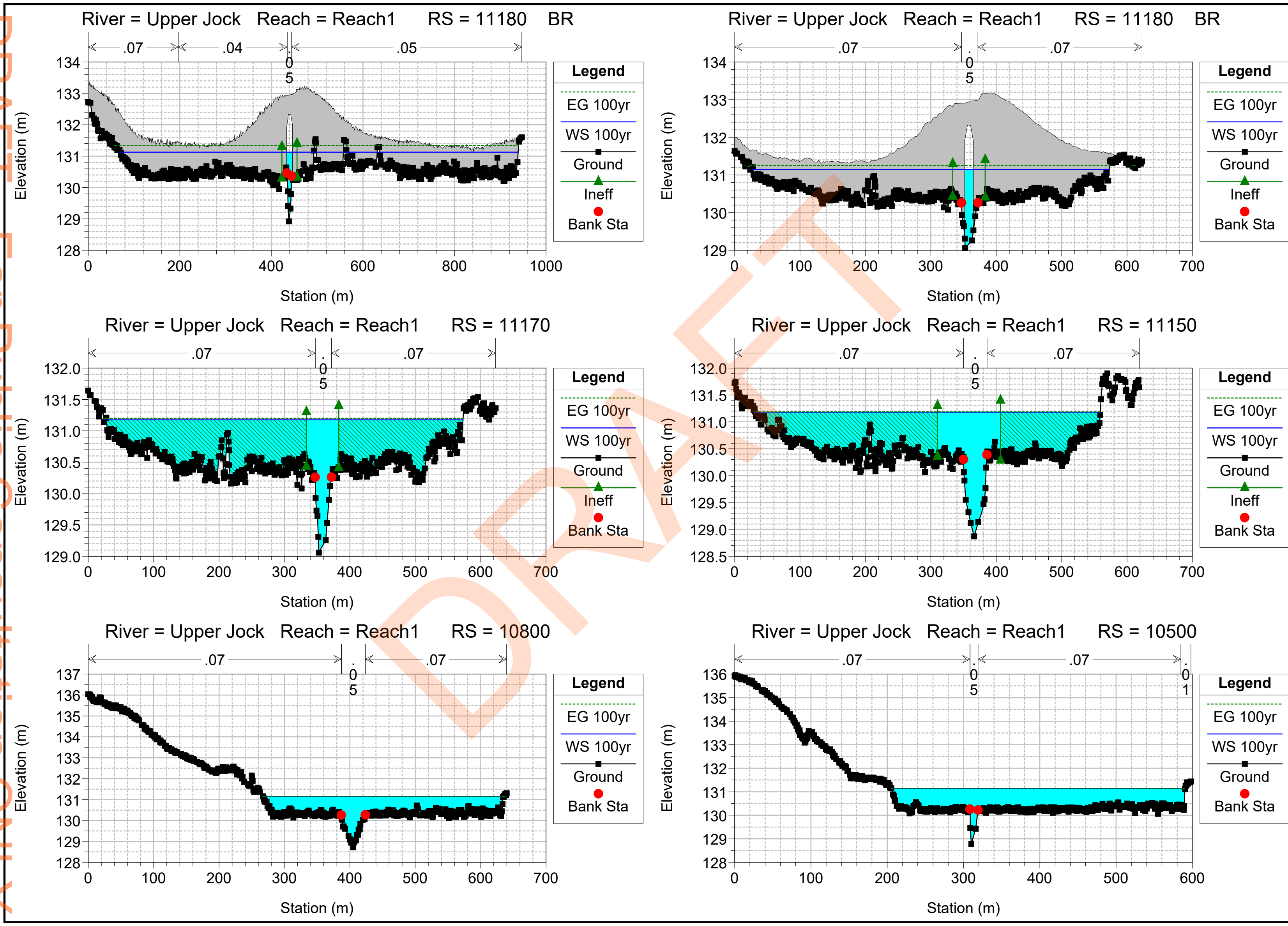

River = Upper Jock Reach = Reach1 RS = 16800
.08
.07
.07
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta

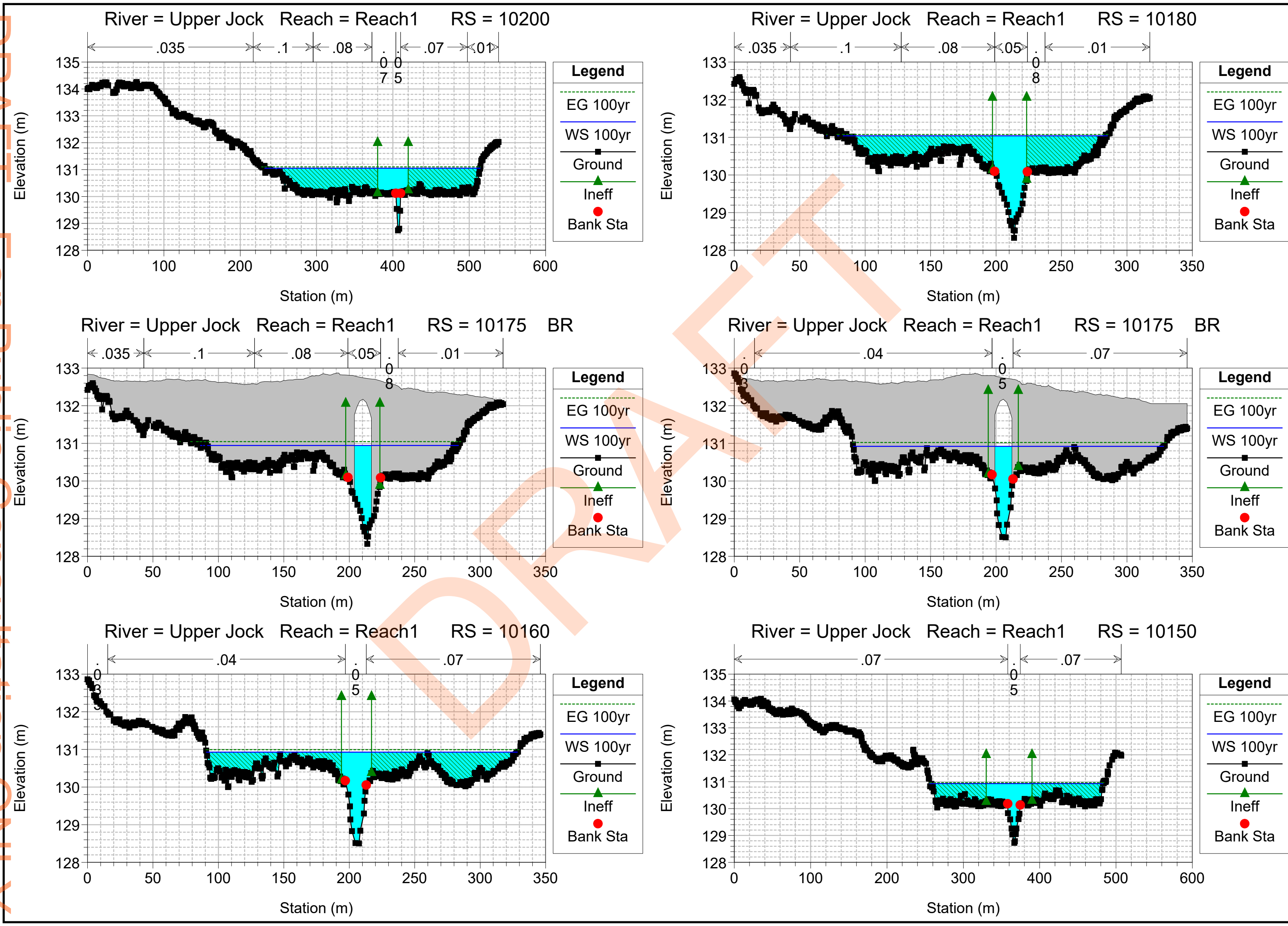

River = Upper Jock Reach = Reach1 RS = 15800
.07
.07
.1
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta

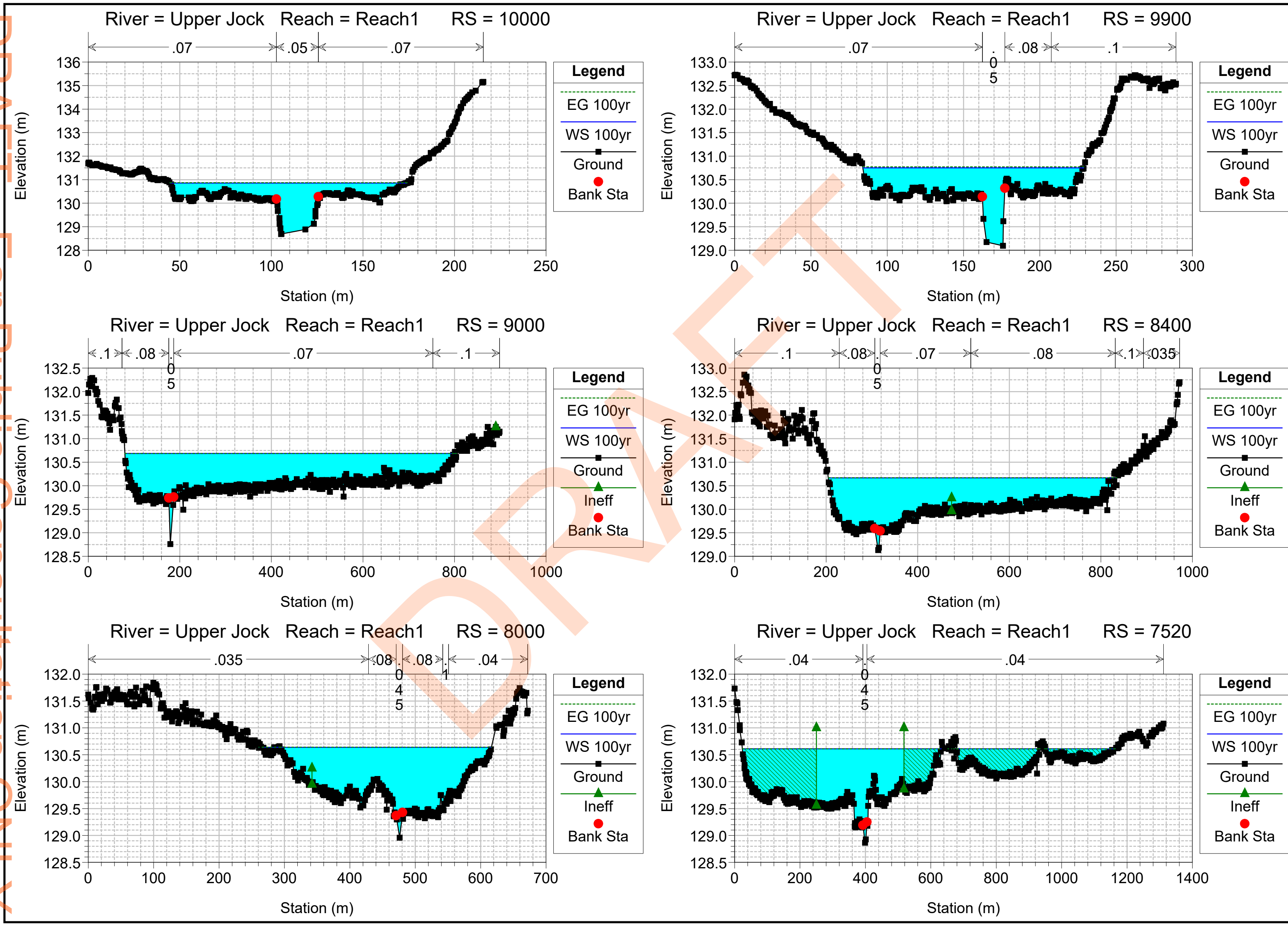

River = Upper Jock Reach = Reach1 RS = 14750
.07
.07
.08
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta

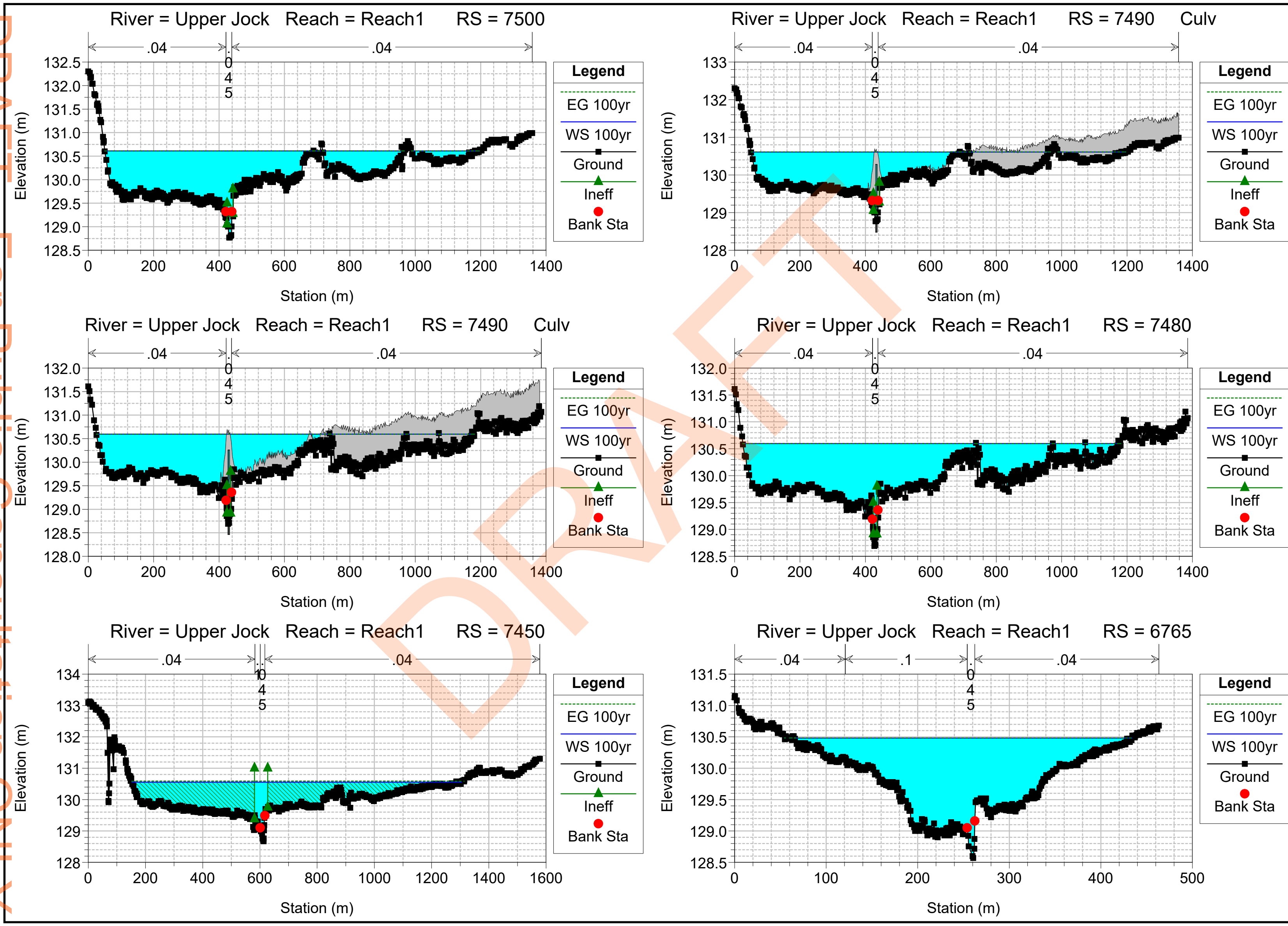

River = Upper Jock Reach = Reach1 RS = 14000
.04
.1
.07
.07
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta


River = Upper Jock Reach = Reach1 RS = 13300
River = Upper Jock Reach = Reach1 RS = 12500
River = Upper Jock Reach = Reach1 RS = 12000
River = Upper Jock Reach = Reach1 RS = 11600
River = Upper Jock Reach = Reach1 RS = 11250
River = Upper Jock Reach = Reach1 RS = 11200
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta


River = Upper Jock Reach = Reach1 RS = 11180 BR
River = Upper Jock Reach = Reach1 RS = 11180 BR
River = Upper Jock Reach = Reach1 RS = 11170
River = Upper Jock Reach = Reach1 RS = 11150
River = Upper Jock Reach = Reach1 RS = 10800
River = Upper Jock Reach = Reach1 RS = 10500
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)


River = Upper Jock Reach = Reach1 RS = 10200
.035 .1 .08 .07 .05 .07 .01
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
River = Upper Jock Reach = Reach1 RS = 10180
.035 .1 .08 .05 .08 .01
River = Upper Jock Reach = Reach1 RS = 10175 BR
.035 .1 .08 .05 .08 .01
River = Upper Jock Reach = Reach1 RS = 10175 BR
.03 .04 .05 .07
River = Upper Jock Reach = Reach1 RS = 10160
.03 .04 .05 .07
River = Upper Jock Reach = Reach1 RS = 10150
.07 .05 .07


River = Upper Jock Reach = Reach1 RS = 10000
River = Upper Jock Reach = Reach1 RS = 9900
River = Upper Jock Reach = Reach1 RS = 9000
River = Upper Jock Reach = Reach1 RS = 8400
River = Upper Jock Reach = Reach1 RS = 8000
River = Upper Jock Reach = Reach1 RS = 7520
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta



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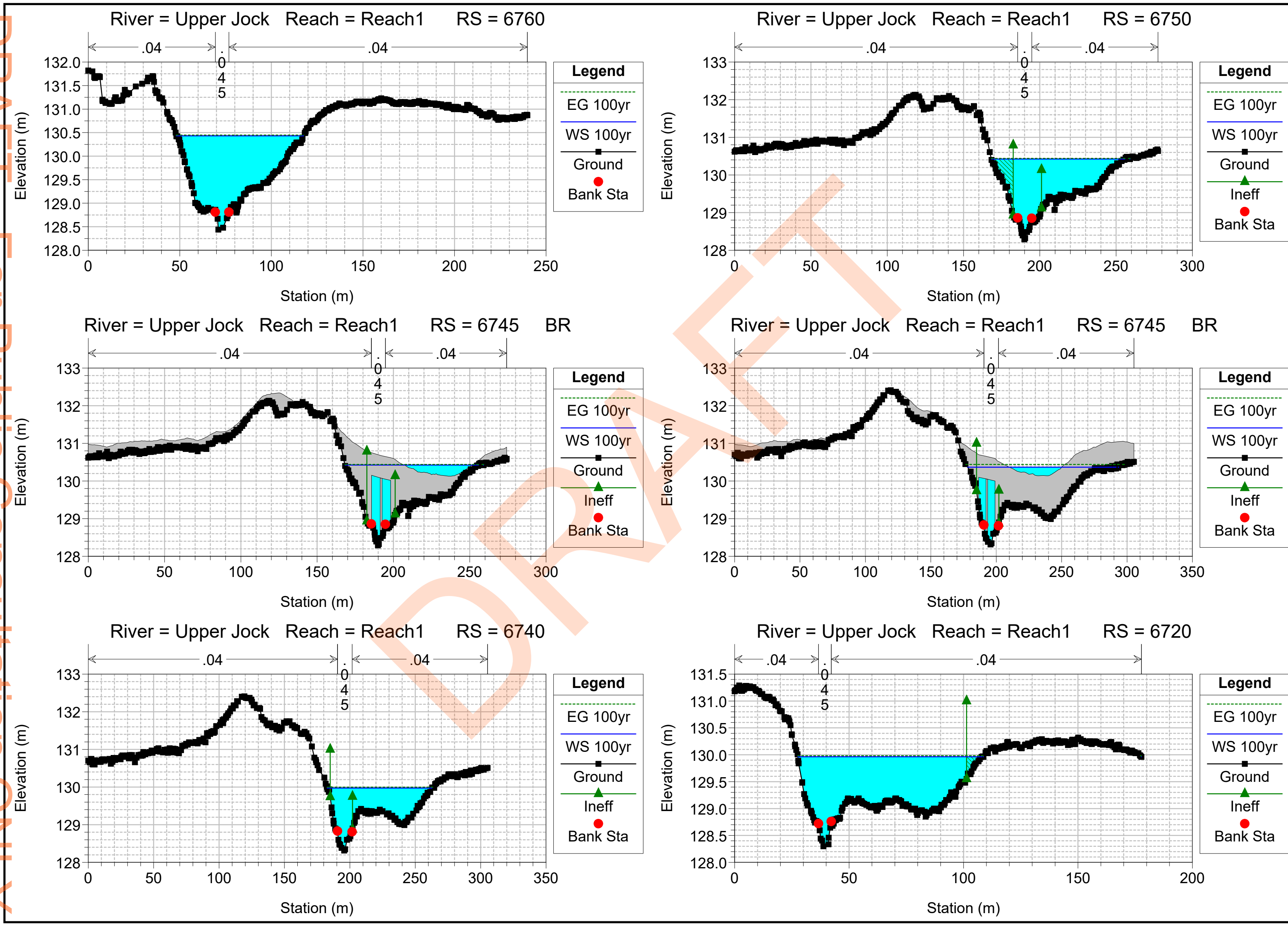
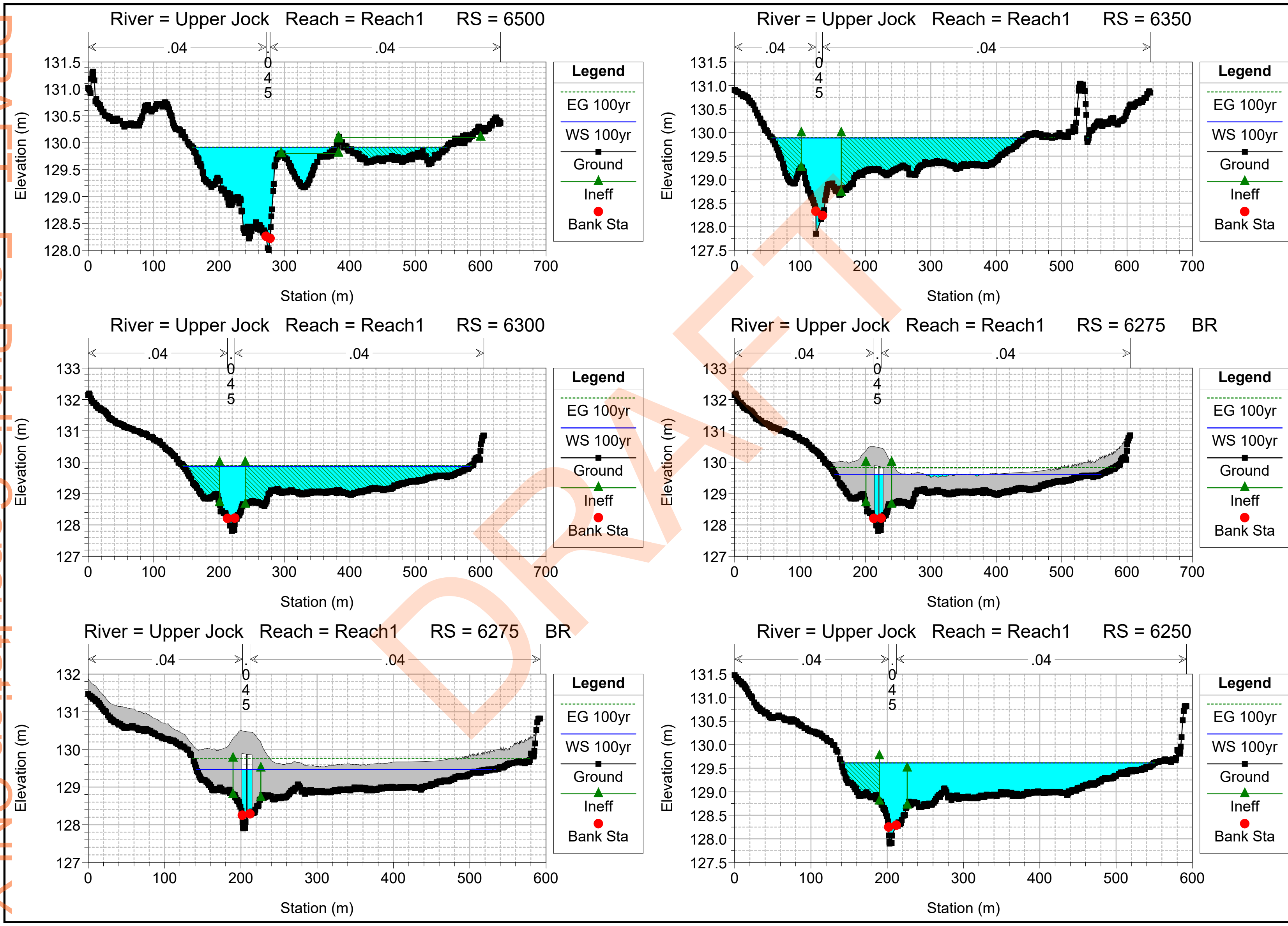

River = Upper Jock Reach = Reach1 RS = 6760
Legend
EG 100yr
WS 100yr
Ground
Bank Sta
Elevation (m)
Station (m)
River = Upper Jock Reach = Reach1 RS = 6750
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
River = Upper Jock Reach = Reach1 RS = 6745 BR
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
River = Upper Jock Reach = Reach1 RS = 6745 BR
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
River = Upper Jock Reach = Reach1 RS = 6740
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
River = Upper Jock Reach = Reach1 RS = 6720
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)



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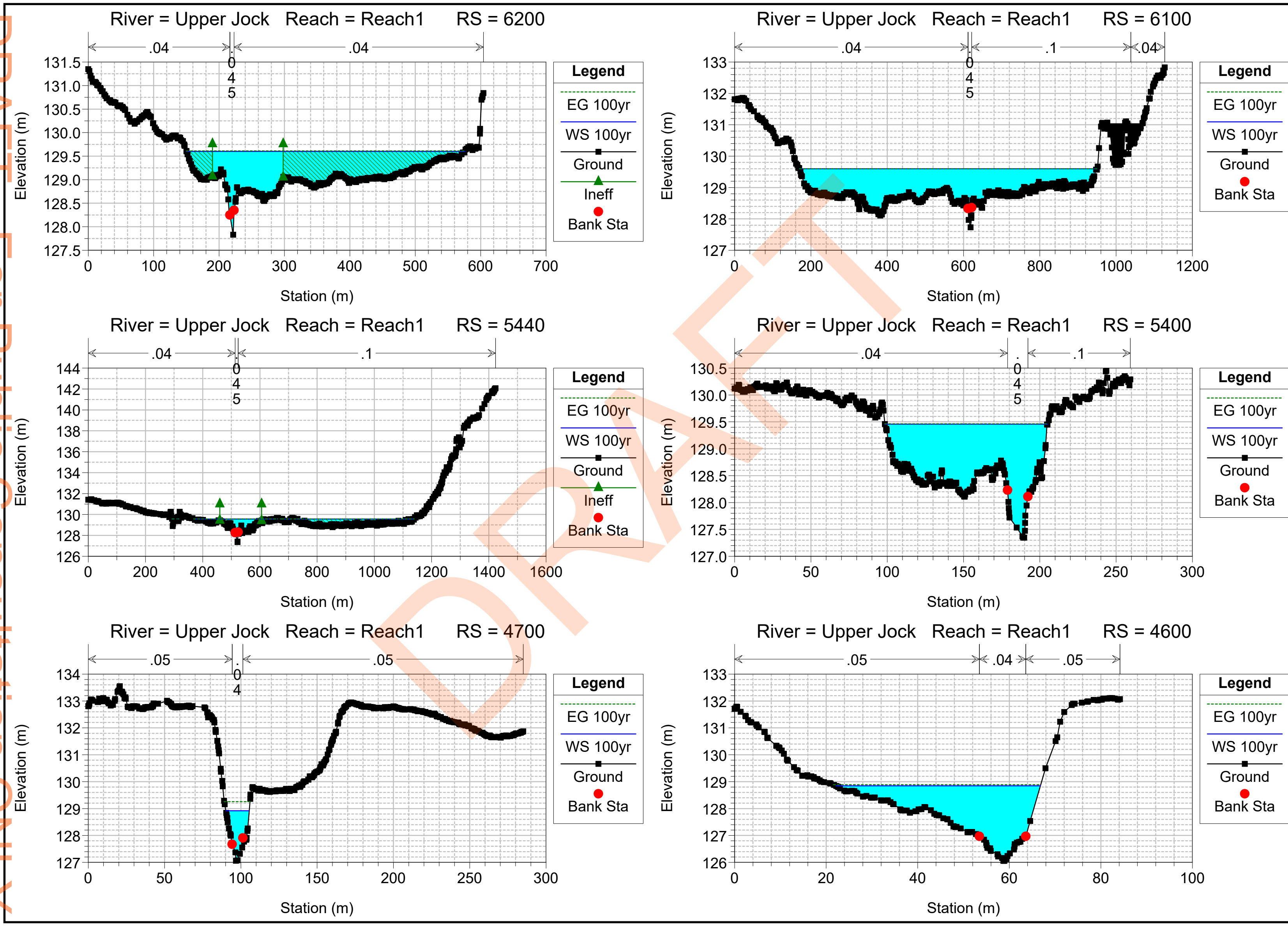
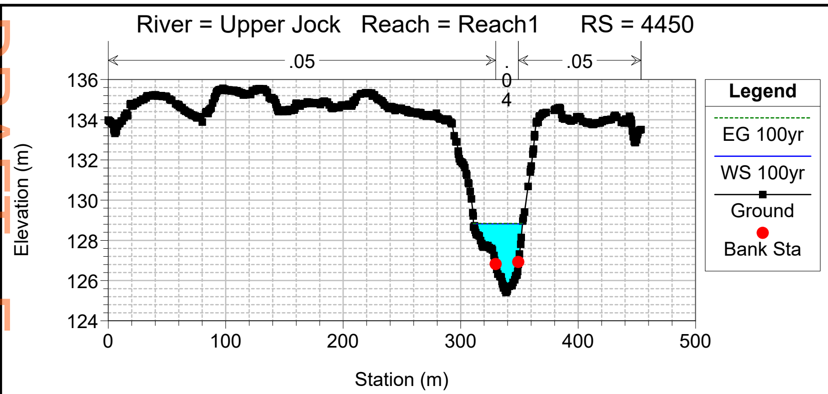
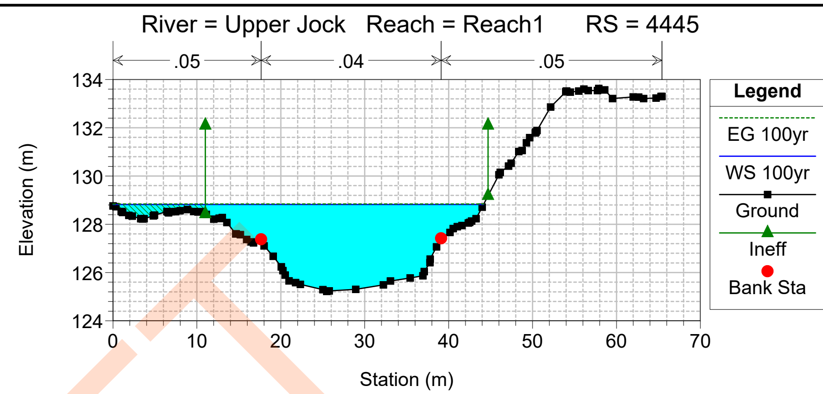
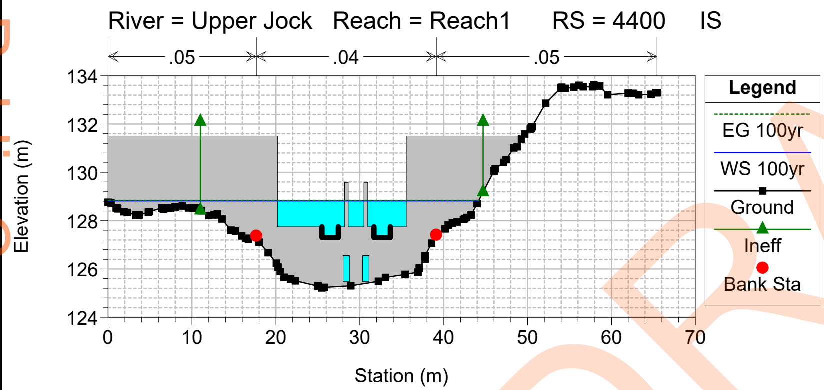
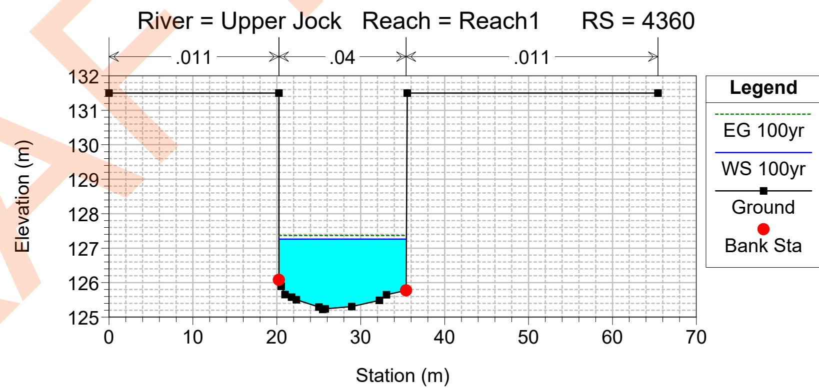
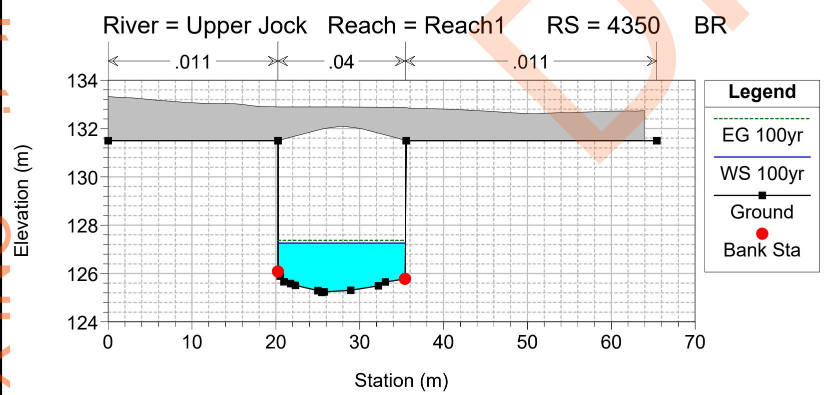

River = Upper Jock Reach = Reach1 RS = 6200
.04
.04
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
River = Upper Jock Reach = Reach1 RS = 6100
.04
.1
.04
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Bank Sta
River = Upper Jock Reach = Reach1 RS = 5440
.04
.1
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
River = Upper Jock Reach = Reach1 RS = 5400
.04
.1
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Bank Sta
River = Upper Jock Reach = Reach1 RS = 4700
.05
.05
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Bank Sta
River = Upper Jock Reach = Reach1 RS = 4600
.05
.04
.05
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Bank Sta

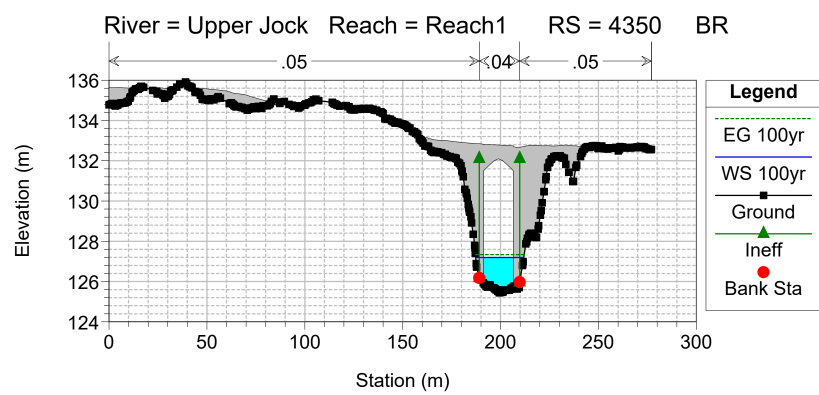

River = Upper Jock Reach = Reach1 RS = 4450
.05
.04
.05
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Bank Sta

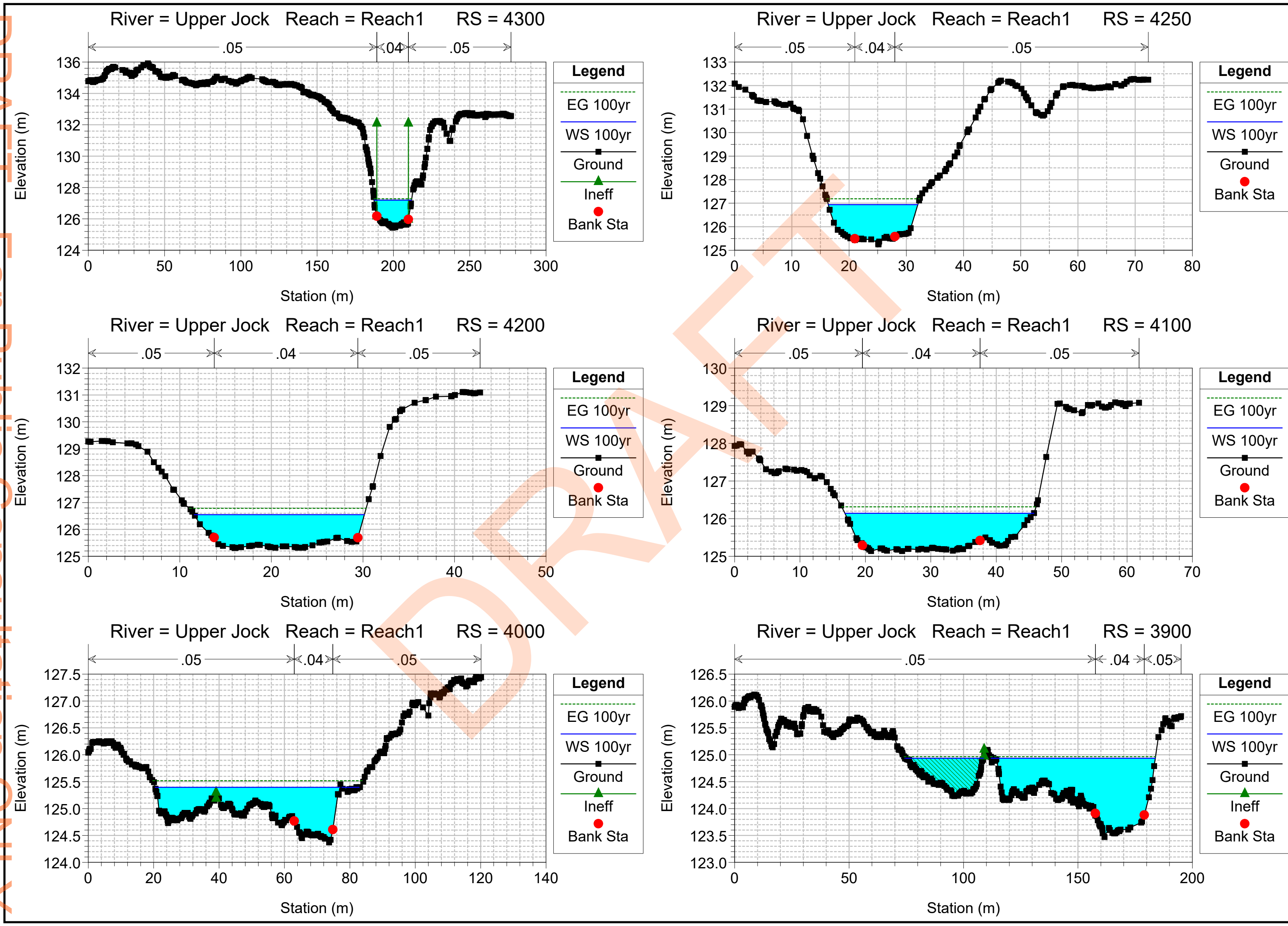

River = Upper Jock Reach = Reach1 RS = 4445
.05
.04
.05
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta


River = Upper Jock Reach = Reach1 RS = 4400 IS
.05
.04
.05
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta

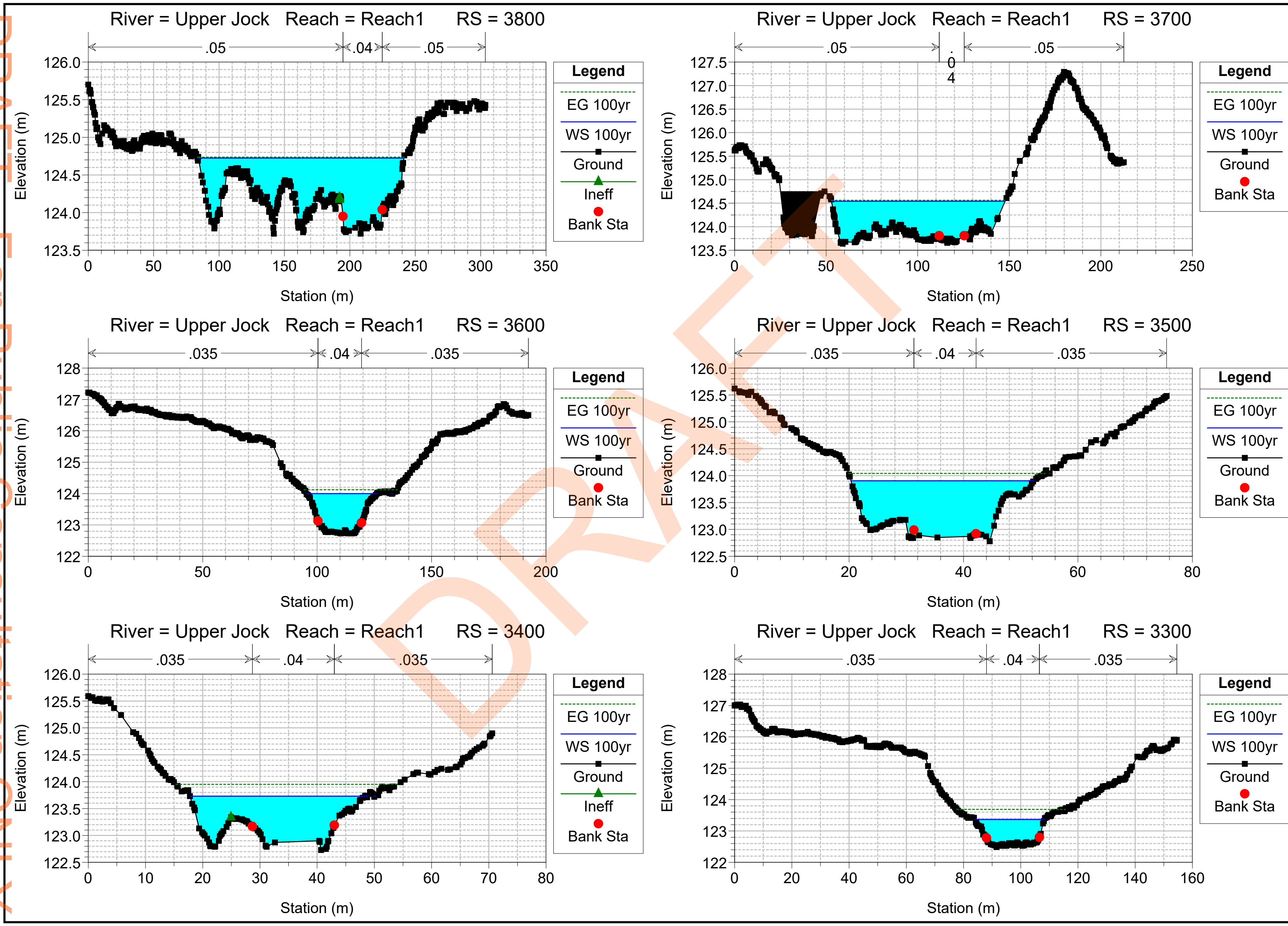

River = Upper Jock Reach = Reach1 RS = 4360
.011
.04
.011
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Bank Sta

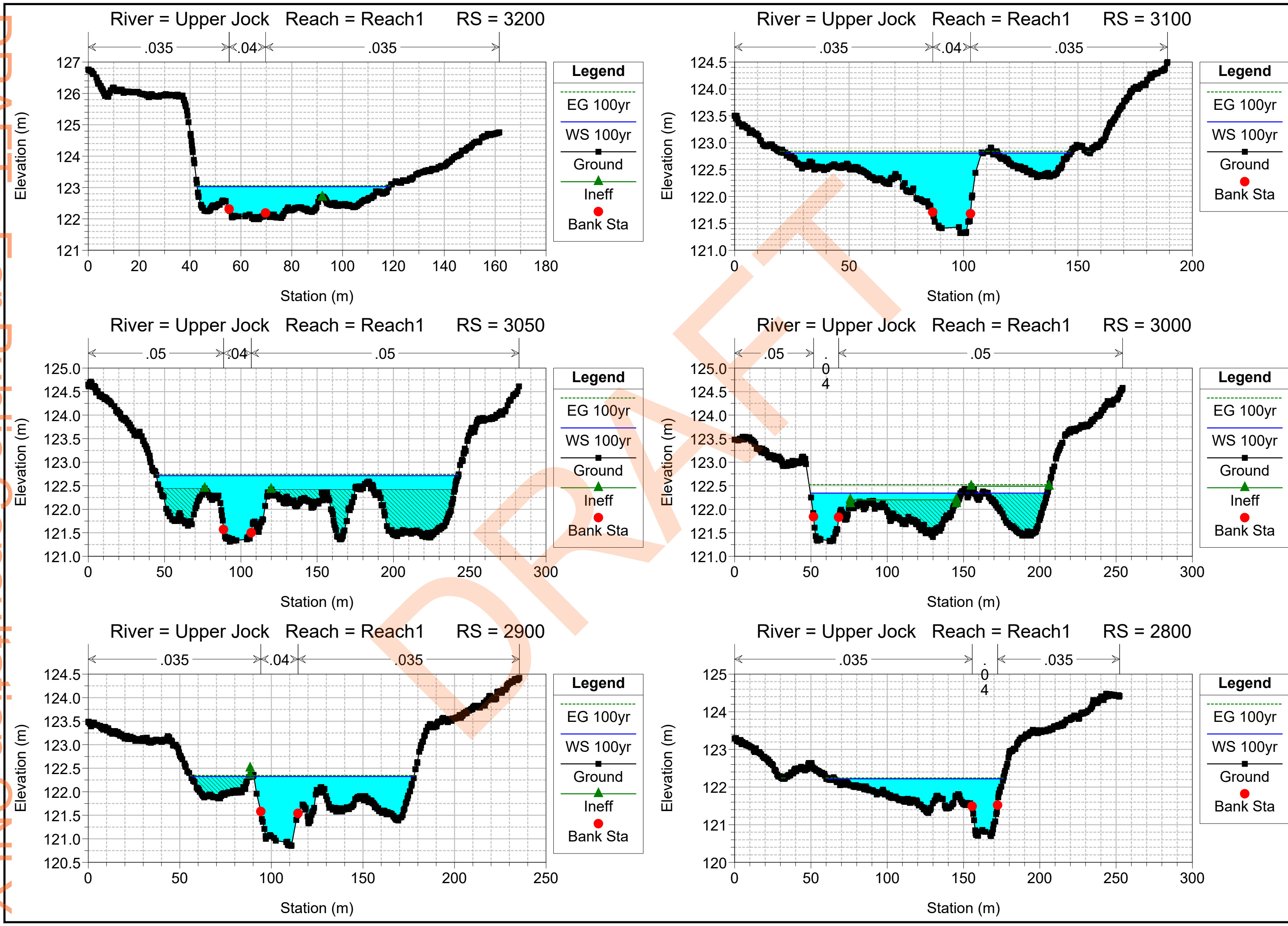

River = Upper Jock Reach = Reach1 RS = 4350 BR
.011
.04
.011
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Bank Sta

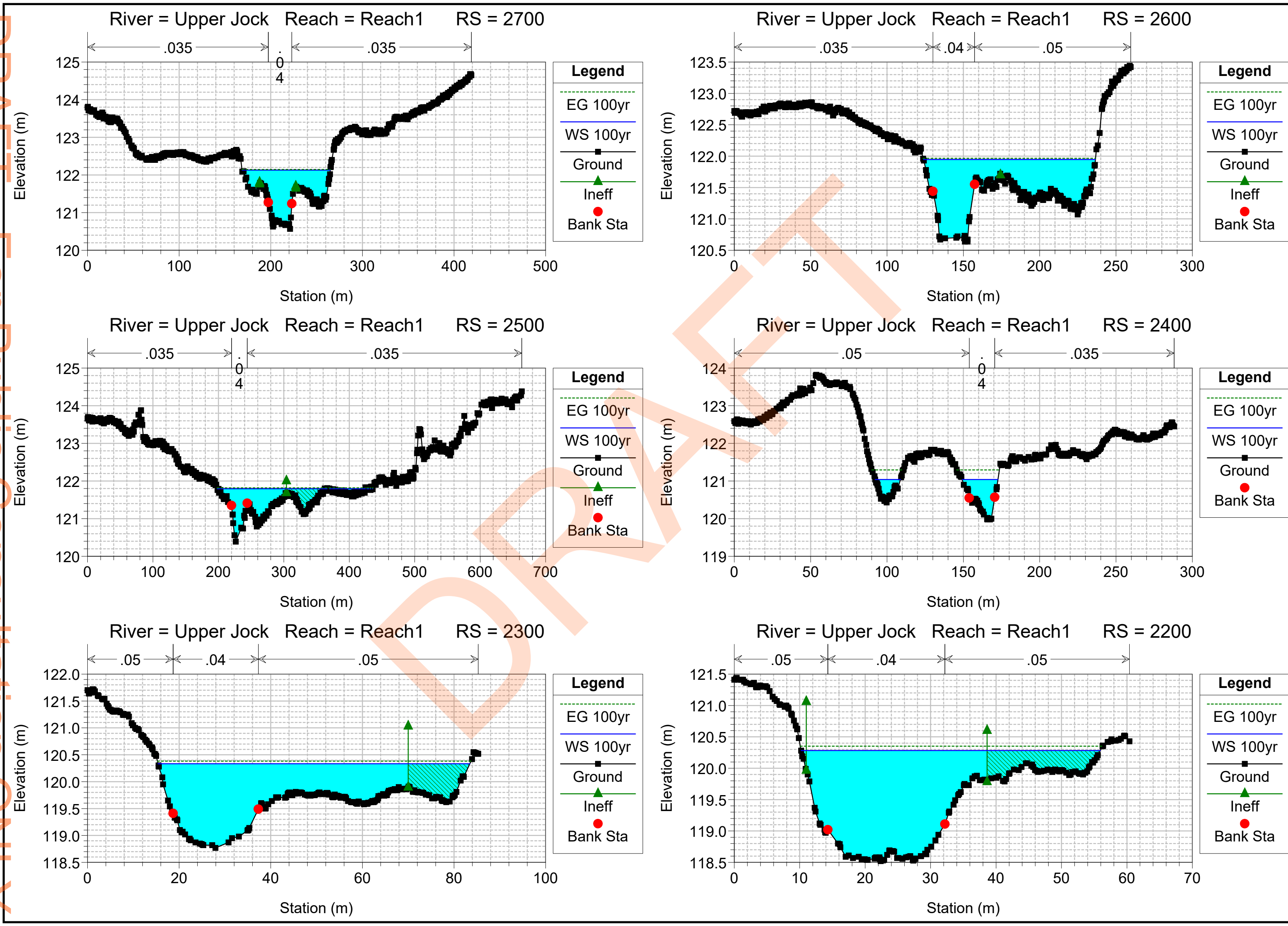

River = Upper Jock Reach = Reach1 RS = 4350 BR
.05
.04
.05
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta

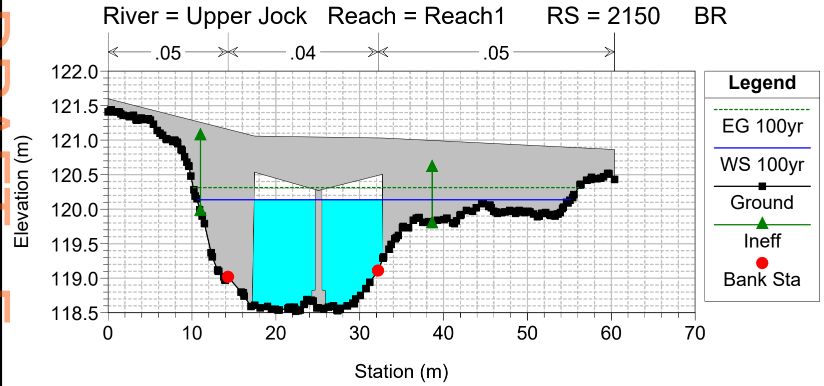


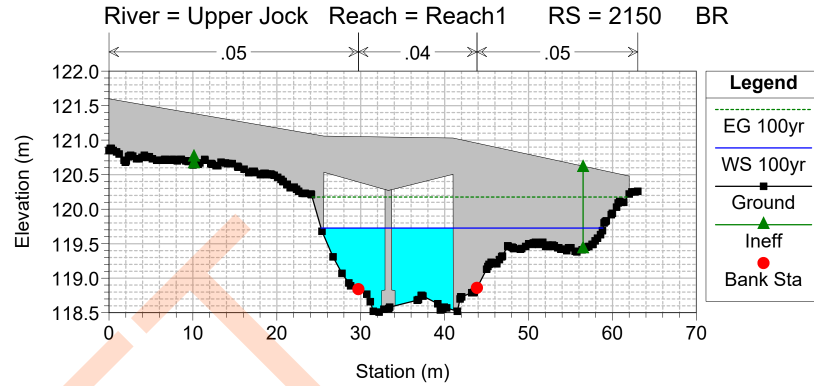
River = Upper Jock Reach = Reach1 RS = 4300
River = Upper Jock Reach = Reach1 RS = 4250
River = Upper Jock Reach = Reach1 RS = 4200
River = Upper Jock Reach = Reach1 RS = 4100
River = Upper Jock Reach = Reach1 RS = 4000
River = Upper Jock Reach = Reach1 RS = 3900
.05
.04
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
DRAFT

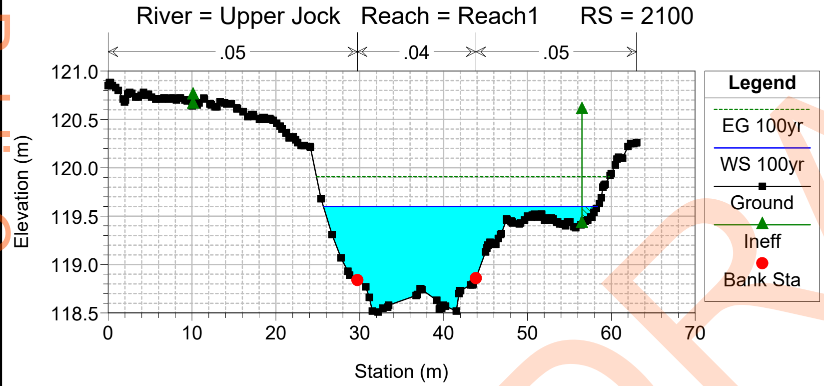

River = Upper Jock Reach = Reach1 RS = 3800
.05
.04
.05
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
River = Upper Jock Reach = Reach1 RS = 3700
.05
.04
.05
Legend
EG 100yr
WS 100yr
Ground
Bank Sta
Elevation (m)
Station (m)
River = Upper Jock Reach = Reach1 RS = 3600
.035
.04
.035
Legend
EG 100yr
WS 100yr
Ground
Bank Sta
Elevation (m)
Station (m)
River = Upper Jock Reach = Reach1 RS = 3500
.035
.04
.035
Legend
EG 100yr
WS 100yr
Ground
Bank Sta
Elevation (m)
Station (m)
River = Upper Jock Reach = Reach1 RS = 3400
.035
.04
.035
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
River = Upper Jock Reach = Reach1 RS = 3300
.035
.04
.035
Legend
EG 100yr
WS 100yr
Ground
Bank Sta
Elevation (m)
Station (m)

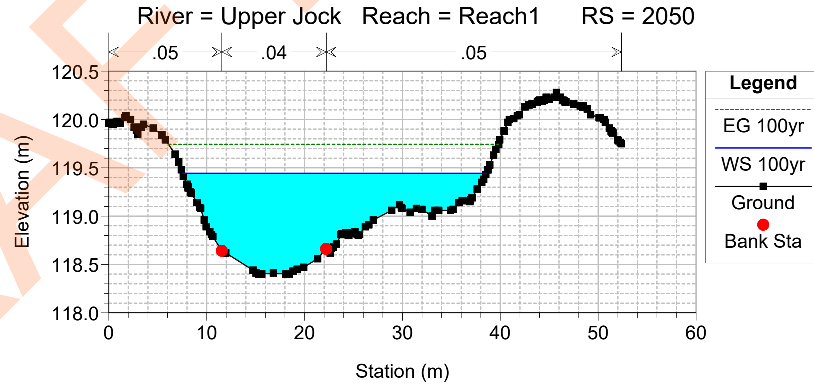

River = Upper Jock Reach = Reach1 RS = 3200
.035 .04 .035
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
River = Upper Jock Reach = Reach1 RS = 3100
.035 .04 .035
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Bank Sta
River = Upper Jock Reach = Reach1 RS = 3050
.05 .04 .05
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
River = Upper Jock Reach = Reach1 RS = 3000
.05 .04 .05
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
River = Upper Jock Reach = Reach1 RS = 2900
.035 .04 .035
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
River = Upper Jock Reach = Reach1 RS = 2800
.035 .04 .035
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Bank Sta


River = Upper Jock Reach = Reach1 RS = 2700
.035
.04
.035
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
River = Upper Jock Reach = Reach1 RS = 2600
.035
.04
.05
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
River = Upper Jock Reach = Reach1 RS = 2500
.035
.04
.035
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
River = Upper Jock Reach = Reach1 RS = 2400
.05
.04
.035
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Bank Sta
River = Upper Jock Reach = Reach1 RS = 2300
.05
.04
.05
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
River = Upper Jock Reach = Reach1 RS = 2200
.05
.04
.05
Elevation (m)
Station (m)
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
DRAFT


River = Upper Jock Reach = Reach1 RS = 2150 BR
.05
.04
.05
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
122.0
121.5
121.0
120.5
120.0
119.5
119.0
118.5
0
10
20
30
40
50
60
70


River = Upper Jock Reach = Reach1 RS = 2150 BR
.05
.04
.05
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
122.0
121.5
121.0
120.5
120.0
119.5
119.0
118.5
0
10
20
30
40
50
60
70


River = Upper Jock Reach = Reach1 RS = 2100
.05
.04
.05
Legend
EG 100yr
WS 100yr
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
121.0
120.5
120.0
119.5
119.0
118.5
0
10
20
30
40
50
60
70


River = Upper Jock Reach = Reach1 RS = 2050
.05
.04
.05
Legend
EG 100yr
WS 100yr
Ground
Bank Sta
Elevation (m)
Station (m)
120.5
120.0
119.5
119.0
118.5
118.0
0
10
20
30
40
50
60

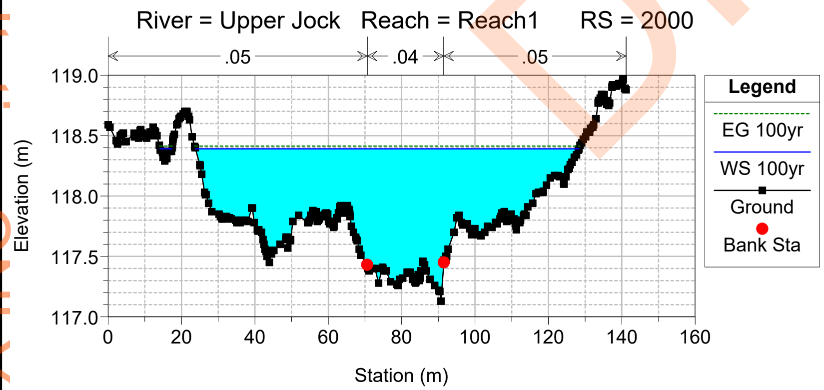

River = Upper Jock Reach = Reach1 RS = 2000
.05
.04
.05
Legend
EG 100yr
WS 100yr
Ground
Bank Sta
Elevation (m)
Station (m)
119.0
118.5
118.0
117.5
117.0
0
20
40
60
80
100
120
140
160

Table B1 Manning n values

River	Reach	Xsec ID	Left Overbank					Main Channel		Right Overbank				
			n				Description	n	Description	n				Description
Upper Jock River	Reach1	25400			0.035	0.07	dense pasture and wetland cattails	0.048	Straight, some weeds and stones, lower stage and with ineffective areas	0.07	0.08	0.1		wetland cattails and dense brush in summer and dense trees in summer
	Reach1	24900			0.035	0.07	dense pasture and wetland cattails	0.048	Straight, some weeds and stones, lower stage and with ineffective areas	0.07	0.1	0.08		wetland cattails and dense trees in summer and dense brush in summer
	Reach1	24500			0.035	0.07	dense pasture and wetland cattails	0.048	Straight, some weeds and stones, lower stage and with ineffective areas	0.07	0.08	0.1		wetland cattails and dense brush in summer and dense trees in summer
	Reach1	24200			0.01	0.07	Impervious surface and wetland cattails	0.048	Straight, some weeds and stones, lower stage and with ineffective areas	0.07	0.08			wetland cattails and dense brush in summer
	Reach1	24100			0.08	0.07	dense brush in summer and wetland cattails	0.048	Straight, some weeds and stones, lower stage and with ineffective areas	0.07	0.1			wetland cattails and dense trees in summer
	Reach1	23900			0.08	0.07	dense brush in summer and wetland cattails	0.048	Straight, some weeds and stones, lower stage and with ineffective areas	0.07	0.1			wetland cattails and dense trees in summer
	Reach1	23800		0.02	0.08	0.07	urban developments with pervious surfaces and dense brush in summer and wetland cattails	0.048	Straight, some weeds and stones, lower stage and with ineffective areas	0.07	0.04	0.1	0.04	wetland cattails and mature crops and dense trees in summer and mature crops
	Reach1	23700				0.05	light brush and tress in summer	0.048	Straight, some weeds and stones, lower stage and with ineffective areas	0.05				light brush and tress in summer
	Reach1	23690				0.05	light brush and tress in summer	0.048	Straight, some weeds and stones, lower stage and with ineffective areas	0.05				light brush and tress in summer
	Reach1	23650	Richmond Road Culvert											
	Reach1	23610				0.05	light brush and tress in summer	0.048	Straight, some weeds and stones, lower stage and with ineffective areas	0.05				light brush and tress in summer
	Reach1	23600				0.035	dense pasture	0.048	Straight, some weeds and stones, lower stage and with ineffective areas	0.035				dense pasture
	Reach1	23400		0.1	0.035	0.07	dense trees in summer and dense pasture and wetland cattails	0.05	Winding, sluggish, weedy	0.07	0.035			wetland cattails and dense pasture
	Reach1	22500				0.1	dense trees in summer	0.06	Winding, more sluggish and weedy	0.1				dense trees in summer
	Reach1	21800				0.1	dense trees in summer	0.06	Winding, more sluggish and weedy	0.1				dense trees in summer
	Reach1	20750				0.1	dense trees in summer	0.06	Winding, more sluggish and weedy	0.1				dense trees in summer
	Reach1	19500		0.04	0.1	0.07	mature crops and dense trees in summer and wetland cattails	0.05	Winding, sluggish, weedy	0.07	0.08	0.1		wetland cattails and dense brush in summer and dense trees in summer
	Reach1	18800			0.04	0.07	mature crops and wetland cattails	0.05	Winding, sluggish, weedy	0.07	0.1	0.08		wetland cattails and dense trees in summer and dense brush in summer
	Reach1	17700	0.04	0.1	0.08	0.07	mature crops and dense trees in summer and dense brush in summer and wetland cattails	0.05	Winding, sluggish, weedy	0.07	0.08			wetland cattails and dense brush in summer
	Reach1	16800			0.08	0.07	dense brush in summer and wetland cattails	0.05	Winding, sluggish, weedy	0.07				wetland cattails
	Reach1	15800			0.08	0.07	dense brush in summer and wetland cattails	0.05	Winding, sluggish, weedy	0.07	0.08	0.1		wetland cattails and dense brush in summer and dense trees in summer
	Reach1	14750		0.04	0.1	0.07	mature crops and dense trees in summer and wetland cattails	0.05	Winding, sluggish, weedy	0.07	0.08			wetland cattails and dense brush in summer
	Reach1	14000		0.04	0.1	0.07	mature crops and dense trees in summer and wetland cattails	0.05	Winding, sluggish, weedy	0.07	0.01			wetland cattails and Impervious surface
	Reach1	13300		0.035	0.08	0.07	dense pasture and dense brush in summer and wetland cattails	0.05	Winding, sluggish, weedy	0.07	0.08	0.1		wetland cattails and dense brush in summer and dense trees in summer
	Reach1	12500			0.035	0.07	dense pasture and wetland cattails	0.05	Winding, sluggish, weedy	0.07	0.08	0.1		wetland cattails and dense brush in summer and dense trees in summer
	Reach1	12000			0.04	0.07	mature crops and wetland cattails	0.05	Winding, sluggish, weedy	0.07	0.08			wetland cattails and dense brush in summer
	Reach1	11600			0.04	0.07	mature crops and wetland cattails	0.05	Winding, sluggish, weedy	0.07	0.08	0.1		wetland cattails and dense brush in summer and dense trees in summer
	Reach1	11250				0.07	wetland cattails	0.05	Winding, sluggish, weedy	0.07				wetland cattails

River	Reach	Xsec ID	Left Overbank					Main Channel		Right Overbank				
			n				Description	n	Description	n				Description
Upper Jock River	Reach1	11200			0.07	0.04	wetland cattails and mature crops	0.05	Winding, sluggish, weedy	0.05				light brush and tress in summer
	Reach1	11180	Cemetery Side Road Bridge											
	Reach1	11170				0.07	wetland cattails	0.05	Winding, sluggish, weedy	0.07				wetland cattails
	Reach1	11150				0.07	wetland cattails	0.05	Winding, sluggish, weedy	0.07				wetland cattails
	Reach1	10800				0.07	wetland cattails	0.05	Winding, sluggish, weedy	0.07				wetland cattails
	Reach1	10500				0.07	wetland cattails	0.05	Winding, sluggish, weedy	0.07	0.01			wetland cattails and Impervious surface
	Reach1	10200	0.035	0.1	0.08	0.07	dense pasture and dense trees in summer and dense brush in summer and wetland cattails	0.05	Winding, sluggish, weedy	0.07	0.01			wetland cattails and Impervious surface
	Reach1	10180		0.035	0.1	0.08	dense pasture and dense trees in summer and dense brush in summer	0.05	Winding, sluggish, weedy	0.08	0.01			dense brush in summer and Impervious surface
	Reach1	10175	Beckwith 9 Line Bridge											
	Reach1	10160			0.035	0.04	dense pasture and mature crops	0.05	Winding, sluggish, weedy	0.07				wetland cattails
	Reach1	10150				0.07	wetland cattails	0.05	Winding, sluggish, weedy	0.07				wetland cattails
	Reach1	10000				0.07	wetland cattails	0.05	Winding, sluggish, weedy	0.07				wetland cattails
	Reach1	9900				0.07	wetland cattails	0.05	Winding, sluggish, weedy	0.08	0.1			dense brush in summer and dense trees in summer
	Reach1	9000			0.1	0.08	dense trees in summer and dense brush in summer	0.05	Winding, sluggish, weedy	0.07	0.1			wetland cattails and dense trees in summer
	Reach1	8400			0.1	0.08	dense trees in summer and dense brush in summer	0.05	Winding, sluggish, weedy	0.07	0.08	0.1	0.035	wetland cattails and dense brush in summer and dense trees in summer and dense pasture
	Reach1	8000			0.035	0.08	dense pasture and dense brush in summer	0.045	Clean , striaght, more weeds and stones	0.08	0.1	0.04		dense brush in summer and dense trees in summer and mature crops
	Reach1	7520				0.04	mature crops	0.045	Clean , striaght, more weeds and stones	0.04				mature crops
	Reach1	7500				0.04	mature crops	0.045	Clean , striaght, more weeds and stones	0.04				mature crops
	Reach1	7490	562 Beckwith 9 Line Culvert											
	Reach1	7480				0.04	mature crops	0.045	Clean , striaght, more weeds and stones	0.04				mature crops
	Reach1	7450			0.04	0.1	mature crops and dense trees in summer	0.045	Clean , striaght, more weeds and stones	0.04				mature crops
	Reach1	6765			0.04	0.1	mature crops and dense trees in summer	0.045	Clean , striaght, more weeds and stones	0.04				mature crops
	Reach1	6760				0.04	mature crops	0.045	Clean , striaght, more weeds and stones	0.04				mature crops
	Reach1	6750				0.04	mature crops	0.045	Clean , striaght, more weeds and stones	0.04				mature crops
	Reach1	6745	500 Beckwith 9 Line Bridge											
	Reach1	6740				0.04	mature crops	0.045	Clean , striaght, more weeds and stones	0.04				mature crops
	Reach1	6720				0.04	mature crops	0.045	Clean , striaght, more weeds and stones	0.04				mature crops
	Reach1	6500				0.04	mature crops	0.045	Clean , striaght, more weeds and stones	0.04				mature crops
	Reach1	6350				0.04	mature crops	0.045	Clean , striaght, more weeds and stones	0.04				mature crops
	Reach1	6300				0.04	mature crops	0.045	Clean , striaght, more weeds and stones	0.04				mature crops
	Reach1	6275	400 Beckwith 9 Line Bridge											
	Reach1	6250				0.04	mature crops	0.045	Clean , striaght, more weeds and stones	0.04				mature crops
	Reach1	6200				0.04	mature crops	0.045	Clean , striaght, more weeds and stones	0.04				mature crops
	Reach1	6100				0.04	mature crops	0.045	Clean , striaght, more weeds and stones	0.1	0.04			dense trees in summer and mature crops
	Reach1	5440				0.04	mature crops	0.045	Clean , striaght, more weeds and stones	0.1				dense trees in summer
	Reach1	5400				0.04	mature crops	0.045	Clean , striaght, more weeds and stones	0.1				dense trees in summer
	Reach1	4700				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	4600				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	4450				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	4445				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	4400	Ashton Station Dam											
	Reach1	4360				0.011	Impervious surface	0.04	Clean , striaght, weeds and stones	0.011				Impervious surface

River	Reach	Xsec ID	Left Overbank					Main Channel		Right Overbank				
			n				Description	n	Description	n				Description
Upper Jock River	Reach1	4350	Ashton Station Bridge											
	Reach1	4300				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	4250				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	4200				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	4100				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	4000				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	3900				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	3800				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	3700				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	3600				0.035	dense pasture	0.04	Clean , striaght, weeds and stones	0.035				dense pasture
	Reach1	3500				0.035	dense pasture	0.04	Clean , striaght, weeds and stones	0.035				dense pasture
	Reach1	3400				0.035	dense pasture	0.04	Clean , striaght, weeds and stones	0.035				dense pasture
	Reach1	3300				0.035	dense pasture	0.04	Clean , striaght, weeds and stones	0.035				dense pasture
	Reach1	3200				0.035	dense pasture	0.04	Clean , striaght, weeds and stones	0.035				dense pasture
	Reach1	3100				0.035	dense pasture	0.04	Clean , striaght, weeds and stones	0.035				dense pasture
	Reach1	3050				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	3000				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	2900				0.035	dense pasture	0.04	Clean , striaght, weeds and stones	0.035				dense pasture
	Reach1	2800				0.035	dense pasture	0.04	Clean , striaght, weeds and stones	0.035				dense pasture
	Reach1	2700				0.035	dense pasture	0.04	Clean , striaght, weeds and stones	0.035				dense pasture
	Reach1	2600				0.035	dense pasture	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	2500				0.035	dense pasture	0.04	Clean , striaght, weeds and stones	0.035				dense pasture
	Reach1	2400				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.035				dense pasture
	Reach1	2300				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	2200				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	2150	McCafferey Trail Bridge											
	Reach1	2100				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	2050				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer
	Reach1	2000				0.05	light brush and tress in summer	0.04	Clean , striaght, weeds and stones	0.05				light brush and tress in summer

Table B2 HEC RAS Detailed Output

HEC RAS Plan: ReturnPeriodAnalysis02 Profile: 100yr Geometry: v012 Flow:postreview13May20

River	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	Froude # Chl
				(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper Jock	Reach1	2000	100yr	39.52	117.13	118.39	117.99	118.41	0.00	0.84	69.15	107.78	0.26
Upper Jock	Reach1	2050	100yr	39.52	118.40	119.44	119.44	119.74	0.01	2.75	19.05	31.04	0.90
Upper Jock	Reach1	2100	100yr	39.52	118.51	119.60	119.60	119.91	0.01	2.59	18.18	32.69	0.85
Upper Jock	Reach1	2150						Bridge					
Upper Jock	Reach1	2200	100yr	39.52	118.52	120.28	119.46	120.35	0.00	1.22	36.16	45.71	0.31
Upper Jock	Reach1	2300	100yr	39.52	118.77	120.33	119.84	120.38	0.00	1.12	46.95	68.05	0.31
Upper Jock	Reach1	2400	100yr	39.52	119.98	121.04	121.04	121.30	0.01	2.45	20.05	39.99	0.89
Upper Jock	Reach1	2500	100yr	39.52	120.39	121.80	121.34	121.82	0.00	0.76	62.02	226.70	0.24
Upper Jock	Reach1	2600	100yr	39.52	120.64	121.95	121.44	121.97	0.00	0.77	73.21	112.65	0.24
Upper Jock	Reach1	2700	100yr	39.52	120.57	122.13	121.42	122.14	0.00	0.65	74.34	96.14	0.18
Upper Jock	Reach1	2800	100yr	39.52	120.70	122.22	0.00	122.24	0.00	0.84	65.32	113.28	0.23
Upper Jock	Reach1	2900	100yr	39.52	120.85	122.33	121.80	122.35	0.00	0.73	66.55	120.24	0.21
Upper Jock	Reach1	3000	100yr	39.52	121.32	122.34	122.17	122.52	0.01	2.07	29.67	145.62	0.68
Upper Jock	Reach1	3050	100yr	39.52	121.31	122.72	122.10	122.74	0.00	0.91	84.88	197.82	0.25
Upper Jock	Reach1	3100	100yr	39.52	121.32	122.81	0.00	122.84	0.00	0.96	60.37	119.74	0.26
Upper Jock	Reach1	3200	100yr	39.52	121.99	123.03	122.66	123.06	0.00	0.91	49.46	75.49	0.30
Upper Jock	Reach1	3300	100yr	39.52	122.49	123.37	123.37	123.69	0.01	2.56	16.17	24.39	0.92
Upper Jock	Reach1	3400	100yr	39.52	122.73	123.73	123.65	123.95	0.01	2.19	19.39	31.09	0.77
Upper Jock	Reach1	3500	100yr	39.52	122.84	123.91	0.00	124.04	0.00	1.77	24.66	32.01	0.56
Upper Jock	Reach1	3600	100yr	39.52	122.73	124.00	0.00	124.12	0.00	1.61	26.61	31.34	0.47
Upper Jock	Reach1	3700	100yr	39.52	123.66	124.54	0.00	124.56	0.00	0.83	63.69	94.83	0.29
Upper Jock	Reach1	3800	100yr	39.52	123.72	124.72	124.25	124.74	0.00	0.63	92.65	157.50	0.21
Upper Jock	Reach1	3900	100yr	39.52	123.47	124.94	124.35	124.97	0.00	0.91	59.42	105.54	0.26
Upper Jock	Reach1	4000	100yr	39.52	124.37	125.40	125.30	125.52	0.01	1.96	30.14	61.61	0.67
Upper Jock	Reach1	4100	100yr	39.52	125.14	126.14	0.00	126.31	0.01	1.94	23.03	28.90	0.64
Upper Jock	Reach1	4200	100yr	39.52	125.31	126.55	0.00	126.79	0.01	2.19	18.81	18.58	0.66
Upper Jock	Reach1	4250	100yr	39.52	125.26	126.94	0.00	127.19	0.01	2.51	19.26	15.62	0.66
Upper Jock	Reach1	4300	100yr	39.52	125.44	127.20	126.42	127.28	0.00	1.27	31.02	24.58	0.33
Upper Jock	Reach1	4350						Bridge					
Upper Jock	Reach1	4360	100yr	39.52	125.22	127.26	126.35	127.37	0.00	1.45	27.32	15.19	0.34
Upper Jock	Reach1	4400						Inl Struct					
Upper Jock	Reach1	4445	100yr	39.52	125.22	128.82	126.33	128.84	0.00	0.57	76.73	44.16	0.10
Upper Jock	Reach1	4450	100yr	39.52	125.41	128.82	0.00	128.84	0.00	0.62	77.47	41.75	0.12
Upper Jock	Reach1	4600	100yr	39.52	126.06	128.85	0.00	128.89	0.00	1.10	53.45	44.64	0.23
Upper Jock	Reach1	4700	100yr	39.52	127.06	128.92	0.00	129.26	0.01	2.82	17.19	15.37	0.72
Upper Jock	Reach1	5400	100yr	39.52	127.35	129.46	0.00	129.46	0.00	0.47	111.50	106.68	0.11
Upper Jock	Reach1	5440	100yr	39.52	127.36	129.56	128.80	129.57	0.00	0.73	117.54	750.11	0.18
Upper Jock	Reach1	6100	100yr	39.52	127.73	129.60	0.00	129.60	0.00	0.10	637.89	780.02	0.03
Upper Jock	Reach1	6200	100yr	39.52	127.83	129.60	128.99	129.61	0.00	0.55	92.62	425.47	0.14
Upper Jock	Reach1	6250	100yr	39.52	127.90	129.61	128.92	129.62	0.00	0.27	229.93	410.81	0.07
Upper Jock	Reach1	6275						Bridge					
Upper Jock	Reach1	6300	100yr	39.52	127.81	129.87	128.79	129.89	0.00	0.66	62.18	438.43	0.15
Upper Jock	Reach1	6350	100yr	39.52	127.85	129.89	129.03	129.90	0.00	0.60	75.42	388.26	0.14
Upper Jock	Reach1	6500	100yr	39.52	128.01	129.91	128.80	129.92	0.00	0.37	157.73	373.06	0.09
Upper Jock	Reach1	6720	100yr	39.52	128.30	129.96	129.36	129.98	0.00	0.71	68.28	80.65	0.18
Upper Jock	Reach1	6740	100yr	39.52	128.32	129.97	129.54	130.00	0.00	0.86	60.29	80.10	0.23
Upper Jock	Reach1	6745						Bridge					
Upper Jock	Reach1	6750	100yr	39.52	128.29	130.42	129.49	130.44	0.00	0.71	73.03	87.68	0.17
Upper Jock	Reach1	6760	100yr	39.52	128.44	130.43	0.00	130.45	0.00	0.69	72.96	69.50	0.16
Upper Jock	Reach1	6765	100yr	39.52	128.57	130.48	0.00	130.48	0.00	0.32	269.65	372.33	0.08
Upper Jock	Reach1	7450	100yr	39.52	128.67	130.56	129.71	130.59	0.00	0.90	60.77	1149.92	0.23
Upper Jock	Reach1	7480	100yr	39.52	128.69	130.60	129.68	130.60	0.00	0.08	770.96	1152.55	0.02
Upper Jock	Reach1	7490						Culvert					
Upper Jock	Reach1	7500	100yr	39.52	128.77	130.61	129.71	130.61	0.00	0.09	663.50	1110.25	0.02
Upper Jock	Reach1	7520	100yr	39.52	128.87	130.61	129.66	130.61	0.00	0.18	270.02	1079.23	0.04
Upper Jock	Reach1	8000	100yr	39.52	128.96	130.64	129.79	130.64	0.00	0.24	264.19	348.89	0.06
Upper Jock	Reach1	8400	100yr	39.52	129.13	130.67	129.85	130.67	0.00	0.19	446.60	626.42	0.05
Upper Jock	Reach1	9000	100yr	39.52	128.76	130.69	130.03	130.69	0.00	0.18	491.16	723.74	0.05
Upper Jock	Reach1	9900	100yr	39.52	129.10	130.75	0.00	130.77	0.00	0.90	87.36	144.68	0.24
Upper Jock	Reach1	10000	100yr	36.79	128.69	130.86	0.00	130.87	0.00	0.62	97.42	129.26	0.14
Upper Jock	Reach1	10150	100yr	36.79	128.73	130.93	130.28	130.96	0.00	0.94	57.07	226.90	0.24
Upper Jock	Reach1	10160	100yr	36.79	128.50	130.93	129.88	130.99	0.00	1.16	34.14	237.44	0.28

River	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	Froude # Chl
				(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper Jock	Reach1	10175	Bridge										
Upper Jock	Reach1	10180	100yr	36.79	128.33	131.04	129.82	131.07	0.00	0.83	45.52	201.65	0.20
Upper Jock	Reach1	10200	100yr	36.79	128.74	131.05	130.57	131.10	0.00	1.39	42.46	281.93	0.33
Upper Jock	Reach1	10500	100yr	36.79	128.78	131.14	0.00	131.14	0.00	0.21	336.06	385.02	0.05
Upper Jock	Reach1	10800	100yr	36.79	128.72	131.15	0.00	131.15	0.00	0.21	321.06	367.97	0.05
Upper Jock	Reach1	11150	100yr	36.79	128.87	131.18	129.76	131.19	0.00	0.43	115.22	528.22	0.10
Upper Jock	Reach1	11170	100yr	36.79	129.06	131.18	130.07	131.20	0.00	0.72	62.13	547.39	0.18
Upper Jock	Reach1	11180	Bridge										
Upper Jock	Reach1	11200	100yr	36.79	128.92	131.41	130.66	131.41	0.00	0.07	768.41	880.67	0.02
Upper Jock	Reach1	11250	100yr	36.79	129.04	131.41	130.17	131.41	0.00	0.09	825.14	901.22	0.02
Upper Jock	Reach1	11600	100yr	36.79	129.11	131.41	130.52	131.41	0.00	0.07	1027.67	1116.05	0.02
Upper Jock	Reach1	12000	100yr	36.79	129.10	131.41	130.51	131.41	0.00	0.06	1256.19	1535.77	0.01
Upper Jock	Reach1	12500	100yr	36.79	129.23	131.41	130.58	131.41	0.00	0.05	1514.05	2004.78	0.01
Upper Jock	Reach1	13300	100yr	36.79	129.30	131.42	130.69	131.42	0.00	0.08	1095.16	2161.32	0.02
Upper Jock	Reach1	14000	100yr	36.79	129.56	131.42	130.58	131.42	0.00	0.11	1011.27	2547.51	0.03
Upper Jock	Reach1	14750	100yr	32.77	129.88	131.44	130.63	131.44	0.00	0.13	596.50	2035.54	0.03
Upper Jock	Reach1	15800	100yr	32.77	129.92	131.45	130.82	131.45	0.00	0.11	661.92	1998.28	0.03
Upper Jock	Reach1	16800	100yr	32.77	129.78	131.49	131.08	131.49	0.00	0.19	446.23	1644.69	0.06
Upper Jock	Reach1	17700	100yr	32.77	130.00	131.57	131.27	131.57	0.00	0.24	344.42	1796.52	0.08
Upper Jock	Reach1	18800	100yr	32.77	130.10	131.73	131.33	131.73	0.00	0.35	237.53	1129.33	0.09
Upper Jock	Reach1	19500	100yr	32.77	130.16	131.81	131.31	131.81	0.00	0.22	316.37	864.15	0.07
Upper Jock	Reach1	20750	100yr	25.71	130.49	131.91	131.19	131.91	0.00	0.22	339.48	1008.64	0.06
Upper Jock	Reach1	21800	100yr	25.71	131.63	132.29	0.00	132.30	0.01	0.88	74.73	873.21	0.43
Upper Jock	Reach1	22500	100yr	25.71	131.71	132.90	132.48	132.90	0.00	0.24	240.55	869.23	0.08
Upper Jock	Reach1	23400	100yr	25.71	132.01	133.22	132.99	133.24	0.00	0.83	63.87	717.58	0.27
Upper Jock	Reach1	23600	100yr	15.58	132.30	133.58	133.31	133.60	0.00	0.55	26.17	473.38	0.21
Upper Jock	Reach1	23610	100yr	15.58	132.35	133.55	133.50	133.70	0.02	2.04	9.54	387.76	0.77
Upper Jock	Reach1	23650	Culvert										
Upper Jock	Reach1	23690	100yr	15.58	132.42	134.30	133.46	134.33	0.00	0.73	22.92	673.88	0.19
Upper Jock	Reach1	23700	100yr	15.58	132.47	134.33	133.53	134.34	0.00	0.45	42.24	653.34	0.12
Upper Jock	Reach1	23800	100yr	15.58	133.13	134.42	134.10	134.44	0.00	0.96	27.77	140.27	0.33
Upper Jock	Reach1	23900	100yr	15.58	133.19	134.64	134.35	134.66	0.00	1.02	29.96	158.04	0.31
Upper Jock	Reach1	24100	100yr	15.58	133.65	134.95	134.66	134.98	0.00	0.87	31.40	191.78	0.29
Upper Jock	Reach1	24200	100yr	15.58	134.02	135.22	0.00	135.23	0.00	0.68	49.83	154.98	0.24
Upper Jock	Reach1	24500	100yr	15.58	133.76	135.40	134.81	135.40	0.00	0.40	94.21	263.70	0.11
Upper Jock	Reach1	24900	100yr	15.58	134.10	135.54	135.30	135.54	0.00	0.44	68.63	255.23	0.17
Upper Jock	Reach1	25400	100yr	15.58	134.39	135.66	0.00	135.66	0.00	0.22	135.41	370.04	0.08

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Appendix C

Field Verification of LIDAR Data

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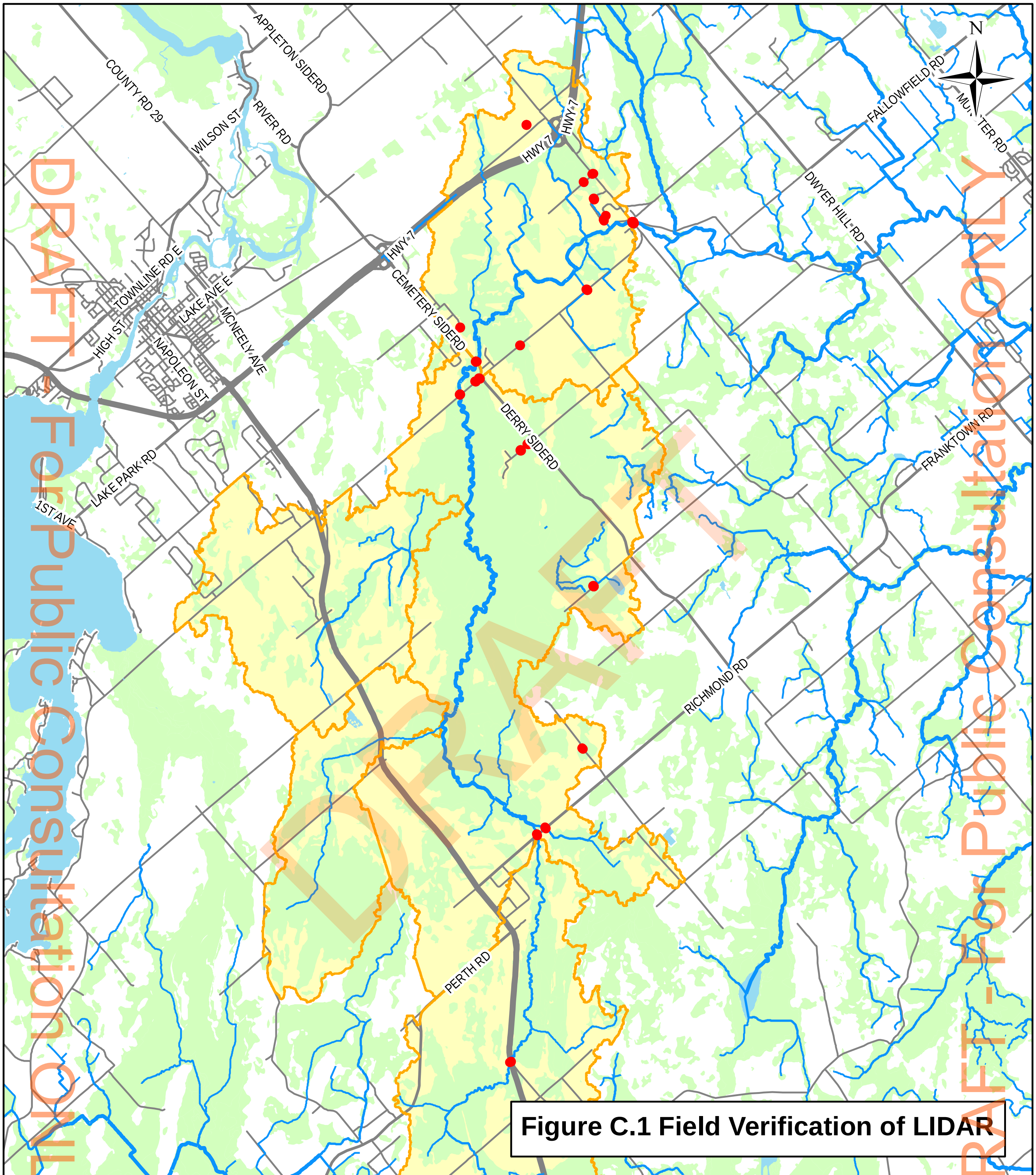


Figure C.1 Field Verification of LIDAR

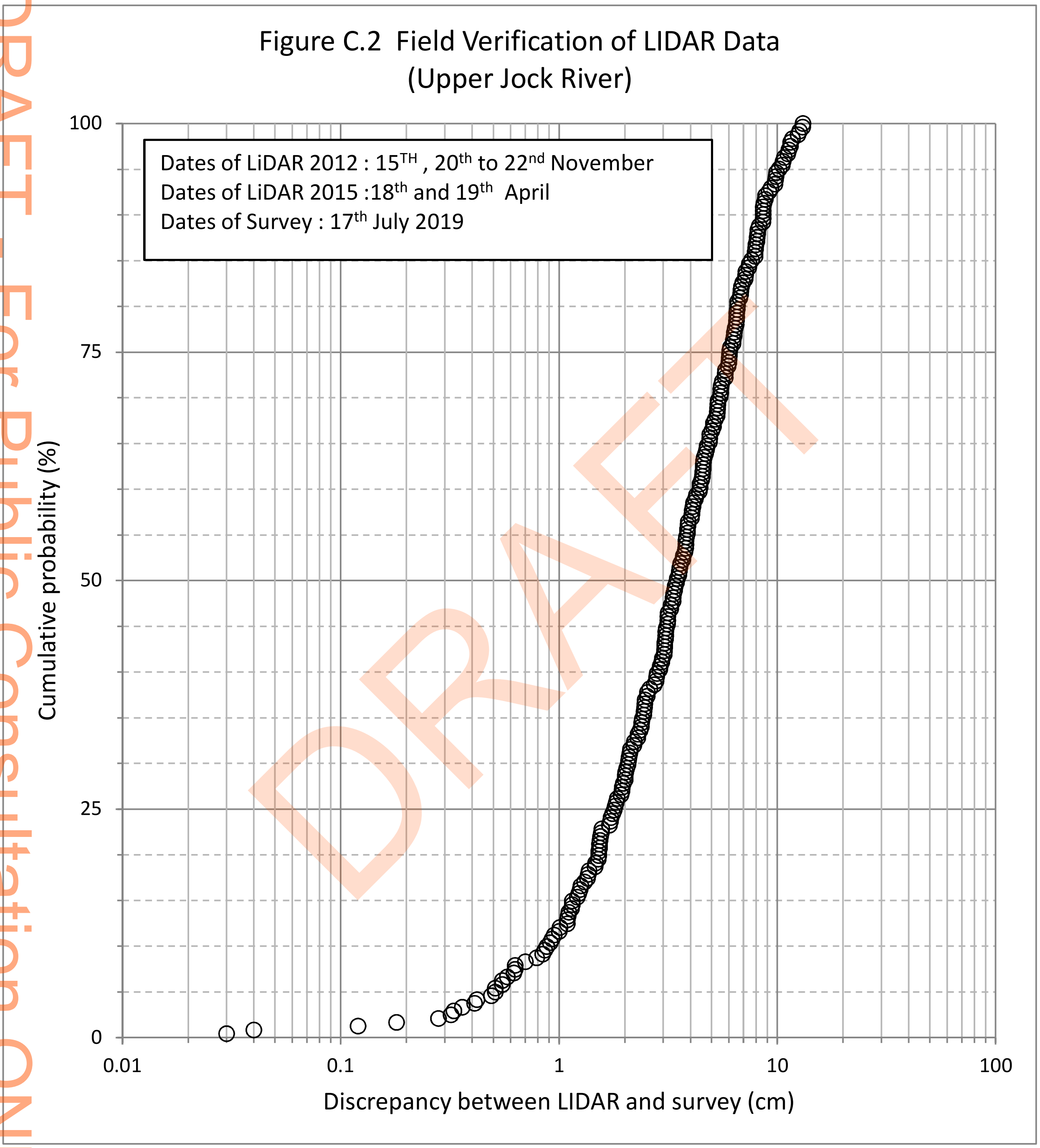
Rideau Valley Conservation Authority

- Trimble Points
- Upper Jock River Basin
- Wetlands

0 1 2 4 Kilometers

Map Scale: 1:100,000

Date Modified:



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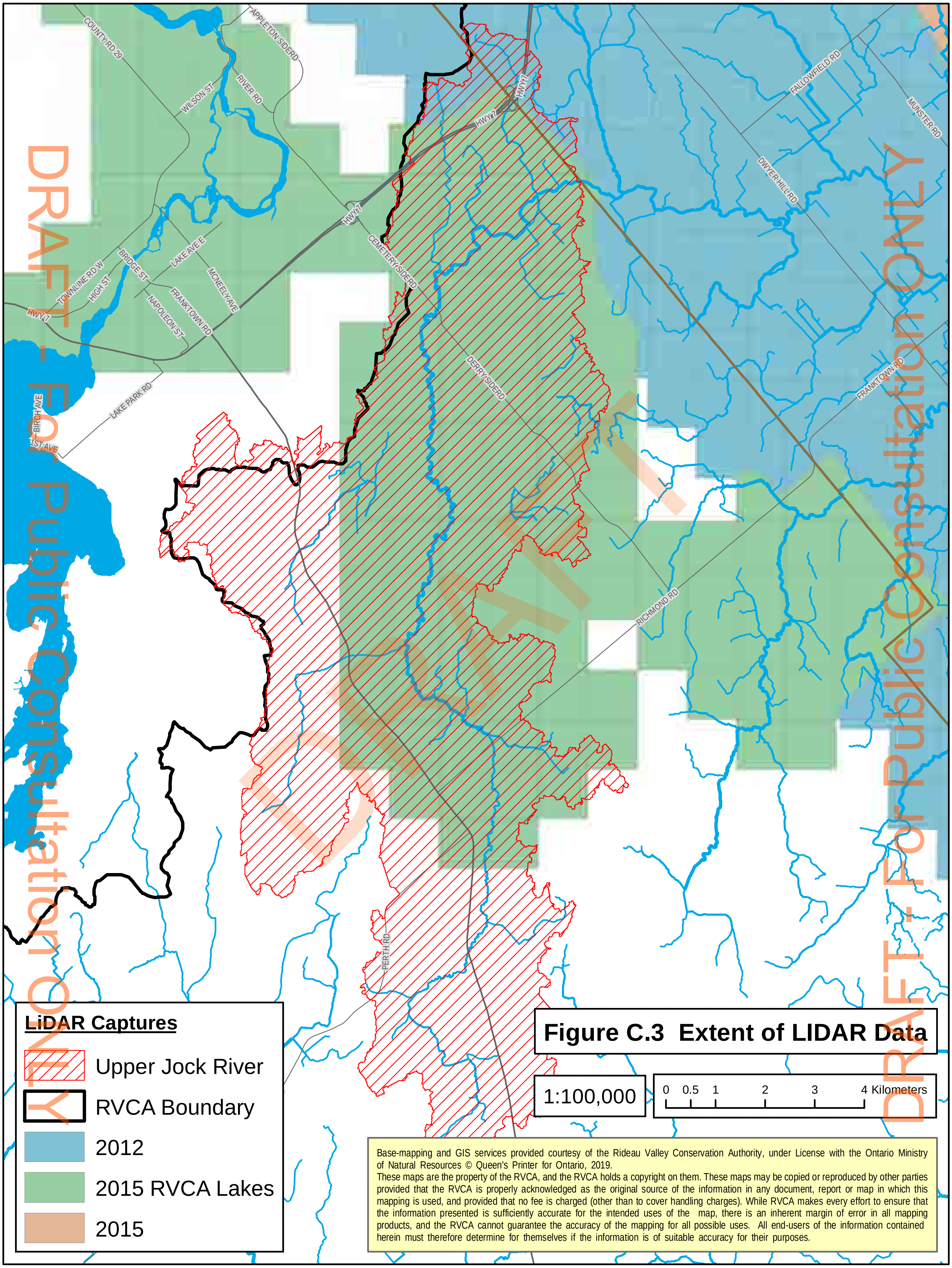

Figure C.3 Extent of LIDAR Data

Table C.1 Field verification of LIDAR data (spot heights)

	RVCA Field Survey (17th July 2019)								Nearest Lidar Point	Comparison		
Location ID	X (m)	Y (m)	Z (m)	Horizontal Accuracy (m)	Veritcal Accuracy (m)	Date	Time	Field Observations	Z (m)	△z (m)	|△z | (cm)	|△z| > 0.33m
irwine_st_001	416641.918	4987613.946	143.925	0.010	0.019	07/17/2019	9:33	Paved	143.876	-0.049	4.90	
irwine_st_002	416641.392	4987617.278	144.006	0.009	0.018	07/17/2019	9:34	Paved	143.959	-0.047	4.69	
irwine_st_003	416641.112	4987619.592	144.062	0.010	0.019	07/17/2019	9:34	Paved	144.007	-0.055	5.54	
irwine_st_004	416640.691	4987622.358	144.125	0.010	0.019	07/17/2019	9:34	Paved	144.044	-0.081	8.06	
irwine_st_005	416640.280	4987625.105	144.186	0.009	0.018	07/17/2019	9:34	Paved	144.119	-0.067	6.74	
irwine_st_006	416639.508	4987630.445	144.304	0.010	0.019	07/17/2019	9:35	Paved	144.239	-0.065	6.51	
hwy_15_001	416606.372	4987756.942	146.602	0.010	0.020	07/17/2019	9:48	Paved	146.572	-0.031	3.05	
hwy_15_002	416602.194	4987763.721	146.634	0.010	0.020	07/17/2019	9:49	Paved	146.670	0.036	3.61	
hwy_15_003	416599.305	4987767.679	146.781	0.010	0.020	07/17/2019	9:50	Paved	146.752	-0.029	2.91	
hwy_15_004	416595.845	4987773.183	146.845	0.010	0.020	07/17/2019	9:52	Paved	146.826	-0.019	1.95	
hwy_15_005	416562.685	4987818.483	147.138	0.010	0.020	07/17/2019	10:03	Paved	147.092	-0.046	4.57	
hwy_15_006	416558.029	4987824.017	147.159	0.010	0.020	07/17/2019	10:04	Paved	147.148	-0.011	1.15	
hwy_15_007	416552.041	4987831.486	147.207	0.010	0.020	07/17/2019	10:08	Paved	147.121	-0.086	8.60	
hwy_15_008	416549.206	4987834.782	147.218	0.009	0.020	07/17/2019	10:09	Paved	147.180	-0.038	3.81	
hwy_15_009	416529.480	4987859.332	147.363	0.010	0.020	07/17/2019	10:12	Paved	147.310	-0.053	5.34	
church_st_001	416841.574	4988236.333	144.757	0.010	0.016	07/17/2019	10:23	Paved	144.773	0.016	1.55	
church_st_002	416845.154	4988239.327	144.708	0.009	0.015	07/17/2019	10:23	Paved	144.728	0.020	2.01	
church_st_003	416851.236	4988244.321	144.629	0.008	0.014	07/17/2019	10:23	Paved	144.639	0.010	1.00	
church_st_004	416861.001	4988252.540	144.379	0.009	0.014	07/17/2019	10:24	Paved	144.398	0.019	1.92	
church_st_005	416868.261	4988258.357	144.211	0.009	0.015	07/17/2019	10:24	Paved	144.250	0.039	3.90	
church_st_006	416878.303	4988266.208	143.999	0.009	0.015	07/17/2019	10:25	Paved	144.078	0.079	7.94	
church_st_007	416890.306	4988275.636	143.958	0.010	0.017	07/17/2019	10:25	Paved	143.921	-0.037	3.71	
church_st_008	416905.266	4988287.564	143.913	0.010	0.018	07/17/2019	10:25	Paved	143.863	-0.050	5.01	
church_st_009	416917.567	4988297.826	143.734	0.010	0.018	07/17/2019	10:26	Paved	143.681	-0.053	5.30	
church_st_010	416926.854	4988305.647	143.321	0.011	0.019	07/17/2019	10:26	Paved	143.338	0.017	1.72	
church_st_011	416936.811	4988313.423	142.849	0.011	0.018	07/17/2019	10:27	Paved	142.869	0.020	2.02	
church_st_012	416945.012	4988320.026	142.607	0.011	0.018	07/17/2019	10:27	Paved	142.608	0.001	0.12	
church_st_013	416949.401	4988324.933	142.485	0.011	0.018	07/17/2019	10:27	Paved	142.500	0.015	1.54	
church_st_014	416951.927	4988328.936	142.386	0.010	0.018	07/17/2019	10:28	Paved	142.441	0.055	5.50	
church_st_015	416952.719	4988333.462	142.343	0.010	0.016	07/17/2019	10:28	Paved	142.377	0.034	3.38	
powell_st_001	416951.185	4988340.517	142.284	0.010	0.016	07/17/2019	10:29	Paved	142.292	0.008	0.84	
powell_st_002	416947.767	4988346.049	142.273	0.010	0.016	07/17/2019	10:29	Paved	142.310	0.037	3.69	
powell_st_003	416943.346	4988352.058	142.294	0.010	0.015	07/17/2019	10:30	Paved	142.322	0.028	2.80	
powell_st_004	416939.876	4988356.920	142.316	0.010	0.016	07/17/2019	10:30	Paved	142.345	0.029	2.89	
powell_st_005	416936.894	4988360.939	142.318	0.010	0.016	07/17/2019	10:30	Paved	142.333	0.015	1.53	
powell_st_006	416933.784	4988365.221	142.345	0.010	0.016	07/17/2019	10:30	Paved	142.414	0.069	6.94	
powell_st_007	416929.694	4988370.337	142.338	0.010	0.016	07/17/2019	10:31	Paved	142.380	0.042	4.21	
powell_st_008	416926.503	4988374.556	142.339	0.010	0.017	07/17/2019	10:31	Paved	142.399	0.060	6.04	
powell_st_009	416921.776	4988380.761	142.344	0.009	0.016	07/17/2019	10:31	Paved	142.353	0.009	0.93	
powell_st_010	416917.398	4988386.165	142.364	0.010	0.017	07/17/2019	10:32	Paved	142.380	0.016	1.56	
powell_st_011	416909.913	4988395.808	142.302	0.010	0.016	07/17/2019	10:32	Paved	142.363	0.061	6.09	
powell_st_012	416903.835	4988403.203	142.148	0.010	0.016	07/17/2019	10:32	Paved	142.189	0.041	4.13	
powell_st_013	416895.476	4988413.408	141.945	0.010	0.015	07/17/2019	10:33	Paved	141.914	-0.031	3.08	
powell_st_014	416886.142	4988424.766	141.677	0.010	0.016	07/17/2019	10:33	Paved	141.742	0.065	6.47	
powell_st_015	416879.510	4988433.059	141.448	0.011	0.017	07/17/2019	10:33	Paved	141.472	0.023	2.35	
powell_st_016	416875.223	4988438.197	141.351	0.011	0.018	07/17/2019	10:34	Paved	141.311	-0.040	4.04	
richmond_rd_001	416455.760	4988944.658	138.407	0.009	0.013	07/17/2019	10:42	Paved	138.369	-0.038	3.77	
richmond_rd_002	416459.806	4988948.077	138.377	0.010	0.014	07/17/2019	10:43	Paved	138.347	-0.030	3.04	
richmond_rd_003	416465.814	4988953.300	138.324	0.010	0.015	07/17/2019	10:43	Paved	138.291	-0.034	3.35	
richmond_rd_004	416472.840	4988959.453	138.279	0.010	0.014	07/17/2019	10:43	Paved	138.265	-0.014	1.37	
richmond_rd_005	416475.707	4988961.903	138.228	0.010	0.015	07/17/2019	10:44	Paved	138.225	-0.003	0.33	
richmond_rd_006	416478.233	4988964.042	138.224	0.010	0.015	07/17/2019	10:44	Paved	138.242	0.018	1.76	

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Table C.1 Field verification of LIDAR data (spot heights)

	RVCA Field Survey (17th July 2019)								Nearest Lidar Point	Comparison		
Location ID	X (m)	Y (m)	Z (m)	Horizontal Accuracy (m)	Veritcal Accuracy (m)	Date	Time	Field Observations	Z (m)	△Z (m)	|△Z | (cm)	|△Z| > 0.33m
richmond_rd_007	416482.156	4988967.310	138.177	0.011	0.016	07/17/2019	10:44	Paved	138.164	-0.013	1.31	
richmond_rd_008	416485.422	4988970.311	138.169	0.011	0.016	07/17/2019	10:44	Paved	138.138	-0.031	3.10	
richmond_rd_009	416488.213	4988972.609	138.137	0.011	0.016	07/17/2019	10:45	Paved	138.128	-0.009	0.91	
richmond_rd_010	416492.378	4988976.243	138.105	0.011	0.016	07/17/2019	10:45	Paved	138.100	-0.005	0.51	
richmond_rd_011	416495.315	4988978.723	138.088	0.010	0.015	07/17/2019	10:45	Paved	138.064	-0.024	2.40	
richmond_rd_012	416498.995	4988982.032	138.054	0.011	0.017	07/17/2019	10:46	Paved	138.034	-0.020	2.04	
richmond_rd_013	416502.040	4988984.594	138.029	0.011	0.017	07/17/2019	10:46	Paved	138.061	0.032	3.16	
richmond_rd_014	416506.625	4988988.615	137.994	0.011	0.016	07/17/2019	10:46	Paved	138.000	0.006	0.55	
richmond_rd_015	416511.986	4988993.216	137.969	0.010	0.015	07/17/2019	10:47	Paved	137.975	0.006	0.63	
richmond_rd_016	416513.664	4988994.643	137.947	0.010	0.014	07/17/2019	10:47	Paved	137.926	-0.021	2.08	
richmond_rd_017	417089.398	4989490.635	134.691	0.011	0.015	07/17/2019	10:57	Paved	134.676	-0.015	1.52	
richmond_rd_018	417094.644	4989495.115	134.699	0.012	0.016	07/17/2019	10:57	Paved	134.678	-0.021	2.12	
richmond_rd_019	417094.649	4989495.116	134.696	0.011	0.015	07/17/2019	10:57	Paved	134.678	-0.018	1.81	
richmond_rd_020	417098.604	4989498.487	134.696	0.011	0.015	07/17/2019	10:58	Paved	134.670	-0.026	2.60	
richmond_rd_021	417103.393	4989502.696	134.701	0.010	0.014	07/17/2019	10:58	Paved	134.686	-0.015	1.52	
richmond_rd_022	417107.230	4989506.112	134.701	0.010	0.014	07/17/2019	10:59	Paved	134.683	-0.018	1.83	
richmond_rd_023	417109.967	4989508.463	134.694	0.010	0.013	07/17/2019	10:59	Paved	134.678	-0.016	1.57	
richmond_rd_024	417113.254	4989511.154	134.700	0.010	0.014	07/17/2019	10:59	Paved	134.655	-0.045	4.55	
richmond_rd_025	417116.395	4989513.873	134.702	0.010	0.013	07/17/2019	11:00	Paved	134.661	-0.041	4.06	
richmond_rd_026	417251.868	4989630.936	134.490	0.010	0.013	07/17/2019	11:05	Paved	134.460	-0.031	3.05	
richmond_rd_027	417256.165	4989634.562	134.483	0.010	0.013	07/17/2019	11:05	Paved	134.459	-0.024	2.44	
richmond_rd_028	417261.021	4989639.018	134.497	0.010	0.013	07/17/2019	11:06	Paved	134.474	-0.023	2.30	
richmond_rd_029	417265.459	4989642.665	134.487	0.010	0.013	07/17/2019	11:06	Paved	134.443	-0.044	4.43	
richmond_rd_030	417268.037	4989644.867	134.485	0.010	0.013	07/17/2019	11:07	Paved	134.417	-0.068	6.80	
richmond_rd_031	417271.523	4989647.938	134.488	0.010	0.013	07/17/2019	11:07	Paved	134.480	-0.008	0.79	
cuck_nst_rd_001	418469.209	4989226.798	137.446	0.010	0.013	07/17/2019	11:18	Gravel	137.426	-0.020	2.01	
cuck_nst_rd_002	418477.443	4989233.660	137.491	0.014	0.016	07/17/2019	11:18	Gravel	137.464	-0.027	2.73	
cuck_nst_rd_003	418487.737	4989241.898	137.485	0.012	0.016	07/17/2019	11:19	Gravel	137.440	-0.045	4.50	
cuck_nst_rd_004	418496.236	4989248.167	137.453	0.011	0.015	07/17/2019	11:19	Gravel	137.388	-0.066	6.55	
cuck_nst_rd_005	418507.191	4989256.791	137.486	0.013	0.017	07/17/2019	11:20	Gravel	137.421	-0.065	6.52	
cuck_nst_rd_006	418517.007	4989264.459	137.499	0.013	0.018	07/17/2019	11:20	Gravel	137.461	-0.038	3.83	
cuck_nst_rd_007	418532.065	4989276.321	137.484	0.013	0.018	07/17/2019	11:21	Gravel	137.481	-0.003	0.32	
cuck_nst_rd_008	418546.596	4989287.335	137.667	0.013	0.017	07/17/2019	11:21	Gravel	137.631	-0.036	3.56	
cuck_nst_rd_009	418558.613	4989296.603	137.917	0.015	0.019	07/17/2019	11:22	Gravel	137.904	-0.013	1.26	
cuck_nst_rd_010	418571.541	4989306.425	138.355	0.014	0.017	07/17/2019	11:22	Gravel	138.334	-0.021	2.11	
davis_sd_rd_001	417982.652	4991043.067	136.990	0.009	0.012	07/17/2019	11:41	Gravel	137.121	0.130	13.05	
davis_sd_rd_002	417976.984	4991049.488	136.953	0.009	0.012	07/17/2019	11:41	Gravel	137.061	0.108	10.77	
davis_sd_rd_003	417968.596	4991059.083	136.922	0.010	0.013	07/17/2019	11:41	Gravel	137.035	0.113	11.30	
davis_sd_rd_004	417961.779	4991066.760	136.927	0.010	0.014	07/17/2019	11:41	Gravel	137.051	0.124	12.42	
davis_sd_rd_005	417953.181	4991076.504	136.937	0.011	0.015	07/17/2019	11:42	Gravel	137.052	0.115	11.46	
davis_sd_rd_006	417946.201	4991084.310	136.943	0.011	0.014	07/17/2019	11:42	Gravel	137.069	0.126	12.63	
davis_sd_rd_007	417939.788	4991091.934	136.983	0.011	0.014	07/17/2019	11:42	Gravel	137.046	0.063	6.34	
davis_sd_rd_008	417930.894	4991101.806	137.039	0.011	0.016	07/17/2019	11:43	Gravel	137.107	0.068	6.79	
davis_sd_rd_009	417918.543	4991116.925	137.156	0.014	0.019	07/17/2019	11:44	Gravel	137.167	0.011	1.11	
davis_sd_rd_010	417909.822	4991129.543	137.225	0.011	0.015	07/17/2019	11:44	Gravel	137.250	0.025	2.48	
davis_sd_rd_011	417904.427	4991139.815	137.287	0.011	0.015	07/17/2019	11:44	Gravel	137.326	0.039	3.87	
davis_sd_rd_012	417898.339	4991155.870	137.381	0.010	0.015	07/17/2019	11:45	Gravel	137.440	0.059	5.94	
davis_sd_rd_013	417894.510	4991174.697	137.532	0.014	0.020	07/17/2019	11:45	Gravel	137.618	0.086	8.59	
davis_sd_rd_014	417890.047	4991190.400	137.753	0.011	0.017	07/17/2019	11:46	Gravel	137.759	0.006	0.55	
davis_sd_rd_015	417884.055	4991205.897	138.117	0.014	0.019	07/17/2019	11:47	Gravel	138.102	-0.015	1.53	
fergusson_rd_001	418491.438	4992871.723	133.003	0.008	0.013	07/17/2019	12:00	Gravel	132.950	-0.053	5.33	
fergusson_rd_002	418501.354	4992879.195	133.088	0.010	0.018	07/17/2019	12:00	Gravel	133.101	0.013	1.25	

Table C.1 Field verification of LIDAR data (spot heights)

	RVCA Field Survey (17th July 2019)								Nearest Lidar Point	Comparison		
Location ID	X (m)	Y (m)	Z (m)	Horizontal Accuracy (m)	Veritcal Accuracy (m)	Date	Time	Field Observations	Z (m)	△z (m)	|△z | (cm)	|△z| > 0.33m
fergusson_rd_003	418513.799	4992889.202	133.050	0.011	0.019	07/17/2019	12:00	Gravel	133.002	-0.048	4.77	
fergusson_rd_004	418532.348	4992904.582	132.679	0.011	0.018	07/17/2019	12:01	Gravel	132.641	-0.038	3.81	
fergusson_rd_005	418540.409	4992911.483	132.481	0.011	0.018	07/17/2019	12:01	Gravel	132.468	-0.013	1.35	
fergusson_rd_006	418550.764	4992920.055	132.298	0.011	0.019	07/17/2019	12:02	Gravel	132.304	0.006	0.62	
fergusson_rd_007	418562.736	4992930.071	132.129	0.012	0.019	07/17/2019	12:02	Gravel	132.129	0.000	0.03	
fergusson_rd_008	418574.545	4992939.366	132.085	0.011	0.018	07/17/2019	12:03	Gravel	132.067	-0.018	1.79	
fergusson_rd_009	418587.111	4992950.642	132.016	0.011	0.019	07/17/2019	12:03	Gravel	132.035	0.019	1.85	
fergusson_rd_010	418594.281	4992956.427	132.014	0.011	0.018	07/17/2019	12:03	Gravel	132.100	0.086	8.60	
fergusson_rd_011	418609.407	4992968.717	132.177	0.012	0.020	07/17/2019	12:04	Gravel	132.146	-0.031	3.08	
fergusson_rd_012	418620.522	4992977.811	132.466	0.011	0.019	07/17/2019	12:05	Gravel	132.402	-0.064	6.40	
fergusson_rd_013	418643.267	4992996.123	133.392	0.011	0.019	07/17/2019	12:06	Gravel	133.337	-0.055	5.47	
fergusson_rd_014	418681.568	4993032.447	134.976	0.011	0.019	07/17/2019	12:07	Gravel	134.864	-0.112	11.17	
kidd_rd_001	418365.052	4994294.918	132.829	0.005	0.009	07/17/2019	12:15	Gravel	132.820	-0.010	0.95	
kidd_rd_002	418382.239	4994309.912	132.926	0.006	0.010	07/17/2019	12:16	Gravel	132.967	0.041	4.11	
kidd_rd_003	418393.661	4994319.580	133.031	0.007	0.012	07/17/2019	12:16	Gravel	133.059	0.028	2.81	
kidd_rd_004	418407.567	4994331.459	133.194	0.008	0.013	07/17/2019	12:17	Gravel	133.219	0.025	2.47	
kidd_rd_005	418414.518	4994337.396	133.283	0.009	0.015	07/17/2019	12:18	Gravel	133.268	-0.015	1.46	
kidd_rd_006	418424.814	4994346.011	133.418	0.008	0.014	07/17/2019	12:18	Gravel	133.449	0.031	3.14	
kidd_rd_007	418433.195	4994352.843	133.513	0.011	0.019	07/17/2019	12:19	Gravel	133.507	-0.006	0.58	
kidd_rd_008	418444.757	4994363.059	133.642	0.011	0.019	07/17/2019	12:19	Gravel	133.708	0.066	6.56	
kidd_rd_009	418465.008	4994378.285	134.052	0.009	0.016	07/17/2019	12:20	Gravel	134.047	-0.005	0.49	
kidd_rd_010	418480.743	4994391.762	134.464	0.010	0.019	07/17/2019	12:21	Gravel	134.433	-0.031	3.07	
glenash_rd_001	417014.570	4996808.198	131.495	0.009	0.016	07/17/2019	12:33	Paved	131.550	0.055	5.50	
glenash_rd_002	417009.907	4996804.323	131.461	0.009	0.017	07/17/2019	12:33	Paved	131.482	0.021	2.09	
glenash_rd_003	417003.748	4996799.142	131.560	0.009	0.018	07/17/2019	12:34	Paved	131.556	-0.004	0.36	
glenash_rd_004	416996.738	4996793.343	131.582	0.009	0.017	07/17/2019	12:34	Paved	131.599	0.017	1.73	
glenash_rd_005	416990.991	4996788.661	131.562	0.010	0.017	07/17/2019	12:34	Paved	131.614	0.052	5.20	
glenash_rd_006	416983.509	4996782.540	131.579	0.008	0.014	07/17/2019	12:34	Paved	131.576	-0.003	0.28	
glenash_rd_007	416976.468	4996776.805	131.578	0.009	0.017	07/17/2019	12:35	Paved	131.619	0.041	4.07	
glenash_rd_008	416964.086	4996766.806	131.522	0.009	0.018	07/17/2019	12:35	Paved	131.621	0.099	9.87	
glenash_rd_009	416955.080	4996759.030	131.533	0.009	0.018	07/17/2019	12:35	Paved	131.605	0.072	7.16	
glenash_rd_010	416945.609	4996751.258	131.590	0.009	0.018	07/17/2019	12:36	Paved	131.537	-0.054	5.35	
derry_sd_rd_001	417036.131	4996816.867	132.021	0.009	0.016	07/17/2019	12:38	Paved	132.067	0.046	4.58	
derry_sd_rd_002	417045.249	4996806.254	132.064	0.009	0.015	07/17/2019	12:39	Paved	132.052	-0.012	1.23	
derry_sd_rd_003	417054.119	4996795.868	132.175	0.009	0.015	07/17/2019	12:39	Paved	132.208	0.033	3.33	
derry_sd_rd_004	417063.600	4996784.589	132.214	0.009	0.015	07/17/2019	12:40	Paved	132.247	0.032	3.25	
derry_sd_rd_005	417071.997	4996774.443	132.256	0.009	0.016	07/17/2019	12:40	Paved	132.316	0.060	6.02	
derry_sd_rd_006	417080.604	4996764.216	132.306	0.009	0.016	07/17/2019	12:41	Paved	132.353	0.047	4.74	
derry_sd_rd_007	417097.434	4996744.243	132.431	0.010	0.017	07/17/2019	12:41	Paved	132.421	-0.010	1.01	
derry_sd_rd_008	417017.550	4996838.462	131.870	0.009	0.014	07/17/2019	12:44	Paved	131.881	0.011	1.09	
derry_sd_rd_009	416998.156	4996861.736	131.812	0.008	0.014	07/17/2019	12:45	Paved	131.877	0.065	6.49	
derry_sd_rd_010	416933.665	4996937.587	132.133	0.011	0.019	07/17/2019	12:47	Paved	132.212	0.079	7.90	
derry_sd_rd_011	415984.698	4997922.269	131.119	0.010	0.016	07/17/2019	12:57	Paved	131.217	0.098	9.81	
derry_sd_rd_012	415992.457	4997928.530	131.181	0.010	0.015	07/17/2019	12:58	Paved	131.257	0.076	7.62	
derry_sd_rd_013	416003.954	4997938.003	131.231	0.009	0.013	07/17/2019	12:59	Paved	131.310	0.079	7.90	
derry_sd_rd_014	416009.320	4997942.880	131.261	0.009	0.013	07/17/2019	12:59	Paved	131.363	0.102	10.19	
derry_sd_rd_015	416015.602	4997948.143	131.264	0.008	0.012	07/17/2019	12:59	Paved	131.332	0.068	6.84	
derry_sd_rd_016	416022.681	4997954.374	131.266	0.009	0.013	07/17/2019	13:00	Paved	131.365	0.099	9.91	
derry_sd_rd_017	416069.881	4997957.518	131.462	0.008	0.011	07/17/2019	13:03	Paved	131.577	0.115	11.50	
derry_sd_rd_018	416075.582	4997947.677	131.516	0.008	0.012	07/17/2019	13:03	Paved	131.602	0.086	8.61	
derry_sd_rd_019	416081.755	4997937.795	131.559	0.008	0.012	07/17/2019	13:04	Paved	131.605	0.046	4.62	
derry_sd_rd_020	416090.151	4997926.237	131.532	0.008	0.012	07/17/2019	13:04	Paved	131.623	0.091	9.14	

Table C.1 Field verification of LIDAR data (spot heights)

	RVCA Field Survey (17th July 2019)								Nearest Lidar Point	Comparison		
Location ID	X (m)	Y (m)	Z (m)	Horizontal Accuracy (m)	Veritcal Accuracy (m)	Date	Time	Field Observations	Z (m)	△z (m)	|△z | (cm)	|△z| > 0.33m
derry_sd_rd_021	416099.429	4997915.142	131.572	0.009	0.013	07/17/2019	13:05	Paved	131.644	0.072	7.18	
derry_sd_rd_022	416105.253	4997908.293	131.592	0.009	0.014	07/17/2019	13:05	Paved	131.636	0.044	4.39	
beckwi_9rd_001	416090.942	4998012.086	131.827	0.009	0.012	07/17/2019	13:08	Paved	131.915	0.088	8.83	
beckwi_9rd_002	416108.065	4998025.722	132.194	0.009	0.012	07/17/2019	13:09	Paved	132.276	0.082	8.15	
beckwi_9rd_003	416125.164	4998040.213	132.728	0.009	0.012	07/17/2019	13:10	Paved	132.760	0.031	3.15	
beckwi_9rd_004	416138.698	4998051.407	133.321	0.009	0.012	07/17/2019	13:10	Paved	133.402	0.081	8.13	
beckwi_9rd_005	416151.632	4998062.321	133.891	0.009	0.013	07/17/2019	13:11	Paved	133.927	0.036	3.58	
beckwi_9rd_006	416165.291	4998073.586	134.438	0.009	0.013	07/17/2019	13:11	Paved	134.536	0.098	9.76	
beckwi_9rd_007	416182.213	4998087.766	135.096	0.010	0.014	07/17/2019	13:12	Paved	135.131	0.035	3.45	
beckwi_9rd_008	416196.905	4998100.148	135.548	0.010	0.013	07/17/2019	13:12	Paved	135.570	0.022	2.21	
beckwi_9rd_009	416208.123	4998109.462	135.772	0.009	0.013	07/17/2019	13:13	Paved	135.835	0.063	6.27	
hwy_15a_005	415278.742	4989519.542	138.297	0.015	0.020	07/17/2019	14:51	Paved	138.282	-0.015	1.47	
hwy_15a_006	415294.786	4989499.539	138.373	0.014	0.019	07/17/2019	14:52	Paved	138.343	-0.030	2.97	
hwy_15a_007	415313.329	4989476.498	138.326	0.010	0.016	07/17/2019	14:52	Paved	138.277	-0.049	4.90	
hwy_15a_008	415329.218	4989456.995	138.432	0.012	0.018	07/17/2019	14:53	Paved	138.401	-0.031	3.15	
hwy_15a_009	415334.983	4989449.734	138.425	0.011	0.018	07/17/2019	14:54	Paved	138.359	-0.066	6.57	
hwy_15a_010	415342.083	4989441.007	138.403	0.013	0.020	07/17/2019	14:54	Paved	138.323	-0.080	7.97	
hwy_15a_016	414202.004	4991142.847	139.853	0.007	0.012	07/17/2019	15:05	Paved	139.881	0.028	2.78	
hwy_15a_017	414202.593	4991159.004	139.952	0.008	0.014	07/17/2019	15:05	Paved	139.950	-0.002	0.18	
hwy_15a_018	414203.475	4991177.974	140.082	0.011	0.018	07/17/2019	15:06	Paved	140.140	0.058	5.79	
hwy_15a_019	414204.297	4991196.806	140.177	0.011	0.018	07/17/2019	15:06	Paved	140.216	0.039	3.88	
hwy_15a_020	414205.031	4991217.264	140.368	0.010	0.018	07/17/2019	15:07	Paved	140.449	0.081	8.09	
hwy_15a_021	414205.896	4991244.799	140.586	0.010	0.016	07/17/2019	15:08	Paved	140.660	0.074	7.44	
hwy_15a_022	414206.389	4991272.992	140.776	0.010	0.017	07/17/2019	15:09	Paved	140.772	-0.004	0.41	
hwy_15a_023	414205.980	4991293.950	140.946	0.010	0.018	07/17/2019	15:10	Paved	141.009	0.063	6.29	
hwy_15a_024	414205.485	4991313.621	140.962	0.010	0.017	07/17/2019	15:11	Paved	141.013	0.051	5.10	
beckwi_7ln_001	415086.154	4993403.999	134.440	0.012	0.019	07/17/2019	15:20	Gravel	134.380	-0.060	6.00	
beckwi_7ln_002	415069.581	4993390.730	134.578	0.012	0.020	07/17/2019	15:21	Gravel	134.557	-0.021	2.07	
beckwi_7ln_003	414769.415	4993134.971	139.901	0.006	0.010	07/17/2019	15:27	Gravel	139.848	-0.053	5.31	
beckwi_7ln_004	414761.976	4993128.531	139.986	0.008	0.016	07/17/2019	15:27	Gravel	139.977	-0.009	0.88	
beckwi_7ln_005	414755.086	4993122.780	140.050	0.008	0.015	07/17/2019	15:28	Gravel	140.084	0.034	3.40	
beckwi_7ln_006	414747.207	4993116.062	140.115	0.008	0.014	07/17/2019	15:28	Gravel	140.119	0.004	0.42	
beckwi_7ln_007	414739.505	4993109.562	140.217	0.008	0.015	07/17/2019	15:28	Gravel	140.193	-0.024	2.38	
beckwi_7ln_008	414732.779	4993103.490	140.265	0.009	0.016	07/17/2019	15:28	Gravel	140.279	0.014	1.36	
beckwi_7ln_009	414724.564	4993096.403	140.308	0.009	0.017	07/17/2019	15:29	Gravel	140.285	-0.023	2.29	
beckwi_7ln_010	414716.944	4993089.767	140.328	0.009	0.020	07/17/2019	15:30	Gravel	140.317	-0.012	1.15	
beckwi_7ln_011	414707.662	4993081.742	140.242	0.010	0.019	07/17/2019	15:30	Gravel	140.272	0.030	2.96	
beckwi_9lna_001	414542.982	4996683.264	135.161	0.009	0.016	07/17/2019	15:42	Paved	135.141	-0.020	1.97	
beckwi_9lna_002	414552.754	4996691.427	135.126	0.010	0.018	07/17/2019	15:42	Paved	135.115	-0.011	1.14	
beckwi_9lna_003	414561.646	4996699.300	135.121	0.010	0.020	07/17/2019	15:42	Paved	135.039	-0.083	8.25	
beckwi_9lna_004	414573.022	4996709.082	135.166	0.008	0.016	07/17/2019	15:43	Paved	135.092	-0.074	7.39	
beckwi_9lna_005	414586.489	4996721.542	135.286	0.008	0.015	07/17/2019	15:43	Paved	135.242	-0.044	4.42	
beckwi_9lna_006	414595.685	4996729.918	135.374	0.008	0.015	07/17/2019	15:44	Paved	135.328	-0.046	4.57	
beckwi_9lna_007	414623.143	4996755.229	135.626	0.008	0.015	07/17/2019	15:45	Paved	135.563	-0.064	6.35	
beckwi_9lna_008	414645.725	4996776.010	135.765	0.008	0.014	07/17/2019	15:46	Paved	135.707	-0.058	5.76	
beckwi_9lna_009	414667.410	4996795.180	136.139	0.010	0.019	07/17/2019	15:46	Paved	136.172	0.033	3.33	
beckwi_9lna_010	414667.394	4996795.203	136.128	0.011	0.019	07/17/2019	15:47	Paved	136.173	0.045	4.53	
beckwi_9lna_011	414679.654	4996805.463	136.384	0.011	0.018	07/17/2019	15:48	Paved	136.409	0.025	2.45	
cemtry_sdrd_a001	415130.805	4999157.073	134.808	0.011	0.017	07/17/2019	15:58	Paved	134.691	-0.117	11.73	
cemtry_sdrd_a002	415122.049	4999166.340	134.832	0.009	0.014	07/17/2019	15:59	Paved	134.726	-0.106	10.61	
cemtry_sdrd_a003	415113.393	4999176.505	134.880	0.011	0.018	07/17/2019	15:59	Paved	134.721	-0.159	15.89	
cemtry_sdrd_a004	415105.291	4999186.182	134.952	0.011	0.018	07/17/2019	15:59	Paved	134.821	-0.131	13.09	

Table C.1 Field verification of LIDAR data (spot heights)

	RVCA Field Survey (17th July 2019)								Nearest Lidar Point	Comparison		
Location ID	X (m)	Y (m)	Z (m)	Horizontal Accuracy (m)	Veritcal Accuracy (m)	Date	Time	Field Observations	Z (m)	△Z (m)	|△Z | (cm)	|△Z| > 0.33m
cemtry_sdrd_a005	415094.450	4999199.612	135.000	0.010	0.016	07/17/2019	16:00	Paved	134.940	-0.060	6.03	
cemtry_sdrd_a006	415083.894	4999212.345	135.096	0.009	0.014	07/17/2019	16:00	Paved	134.954	-0.142	14.20	
cemtry_sdrd_a007	415070.994	4999228.859	135.094	0.008	0.013	07/17/2019	16:01	Paved	135.008	-0.086	8.60	
cemtry_sdrd_a008	415056.478	4999246.870	135.177	0.008	0.013	07/17/2019	16:01	Paved	135.072	-0.105	10.53	
cemtry_sdrd_a009	415044.922	4999261.306	135.175	0.008	0.012	07/17/2019	16:02	Paved	135.088	-0.087	8.68	
cemtry_sdrd_a010	415035.098	4999273.451	135.218	0.008	0.013	07/17/2019	16:03	Paved	135.130	-0.088	8.80	
cemtry_sdrd_a011	415026.528	4999283.322	135.250	0.008	0.012	07/17/2019	16:03	Paved	135.156	-0.094	9.36	
hwy_15b_001	415983.888	5001600.776	134.974	0.003	0.005	07/17/2019	16:13	Paved	134.986	0.012	1.21	
hwy_15b_002	415990.500	5001604.947	134.947	0.004	0.006	07/17/2019	16:14	Paved	134.936	-0.011	1.09	
hwy_15b_003	415999.985	5001610.562	134.875	0.004	0.006	07/17/2019	16:14	Paved	134.892	0.017	1.70	
hwy_15b_004	416011.347	5001617.714	134.795	0.004	0.006	07/17/2019	16:14	Paved	134.834	0.039	3.91	
hwy_15b_005	416023.983	5001625.269	134.711	0.005	0.007	07/17/2019	16:15	Paved	134.720	0.009	0.86	
hwy_15b_006	416039.060	5001634.455	134.609	0.005	0.007	07/17/2019	16:15	Paved	134.579	-0.030	3.03	
hwy_15b_007	416053.648	5001642.798	134.498	0.005	0.007	07/17/2019	16:15	Paved	134.473	-0.025	2.46	
hwy_15b_008	416072.249	5001653.979	134.372	0.005	0.008	07/17/2019	16:16	Paved	134.394	0.022	2.20	
hwy_15b_009	416087.693	5001662.908	134.263	0.005	0.008	07/17/2019	16:16	Paved	134.269	0.006	0.63	
hwy_15b_010	416104.956	5001672.470	134.139	0.006	0.009	07/17/2019	16:17	Paved	134.068	-0.071	7.12	
hwy_15b_011	416123.624	5001683.244	134.026	0.008	0.010	07/17/2019	16:17	Paved	134.041	0.015	1.51	
hwy_15b_012	416136.617	5001690.457	133.935	0.009	0.013	07/17/2019	16:18	Paved	133.910	-0.025	2.53	
hwy_15b_013	416147.808	5001696.640	133.864	0.006	0.009	07/17/2019	16:18	Paved	133.907	0.043	4.26	
hwy_15b_014	416163.567	5001706.844	133.844	0.008	0.014	07/17/2019	16:19	Paved	133.839	-0.005	0.51	
hwy_15b_015	416181.240	5001717.030	133.763	0.008	0.011	07/17/2019	16:19	Paved	133.763	0.000	0.04	
hwy_15b_016	416211.027	5001732.776	133.629	0.006	0.008	07/17/2019	16:20	Paved	133.640	0.011	1.10	
ashonstn_rd_001	418846.056	5000881.296	133.772	0.006	0.008	07/17/2019	16:29	Paved	133.716	-0.056	5.60	
ashonstn_rd_002	418852.355	5000871.937	133.198	0.007	0.009	07/17/2019	16:29	Paved	133.179	-0.019	1.94	
ashonstn_rd_003	418859.866	5000859.859	132.885	0.008	0.010	07/17/2019	16:29	Paved	132.847	-0.038	3.80	
ashonstn_rd_004	418888.788	5000822.820	132.726	0.008	0.010	07/17/2019	16:31	Paved	132.691	-0.035	3.48	
ashonstn_rd_005	418894.100	5000815.662	132.748	0.008	0.010	07/17/2019	16:31	Paved	132.699	-0.049	4.89	
ashonstn_rd_006	418906.715	5000800.558	132.768	0.009	0.011	07/17/2019	16:31	Paved	132.710	-0.058	5.76	
ashonstn_rd_007	418919.344	5000785.409	132.693	0.008	0.010	07/17/2019	16:32	Paved	132.669	-0.024	2.39	
ashonstn_rd_008	418931.341	5000770.791	132.836	0.009	0.012	07/17/2019	16:32	Paved	132.861	0.025	2.54	
ashonstn_rd_009	418952.449	5000746.541	132.642	0.009	0.012	07/17/2019	16:33	Paved	132.607	-0.035	3.54	
ashonstn_rd_010	418965.350	5000731.808	132.395	0.009	0.011	07/17/2019	16:34	Paved	132.388	-0.007	0.70	
ashonstn_rd_011	418977.312	5000717.783	132.128	0.009	0.011	07/17/2019	16:34	Paved	132.077	-0.051	5.09	
ashonstn_rd_012	418996.872	5000693.230	131.964	0.009	0.011	07/17/2019	16:34	Paved	131.997	0.033	3.26	

Mean △Z :	4.3	0 Yes out of 243
Median△Z :	3.5	
Max △Z :	15.9	
Min △Z :	0.0	

Table C.1 Field verification of LIDAR data (spot heights)

	RVCA Field Survey (17th July 2019)								Nearest Lidar Point	Comparison		
Location ID	X (m)	Y (m)	Z (m)	Horizontal Accuracy (m)	Veritcal Accuracy (m)	Date	Time	Field Observations	Z (m)	△Z (m)	|△Z | (cm)	|△Z| > 0.33m
Discarded Points												
cuck_nst_rd_012	419030.022	4989727.619	141.394	0.01	0.014	07/17/2019	11:31	Road Repaved	141.109	-0.285	28.5	
cuck_nst_rd_014	419020.549	4989739.980	141.201	0.012	0.016	07/17/2019	11:32	Road Repaved	140.963	-0.238	23.8	
cuck_nst_rd_015	419015.682	4989745.777	141.153	0.012	0.015	07/17/2019	11:33	Road Repaved	140.862	-0.291	29.1	
cuck_nst_rd_016	419012.386	4989750.588	141.081	0.011	0.015	07/17/2019	11:33	Road Repaved	140.894	-0.187	18.7	
cuck_nst_rd_017	419008.275	4989755.579	141.039	0.011	0.014	07/17/2019	11:33	Road Repaved	140.848	-0.191	19.1	
cuck_nst_rd_018	419003.559	4989761.336	141.035	0.012	0.016	07/17/2019	11:34	Road Repaved	140.800	-0.235	23.5	
cuck_nst_rd_019	418999.533	4989766.573	141.043	0.011	0.014	07/17/2019	11:34	Road Repaved	140.837	-0.206	20.6	
cuck_nst_rd_020	418996.359	4989770.386	141.071	0.011	0.015	07/17/2019	11:35	Road Repaved	140.836	-0.236	23.6	
cemtry_sdrd_001	416051.105	4998118.751	132.21	0.014	0.019	07/17/2019	13:18	Road Repaved	132.017	-0.193	19.3	
cemtry_sdrd_002	416045.754	4998141.729	132.223	0.013	0.016	07/17/2019	13:19	Road Repaved	132.002	-0.221	22.1	
cemtry_sdrd_003	416039.892	4998158.947	132.302	0.015	0.02	07/17/2019	13:20	Road Repaved	132.052	-0.250	25.0	
cemtry_sdrd_004	416033.956	4998173.730	132.436	0.014	0.018	07/17/2019	13:20	Road Repaved	132.218	-0.218	21.8	
cemtry_sdrd_005	416011.962	4998213.765	132.638	0.013	0.016	07/17/2019	13:21	Road Repaved	132.384	-0.254	25.4	
cemtry_sdrd_006	415996.662	4998233.358	132.713	0.014	0.018	07/17/2019	13:22	Road Repaved	132.497	-0.216	21.6	
cemtry_sdrd_007	415978.846	4998253.749	132.864	0.014	0.017	07/17/2019	13:23	Road Repaved	132.698	-0.166	16.6	
cemtry_sdrd_010	415951.660	4998285.704	132.976	0.009	0.012	07/17/2019	13:29	Road Repaved	132.783	-0.193	19.3	
cemtry_sdrd_011	415931.704	4998309.612	132.782	0.01	0.012	07/17/2019	13:29	Road Repaved	132.597	-0.185	18.5	
cemtry_sdrd_012	415917.323	4998327.248	132.669	0.01	0.012	07/17/2019	13:30	Road Repaved	132.540	-0.129	12.9	

Appendix D

SWMHYMO Model Files

```
2     Metric units
*#*******************************************************************************
*#  Project Name: [Upperjock]     Project Number: [10485]
*#  Date         : 21 Oct 2019
*#  Modeller     : [ Calvin Paul ]
*#  Company      : Rideau Valley Conservation Authority
*#  License #    :  5329846
*#*******************************************************************************
*% 100 Year 3 Hour Chicago Design Storm
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                    ["100YC3H.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|-------------------------------------------------------------|
READ STORM           STORM_FILENAME=["storm.001"]
*%-----------------|-------------------------------------------------------------|
DEFAULT VALUES       ICASEdef=[1],  read and print values
                     DEFVAL_FILENAME=["uppe_val.val"]
*%-----------------|-------------------------------------------------------------|
*# Main Channel
CALIB NASHYD         ID=[1], NHYD=["UJ1"], DT=[5]min, AREA=[2048.43](ha),
                     DWF=[0](cms),  CN/C=[73.8], IA=[4.51](mm),
                     N=[3], TP=[12.36]hrs,
                     RAINFALL=[ ,   ,   ,   , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
SAVE HYD             ID=[1],   # OF PCYCLES=[1],  ICASEsh=[1]
                     HYD_COMMENT=["Runoff Hydrograph for UJ1"]
*%-----------------|-------------------------------------------------------------|
ROUTE CHANNEL        IDout=[2], NHYD=["C1"], IDin=[1],
                     RDT=[5](min),
                     CHLGTH=[3496](m),  CHSLOPE=[0.059](%),
                                        FPSLOPE=[0.059](%),
                     SECNUM=[22500],       NSEG=[3]
                     ( SEGROUGH, SEGDIST (m))=[0.07, 1026.63] NSEG times
                                              -0.05, 1044.21
                                              0.07, 1966.60
                     ( DISTANCE (m), ELEVATION (m))=[0.00, 137.93]
                                                    656.64, 134.14
                                                    764.85, 132.43
                                                    1026.63, 132.40
                                                    1036.76, 131.71
                                                    1044.21, 132.51
                                                    1714.14, 132.77
                                                    1966.60, 140.40
*%-----------------|-------------------------------------------------------------|
SAVE HYD             ID=[2],   # OF PCYCLES=[1],  ICASEsh=[1]
                     HYD_COMMENT=["Routing Hydrograph for C1"]
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD         ID=[3], NHYD=["TA1"], DT=[5]min, AREA=[1004.45](ha),
                     DWF=[0](cms),  CN/C=[72.5], IA=[4.83](mm),
                     N=[3], TP=[7.08]hrs,
                     RAINFALL=[ ,   ,   ,   , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
SAVE HYD             ID=[3],   # OF PCYCLES=[1],  ICASEsh=[1]
                     HYD_COMMENT=["Runoff Hydrograph for TA1"]
*%-----------------|-------------------------------------------------------------|
ADD HYD              IDsum=[4], NHYD=["N2"], IDs to add=[2 + 3]
*%-----------------|-------------------------------------------------------------|
SAVE HYD             ID=[4],   # OF PCYCLES=[1],  ICASEsh=[1]
                     HYD_COMMENT=["Confluence Hydrograph for N2"]
*%-----------------|-------------------------------------------------------------|
ROUTE CHANNEL        IDout=[5], NHYD=["C2"], IDin=[4],
                     RDT=[5](min),
                     CHLGTH=[4708](m),  CHSLOPE=[0.018](%),
                                        FPSLOPE=[0.018](%),
                     SECNUM=[16800],       NSEG=[3]
                     ( SEGROUGH, SEGDIST (m))=[0.07, 1254.79] NSEG times
                                              -0.05, 1273.40
                                              0.07, 2745.22
                     ( DISTANCE (m), ELEVATION (m))=[0.00, 133.93]
                                                    425.87, 131.33
                                                    1219.31, 131.11
                                                    1254.79, 130.82
                                                    1256.64, 129.79
                                                    1273.40, 130.93
                                                    1675.33, 130.98
                                                    2745.22, 131.82
```


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```
*%-----------------|-------------------------------------------------------------|
SAVE HYD            ID=[5],    # OF PCYCLES=[1],   ICASEsh=[1]
                    HYD_COMMENT=["Routing Hydrograph for C2"]
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD        ID=[6], NHYD=["TB1"], DT=[5]min, AREA=[1396.83](ha),
                    DWF=[0](cms),  CN/C=[68.8], IA=[5.75](mm),
                    N=[3], TP=[6.94]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
SAVE HYD            ID=[6],    # OF PCYCLES=[1],   ICASEsh=[1]
                    HYD_COMMENT=["Runoff Hydrograph for TB1"]
*%-----------------|-------------------------------------------------------------|
ADD HYD             IDsum=[7], NHYD=["N3"], IDs to add=[5 + 6]
*%-----------------|-------------------------------------------------------------|
SAVE HYD            ID=[7],    # OF PCYCLES=[1],   ICASEsh=[1]
                    HYD_COMMENT=["Confluence Hydrograph for N3"]
*%-----------------|-------------------------------------------------------------|
ROUTE CHANNEL       IDout=[8], NHYD=["C3"], IDin=[7],
                    RDT=[5](min),
                    CHLGTH=[2255](m),  CHSLOPE=[0.043](%),
                                        FPSLOPE=[0.043](%),
                    SECNUM=[11600],       NSEG=[3]
                    ( SEGROUGH, SEGDIST (m))=[0.07, 528.71] NSEG times
                                              -0.05, 538.45
                                              0.07, 1179.62
                    ( DISTANCE (m), ELEVATION (m))=[0.00, 131.97]
                                                    198.37, 130.53
                                                    528.71, 130.28
                                                    530.20, 129.11
                                                    538.45, 130.36
                                                    789.17, 130.63
                                                    1092.52, 130.75
                                                    1179.62, 132.12
*%-----------------|-------------------------------------------------------------|
SAVE HYD            ID=[8],    # OF PCYCLES=[1],   ICASEsh=[1]
                    HYD_COMMENT=["Routing Hydrograph for C3"]
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD        ID=[9], NHYD=["UJ2"], DT=[5]min, AREA=[3783.71](ha),
                    DWF=[0](cms),  CN/C=[80.1], IA=[3.16](mm),
                    N=[3], TP=[22.14]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
SAVE HYD            ID=[9],    # OF PCYCLES=[1],   ICASEsh=[1]
                    HYD_COMMENT=["Runoff Hydrograph for UJ2"]
*%-----------------|-------------------------------------------------------------|
ADD HYD             IDsum=[10], NHYD=["N4"], IDs to add=[8 + 9]
*%-----------------|-------------------------------------------------------------|
SAVE HYD            ID=[10],    # OF PCYCLES=[1],   ICASEsh=[1]
                    HYD_COMMENT=["Confluence Hydrograph for N4"]
*%-----------------|-------------------------------------------------------------|
ROUTE CHANNEL       IDout=[1], NHYD=["C4"], IDin=[10],
                    RDT=[5](min),
                    CHLGTH=[5183](m),  CHSLOPE=[0.067](%),
                                        FPSLOPE=[0.067](%),
                    SECNUM=[8000],       NSEG=[3]
                    ( SEGROUGH, SEGDIST (m))=[0.035, 470.88] NSEG times
                                              -0.045, 480.54
                                              0.035, 651.29
                    ( DISTANCE (m), ELEVATION (m))=[0.00, 131.62]
                                                    114.27, 131.46
                                                    420.60, 129.56
                                                    470.88, 129.37
                                                    476.12, 128.96
                                                    480.54, 129.43
                                                    540.74, 129.51
                                                    651.29, 131.28
*%-----------------|-------------------------------------------------------------|
SAVE HYD            ID=[1],    # OF PCYCLES=[1],   ICASEsh=[1]
                    HYD_COMMENT=["Routing Hydrograph for C4"]
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD        ID=[2], NHYD=["UJ3"], DT=[5]min, AREA=[1810.89](ha),
                    DWF=[0](cms),  CN/C=[72.6], IA=[4.79](mm),
                    N=[3], TP=[5.62]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
```


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```
SAVE HYD            ID=[2],   # OF PCYCLES=[1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff Hydrograph for UJ3"]
*%-----------------|----------------------------------------------------------|
ADD HYD             IDsum=[3], NHYD=["N5"], IDs to add=[1 + 2]
*%-----------------|----------------------------------------------------------|
SAVE HYD            ID=[3],   # OF PCYCLES=[1],  ICASEsh=[1]
                    HYD_COMMENT=["Confluence Hydrograph for N5"]
*%-----------------|----------------------------------------------------------|
*% 100 Year 3 Hour SCS Design Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                   ["100YS3.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|----------------------------------------------------------|
*% 100 Year 6 Hour Chicago Design Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[6]
*%                   ["100YC6H.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|----------------------------------------------------------|
*% 100 Year 6 Hour SCS Design Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[7]
*%                   ["100YS6.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|----------------------------------------------------------|
*% 100 Year 12 Hour Chicago Design Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[12]
*%                   ["100YC12H.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|----------------------------------------------------------|
*% 100 Year 12 Hour SCS Design Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[13]
*%                   ["100YS12.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|----------------------------------------------------------|
*% 100 Year 24 Hour Chicago Design Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[24]
*%                   ["100YC24H.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|----------------------------------------------------------|
*% 100 Year 24 Hour SCS Design Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[25]
*%                   ["100YS24.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|----------------------------------------------------------|
*% Timmins Historical Design Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[80]
*%                   ["Timmins.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|----------------------------------------------------------|
*% Hazel Historical Design Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[90]
*%                   ["Hazel.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|----------------------------------------------------------|
*% 2 Year 24 Hour SCS Design Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[240]
*%                   ["2YS24.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|----------------------------------------------------------|
*% 5 Year 24 Hour SCS Design Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[241]
*%                   ["5YS24.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|----------------------------------------------------------|
*% 10 Year 24 Hour SCS Design Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[242]
*%                   ["10YS24.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|----------------------------------------------------------|
*% 20 Year 24 Hour SCS Design Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[243]
*%                   ["20YS24.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|----------------------------------------------------------|
*% 50 Year 24 Hour SCS Design Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[244]
*%                   ["50YS24.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|----------------------------------------------------------|
*% 200 Year 24 Hour SCS Design Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[245]
*%                   ["200YS24.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|----------------------------------------------------------|
*% 350 Year 24 Hour SCS Design Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[246]
*%                   ["350YS24.stm"] <--storm filename, one per line for NSTORM time
*%-----------------|----------------------------------------------------------|
*% 500 Year 24 Hour SCS Design Storm
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[247]
*%                   ["500YS24.stm"] <--storm filename, one per line for NSTORM time
```

```
*%-----------------|---------------------------------------------------------|
FINISH
```

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

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO       999   999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O     9   9 9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ## 9   9 9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O      9999  9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO          9     9   =========
                                                       9   9 9   9   # 5329846
        StormWater Management HYdrologic Model            999   999    =========

 ******************************************************************************
 *****************************  SWMHYMO Ver/4.05  *****************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                OTTHYMO-83 and OTTHYMO-89.                   *********
 ******************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa,  Ontario: (613) 836-3884           *********
 *********                  Gatineau, Quebec: (819) 243-6858           *********
 *********                  E-Mail: swmhymo@jfsa.Com                   *********
 ******************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Rideau Valley Conservation Authority         +++++++++
 +++++++++                Manotick               SERIAL#:5329846       +++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************
 *********          ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *********
 *********          Maximum value for ID numbers  :     10             *********
 *********          Max. number of rainfall points: 105408             *********
 *********          Max. number of flow points    : 105408             *********
 ******************************************************************************

 ***** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) *****
 *****--------------------------------------------------------------------*****
 *****    ID:  Hydrograph IDentification numbers, (1-10).                 *****
 *****  NHYD:  Hydrograph reference numbers, (6 digits or characters).    *****
 *****  AREA:  Drainage area associated with hydrograph, (ac.) or (ha.).  *****
 ***** QPEAK:  Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s).    *****
 ***** TpeakDate_hh:mm is the date and time of the peak flow.             *****
 *****  R.V.:  Runoff Volume of simulated hydrograph, (in) or (mm).       *****
 *****  R.C.:  Runoff Coefficient of simulated hydrograph, (ratio).       *****
 *****     *:  see WARNING or NOTE message printed at end of run.         *****
 *****    **:  see  ERROR  message printed at end of run.                 *****
 ******************************************************************************
 ******************************************************************************

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

 ******************************************************************************

 **********************   S U M M A R Y   O U T P U T   **********************
 ******************************************************************************
 *       DATE: 2020-05-11     TIME: 11:41:47     RUN COUNTER: 000022          *
 ******************************************************************************
 * Input   filename: C:\UJSYMH~1\uppe.dat                                      *
 * Output  filename: C:\UJSYMH~1\uppe.out                                      *
 * Summary filename: C:\UJSYMH~1\uppe.sum                                      *
 * User comments:                                                              *
 * 1:__________________________________________________________________________*
 * 2:__________________________________________________________________________*
 * 3:__________________________________________________________________________*
 ******************************************************************************


#*****************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date         : 21 Oct 2019
#  Modeller     : [ Calvin Paul ]
#  Company      : Rideau Valley Conservation Authority
#  License #    :  5329846
#*****************************************************************************
  ** END OF RUN :   2

******************************************************************************



 RUN:COMMAND#
 003:0001------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   3 ]
#*****************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date         : 21 Oct 2019
#  Modeller     : [ Calvin Paul ]
#  Company      : Rideau Valley Conservation Authority
#  License #    :  5329846
#*****************************************************************************
 003:0002------------------------------------------------------------------------
     READ STORM
      Filename = storm.001
      Comment  =
      [SDT=10.00:SDUR=   3.00:PTOT=  74.43]
 003:0003------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = C:\UJSYMH~1\uppe_val.val
      ICASEdv  = 1 (read and print data)
      FileTitle= File comment: [Bilberry Creek Default Value File]
                 THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN STANDHYD COM
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=   4.67 mm] [LGP=90.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .045]
      Parameters used in NASHYD:
      [Ia=   1.50 mm] [N= 3.00]
# Main Channel
 003:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:UJ1         2048.43    7.663 No_date   13:45    30.54 .410
      [CN= 73.8: N= 3.00]
      [Tp=12.36:DT= 5.00]
 003:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           01:UJ1         2048.43    7.663 No_date   13:45    30.54  n/a
      fname :C:\UJSYMH~1\H-UJ1.003
      remark:Runoff Hydrograph for UJ1
```

```
 003:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 01:UJ1        2048.43    7.663 No_date   13:45    30.54  n/a
      [RDT= 5.00] out<- 02:C1          2048.43    6.714 No_date   19:05    30.54  n/a
      [L/S/n= 3496./ .059/.050]
      {Vmax=  .202:Dmax=  .783}
 003:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           02:C1          2048.43    6.714 No_date   19:05    30.54  n/a
      fname :C:\UJSYMH~1\H-C1.003
      remark:Routing Hydrograph for C1
 003:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:TA1         1004.45    6.215 No_date    8:30    29.19 .392
      [CN= 72.5: N= 3.00]
      [Tp= 7.08:DT= 5.00]
 003:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           03:TA1         1004.45    6.215 No_date    8:30    29.19  n/a
      fname :C:\UJSYMH~1\H-TA1.003
      remark:Runoff Hydrograph for TA1
 003:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:C1          2048.43    6.714 No_date   19:05    30.54  n/a
                      + 03:TA1         1004.45    6.215 No_date    8:30    29.19  n/a
      [DT= 5.00]  SUM=  04:N2          3052.88   10.129 No_date   12:10    30.09  n/a
 003:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           04:N2          3052.88   10.129 No_date   12:10    30.09  n/a
      fname :C:\UJSYMH~1\H-N2.003
      remark:Confluence Hydrograph for N2
 003:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 04:N2         3052.88   10.129 No_date   12:10    30.09  n/a
      [RDT= 5.00] out<- 05:C2          3052.88    5.837 No_date   25:45    30.09  n/a
      [L/S/n= 4708./ .018/.050]
      {Vmax=  .075:Dmax= 1.374}
 003:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           05:C2          3052.88    5.837 No_date   25:45    30.09  n/a
      fname :C:\UJSYMH~1\H-C2.003
      remark:Routing Hydrograph for C2
 003:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       06:TB1         1396.83    7.746 No_date    8:20    25.65 .345
      [CN= 68.8: N= 3.00]
      [Tp= 6.94:DT= 5.00]
 003:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           06:TB1         1396.83    7.746 No_date    8:20    25.65  n/a
      fname :C:\UJSYMH~1\H-TB1.003
      remark:Runoff Hydrograph for TB1
 003:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            05:C2          3052.88    5.837 No_date   25:45    30.09  n/a
                      + 06:TB1         1396.83    7.746 No_date    8:20    25.65  n/a
      [DT= 5.00]  SUM=  07:N3          4449.71   10.278 No_date    9:45    28.70  n/a
 003:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           07:N3          4449.71   10.278 No_date    9:45    28.70  n/a
      fname :C:\UJSYMH~1\H-N3.003
      remark:Confluence Hydrograph for N3
 003:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 07:N3         4449.71   10.278 No_date    9:45    28.70  n/a
      [RDT= 5.00] out<- 08:C3          4449.71    8.123 No_date   16:45    28.70  n/a
      [L/S/n= 2255./ .043/.050]
      {Vmax=  .112:Dmax= 1.475}
 003:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           08:C3          4449.71    8.123 No_date   16:45    28.70  n/a
      fname :C:\UJSYMH~1\H-C3.003
      remark:Routing Hydrograph for C3
 003:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       09:UJ2         3783.71    9.873 No_date   23:30    37.80 .508
      [CN= 80.1: N= 3.00]
      [Tp=22.14:DT= 5.00]
 003:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           09:UJ2         3783.71    9.873 No_date   23:30    37.80  n/a
      fname :C:\UJSYMH~1\H-UJ2.003
      remark:Runoff Hydrograph for UJ2
 003:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            08:C3          4449.71    8.123 No_date   16:45    28.70  n/a
                      + 09:UJ2         3783.71    9.873 No_date   23:30    37.80  n/a
      [DT= 5.00]  SUM=  10:N4          8233.42   17.582 No_date   21:10    32.88  n/a
 003:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           10:N4          8233.42   17.582 No_date   21:10    32.88  n/a
      fname :C:\UJSYMH~1\H-N4.003
      remark:Confluence Hydrograph for N4
 003:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 10:N4         8233.42   17.582 No_date   21:10    32.88  n/a
      [RDT= 5.00] out<- 01:C4          8233.42   16.900 No_date   25:30    32.88  n/a
      [L/S/n= 5183./ .067/.035]
      {Vmax=  .322:Dmax=  .855}
 003:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           01:C4          8233.42   16.900 No_date   25:30    32.88  n/a
      fname :C:\UJSYMH~1\H-C4.003
      remark:Routing Hydrograph for C4
 003:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:UJ3         1810.89   14.095 No_date    7:00    29.30 .394
      [CN= 72.6: N= 3.00]
      [Tp= 5.62:DT= 5.00]
 003:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           02:UJ3         1810.89   14.095 No_date    7:00    29.30  n/a
      fname :C:\UJSYMH~1\H-UJ3.003
      remark:Runoff Hydrograph for UJ3
 003:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:C4          8233.42   16.900 No_date   25:30    32.88  n/a
                      + 02:UJ3         1810.89   14.095 No_date    7:00    29.30  n/a
      [DT= 5.00]  SUM=  03:N5         10044.31   17.385 No_date   22:30    32.24  n/a
 003:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           03:N5         10044.31   17.385 No_date   22:30    32.24  n/a
      fname :C:\UJSYMH~1\H-N5.003
      remark:Confluence Hydrograph for N5
  ** END OF RUN :   3

******************************************************************************



 RUN:COMMAND#
 004:0001------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   4 ]
#*****************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date         : 21 Oct 2019
#  Modeller     : [ Calvin Paul ]
#  Company      : Rideau Valley Conservation Authority
#  License #    :  5329846
#*****************************************************************************
 004:0002------------------------------------------------------------------------
```

```
     READ STORM
      Filename = storm.001
      Comment  =
      [SDT=30.00:SDUR=   3.00:PTOT=  74.46]
 004:0003---------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = C:\UJSYMH~1\uppe_val.val
      ICASEdv  = 1 (read and print data)
      FileTitle= File comment: [Bilberry Creek Default Value File]
                 THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN STANDHYD COM
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=   4.67 mm] [LGP=90.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .045]
      Parameters used in NASHYD:
      [Ia=   1.50 mm] [N= 3.00]
# Main Channel
 004:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:UJ1         2048.43    7.675 No_date   14:00   30.56 .410
      [CN= 73.8: N= 3.00]
      [Tp=12.36:DT= 5.00]
 004:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           01:UJ1         2048.43    7.675 No_date   14:00   30.56  n/a
      fname :C:\UJSYMH~1\H-UJ1.004
      remark:Runoff Hydrograph for UJ1
 004:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:UJ1         2048.43    7.675 No_date   14:00   30.56  n/a
      [RDT= 5.00] out<- 02:C1          2048.43    6.720 No_date   19:20   30.56  n/a
      [L/S/n= 3496./ .059/.050]
      {Vmax=  .202:Dmax=  .783}
 004:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           02:C1          2048.43    6.720 No_date   19:20   30.56  n/a
      fname :C:\UJSYMH~1\H-C1.004
      remark:Routing Hydrograph for C1
 004:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:TA1         1004.45    6.236 No_date    8:45   29.21 .392
      [CN= 72.5: N= 3.00]
      [Tp= 7.08:DT= 5.00]
 004:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           03:TA1         1004.45    6.236 No_date    8:45   29.21  n/a
      fname :C:\UJSYMH~1\H-TA1.004
      remark:Runoff Hydrograph for TA1
 004:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:C1          2048.43    6.720 No_date   19:20   30.56  n/a
                      + 03:TA1         1004.45    6.236 No_date    8:45   29.21  n/a
      [DT= 5.00]  SUM=  04:N2          3052.88   10.143 No_date   12:25   30.12  n/a
 004:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           04:N2          3052.88   10.143 No_date   12:25   30.12  n/a
      fname :C:\UJSYMH~1\H-N2.004
      remark:Confluence Hydrograph for N2
 004:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 04:N2          3052.88   10.143 No_date   12:25   30.12  n/a
      [RDT= 5.00] out<- 05:C2          3052.88    5.842 No_date   26:05   30.12  n/a
      [L/S/n= 4708./ .018/.050]
      {Vmax=  .075:Dmax= 1.374}
 004:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           05:C2          3052.88    5.842 No_date   26:05   30.12  n/a
      fname :C:\UJSYMH~1\H-C2.004
      remark:Routing Hydrograph for C2
 004:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       06:TB1         1396.83    7.773 No_date    8:35   25.68 .345
      [CN= 68.8: N= 3.00]
      [Tp= 6.94:DT= 5.00]
 004:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           06:TB1         1396.83    7.773 No_date    8:35   25.68  n/a
      fname :C:\UJSYMH~1\H-TB1.004
      remark:Runoff Hydrograph for TB1
 004:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            05:C2          3052.88    5.842 No_date   26:05   30.12  n/a
                      + 06:TB1         1396.83    7.773 No_date    8:35   25.68  n/a
      [DT= 5.00]  SUM=  07:N3          4449.71   10.299 No_date   10:00   28.72  n/a
 004:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           07:N3          4449.71   10.299 No_date   10:00   28.72  n/a
      fname :C:\UJSYMH~1\H-N3.004
      remark:Confluence Hydrograph for N3
 004:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 07:N3          4449.71   10.299 No_date   10:00   28.72  n/a
      [RDT= 5.00] out<- 08:C3          4449.71    8.135 No_date   17:05   28.72  n/a
      [L/S/n= 2255./ .043/.050]
      {Vmax=  .112:Dmax= 1.476}
 004:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           08:C3          4449.71    8.135 No_date   17:05   28.72  n/a
      fname :C:\UJSYMH~1\H-C3.004
      remark:Routing Hydrograph for C3
 004:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       09:UJ2         3783.71    9.883 No_date   23:45   37.83 .508
      [CN= 80.1: N= 3.00]
      [Tp=22.14:DT= 5.00]
 004:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           09:UJ2         3783.71    9.883 No_date   23:45   37.83  n/a
      fname :C:\UJSYMH~1\H-UJ2.004
      remark:Runoff Hydrograph for UJ2
 004:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            08:C3          4449.71    8.135 No_date   17:05   28.72  n/a
                      + 09:UJ2         3783.71    9.883 No_date   23:45   37.83  n/a
      [DT= 5.00]  SUM=  10:N4          8233.42   17.597 No_date   21:35   32.91  n/a
 004:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           10:N4          8233.42   17.597 No_date   21:35   32.91  n/a
      fname :C:\UJSYMH~1\H-N4.004
      remark:Confluence Hydrograph for N4
 004:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 10:N4          8233.42   17.597 No_date   21:35   32.91  n/a
      [RDT= 5.00] out<- 01:C4          8233.42   16.912 No_date   25:50   32.91  n/a
      [L/S/n= 5183./ .067/.035]
      {Vmax=  .322:Dmax=  .855}
 004:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           01:C4          8233.42   16.912 No_date   25:50   32.91  n/a
      fname :C:\UJSYMH~1\H-C4.004
      remark:Routing Hydrograph for C4
 004:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:UJ3         1810.89   14.162 No_date    7:15   29.33 .394
      [CN= 72.6: N= 3.00]
      [Tp= 5.62:DT= 5.00]
 004:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           02:UJ3         1810.89   14.162 No_date    7:15   29.33  n/a
      fname :C:\UJSYMH~1\H-UJ3.004
      remark:Runoff Hydrograph for UJ3
 004:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:C4          8233.42   16.912 No_date   25:50   32.91  n/a
                      + 02:UJ3         1810.89   14.162 No_date    7:15   29.33  n/a
      [DT= 5.00]  SUM=  03:N5         10044.31   17.399 No_date   23:30   32.26  n/a
 004:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           03:N5         10044.31   17.399 No_date   23:30   32.26  n/a
      fname :C:\UJSYMH~1\H-N5.004
      remark:Confluence Hydrograph for N5
  ** END OF RUN :   5

*******************************************************************************


 RUN:COMMAND#
 006:0001---------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   6 ]
#******************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date         : 21 Oct 2019
#  Modeller     : [ Calvin Paul ]
#  Company      : Rideau Valley Conservation Authority
#  License #    :  5329846
#******************************************************************************
 006:0002---------------------------------------------------------------------------
     READ STORM
      Filename = storm.001
      Comment  =
      [SDT=10.00:SDUR=   6.00:PTOT=  88.42]
 006:0003---------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = C:\UJSYMH~1\uppe_val.val
      ICASEdv  = 1 (read and print data)
      FileTitle= File comment: [Bilberry Creek Default Value File]
                 THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN STANDHYD COM
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=   4.67 mm] [LGP=90.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .045]
      Parameters used in NASHYD:
      [Ia=   1.50 mm] [N= 3.00]
# Main Channel
 006:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:UJ1         2048.43   10.086 No_date   15:10   40.45 .457
      [CN= 73.8: N= 3.00]
      [Tp=12.36:DT= 5.00]
 006:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           01:UJ1         2048.43   10.086 No_date   15:10   40.45  n/a
      fname :C:\UJSYMH~1\H-UJ1.006
      remark:Runoff Hydrograph for UJ1
 006:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:UJ1         2048.43   10.086 No_date   15:10   40.45  n/a
      [RDT= 5.00] out<- 02:C1          2048.43    8.761 No_date   20:45   40.45  n/a
      [L/S/n= 3496./ .059/.050]
      {Vmax=  .191:Dmax=  .819}
 006:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           02:C1          2048.43    8.761 No_date   20:45   40.45  n/a
      fname :C:\UJSYMH~1\H-C1.006
      remark:Routing Hydrograph for C1
 006:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:TA1         1004.45    8.101 No_date   10:00   38.83 .439
      [CN= 72.5: N= 3.00]
      [Tp= 7.08:DT= 5.00]
 006:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           03:TA1         1004.45    8.101 No_date   10:00   38.83  n/a
      fname :C:\UJSYMH~1\H-TA1.006
      remark:Runoff Hydrograph for TA1
 006:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:C1          2048.43    8.761 No_date   20:45   40.45  n/a
                      + 03:TA1         1004.45    8.101 No_date   10:00   38.83  n/a
      [DT= 5.00]  SUM=  04:N2          3052.88   13.213 No_date   13:35   39.92  n/a
 006:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           04:N2          3052.88   13.213 No_date   13:35   39.92  n/a
      fname :C:\UJSYMH~1\H-N2.006
      remark:Confluence Hydrograph for N2
 006:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 04:N2          3052.88   13.213 No_date   13:35   39.92  n/a
      [RDT= 5.00] out<- 05:C2          3052.88    7.672 No_date   27:10   39.92  n/a
      [L/S/n= 4708./ .018/.050]
      {Vmax=  .075:Dmax= 1.409}
 006:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           05:C2          3052.88    7.672 No_date   27:10   39.92  n/a
      fname :C:\UJSYMH~1\H-C2.006
      remark:Routing Hydrograph for C2
 006:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       06:TB1         1396.83   10.207 No_date    9:50   34.54 .391
      [CN= 68.8: N= 3.00]
      [Tp= 6.94:DT= 5.00]
 006:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           06:TB1         1396.83   10.207 No_date    9:50   34.54  n/a
      fname :C:\UJSYMH~1\H-TB1.006
      remark:Runoff Hydrograph for TB1
 006:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            05:C2          3052.88    7.672 No_date   27:10   39.92  n/a
                      + 06:TB1         1396.83   10.207 No_date    9:50   34.54  n/a
      [DT= 5.00]  SUM=  07:N3          4449.71   13.361 No_date   11:15   38.23  n/a
 006:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           07:N3          4449.71   13.361 No_date   11:15   38.23  n/a
      fname :C:\UJSYMH~1\H-N3.006
      remark:Confluence Hydrograph for N3
 006:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 07:N3          4449.71   13.361 No_date   11:15   38.23  n/a
      [RDT= 5.00] out<- 08:C3          4449.71   10.640 No_date   18:20   38.23  n/a
      [L/S/n= 2255./ .043/.050]
      {Vmax=  .115:Dmax= 1.507}
 006:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           08:C3          4449.71   10.640 No_date   18:20   38.23  n/a
      fname :C:\UJSYMH~1\H-C3.006
      remark:Routing Hydrograph for C3
 006:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       09:UJ2         3783.71   12.775 No_date   24:50   49.00 .554
      [CN= 80.1: N= 3.00]
      [Tp=22.14:DT= 5.00]
 006:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           09:UJ2         3783.71   12.775 No_date   24:50   49.00  n/a
      fname :C:\UJSYMH~1\H-UJ2.006
      remark:Runoff Hydrograph for UJ2
 006:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            08:C3          4449.71   10.640 No_date   18:20   38.23  n/a
```

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              + 09:UJ2          3783.71   12.775 No_date   24:50   49.00  n/a
    [DT= 5.00]  SUM= 10:N4      8233.42   22.923 No_date   22:40   43.18  n/a
006:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          10:N4      8233.42   22.923 No_date   22:40   43.18  n/a
    fname :C:\UJSYMH~1\H-N4.006
    remark:Confluence Hydrograph for N4
006:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   ROUTE CHANNEL   -> 10:N4     8233.42   22.923 No_date   22:40   43.18  n/a
    [RDT= 5.00] out<- 01:C4     8233.42   22.229 No_date   26:20   43.18  n/a
    [L/S/n= 5183./ .067/.035]
    {Vmax=  .354:Dmax=  .919}
006:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          01:C4      8233.42   22.229 No_date   26:20   43.18  n/a
    fname :C:\UJSYMH~1\H-C4.006
    remark:Routing Hydrograph for C4
006:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   CALIB NASHYD      02:UJ3     1810.89   18.131 No_date    8:35   38.97 .441
    [CN= 72.6: N= 3.00]
    [Tp= 5.62:DT= 5.00]
006:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          02:UJ3     1810.89   18.131 No_date    8:35   38.97  n/a
    fname :C:\UJSYMH~1\H-UJ3.006
    remark:Runoff Hydrograph for UJ3
006:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   ADD HYD           01:C4      8233.42   22.229 No_date   26:20   43.18  n/a
                   + 02:UJ3     1810.89   18.131 No_date    8:35   38.97  n/a
    [DT= 5.00]  SUM= 03:N5     10044.31   23.120 No_date   23:00   42.42  n/a
006:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          03:N5     10044.31   23.120 No_date   23:00   42.42  n/a
    fname :C:\UJSYMH~1\H-N5.006
    remark:Confluence Hydrograph for N5
 ** END OF RUN :    6

********************************************************************************



RUN:COMMAND#
007:0001-----------------------------------------------------------------------------
   START
    [TZERO =    .00 hrs on        0]
    [METOUT=   2    (1=imperial, 2=metric output)]
    [NSTORM=   1 ]
    [NRUN  =   7 ]
#******************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date         : 21 Oct 2019
#  Modeller     : [ Calvin Paul ]
#  Company      : Rideau Valley Conservation Authority
#  License #    :  5329846
#******************************************************************************
007:0002-----------------------------------------------------------------------------
   READ STORM
    Filename = storm.001
    Comment  =
    [SDT=30.00:SDUR=   6.00:PTOT=  88.43]
007:0003-----------------------------------------------------------------------------
   DEFAULT VALUES
    Filename = C:\UJSYMH~1\uppe_val.val
    ICASEdv  = 1 (read and print data)
    FileTitle= File comment: [Bilberry Creek Default Value File]
               THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN STANDHYD COM
    Horton's infiltration equation parameters:
    [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
    Parameters for PERVIOUS surfaces in STANDHYD:
    [IAper=   4.67 mm] [LGP=90.00 m] [MNP= .250]
    Parameters for IMPERVIOUS surfaces in STANDHYD:
    [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .045]
    Parameters used in NASHYD:
    [Ia=   1.50 mm] [N= 3.00]
# Main Channel
007:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   CALIB NASHYD      01:UJ1     2048.43   10.125 No_date   15:45   40.46 .457
    [CN= 73.8: N= 3.00]
    [Tp=12.36:DT= 5.00]
007:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          01:UJ1     2048.43   10.125 No_date   15:45   40.46  n/a
    fname :C:\UJSYMH~1\H-UJ1.007
    remark:Runoff Hydrograph for UJ1
007:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   ROUTE CHANNEL   -> 01:UJ1    2048.43   10.125 No_date   15:45   40.46  n/a
    [RDT= 5.00] out<- 02:C1     2048.43    8.777 No_date   21:20   40.46  n/a
    [L/S/n= 3496./ .059/.050]
    {Vmax=  .191:Dmax=  .819}
007:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          02:C1      2048.43    8.777 No_date   21:20   40.46  n/a
    fname :C:\UJSYMH~1\H-C1.007
    remark:Routing Hydrograph for C1
007:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   CALIB NASHYD      03:TA1     1004.45    8.200 No_date   10:30   38.84 .439
    [CN= 72.5: N= 3.00]
    [Tp= 7.08:DT= 5.00]
007:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          03:TA1     1004.45    8.200 No_date   10:30   38.84  n/a
    fname :C:\UJSYMH~1\H-TA1.007
    remark:Runoff Hydrograph for TA1
007:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   ADD HYD           02:C1      2048.43    8.777 No_date   21:20   40.46  n/a
                   + 03:TA1     1004.45    8.200 No_date   10:30   38.84  n/a
    [DT= 5.00]  SUM= 04:N2      3052.88   13.258 No_date   14:05   39.93  n/a
007:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          04:N2      3052.88   13.258 No_date   14:05   39.93  n/a
    fname :C:\UJSYMH~1\H-N2.007
    remark:Confluence Hydrograph for N2
007:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   ROUTE CHANNEL   -> 04:N2     3052.88   13.258 No_date   14:05   39.93  n/a
    [RDT= 5.00] out<- 05:C2     3052.88    7.688 No_date   27:40   39.93  n/a
    [L/S/n= 4708./ .018/.050]
    {Vmax=  .075:Dmax= 1.409}
007:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          05:C2      3052.88    7.688 No_date   27:40   39.93  n/a
    fname :C:\UJSYMH~1\H-C2.007
    remark:Routing Hydrograph for C2
007:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   CALIB NASHYD      06:TB1     1396.83   10.339 No_date   10:25   34.55 .391
    [CN= 68.8: N= 3.00]
    [Tp= 6.94:DT= 5.00]
007:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          06:TB1     1396.83   10.339 No_date   10:25   34.55  n/a
    fname :C:\UJSYMH~1\H-TB1.007
    remark:Runoff Hydrograph for TB1
```

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007:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   ADD HYD           05:C2      3052.88    7.688 No_date   27:40   39.93  n/a
                   + 06:TB1     1396.83   10.339 No_date   10:25   34.55  n/a
    [DT= 5.00]  SUM= 07:N3      4449.71   13.448 No_date   11:35   38.24  n/a
007:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          07:N3      4449.71   13.448 No_date   11:35   38.24  n/a
    fname :C:\UJSYMH~1\H-N3.007
    remark:Confluence Hydrograph for N3
007:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   ROUTE CHANNEL   -> 07:N3     4449.71   13.448 No_date   11:35   38.24  n/a
    [RDT= 5.00] out<- 08:C3     4449.71   10.662 No_date   18:55   38.24  n/a
    [L/S/n= 2255./ .043/.050]
    {Vmax=  .115:Dmax= 1.507}
007:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          08:C3      4449.71   10.662 No_date   18:55   38.24  n/a
    fname :C:\UJSYMH~1\H-C3.007
    remark:Routing Hydrograph for C3
007:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   CALIB NASHYD      09:UJ2     3783.71   12.790 No_date   25:25   49.01 .554
    [CN= 80.1: N= 3.00]
    [Tp=22.14:DT= 5.00]
007:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          09:UJ2     3783.71   12.790 No_date   25:25   49.01  n/a
    fname :C:\UJSYMH~1\H-UJ2.007
    remark:Runoff Hydrograph for UJ2
007:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   ADD HYD           08:C3      4449.71   10.662 No_date   18:55   38.24  n/a
                   + 09:UJ2     3783.71   12.790 No_date   25:25   49.01  n/a
    [DT= 5.00]  SUM= 10:N4      8233.42   22.944 No_date   23:20   43.19  n/a
007:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          10:N4      8233.42   22.944 No_date   23:20   43.19  n/a
    fname :C:\UJSYMH~1\H-N4.007
    remark:Confluence Hydrograph for N4
007:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   ROUTE CHANNEL   -> 10:N4     8233.42   22.944 No_date   23:20   43.19  n/a
    [RDT= 5.00] out<- 01:C4     8233.42   22.250 No_date   26:55   43.19  n/a
    [L/S/n= 5183./ .067/.035]
    {Vmax=  .354:Dmax=  .919}
007:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          01:C4      8233.42   22.250 No_date   26:55   43.19  n/a
    fname :C:\UJSYMH~1\H-C4.007
    remark:Routing Hydrograph for C4
007:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   CALIB NASHYD      02:UJ3     1810.89   18.487 No_date    9:05   38.98 .441
    [CN= 72.6: N= 3.00]
    [Tp= 5.62:DT= 5.00]
007:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          02:UJ3     1810.89   18.487 No_date    9:05   38.98  n/a
    fname :C:\UJSYMH~1\H-UJ3.007
    remark:Runoff Hydrograph for UJ3
007:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   ADD HYD           01:C4      8233.42   22.250 No_date   26:55   43.19  n/a
                   + 02:UJ3     1810.89   18.487 No_date    9:05   38.98  n/a
    [DT= 5.00]  SUM= 03:N5     10044.31   23.125 No_date   23:35   42.43  n/a
007:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          03:N5     10044.31   23.125 No_date   23:35   42.43  n/a
    fname :C:\UJSYMH~1\H-N5.007
    remark:Confluence Hydrograph for N5
 ** END OF RUN :   11

********************************************************************************



RUN:COMMAND#
012:0001-----------------------------------------------------------------------------
   START
    [TZERO =    .00 hrs on        0]
    [METOUT=   2    (1=imperial, 2=metric output)]
    [NSTORM=   1 ]
    [NRUN  =  12 ]
#******************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date         : 21 Oct 2019
#  Modeller     : [ Calvin Paul ]
#  Company      : Rideau Valley Conservation Authority
#  License #    :  5329846
#******************************************************************************
012:0002-----------------------------------------------------------------------------
   READ STORM
    Filename = storm.001
    Comment  =
    [SDT=10.00:SDUR=  12.00:PTOT= 104.44]
012:0003-----------------------------------------------------------------------------
   DEFAULT VALUES
    Filename = C:\UJSYMH~1\uppe_val.val
    ICASEdv  = 1 (read and print data)
    FileTitle= File comment: [Bilberry Creek Default Value File]
               THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN STANDHYD COM
    Horton's infiltration equation parameters:
    [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
    Parameters for PERVIOUS surfaces in STANDHYD:
    [IAper=   4.67 mm] [LGP=90.00 m] [MNP= .250]
    Parameters for IMPERVIOUS surfaces in STANDHYD:
    [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .045]
    Parameters used in NASHYD:
    [Ia=   1.50 mm] [N= 3.00]
# Main Channel
012:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   CALIB NASHYD      01:UJ1     2048.43   12.758 No_date   18:10   52.53 .503
    [CN= 73.8: N= 3.00]
    [Tp=12.36:DT= 5.00]
012:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          01:UJ1     2048.43   12.758 No_date   18:10   52.53  n/a
    fname :C:\UJSYMH~1\H-UJ1.012
    remark:Runoff Hydrograph for UJ1
012:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   ROUTE CHANNEL   -> 01:UJ1    2048.43   12.758 No_date   18:10   52.53  n/a
    [RDT= 5.00] out<- 02:C1     2048.43   11.036 No_date   23:40   52.53  n/a
    [L/S/n= 3496./ .059/.050]
    {Vmax=  .180:Dmax=  .858}
012:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          02:C1      2048.43   11.036 No_date   23:40   52.53  n/a
    fname :C:\UJSYMH~1\H-C1.012
    remark:Routing Hydrograph for C1
012:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   CALIB NASHYD      03:TA1     1004.45    9.720 No_date   13:00   50.63 .485
    [CN= 72.5: N= 3.00]
    [Tp= 7.08:DT= 5.00]
012:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   SAVE HYD          03:TA1     1004.45    9.720 No_date   13:00   50.63  n/a
```

```
     fname :C:\UJSYMH~1\H-TA1.012
     remark:Runoff Hydrograph for TA1
 012:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              02:C1          2048.43   11.036 No_date   23:40    52.53  n/a
                       + 03:TA1         1004.45    9.720 No_date   13:00    50.63  n/a
     [DT= 5.00]  SUM=    04:N2          3052.88   16.564 No_date   16:45    51.91  n/a
 012:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             04:N2          3052.88   16.564 No_date   16:45    51.91  n/a
     fname :C:\UJSYMH~1\H-N2.012
     remark:Confluence Hydrograph for N2
 012:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 04:N2            3052.88   16.564 No_date   16:45    51.91  n/a
     [RDT= 5.00] out<- 05:C2            3052.88    9.822 No_date   30:05    51.91  n/a
     [L/S/n= 4708./ .018/.050]
     {Vmax=  .076:Dmax= 1.447}
 012:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             05:C2          3052.88    9.822 No_date   30:05    51.91  n/a
     fname :C:\UJSYMH~1\H-C2.012
     remark:Routing Hydrograph for C2
 012:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD         06:TB1         1396.83   12.328 No_date   12:55    45.54 .436
     [CN= 68.8: N= 3.00]
     [Tp= 6.94:DT= 5.00]
 012:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             06:TB1         1396.83   12.328 No_date   12:55    45.54  n/a
     fname :C:\UJSYMH~1\H-TB1.012
     remark:Runoff Hydrograph for TB1
 012:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              05:C2          3052.88    9.822 No_date   30:05    51.91  n/a
                       + 06:TB1         1396.83   12.328 No_date   12:55    45.54  n/a
     [DT= 5.00]  SUM=    07:N3          4449.71   16.581 No_date   15:10    49.91  n/a
 012:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             07:N3          4449.71   16.581 No_date   15:10    49.91  n/a
     fname :C:\UJSYMH~1\H-N3.012
     remark:Confluence Hydrograph for N3
 012:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 07:N3            4449.71   16.581 No_date   15:10    49.91  n/a
     [RDT= 5.00] out<- 08:C3            4449.71   13.895 No_date   21:00    49.91  n/a
     [L/S/n= 2255./ .043/.050]
     {Vmax=  .118:Dmax= 1.538}
 012:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             08:C3          4449.71   13.895 No_date   21:00    49.91  n/a
     fname :C:\UJSYMH~1\H-C3.012
     remark:Routing Hydrograph for C3
 012:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD         09:UJ2         3783.71   16.146 No_date   27:40    62.40 .597
     [CN= 80.1: N= 3.00]
     [Tp=22.14:DT= 5.00]
 012:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             09:UJ2         3783.71   16.146 No_date   27:40    62.40  n/a
     fname :C:\UJSYMH~1\H-UJ2.012
     remark:Runoff Hydrograph for UJ2
 012:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              08:C3          4449.71   13.895 No_date   21:00    49.91  n/a
                       + 09:UJ2         3783.71   16.146 No_date   27:40    62.40  n/a
     [DT= 5.00]  SUM=    10:N4          8233.42   29.281 No_date   24:50    55.65  n/a
 012:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             10:N4          8233.42   29.281 No_date   24:50    55.65  n/a
     fname :C:\UJSYMH~1\H-N4.012
     remark:Confluence Hydrograph for N4
 012:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 10:N4            8233.42   29.281 No_date   24:50    55.65  n/a
     [RDT= 5.00] out<- 01:C4            8233.42   28.423 No_date   28:45    55.65  n/a
     [L/S/n= 5183./ .067/.035]
     {Vmax=  .376:Dmax=  .976}
 012:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             01:C4          8233.42   28.423 No_date   28:45    55.65  n/a
     fname :C:\UJSYMH~1\H-C4.012
     remark:Routing Hydrograph for C4
 012:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD         02:UJ3         1810.89   20.919 No_date   11:15    50.79 .486
     [CN= 72.6: N= 3.00]
     [Tp= 5.62:DT= 5.00]
 012:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             02:UJ3         1810.89   20.919 No_date   11:15    50.79  n/a
     fname :C:\UJSYMH~1\H-UJ3.012
     remark:Runoff Hydrograph for UJ3
 012:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              01:C4          8233.42   28.423 No_date   28:45    55.65  n/a
                       + 02:UJ3         1810.89   20.919 No_date   11:15    50.79  n/a
     [DT= 5.00]  SUM=    03:N5         10044.31   30.331 No_date   20:15    54.77  n/a
 012:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             03:N5         10044.31   30.331 No_date   20:15    54.77  n/a
     fname :C:\UJSYMH~1\H-N5.012
     remark:Confluence Hydrograph for N5
  ** END OF RUN :  12

*******************************************************************************



 RUN:COMMAND#
 013:0001------------------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =  13 ]
#******************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date         : 21 Oct 2019
#  Modeller     : [ Calvin Paul ]
#  Company      : Rideau Valley Conservation Authority
#  License #    :  5329846
#******************************************************************************
 013:0002------------------------------------------------------------------------------
    READ STORM
     Filename = storm.001
     Comment  =
     [SDT=30.00:SDUR=  12.00:PTOT= 104.44]
 013:0003------------------------------------------------------------------------------
    DEFAULT VALUES
     Filename = C:\UJSYMH~1\uppe_val.val
     ICASEdv  = 1 (read and print data)
     FileTitle= File comment: [Bilberry Creek Default Value File]
                THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN STANDHYD COM
     Horton's infiltration equation parameters:
     [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
     Parameters for PERVIOUS surfaces in STANDHYD:
     [IAper=   4.67 mm] [LGP=90.00 m] [MNP= .250]
     Parameters for IMPERVIOUS surfaces in STANDHYD:
     [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .045]
     Parameters used in NASHYD:
     [Ia=   1.50 mm] [N= 3.00]
# Main Channel
 013:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD         01:UJ1         2048.43   12.961 No_date   19:15    52.53 .503
     [CN= 73.8: N= 3.00]
     [Tp=12.36:DT= 5.00]
 013:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             01:UJ1         2048.43   12.961 No_date   19:15    52.53  n/a
     fname :C:\UJSYMH~1\H-UJ1.013
     remark:Runoff Hydrograph for UJ1
 013:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 01:UJ1           2048.43   12.961 No_date   19:15    52.53  n/a
     [RDT= 5.00] out<- 02:C1            2048.43   11.155 No_date   25:10    52.53  n/a
     [L/S/n= 3496./ .059/.050]
     {Vmax=  .180:Dmax=  .861}
 013:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             02:C1          2048.43   11.155 No_date   25:10    52.53  n/a
     fname :C:\UJSYMH~1\H-C1.013
     remark:Routing Hydrograph for C1
 013:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD         03:TA1         1004.45   10.212 No_date   14:05    50.64 .485
     [CN= 72.5: N= 3.00]
     [Tp= 7.08:DT= 5.00]
 013:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             03:TA1         1004.45   10.212 No_date   14:05    50.64  n/a
     fname :C:\UJSYMH~1\H-TA1.013
     remark:Runoff Hydrograph for TA1
 013:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              02:C1          2048.43   11.155 No_date   25:10    52.53  n/a
                       + 03:TA1         1004.45   10.212 No_date   14:05    50.64  n/a
     [DT= 5.00]  SUM=    04:N2          3052.88   16.805 No_date   17:40    51.91  n/a
 013:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             04:N2          3052.88   16.805 No_date   17:40    51.91  n/a
     fname :C:\UJSYMH~1\H-N2.013
     remark:Confluence Hydrograph for N2
 013:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 04:N2            3052.88   16.805 No_date   17:40    51.91  n/a
     [RDT= 5.00] out<- 05:C2            3052.88    9.860 No_date   31:20    51.91  n/a
     [L/S/n= 4708./ .018/.050]
     {Vmax=  .076:Dmax= 1.450}
 013:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             05:C2          3052.88    9.860 No_date   31:20    51.91  n/a
     fname :C:\UJSYMH~1\H-C2.013
     remark:Routing Hydrograph for C2
 013:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD         06:TB1         1396.83   12.991 No_date   14:00    45.54 .436
     [CN= 68.8: N= 3.00]
     [Tp= 6.94:DT= 5.00]
 013:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             06:TB1         1396.83   12.991 No_date   14:00    45.54  n/a
     fname :C:\UJSYMH~1\H-TB1.013
     remark:Runoff Hydrograph for TB1
 013:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              05:C2          3052.88    9.860 No_date   31:20    51.91  n/a
                       + 06:TB1         1396.83   12.991 No_date   14:00    45.54  n/a
     [DT= 5.00]  SUM=    07:N3          4449.71   17.001 No_date   15:55    49.91  n/a
 013:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             07:N3          4449.71   17.001 No_date   15:55    49.91  n/a
     fname :C:\UJSYMH~1\H-N3.013
     remark:Confluence Hydrograph for N3
 013:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 07:N3            4449.71   17.001 No_date   15:55    49.91  n/a
     [RDT= 5.00] out<- 08:C3            4449.71   14.013 No_date   21:55    49.91  n/a
     [L/S/n= 2255./ .043/.050]
     {Vmax=  .119:Dmax= 1.542}
 013:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             08:C3          4449.71   14.013 No_date   21:55    49.91  n/a
     fname :C:\UJSYMH~1\H-C3.013
     remark:Routing Hydrograph for C3
 013:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD         09:UJ2         3783.71   16.217 No_date   28:50    62.40 .597
     [CN= 80.1: N= 3.00]
     [Tp=22.14:DT= 5.00]
 013:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             09:UJ2         3783.71   16.217 No_date   28:50    62.40  n/a
     fname :C:\UJSYMH~1\H-UJ2.013
     remark:Runoff Hydrograph for UJ2
 013:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              08:C3          4449.71   14.013 No_date   21:55    49.91  n/a
                       + 09:UJ2         3783.71   16.217 No_date   28:50    62.40  n/a
     [DT= 5.00]  SUM=    10:N4          8233.42   29.392 No_date   25:55    55.65  n/a
 013:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             10:N4          8233.42   29.392 No_date   25:55    55.65  n/a
     fname :C:\UJSYMH~1\H-N4.013
     remark:Confluence Hydrograph for N4
 013:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 10:N4            8233.42   29.392 No_date   25:55    55.65  n/a
     [RDT= 5.00] out<- 01:C4            8233.42   28.525 No_date   29:50    55.65  n/a
     [L/S/n= 5183./ .067/.035]
     {Vmax=  .376:Dmax=  .977}
 013:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             01:C4          8233.42   28.525 No_date   29:50    55.65  n/a
     fname :C:\UJSYMH~1\H-C4.013
     remark:Routing Hydrograph for C4
 013:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD         02:UJ3         1810.89   22.418 No_date   12:35    50.79 .486
     [CN= 72.6: N= 3.00]
     [Tp= 5.62:DT= 5.00]
 013:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             02:UJ3         1810.89   22.418 No_date   12:35    50.79  n/a
     fname :C:\UJSYMH~1\H-UJ3.013
     remark:Runoff Hydrograph for UJ3
 013:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              01:C4          8233.42   28.525 No_date   29:50    55.65  n/a
                       + 02:UJ3         1810.89   22.418 No_date   12:35    50.79  n/a
     [DT= 5.00]  SUM=    03:N5         10044.31   30.250 No_date   21:15    54.78  n/a
 013:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD             03:N5         10044.31   30.250 No_date   21:15    54.78  n/a
     fname :C:\UJSYMH~1\H-N5.013
     remark:Confluence Hydrograph for N5
  ** END OF RUN :  23

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 RUN:COMMAND#
 024:0001------------------------------------------------------------------------------
    START
```

```
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =  24 ]
#******************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date        : 21 Oct 2019
#  Modeller    : [ Calvin Paul ]
#  Company     : Rideau Valley Conservation Authority
#  License #   :  5329846
#******************************************************************************
 024:0002-----------------------------------------------------------------------
    READ STORM
     Filename = storm.001
     Comment  =
     [SDT=10.00:SDUR=  24.00:PTOT= 123.02]
 024:0003-----------------------------------------------------------------------
    DEFAULT VALUES
     Filename = C:\UJSYMH~1\uppe_val.val
     ICASEdv  = 1 (read and print data)
     FileTitle= File comment: [Bilberry Creek Default Value File]
                THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN STANDHYD COM
     Horton's infiltration equation parameters:
     [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
     Parameters for PERVIOUS surfaces in STANDHYD:
     [IAper=   4.67 mm] [LGP=90.00 m] [MNP= .250]
     Parameters for IMPERVIOUS surfaces in STANDHYD:
     [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .045]
     Parameters used in NASHYD:
     [Ia=   1.50 mm] [N= 3.00]
# Main Channel
 024:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD        01:UJ1          2048.43   14.745 No_date   23:45   67.30 .547
     [CN= 73.8: N= 3.00]
     [Tp=12.36:DT= 5.00]
 024:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            01:UJ1          2048.43   14.745 No_date   23:45   67.30  n/a
     fname :C:\UJSYMH~1\H-UJ1.024
     remark:Runoff Hydrograph for UJ1
 024:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL    -> 01:UJ1          2048.43   14.745 No_date   23:45   67.30  n/a
     [RDT= 5.00] out<- 02:C1            2048.43   13.043 No_date   30:00   67.30  n/a
     [L/S/n= 3496./ .059/.050]
     {Vmax=  .173:Dmax=  .887}
 024:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            02:C1           2048.43   13.043 No_date   30:00   67.30  n/a
     fname :C:\UJSYMH~1\H-C1.024
     remark:Routing Hydrograph for C1
 024:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD        03:TA1          1004.45   10.649 No_date   16:55   65.11 .529
     [CN= 72.5: N= 3.00]
     [Tp= 7.08:DT= 5.00]
 024:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            03:TA1          1004.45   10.649 No_date   16:55   65.11  n/a
     fname :C:\UJSYMH~1\H-TA1.024
     remark:Runoff Hydrograph for TA1
 024:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             02:C1           2048.43   13.043 No_date   30:00   67.30  n/a
                      + 03:TA1          1004.45   10.649 No_date   16:55   65.11  n/a
     [DT= 5.00]  SUM=  04:N2            3052.88   18.995 No_date   23:25   66.58  n/a
 024:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            04:N2           3052.88   18.995 No_date   23:25   66.58  n/a
     fname :C:\UJSYMH~1\H-N2.024
     remark:Confluence Hydrograph for N2
 024:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL    -> 04:N2           3052.88   18.995 No_date   23:25   66.58  n/a
     [RDT= 5.00] out<- 05:C2            3052.88   12.245 No_date   35:40   66.58  n/a
     [L/S/n= 4708./ .018/.050]
     {Vmax=  .077:Dmax= 1.475}
 024:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            05:C2           3052.88   12.245 No_date   35:40   66.58  n/a
     fname :C:\UJSYMH~1\H-C2.024
     remark:Routing Hydrograph for C2
 024:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD        06:TB1          1396.83   13.560 No_date   16:50   59.16 .481
     [CN= 68.8: N= 3.00]
     [Tp= 6.94:DT= 5.00]
 024:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            06:TB1          1396.83   13.560 No_date   16:50   59.16  n/a
     fname :C:\UJSYMH~1\H-TB1.024
     remark:Runoff Hydrograph for TB1
 024:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             05:C2           3052.88   12.245 No_date   35:40   66.58  n/a
                      + 06:TB1          1396.83   13.560 No_date   16:50   59.16  n/a
     [DT= 5.00]  SUM=  07:N3            4449.71   18.748 No_date   20:45   64.25  n/a
 024:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            07:N3           4449.71   18.748 No_date   20:45   64.25  n/a
     fname :C:\UJSYMH~1\H-N3.024
     remark:Confluence Hydrograph for N3
 024:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL    -> 07:N3           4449.71   18.748 No_date   20:45   64.25  n/a
     [RDT= 5.00] out<- 08:C3            4449.71   17.031 No_date   27:55   64.25  n/a
     [L/S/n= 2255./ .043/.050]
     {Vmax=  .121:Dmax= 1.559}
 024:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            08:C3           4449.71   17.031 No_date   27:55   64.25  n/a
     fname :C:\UJSYMH~1\H-C3.024
     remark:Routing Hydrograph for C3
 024:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD        09:UJ2          3783.71   19.681 No_date   33:25   78.52 .638
     [CN= 80.1: N= 3.00]
     [Tp=22.14:DT= 5.00]
 024:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            09:UJ2          3783.71   19.681 No_date   33:25   78.52  n/a
     fname :C:\UJSYMH~1\H-UJ2.024
     remark:Runoff Hydrograph for UJ2
 024:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             08:C3           4449.71   17.031 No_date   27:55   64.25  n/a
                      + 09:UJ2          3783.71   19.681 No_date   33:25   78.52  n/a
     [DT= 5.00]  SUM=  10:N4            8233.42   36.182 No_date   31:10   70.80  n/a
 024:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            10:N4           8233.42   36.182 No_date   31:10   70.80  n/a
     fname :C:\UJSYMH~1\H-N4.024
     remark:Confluence Hydrograph for N4
 024:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL    -> 10:N4           8233.42   36.182 No_date   31:10   70.80  n/a
     [RDT= 5.00] out<- 01:C4            8233.42   35.386 No_date   34:10   70.80  n/a
     [L/S/n= 5183./ .067/.035]
     {Vmax=  .403:Dmax= 1.038}
 024:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            01:C4           8233.42   35.386 No_date   34:10   70.80  n/a
     fname :C:\UJSYMH~1\H-C4.024
     remark:Routing Hydrograph for C4
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 024:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD        02:UJ3          1810.89   22.941 No_date   15:05   65.29 .531
     [CN= 72.6: N= 3.00]
     [Tp= 5.62:DT= 5.00]
 024:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            02:UJ3          1810.89   22.941 No_date   15:05   65.29  n/a
     fname :C:\UJSYMH~1\H-UJ3.024
     remark:Runoff Hydrograph for UJ3
 024:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             01:C4           8233.42   35.386 No_date   34:10   70.80  n/a
                      + 02:UJ3          1810.89   22.941 No_date   15:05   65.29  n/a
     [DT= 5.00]  SUM=  03:N5           10044.31   39.329 No_date   28:20   69.81  n/a
 024:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            03:N5          10044.31   39.329 No_date   28:20   69.81  n/a
     fname :C:\UJSYMH~1\H-N5.024
     remark:Confluence Hydrograph for N5
 ** END OF RUN :  24

*******************************************************************************

 RUN:COMMAND#
 025:0001-----------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =  25 ]
#******************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date        : 21 Oct 2019
#  Modeller    : [ Calvin Paul ]
#  Company     : Rideau Valley Conservation Authority
#  License #   :  5329846
#******************************************************************************
 025:0002-----------------------------------------------------------------------
    READ STORM
     Filename = storm.001
     Comment  =
     [SDT=30.00:SDUR=  24.00:PTOT= 123.01]
 025:0003-----------------------------------------------------------------------
    DEFAULT VALUES
     Filename = C:\UJSYMH~1\uppe_val.val
     ICASEdv  = 1 (read and print data)
     FileTitle= File comment: [Bilberry Creek Default Value File]
                THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN STANDHYD COM
     Horton's infiltration equation parameters:
     [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
     Parameters for PERVIOUS surfaces in STANDHYD:
     [IAper=   4.67 mm] [LGP=90.00 m] [MNP= .250]
     Parameters for IMPERVIOUS surfaces in STANDHYD:
     [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .045]
     Parameters used in NASHYD:
     [Ia=   1.50 mm] [N= 3.00]
# Main Channel
 025:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD        01:UJ1          2048.43   15.583 No_date   26:20   67.29 .547
     [CN= 73.8: N= 3.00]
     [Tp=12.36:DT= 5.00]
 025:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            01:UJ1          2048.43   15.583 No_date   26:20   67.29  n/a
     fname :C:\UJSYMH~1\H-UJ1.025
     remark:Runoff Hydrograph for UJ1
 025:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL    -> 01:UJ1          2048.43   15.583 No_date   26:20   67.29  n/a
     [RDT= 5.00] out<- 02:C1            2048.43   13.518 No_date   31:55   67.29  n/a
     [L/S/n= 3496./ .059/.050]
     {Vmax=  .170:Dmax=  .900}
 025:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            02:C1           2048.43   13.518 No_date   31:55   67.29  n/a
     fname :C:\UJSYMH~1\H-C1.025
     remark:Routing Hydrograph for C1
 025:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD        03:TA1          1004.45   11.490 No_date   20:10   65.10 .529
     [CN= 72.5: N= 3.00]
     [Tp= 7.08:DT= 5.00]
 025:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            03:TA1          1004.45   11.490 No_date   20:10   65.10  n/a
     fname :C:\UJSYMH~1\H-TA1.025
     remark:Runoff Hydrograph for TA1
 025:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             02:C1           2048.43   13.518 No_date   31:55   67.29  n/a
                      + 03:TA1          1004.45   11.490 No_date   20:10   65.10  n/a
     [DT= 5.00]  SUM=  04:N2            3052.88   19.993 No_date   25:30   66.57  n/a
 025:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            04:N2           3052.88   19.993 No_date   25:30   66.57  n/a
     fname :C:\UJSYMH~1\H-N2.025
     remark:Confluence Hydrograph for N2
 025:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL    -> 04:N2           3052.88   19.993 No_date   25:30   66.57  n/a
     [RDT= 5.00] out<- 05:C2            3052.88   12.420 No_date   38:10   66.57  n/a
     [L/S/n= 4708./ .018/.050]
     {Vmax=  .077:Dmax= 1.481}
 025:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            05:C2           3052.88   12.420 No_date   38:10   66.57  n/a
     fname :C:\UJSYMH~1\H-C2.025
     remark:Routing Hydrograph for C2
 025:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD        06:TB1          1396.83   14.698 No_date   20:05   59.15 .481
     [CN= 68.8: N= 3.00]
     [Tp= 6.94:DT= 5.00]
 025:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            06:TB1          1396.83   14.698 No_date   20:05   59.15  n/a
     fname :C:\UJSYMH~1\H-TB1.025
     remark:Runoff Hydrograph for TB1
 025:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             05:C2           3052.88   12.420 No_date   38:10   66.57  n/a
                      + 06:TB1          1396.83   14.698 No_date   20:05   59.15  n/a
     [DT= 5.00]  SUM=  07:N3            4449.71   20.038 No_date   23:20   64.24  n/a
 025:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            07:N3           4449.71   20.038 No_date   23:20   64.24  n/a
     fname :C:\UJSYMH~1\H-N3.025
     remark:Confluence Hydrograph for N3
 025:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL    -> 07:N3           4449.71   20.038 No_date   23:20   64.24  n/a
     [RDT= 5.00] out<- 08:C3            4449.71   17.599 No_date   29:25   64.24  n/a
     [L/S/n= 2255./ .043/.050]
     {Vmax=  .122:Dmax= 1.572}
 025:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD            08:C3           4449.71   17.599 No_date   29:25   64.24  n/a
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     fname :C:\UJSYMH~1\H-C3.025
     remark:Routing Hydrograph for C3
025:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       09:UJ2         3783.71   20.018 No_date   35:45   78.51 .638
     [CN= 80.1: N= 3.00]
     [Tp=22.14:DT= 5.00]
025:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           09:UJ2         3783.71   20.018 No_date   35:45   78.51  n/a
     fname :C:\UJSYMH~1\H-UJ2.025
     remark:Runoff Hydrograph for UJ2
025:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            08:C3          4449.71   17.599 No_date   29:25   64.24  n/a
                     + 09:UJ2         3783.71   20.018 No_date   35:45   78.51  n/a
     [DT= 5.00]  SUM=  10:N4          8233.42   36.793 No_date   33:00   70.80  n/a
025:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           10:N4          8233.42   36.793 No_date   33:00   70.80  n/a
     fname :C:\UJSYMH~1\H-N4.025
     remark:Confluence Hydrograph for N4
025:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 10:N4          8233.42   36.793 No_date   33:00   70.80  n/a
     [RDT= 5.00] out<- 01:C4          8233.42   35.932 No_date   36:15   70.80  n/a
     [L/S/n= 5183./ .067/.035]
     {Vmax=  .405:Dmax= 1.043}
025:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           01:C4          8233.42   35.932 No_date   36:15   70.80  n/a
     fname :C:\UJSYMH~1\H-C4.025
     remark:Routing Hydrograph for C4
025:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:UJ3         1810.89   24.940 No_date   18:20   65.28 .531
     [CN= 72.6: N= 3.00]
     [Tp= 5.62:DT= 5.00]
025:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           02:UJ3         1810.89   24.940 No_date   18:20   65.28  n/a
     fname :C:\UJSYMH~1\H-UJ3.025
     remark:Runoff Hydrograph for UJ3
025:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:C4          8233.42   35.932 No_date   36:15   70.80  n/a
                     + 02:UJ3         1810.89   24.940 No_date   18:20   65.28  n/a
     [DT= 5.00]  SUM=  03:N5         10044.31   39.520 No_date   29:30   69.81  n/a
025:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           03:N5         10044.31   39.520 No_date   29:30   69.81  n/a
     fname :C:\UJSYMH~1\H-N5.025
     remark:Confluence Hydrograph for N5
  ** END OF RUN :  79

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RUN:COMMAND#
080:0001------------------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =  80 ]
#******************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date        : 21 Oct 2019
#  Modeller    : [ Calvin Paul ]
#  Company     : Rideau Valley Conservation Authority
#  License #   :  5329846
#******************************************************************************
080:0002------------------------------------------------------------------------------
    READ STORM
     Filename = storm.001
     Comment  =
     [SDT=10.00:SDUR=  12.00:PTOT= 193.00]
080:0003------------------------------------------------------------------------------
    DEFAULT VALUES
     Filename = C:\UJSYMH~1\uppe_val.val
     ICASEdv  = 1 (read and print data)
     FileTitle= File comment: [Bilberry Creek Default Value File]
               THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN STANDHYD COM
     Horton's infiltration equation parameters:
     [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
     Parameters for PERVIOUS surfaces in STANDHYD:
     [IAper=   4.67 mm] [LGP=90.00 m] [MNP= .250]
     Parameters for IMPERVIOUS surfaces in STANDHYD:
     [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .045]
     Parameters used in NASHYD:
     [Ia=   1.50 mm] [N= 3.00]
# Main Channel
080:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:UJ1         2048.43   30.859 No_date   20:00  127.50 .661
     [CN= 73.8: N= 3.00]
     [Tp=12.36:DT= 5.00]
080:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           01:UJ1         2048.43   30.859 No_date   20:00  127.50  n/a
     fname :C:\UJSYMH~1\H-UJ1.080
     remark:Runoff Hydrograph for UJ1
080:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 01:UJ1         2048.43   30.859 No_date   20:00  127.50  n/a
     [RDT= 5.00] out<- 02:C1          2048.43   24.621 No_date   27:45  127.50  n/a
     [L/S/n= 3496./ .059/.050]
     {Vmax=  .147:Dmax= 1.058}
080:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           02:C1          2048.43   24.621 No_date   27:45  127.50  n/a
     fname :C:\UJSYMH~1\H-C1.080
     remark:Routing Hydrograph for C1
080:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:TA1         1004.45   23.992 No_date   15:05  124.45 .645
     [CN= 72.5: N= 3.00]
     [Tp= 7.08:DT= 5.00]
080:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           03:TA1         1004.45   23.992 No_date   15:05  124.45  n/a
     fname :C:\UJSYMH~1\H-TA1.080
     remark:Runoff Hydrograph for TA1
080:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:C1          2048.43   24.621 No_date   27:45  127.50  n/a
                     + 03:TA1         1004.45   23.992 No_date   15:05  124.45  n/a
     [DT= 5.00]  SUM=  04:N2          3052.88   38.557 No_date   18:10  126.49  n/a
080:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           04:N2          3052.88   38.557 No_date   18:10  126.49  n/a
     fname :C:\UJSYMH~1\H-N2.080
     remark:Confluence Hydrograph for N2
080:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 04:N2          3052.88   38.557 No_date   18:10  126.49  n/a
  *  [RDT= 5.00] out<- 05:C2          3052.88   23.459 No_date   31:30  126.49  n/a
     [L/S/n= 4708./ .018/.050]
     {Vmax=  .086:Dmax= 1.597}
080:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           05:C2          3052.88   23.459 No_date   31:30  126.49  n/a
     fname :C:\UJSYMH~1\H-C2.080
     remark:Routing Hydrograph for C2
080:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       06:TB1         1396.83   31.696 No_date   15:00  115.93 .601
     [CN= 68.8: N= 3.00]
     [Tp= 6.94:DT= 5.00]
080:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           06:TB1         1396.83   31.696 No_date   15:00  115.93  n/a
     fname :C:\UJSYMH~1\H-TB1.080
     remark:Runoff Hydrograph for TB1
080:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            05:C2          3052.88   23.459 No_date   31:30  126.49  n/a
                     + 06:TB1         1396.83   31.696 No_date   15:00  115.93  n/a
     [DT= 5.00]  SUM=  07:N3          4449.71   42.633 No_date   16:50  123.18  n/a
080:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           07:N3          4449.71   42.633 No_date   16:50  123.18  n/a
     fname :C:\UJSYMH~1\H-N3.080
     remark:Confluence Hydrograph for N3
080:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 07:N3          4449.71   42.633 No_date   16:50  123.18  n/a
     [RDT= 5.00] out<- 08:C3          4449.71   36.663 No_date   21:10  123.18  n/a
     [L/S/n= 2255./ .043/.050]
     {Vmax=  .146:Dmax= 1.717}
080:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           08:C3          4449.71   36.663 No_date   21:10  123.18  n/a
     fname :C:\UJSYMH~1\H-C3.080
     remark:Routing Hydrograph for C3
080:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       09:UJ2         3783.71   36.745 No_date   29:25  142.48 .738
     [CN= 80.1: N= 3.00]
     [Tp=22.14:DT= 5.00]
080:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           09:UJ2         3783.71   36.745 No_date   29:25  142.48  n/a
     fname :C:\UJSYMH~1\H-UJ2.080
     remark:Runoff Hydrograph for UJ2
080:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            08:C3          4449.71   36.663 No_date   21:10  123.18  n/a
                     + 09:UJ2         3783.71   36.745 No_date   29:25  142.48  n/a
     [DT= 5.00]  SUM=  10:N4          8233.42   70.009 No_date   25:00  132.05  n/a
080:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           10:N4          8233.42   70.009 No_date   25:00  132.05  n/a
     fname :C:\UJSYMH~1\H-N4.080
     remark:Confluence Hydrograph for N4
080:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 10:N4          8233.42   70.009 No_date   25:00  132.05  n/a
     [RDT= 5.00] out<- 01:C4          8233.42   68.531 No_date   28:10  132.05  n/a
     [L/S/n= 5183./ .067/.035]
     {Vmax=  .483:Dmax= 1.258}
080:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           01:C4          8233.42   68.531 No_date   28:10  132.05  n/a
     fname :C:\UJSYMH~1\H-C4.080
     remark:Routing Hydrograph for C4
080:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:UJ3         1810.89   51.676 No_date   13:45  124.70 .646
     [CN= 72.6: N= 3.00]
     [Tp= 5.62:DT= 5.00]
080:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           02:UJ3         1810.89   51.676 No_date   13:45  124.70  n/a
     fname :C:\UJSYMH~1\H-UJ3.080
     remark:Runoff Hydrograph for UJ3
080:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:C4          8233.42   68.531 No_date   28:10  132.05  n/a
                     + 02:UJ3         1810.89   51.676 No_date   13:45  124.70  n/a
     [DT= 5.00]  SUM=  03:N5         10044.31   80.391 No_date   19:05  130.72  n/a
080:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           03:N5         10044.31   80.391 No_date   19:05  130.72  n/a
     fname :C:\UJSYMH~1\H-N5.080
     remark:Confluence Hydrograph for N5
  ** END OF RUN :  89

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RUN:COMMAND#
090:0001------------------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =  90 ]
#******************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date        : 21 Oct 2019
#  Modeller    : [ Calvin Paul ]
#  Company     : Rideau Valley Conservation Authority
#  License #   :  5329846
#******************************************************************************
090:0002------------------------------------------------------------------------------
    READ STORM
     Filename = storm.001
     Comment  =
     [SDT=60.00:SDUR=  48.00:PTOT= 285.08]
090:0003------------------------------------------------------------------------------
    DEFAULT VALUES
     Filename = C:\UJSYMH~1\uppe_val.val
     ICASEdv  = 1 (read and print data)
     FileTitle= File comment: [Bilberry Creek Default Value File]
               THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN STANDHYD COM
     Horton's infiltration equation parameters:
     [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
     Parameters for PERVIOUS surfaces in STANDHYD:
     [IAper=   4.67 mm] [LGP=90.00 m] [MNP= .250]
     Parameters for IMPERVIOUS surfaces in STANDHYD:
     [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .045]
     Parameters used in NASHYD:
     [Ia=   1.50 mm] [N= 3.00]
# Main Channel
090:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:UJ1         2048.43   46.228 No_date   56:30  212.33 .745
     [CN= 73.8: N= 3.00]
     [Tp=12.36:DT= 5.00]
090:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           01:UJ1         2048.43   46.228 No_date   56:30  212.33  n/a
     fname :C:\UJSYMH~1\H-UJ1.090
     remark:Runoff Hydrograph for UJ1
090:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 01:UJ1         2048.43   46.228 No_date   56:30  212.33  n/a
     [RDT= 5.00] out<- 02:C1          2048.43   38.450 No_date   62:00  212.33  n/a
```

```
     [L/S/n= 3496./ .059/.050]
     {Vmax=  .157:Dmax= 1.114}
090:0007-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          02:C1         2048.43   38.450 No_date   62:00  212.33  n/a
     fname :C:\UJSYMH~1\H-C1.090
     remark:Routing Hydrograph for C1
090:0008-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      03:TA1        1004.45   34.946 No_date   51:55  208.55 .732
     [CN= 72.5: N= 3.00]
     [Tp= 7.08:DT= 5.00]
090:0009-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          03:TA1        1004.45   34.946 No_date   51:55  208.55  n/a
     fname :C:\UJSYMH~1\H-TA1.090
     remark:Runoff Hydrograph for TA1
090:0010-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           02:C1         2048.43   38.450 No_date   62:00  212.33  n/a
                    + 03:TA1        1004.45   34.946 No_date   51:55  208.55  n/a
     [DT= 5.00]  SUM= 04:N2         3052.88   59.017 No_date   55:35  211.09  n/a
090:0011-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          04:N2         3052.88   59.017 No_date   55:35  211.09  n/a
     fname :C:\UJSYMH~1\H-N2.090
     remark:Confluence Hydrograph for N2
090:0012-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 04:N2        3052.88   59.017 No_date   55:35  211.09  n/a
     [RDT= 5.00] out<- 05:C2        3052.88   38.380 No_date   64:45  211.08  n/a
     [L/S/n= 4708./ .018/.050]
     {Vmax=  .096:Dmax= 1.687}
090:0013-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          05:C2         3052.88   38.380 No_date   64:45  211.08  n/a
     fname :C:\UJSYMH~1\H-C2.090
     remark:Routing Hydrograph for C2
090:0014-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      06:TB1        1396.83   47.391 No_date   51:50  197.77 .694
     [CN= 68.8: N= 3.00]
     [Tp= 6.94:DT= 5.00]
090:0015-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          06:TB1        1396.83   47.391 No_date   51:50  197.77  n/a
     fname :C:\UJSYMH~1\H-TB1.090
     remark:Runoff Hydrograph for TB1
090:0016-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           05:C2         3052.88   38.380 No_date   64:45  211.08  n/a
                    + 06:TB1        1396.83   47.391 No_date   51:50  197.77  n/a
     [DT= 5.00]  SUM= 07:N3         4449.71   69.554 No_date   53:35  206.90  n/a
090:0017-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          07:N3         4449.71   69.554 No_date   53:35  206.90  n/a
     fname :C:\UJSYMH~1\H-N3.090
     remark:Confluence Hydrograph for N3
090:0018-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 07:N3        4449.71   69.554 No_date   53:35  206.90  n/a
     [RDT= 5.00] out<- 08:C3        4449.71   62.902 No_date   57:00  206.90  n/a
     [L/S/n= 2255./ .043/.050]
     {Vmax=  .172:Dmax= 1.837}
090:0019-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          08:C3         4449.71   62.902 No_date   57:00  206.90  n/a
     fname :C:\UJSYMH~1\H-C3.090
     remark:Routing Hydrograph for C3
090:0020-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      09:UJ2        3783.71   55.437 No_date   65:15  230.36 .808
     [CN= 80.1: N= 3.00]
     [Tp=22.14:DT= 5.00]
090:0021-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          09:UJ2        3783.71   55.437 No_date   65:15  230.36  n/a
     fname :C:\UJSYMH~1\H-UJ2.090
     remark:Runoff Hydrograph for UJ2
090:0022-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           08:C3         4449.71   62.902 No_date   57:00  206.90  n/a
                    + 09:UJ2        3783.71   55.437 No_date   65:15  230.36  n/a
     [DT= 5.00]  SUM= 10:N4         8233.42  112.704 No_date   60:10  217.68  n/a
090:0023-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          10:N4         8233.42  112.704 No_date   60:10  217.68  n/a
     fname :C:\UJSYMH~1\H-N4.090
     remark:Confluence Hydrograph for N4
090:0024-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 10:N4        8233.42  112.704 No_date   60:10  217.68  n/a
     [RDT= 5.00] out<- 01:C4        8233.42  110.453 No_date   62:30  217.68  n/a
     [L/S/n= 5183./ .067/.035]
     {Vmax=  .550:Dmax= 1.463}
090:0025-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          01:C4         8233.42  110.453 No_date   62:30  217.68  n/a
     fname :C:\UJSYMH~1\H-C4.090
     remark:Routing Hydrograph for C4
090:0026-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:UJ3        1810.89   74.701 No_date   50:40  208.86 .733
     [CN= 72.6: N= 3.00]
     [Tp= 5.62:DT= 5.00]
090:0027-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          02:UJ3        1810.89   74.701 No_date   50:40  208.86  n/a
     fname :C:\UJSYMH~1\H-UJ3.090
     remark:Runoff Hydrograph for UJ3
090:0028-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:C4         8233.42  110.453 No_date   62:30  217.68  n/a
                    + 02:UJ3        1810.89   74.701 No_date   50:40  208.86  n/a
     [DT= 5.00]  SUM= 03:N5        10044.31  138.684 No_date   54:30  216.09  n/a
090:0029-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          03:N5        10044.31  138.684 No_date   54:30  216.09  n/a
     fname :C:\UJSYMH~1\H-N5.090
     remark:Confluence Hydrograph for N5
 ** END OF RUN : 239

*******************************************************************************

RUN:COMMAND#
240:0001--------------------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  = 240 ]
#******************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date        : 21 Oct 2019
#  Modeller    : [ Calvin Paul ]
#  Company     : Rideau Valley Conservation Authority
#  License #   :  5329846
#******************************************************************************
240:0002--------------------------------------------------------------------------------
    READ STORM
     Filename = storm.001
     Comment  =
     [SDT=30.00:SDUR=  24.00:PTOT=  50.07]
240:0003--------------------------------------------------------------------------------
    DEFAULT VALUES
     Filename = C:\UJSYMH~1\uppe_val.val
     ICASEdv  = 1 (read and print data)
     FileTitle= File comment: [Bilberry Creek Default Value File]
                THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN STANDHYD COM
     Horton's infiltration equation parameters:
     [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
     Parameters for PERVIOUS surfaces in STANDHYD:
     [IAper=   4.67 mm] [LGP=90.00 m] [MNP= .250]
     Parameters for IMPERVIOUS surfaces in STANDHYD:
     [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .045]
     Parameters used in NASHYD:
     [Ia=   1.50 mm] [N= 3.00]
# Main Channel
240:0004-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      01:UJ1        2048.43    3.531 No_date   26:55   15.30 .305
     [CN= 73.8: N= 3.00]
     [Tp=12.36:DT= 5.00]
240:0005-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          01:UJ1        2048.43    3.531 No_date   26:55   15.30  n/a
     fname :C:\UJSYMH~1\H-UJ1.240
     remark:Runoff Hydrograph for UJ1
240:0006-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 01:UJ1       2048.43    3.531 No_date   26:55   15.30  n/a
     [RDT= 5.00] out<- 02:C1        2048.43    3.221 No_date   31:30   15.30  n/a
     [L/S/n= 3496./ .059/.050]
     {Vmax=  .225:Dmax=  .722}
240:0007-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          02:C1         2048.43    3.221 No_date   31:30   15.30  n/a
     fname :C:\UJSYMH~1\H-C1.240
     remark:Routing Hydrograph for C1
240:0008-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      03:TA1        1004.45    2.503 No_date   20:45   14.46 .289
     [CN= 72.5: N= 3.00]
     [Tp= 7.08:DT= 5.00]
240:0009-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          03:TA1        1004.45    2.503 No_date   20:45   14.46  n/a
     fname :C:\UJSYMH~1\H-TA1.240
     remark:Runoff Hydrograph for TA1
240:0010-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           02:C1         2048.43    3.221 No_date   31:30   15.30  n/a
                    + 03:TA1        1004.45    2.503 No_date   20:45   14.46  n/a
     [DT= 5.00]  SUM= 04:N2         3052.88    4.772 No_date   26:15   15.02  n/a
240:0011-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          04:N2         3052.88    4.772 No_date   26:15   15.02  n/a
     fname :C:\UJSYMH~1\H-N2.240
     remark:Confluence Hydrograph for N2
240:0012-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 04:N2        3052.88    4.772 No_date   26:15   15.02  n/a
     [RDT= 5.00] out<- 05:C2        3052.88    3.409 No_date   42:40   15.02  n/a
     [L/S/n= 4708./ .018/.050]
     {Vmax=  .076:Dmax= 1.267}
240:0013-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          05:C2         3052.88    3.409 No_date   42:40   15.02  n/a
     fname :C:\UJSYMH~1\H-C2.240
     remark:Routing Hydrograph for C2
240:0014-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      06:TB1        1396.83    2.995 No_date   20:40   12.32 .246
     [CN= 68.8: N= 3.00]
     [Tp= 6.94:DT= 5.00]
240:0015-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          06:TB1        1396.83    2.995 No_date   20:40   12.32  n/a
     fname :C:\UJSYMH~1\H-TB1.240
     remark:Runoff Hydrograph for TB1
240:0016-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           05:C2         3052.88    3.409 No_date   42:40   15.02  n/a
                    + 06:TB1        1396.83    2.995 No_date   20:40   12.32  n/a
     [DT= 5.00]  SUM= 07:N3         4449.71    4.708 No_date   24:35   14.17  n/a
240:0017-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          07:N3         4449.71    4.708 No_date   24:35   14.17  n/a
     fname :C:\UJSYMH~1\H-N3.240
     remark:Confluence Hydrograph for N3
240:0018-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 07:N3        4449.71    4.708 No_date   24:35   14.17  n/a
     [RDT= 5.00] out<- 08:C3        4449.71    4.126 No_date   31:25   14.17  n/a
     [L/S/n= 2255./ .043/.050]
     {Vmax=  .121:Dmax= 1.358}
240:0019-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          08:C3         4449.71    4.126 No_date   31:25   14.17  n/a
     fname :C:\UJSYMH~1\H-C3.240
     remark:Routing Hydrograph for C3
240:0020-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      09:UJ2        3783.71    5.099 No_date   36:15   20.01 .400
     [CN= 80.1: N= 3.00]
     [Tp=22.14:DT= 5.00]
240:0021-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          09:UJ2        3783.71    5.099 No_date   36:15   20.01  n/a
     fname :C:\UJSYMH~1\H-UJ2.240
     remark:Runoff Hydrograph for UJ2
240:0022-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           08:C3         4449.71    4.126 No_date   31:25   14.17  n/a
                    + 09:UJ2        3783.71    5.099 No_date   36:15   20.01  n/a
     [DT= 5.00]  SUM= 10:N4         8233.42    9.119 No_date   34:35   16.85  n/a
240:0023-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          10:N4         8233.42    9.119 No_date   34:35   16.85  n/a
     fname :C:\UJSYMH~1\H-N4.240
     remark:Confluence Hydrograph for N4
240:0024-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 10:N4        8233.42    9.119 No_date   34:35   16.85  n/a
     [RDT= 5.00] out<- 01:C4        8233.42    8.658 No_date   40:30   16.85  n/a
     [L/S/n= 5183./ .067/.035]
     {Vmax=  .260:Dmax=  .736}
240:0025-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          01:C4         8233.42    8.658 No_date   40:30   16.85  n/a
     fname :C:\UJSYMH~1\H-C4.240
     remark:Routing Hydrograph for C4
240:0026-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:UJ3        1810.89    5.404 No_date   18:45   14.53 .290
     [CN= 72.6: N= 3.00]
     [Tp= 5.62:DT= 5.00]
240:0027-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          02:UJ3        1810.89    5.404 No_date   18:45   14.53  n/a
     fname :C:\UJSYMH~1\H-UJ3.240
     remark:Runoff Hydrograph for UJ3
240:0028-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:C4         8233.42    8.658 No_date   40:30   16.85  n/a
                    + 02:UJ3        1810.89    5.404 No_date   18:45   14.53  n/a
     [DT= 5.00]  SUM= 03:N5        10044.31    8.871 No_date   37:20   16.43  n/a
240:0029-------------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD          03:N5        10044.31    8.871 No_date   37:20   16.43  n/a
     fname :C:\UJSYMH~1\H-N5.240
```

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     remark:Confluence Hydrograph for N5
 ** END OF RUN : 240

********************************************************************************




 RUN:COMMAND#
 241:0001----------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  = 241 ]
#*******************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date         : 21 Oct 2019
#  Modeller     : [ Calvin Paul ]
#  Company      : Rideau Valley Conservation Authority
#  License #    :  5329846
#*******************************************************************************
 241:0002----------------------------------------------------------------------------
     READ STORM
      Filename = storm.001
      Comment  =
      [SDT=30.00:SDUR=  24.00:PTOT=  70.01]
 241:0003----------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = C:\UJSYMH~1\uppe_val.val
      ICASEdv  = 1 (read and print data)
      FileTitle= File comment: [Bilberry Creek Default Value File]
                 THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN STANDHYD COM
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=    4.67 mm] [LGP=90.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=    1.57 mm] [CLI= 1.50]   [MNI= .045]
      Parameters used in NASHYD:
      [Ia=   1.50 mm] [N= 3.00]
# Main Channel
 241:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:UJ1          2048.43    6.370 No_date   26:45   27.56 .394
      [CN= 73.8: N= 3.00]
      [Tp=12.36:DT= 5.00]
 241:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           01:UJ1          2048.43    6.370 No_date   26:45   27.56  n/a
      fname :C:\UJSYMH~1\H-UJ1.241
      remark:Runoff Hydrograph for UJ1
 241:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 01:UJ1          2048.43    6.370 No_date   26:45   27.56  n/a
      [RDT= 5.00] out<- 02:C1           2048.43    5.738 No_date   31:40   27.56  n/a
      [L/S/n= 3496./ .059/.050]
      {Vmax=  .209:Dmax=   .764}
 241:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           02:C1           2048.43    5.738 No_date   31:40   27.56  n/a
      fname :C:\UJSYMH~1\H-C1.241
      remark:Routing Hydrograph for C1
 241:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:TA1          1004.45    4.590 No_date   20:30   26.30 .376
      [CN= 72.5: N= 3.00]
      [Tp= 7.08:DT= 5.00]
 241:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           03:TA1          1004.45    4.590 No_date   20:30   26.30  n/a
      fname :C:\UJSYMH~1\H-TA1.241
      remark:Runoff Hydrograph for TA1
 241:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:C1           2048.43    5.738 No_date   31:40   27.56  n/a
                      + 03:TA1          1004.45    4.590 No_date   20:30   26.30  n/a
      [DT= 5.00]  SUM=  04:N2           3052.88    8.496 No_date   26:05   27.14  n/a
 241:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           04:N2           3052.88    8.496 No_date   26:05   27.14  n/a
      fname :C:\UJSYMH~1\H-N2.241
      remark:Confluence Hydrograph for N2
 241:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 04:N2           3052.88    8.496 No_date   26:05   27.14  n/a
      [RDT= 5.00] out<- 05:C2           3052.88    5.228 No_date   47:10   27.14  n/a
      [L/S/n= 4708./ .018/.050]
      {Vmax=  .075:Dmax= 1.348}
 241:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           05:C2           3052.88    5.228 No_date   47:10   27.14  n/a
      fname :C:\UJSYMH~1\H-C2.241
      remark:Routing Hydrograph for C2
 241:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       06:TB1          1396.83    5.646 No_date   20:25   23.01 .329
      [CN= 68.8: N= 3.00]
      [Tp= 6.94:DT= 5.00]
 241:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           06:TB1          1396.83    5.646 No_date   20:25   23.01  n/a
      fname :C:\UJSYMH~1\H-TB1.241
      remark:Runoff Hydrograph for TB1
 241:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            05:C2           3052.88    5.228 No_date   47:10   27.14  n/a
                      + 06:TB1          1396.83    5.646 No_date   20:25   23.01  n/a
      [DT= 5.00]  SUM=  07:N3           4449.71    8.186 No_date   23:10   25.84  n/a
 241:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           07:N3           4449.71    8.186 No_date   23:10   25.84  n/a
      fname :C:\UJSYMH~1\H-N3.241
      remark:Confluence Hydrograph for N3
 241:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 07:N3           4449.71    8.186 No_date   23:10   25.84  n/a
      [RDT= 5.00] out<- 08:C3           4449.71    7.058 No_date   30:25   25.84  n/a
      [L/S/n= 2255./ .043/.050]
      {Vmax=  .115:Dmax= 1.431}
 241:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           08:C3           4449.71    7.058 No_date   30:25   25.84  n/a
      fname :C:\UJSYMH~1\H-C3.241
      remark:Routing Hydrograph for C3
 241:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       09:UJ2          3783.71    8.766 No_date   36:05   34.38 .491
      [CN= 80.1: N= 3.00]
      [Tp=22.14:DT= 5.00]
 241:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           09:UJ2          3783.71    8.766 No_date   36:05   34.38  n/a
      fname :C:\UJSYMH~1\H-UJ2.241
      remark:Runoff Hydrograph for UJ2
 241:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            08:C3           4449.71    7.058 No_date   30:25   25.84  n/a
                      + 09:UJ2          3783.71    8.766 No_date   36:05   34.38  n/a
      [DT= 5.00]  SUM=  10:N4           8233.42   15.593 No_date   34:15   29.77  n/a
 241:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           10:N4           8233.42   15.593 No_date   34:15   29.77  n/a
      fname :C:\UJSYMH~1\H-N4.241
      remark:Confluence Hydrograph for N4
 241:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 10:N4           8233.42   15.593 No_date   34:15   29.77  n/a
      [RDT= 5.00] out<- 01:C4           8233.42   15.005 No_date   38:30   29.77  n/a
      [L/S/n= 5183./ .067/.035]
      {Vmax=  .311:Dmax=   .831}
 241:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           01:C4           8233.42   15.005 No_date   38:30   29.77  n/a
      fname :C:\UJSYMH~1\H-C4.241
      remark:Routing Hydrograph for C4
 241:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:UJ3          1810.89    9.933 No_date   18:35   26.40 .377
      [CN= 72.6: N= 3.00]
      [Tp= 5.62:DT= 5.00]
 241:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           02:UJ3          1810.89    9.933 No_date   18:35   26.40  n/a
      fname :C:\UJSYMH~1\H-UJ3.241
      remark:Runoff Hydrograph for UJ3
 241:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:C4           8233.42   15.005 No_date   38:30   29.77  n/a
                      + 02:UJ3          1810.89    9.933 No_date   18:35   26.40  n/a
      [DT= 5.00]  SUM=  03:N5          10044.31   15.738 No_date   33:10   29.16  n/a
 241:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           03:N5          10044.31   15.738 No_date   33:10   29.16  n/a
      fname :C:\UJSYMH~1\H-N5.241
      remark:Confluence Hydrograph for N5
 ** END OF RUN : 241

********************************************************************************




 RUN:COMMAND#
 242:0001----------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  = 242 ]
#*******************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date         : 21 Oct 2019
#  Modeller     : [ Calvin Paul ]
#  Company      : Rideau Valley Conservation Authority
#  License #    :  5329846
#*******************************************************************************
 242:0002----------------------------------------------------------------------------
     READ STORM
      Filename = storm.001
      Comment  =
      [SDT=30.00:SDUR=  24.00:PTOT=  82.59]
 242:0003----------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = C:\UJSYMH~1\uppe_val.val
      ICASEdv  = 1 (read and print data)
      FileTitle= File comment: [Bilberry Creek Default Value File]
                 THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN STANDHYD COM
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=    4.67 mm] [LGP=90.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=    1.57 mm] [CLI= 1.50]   [MNI= .045]
      Parameters used in NASHYD:
      [Ia=   1.50 mm] [N= 3.00]
# Main Channel
 242:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:UJ1          2048.43    8.382 No_date   26:35   36.23 .439
      [CN= 73.8: N= 3.00]
      [Tp=12.36:DT= 5.00]
 242:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           01:UJ1          2048.43    8.382 No_date   26:35   36.23  n/a
      fname :C:\UJSYMH~1\H-UJ1.242
      remark:Runoff Hydrograph for UJ1
 242:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 01:UJ1          2048.43    8.382 No_date   26:35   36.23  n/a
      [RDT= 5.00] out<- 02:C1           2048.43    7.484 No_date   31:50   36.23  n/a
      [L/S/n= 3496./ .059/.050]
      {Vmax=  .199:Dmax=   .793}
 242:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           02:C1           2048.43    7.484 No_date   31:50   36.23  n/a
      fname :C:\UJSYMH~1\H-C1.242
      remark:Routing Hydrograph for C1
 242:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:TA1          1004.45    6.083 No_date   20:25   34.73 .421
      [CN= 72.5: N= 3.00]
      [Tp= 7.08:DT= 5.00]
 242:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           03:TA1          1004.45    6.083 No_date   20:25   34.73  n/a
      fname :C:\UJSYMH~1\H-TA1.242
      remark:Runoff Hydrograph for TA1
 242:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:C1           2048.43    7.484 No_date   31:50   36.23  n/a
                      + 03:TA1          1004.45    6.083 No_date   20:25   34.73  n/a
      [DT= 5.00]  SUM=  04:N2           3052.88   11.077 No_date   25:55   35.74  n/a
 242:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           04:N2           3052.88   11.077 No_date   25:55   35.74  n/a
      fname :C:\UJSYMH~1\H-N2.242
      remark:Confluence Hydrograph for N2
 242:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 04:N2           3052.88   11.077 No_date   25:55   35.74  n/a
 *    [RDT= 5.00] out<- 05:C2           3052.88    6.763 No_date   38:25   35.74  n/a
      [L/S/n= 4708./ .018/.050]
      {Vmax=  .075:Dmax= 1.384}
 242:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           05:C2           3052.88    6.763 No_date   38:25   35.74  n/a
      fname :C:\UJSYMH~1\H-C2.242
      remark:Routing Hydrograph for C2
 242:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       06:TB1          1396.83    7.575 No_date   20:20   30.75 .372
      [CN= 68.8: N= 3.00]
      [Tp= 6.94:DT= 5.00]
 242:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           06:TB1          1396.83    7.575 No_date   20:20   30.75  n/a
      fname :C:\UJSYMH~1\H-TB1.242
      remark:Runoff Hydrograph for TB1
 242:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            05:C2           3052.88    6.763 No_date   38:25   35.74  n/a
                      + 06:TB1          1396.83    7.575 No_date   20:20   30.75  n/a
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      [DT= 5.00]  SUM=  07:N3          4449.71   10.618 No_date   22:40   34.17  n/a
 242:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           07:N3          4449.71   10.618 No_date   22:40   34.17  n/a
      fname :C:\UJSYMH~1\H-N3.242
      remark:Confluence Hydrograph for N3
 242:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 07:N3          4449.71   10.618 No_date   22:40   34.17  n/a
      [RDT= 5.00] out<- 08:C3          4449.71    9.218 No_date   31:00   34.17  n/a
      [L/S/n= 2255./ .043/.050]
      {Vmax=  .112:Dmax= 1.480}
 242:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           08:C3          4449.71    9.218 No_date   31:00   34.17  n/a
      fname :C:\UJSYMH~1\H-C3.242
      remark:Routing Hydrograph for C3
 242:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       09:UJ2         3783.71   11.285 No_date   36:00   44.26 .536
      [CN= 80.1: N= 3.00]
      [Tp=22.14:DT= 5.00]
 242:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           09:UJ2         3783.71   11.285 No_date   36:00   44.26  n/a
      fname :C:\UJSYMH~1\H-UJ2.242
      remark:Runoff Hydrograph for UJ2
 242:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            08:C3          4449.71    9.218 No_date   31:00   34.17  n/a
                      + 09:UJ2         3783.71   11.285 No_date   36:00   44.26  n/a
      [DT= 5.00]  SUM=  10:N4          8233.42   20.260 No_date   34:30   38.81  n/a
 242:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           10:N4          8233.42   20.260 No_date   34:30   38.81  n/a
      fname :C:\UJSYMH~1\H-N4.242
      remark:Confluence Hydrograph for N4
 242:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 10:N4          8233.42   20.260 No_date   34:30   38.81  n/a
      [RDT= 5.00] out<- 01:C4          8233.42   19.599 No_date   37:55   38.81  n/a
      [L/S/n= 5183./ .067/.035]
      {Vmax=  .337:Dmax=  .887}
 242:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           01:C4          8233.42   19.599 No_date   37:55   38.81  n/a
      fname :C:\UJSYMH~1\H-C4.242
      remark:Routing Hydrograph for C4
 242:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:UJ3         1810.89   13.175 No_date   18:30   34.85 .422
      [CN= 72.6: N= 3.00]
      [Tp= 5.62:DT= 5.00]
 242:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           02:UJ3         1810.89   13.175 No_date   18:30   34.85  n/a
      fname :C:\UJSYMH~1\H-UJ3.242
      remark:Runoff Hydrograph for UJ3
 242:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:C4          8233.42   19.599 No_date   37:55   38.81  n/a
                      + 02:UJ3         1810.89   13.175 No_date   18:30   34.85  n/a
      [DT= 5.00]  SUM=  03:N5         10044.31   20.710 No_date   32:50   38.10  n/a
 242:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           03:N5         10044.31   20.710 No_date   32:50   38.10  n/a
      fname :C:\UJSYMH~1\H-N5.242
      remark:Confluence Hydrograph for N5
   ** END OF RUN : 242

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 RUN:COMMAND#
 243:0001--------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  = 243 ]
#******************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date         : 21 Oct 2019
#  Modeller     : [ Calvin Paul ]
#  Company      : Rideau Valley Conservation Authority
#  License #    :  5329846
#******************************************************************************
 243:0002--------------------------------------------------------------------------
     READ STORM
      Filename = storm.001
      Comment  =
      [SDT=30.00:SDUR=  24.00:PTOT=  95.06]
 243:0003--------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = C:\UJSYMH~1\uppe_val.val
      ICASEdv  = 1 (read and print data)
      FileTitle= File comment: [Bilberry Creek Default Value File]
                 THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN STANDHYD COM
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=   4.67 mm] [LGP=90.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .045]
      Parameters used in NASHYD:
      [Ia=   1.50 mm] [N= 3.00]
# Main Channel
 243:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:UJ1         2048.43   10.500 No_date   26:30   45.37 .477
      [CN= 73.8: N= 3.00]
      [Tp=12.36:DT= 5.00]
 243:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           01:UJ1         2048.43   10.500 No_date   26:30   45.37  n/a
      fname :C:\UJSYMH~1\H-UJ1.243
      remark:Runoff Hydrograph for UJ1
 243:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:UJ1         2048.43   10.500 No_date   26:30   45.37  n/a
      [RDT= 5.00] out<- 02:C1          2048.43    9.293 No_date   32:05   45.37  n/a
      [L/S/n= 3496./ .059/.050]
      {Vmax=  .190:Dmax=  .825}
 243:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           02:C1          2048.43    9.293 No_date   32:05   45.37  n/a
      fname :C:\UJSYMH~1\H-C1.243
      remark:Routing Hydrograph for C1
 243:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:TA1         1004.45    7.666 No_date   20:20   43.64 .459
      [CN= 72.5: N= 3.00]
      [Tp= 7.08:DT= 5.00]
 243:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           03:TA1         1004.45    7.666 No_date   20:20   43.64  n/a
      fname :C:\UJSYMH~1\H-TA1.243
      remark:Runoff Hydrograph for TA1
 243:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:C1          2048.43    9.293 No_date   32:05   45.37  n/a
                      + 03:TA1         1004.45    7.666 No_date   20:20   43.64  n/a
      [DT= 5.00]  SUM=  04:N2          3052.88   13.750 No_date   25:45   44.80  n/a
 243:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           04:N2          3052.88   13.750 No_date   25:45   44.80  n/a
      fname :C:\UJSYMH~1\H-N2.243
      remark:Confluence Hydrograph for N2
 243:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 04:N2          3052.88   13.750 No_date   25:45   44.80  n/a
      [RDT= 5.00] out<- 05:C2          3052.88    8.414 No_date   38:15   44.80  n/a
      [L/S/n= 4708./ .018/.050]
      {Vmax=  .076:Dmax= 1.415}
 243:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           05:C2          3052.88    8.414 No_date   38:15   44.80  n/a
      fname :C:\UJSYMH~1\H-C2.243
      remark:Routing Hydrograph for C2
 243:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       06:TB1         1396.83    9.641 No_date   20:15   39.00 .410
      [CN= 68.8: N= 3.00]
      [Tp= 6.94:DT= 5.00]
 243:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           06:TB1         1396.83    9.641 No_date   20:15   39.00  n/a
      fname :C:\UJSYMH~1\H-TB1.243
      remark:Runoff Hydrograph for TB1
 243:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            05:C2          3052.88    8.414 No_date   38:15   44.80  n/a
                      + 06:TB1         1396.83    9.641 No_date   20:15   39.00  n/a
      [DT= 5.00]  SUM=  07:N3          4449.71   13.229 No_date   24:05   42.98  n/a
 243:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           07:N3          4449.71   13.229 No_date   24:05   42.98  n/a
      fname :C:\UJSYMH~1\H-N3.243
      remark:Confluence Hydrograph for N3
 243:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 07:N3          4449.71   13.229 No_date   24:05   42.98  n/a
      [RDT= 5.00] out<- 08:C3          4449.71   11.595 No_date   30:30   42.98  n/a
      [L/S/n= 2255./ .043/.050]
      {Vmax=  .115:Dmax= 1.505}
 243:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           08:C3          4449.71   11.595 No_date   30:30   42.98  n/a
      fname :C:\UJSYMH~1\H-C3.243
      remark:Routing Hydrograph for C3
 243:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       09:UJ2         3783.71   13.892 No_date   35:55   54.49 .573
      [CN= 80.1: N= 3.00]
      [Tp=22.14:DT= 5.00]
 243:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           09:UJ2         3783.71   13.892 No_date   35:55   54.49  n/a
      fname :C:\UJSYMH~1\H-UJ2.243
      remark:Runoff Hydrograph for UJ2
 243:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            08:C3          4449.71   11.595 No_date   30:30   42.98  n/a
                      + 09:UJ2         3783.71   13.892 No_date   35:55   54.49  n/a
      [DT= 5.00]  SUM=  10:N4          8233.42   25.088 No_date   33:45   48.27  n/a
 243:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           10:N4          8233.42   25.088 No_date   33:45   48.27  n/a
      fname :C:\UJSYMH~1\H-N4.243
      remark:Confluence Hydrograph for N4
 243:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 10:N4          8233.42   25.088 No_date   33:45   48.27  n/a
      [RDT= 5.00] out<- 01:C4          8233.42   24.381 No_date   37:35   48.27  n/a
      [L/S/n= 5183./ .067/.035]
      {Vmax=  .361:Dmax=  .939}
 243:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           01:C4          8233.42   24.381 No_date   37:35   48.27  n/a
      fname :C:\UJSYMH~1\H-C4.243
      remark:Routing Hydrograph for C4
 243:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:UJ3         1810.89   16.619 No_date   18:30   43.78 .461
      [CN= 72.6: N= 3.00]
      [Tp= 5.62:DT= 5.00]
 243:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           02:UJ3         1810.89   16.619 No_date   18:30   43.78  n/a
      fname :C:\UJSYMH~1\H-UJ3.243
      remark:Runoff Hydrograph for UJ3
 243:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:C4          8233.42   24.381 No_date   37:35   48.27  n/a
                      + 02:UJ3         1810.89   16.619 No_date   18:30   43.78  n/a
      [DT= 5.00]  SUM=  03:N5         10044.31   26.159 No_date   31:35   47.46  n/a
 243:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           03:N5         10044.31   26.159 No_date   31:35   47.46  n/a
      fname :C:\UJSYMH~1\H-N5.243
      remark:Confluence Hydrograph for N5
   ** END OF RUN : 243

*******************************************************************************


 RUN:COMMAND#
 244:0001--------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  = 244 ]
#******************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date         : 21 Oct 2019
#  Modeller     : [ Calvin Paul ]
#  Company      : Rideau Valley Conservation Authority
#  License #    :  5329846
#******************************************************************************
 244:0002--------------------------------------------------------------------------
     READ STORM
      Filename = storm.001
      Comment  =
      [SDT=30.00:SDUR=  24.00:PTOT= 110.93]
 244:0003--------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = C:\UJSYMH~1\uppe_val.val
      ICASEdv  = 1 (read and print data)
      FileTitle= File comment: [Bilberry Creek Default Value File]
                 THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN STANDHYD COM
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=   4.67 mm] [LGP=90.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .045]
      Parameters used in NASHYD:
      [Ia=   1.50 mm] [N= 3.00]
```

```
# Main Channel
 244:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:UJ1         2048.43   13.337 No_date   26:25   57.60 .519
      [CN= 73.8: N= 3.00]
      [Tp=12.36:DT= 5.00]
 244:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           01:UJ1         2048.43   13.337 No_date   26:25   57.60  n/a
      fname :C:\UJSYMH~1\H-UJ1.244
      remark:Runoff Hydrograph for UJ1
 244:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 01:UJ1        2048.43   13.337 No_date   26:25   57.60  n/a
      [RDT= 5.00] out<- 02:C1          2048.43   11.675 No_date   32:20   57.60  n/a
      [L/S/n= 3496./ .059/.050]
      {Vmax=  .178:Dmax=  .866}
 244:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           02:C1          2048.43   11.675 No_date   32:20   57.60  n/a
      fname :C:\UJSYMH~1\H-C1.244
      remark:Routing Hydrograph for C1
 244:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:TA1         1004.45    9.795 No_date   20:15   55.60 .501
      [CN= 72.5: N= 3.00]
      [Tp= 7.08:DT= 5.00]
 244:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           03:TA1         1004.45    9.795 No_date   20:15   55.60  n/a
      fname :C:\UJSYMH~1\H-TA1.244
      remark:Runoff Hydrograph for TA1
 244:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:C1          2048.43   11.675 No_date   32:20   57.60  n/a
                      + 03:TA1         1004.45    9.795 No_date   20:15   55.60  n/a
      [DT= 5.00]  SUM=  04:N2          3052.88   17.263 No_date   25:35   56.95  n/a
 244:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           04:N2          3052.88   17.263 No_date   25:35   56.95  n/a
      fname :C:\UJSYMH~1\H-N2.244
      remark:Confluence Hydrograph for N2
 244:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 04:N2         3052.88   17.263 No_date   25:35   56.95  n/a
      [RDT= 5.00] out<- 05:C2          3052.88   10.642 No_date   38:20   56.94  n/a
      [L/S/n= 4708./ .018/.050]
      {Vmax=  .076:Dmax= 1.455}
 244:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           05:C2          3052.88   10.642 No_date   38:20   56.94  n/a
      fname :C:\UJSYMH~1\H-C2.244
      remark:Routing Hydrograph for C2
 244:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       06:TB1         1396.83   12.448 No_date   20:10   50.20 .453
      [CN= 68.8: N= 3.00]
      [Tp= 6.94:DT= 5.00]
 244:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           06:TB1         1396.83   12.448 No_date   20:10   50.20  n/a
      fname :C:\UJSYMH~1\H-TB1.244
      remark:Runoff Hydrograph for TB1
 244:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            05:C2          3052.88   10.642 No_date   38:20   56.94  n/a
                      + 06:TB1         1396.83   12.448 No_date   20:10   50.20  n/a
      [DT= 5.00]  SUM=  07:N3          4449.71   17.023 No_date   23:40   54.83  n/a
 244:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           07:N3          4449.71   17.023 No_date   23:40   54.83  n/a
      fname :C:\UJSYMH~1\H-N3.244
      remark:Confluence Hydrograph for N3
 244:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 07:N3         4449.71   17.023 No_date   23:40   54.83  n/a
      [RDT= 5.00] out<- 08:C3          4449.71   14.920 No_date   29:40   54.83  n/a
      [L/S/n= 2255./ .043/.050]
      {Vmax=  .119:Dmax= 1.543}
 244:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           08:C3          4449.71   14.920 No_date   29:40   54.83  n/a
      fname :C:\UJSYMH~1\H-C3.244
      remark:Routing Hydrograph for C3
 244:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       09:UJ2         3783.71   17.330 No_date   35:50   67.97 .613
      [CN= 80.1: N= 3.00]
      [Tp=22.14:DT= 5.00]
 244:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           09:UJ2         3783.71   17.330 No_date   35:50   67.97  n/a
      fname :C:\UJSYMH~1\H-UJ2.244
      remark:Runoff Hydrograph for UJ2
 244:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            08:C3          4449.71   14.920 No_date   29:40   54.83  n/a
                      + 09:UJ2         3783.71   17.330 No_date   35:50   67.97  n/a
      [DT= 5.00]  SUM=  10:N4          8233.42   31.616 No_date   33:20   60.86  n/a
 244:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           10:N4          8233.42   31.616 No_date   33:20   60.86  n/a
      fname :C:\UJSYMH~1\H-N4.244
      remark:Confluence Hydrograph for N4
 244:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 10:N4         8233.42   31.616 No_date   33:20   60.86  n/a
      [RDT= 5.00] out<- 01:C4          8233.42   30.778 No_date   36:50   60.86  n/a
      [L/S/n= 5183./ .067/.035]
      {Vmax=  .385:Dmax=  .997}
 244:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           01:C4          8233.42   30.778 No_date   36:50   60.86  n/a
      fname :C:\UJSYMH~1\H-C4.244
      remark:Routing Hydrograph for C4
 244:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:UJ3         1810.89   21.251 No_date   18:25   55.77 .503
      [CN= 72.6: N= 3.00]
      [Tp= 5.62:DT= 5.00]
 244:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           02:UJ3         1810.89   21.251 No_date   18:25   55.77  n/a
      fname :C:\UJSYMH~1\H-UJ3.244
      remark:Runoff Hydrograph for UJ3
 244:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:C4          8233.42   30.778 No_date   36:50   60.86  n/a
                      + 02:UJ3         1810.89   21.251 No_date   18:25   55.77  n/a
      [DT= 5.00]  SUM=  03:N5         10044.31   33.459 No_date   29:40   59.95  n/a
 244:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           03:N5         10044.31   33.459 No_date   29:40   59.95  n/a
      fname :C:\UJSYMH~1\H-N5.244
      remark:Confluence Hydrograph for N5
  ** END OF RUN : 244

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 RUN:COMMAND#
 245:0001------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on         0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  = 245 ]
#******************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date        : 21 Oct 2019
#  Modeller    : [ Calvin Paul ]
#  Company     : Rideau Valley Conservation Authority
#  License #   :  5329846
#******************************************************************************
 245:0002------------------------------------------------------------------------------
     READ STORM
      Filename = storm.001
      Comment  =
      [SDT=30.00:SDUR=  24.00:PTOT= 134.54]
 245:0003------------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = C:\UJSYMH~1\uppe_val.val
      ICASEdv  = 1 (read and print data)
      FileTitle= File comment: [Bilberry Creek Default Value File]
                 THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN STANDHYD COM
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=   4.67 mm] [LGP=90.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .045]
      Parameters used in NASHYD:
      [Ia=   1.50 mm] [N= 3.00]
# Main Channel
 245:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:UJ1         2048.43   17.788 No_date   26:20   76.78 .571
      [CN= 73.8: N= 3.00]
      [Tp=12.36:DT= 5.00]
 245:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           01:UJ1         2048.43   17.788 No_date   26:20   76.78  n/a
      fname :C:\UJSYMH~1\H-UJ1.245
      remark:Runoff Hydrograph for UJ1
 245:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 01:UJ1        2048.43   17.788 No_date   26:20   76.78  n/a
      [RDT= 5.00] out<- 02:C1          2048.43   15.307 No_date   32:40   76.78  n/a
      [L/S/n= 3496./ .059/.050]
      {Vmax=  .163:Dmax=  .932}
 245:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           02:C1          2048.43   15.307 No_date   32:40   76.78  n/a
      fname :C:\UJSYMH~1\H-C1.245
      remark:Routing Hydrograph for C1
 245:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:TA1         1004.45   13.159 No_date   20:10   74.43 .553
      [CN= 72.5: N= 3.00]
      [Tp= 7.08:DT= 5.00]
 245:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           03:TA1         1004.45   13.159 No_date   20:10   74.43  n/a
      fname :C:\UJSYMH~1\H-TA1.245
      remark:Runoff Hydrograph for TA1
 245:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:C1          2048.43   15.307 No_date   32:40   76.78  n/a
                      + 03:TA1         1004.45   13.159 No_date   20:10   74.43  n/a
      [DT= 5.00]  SUM=  04:N2          3052.88   22.633 No_date   25:25   76.01  n/a
 245:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           04:N2          3052.88   22.633 No_date   25:25   76.01  n/a
      fname :C:\UJSYMH~1\H-N2.245
      remark:Confluence Hydrograph for N2
 245:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 04:N2         3052.88   22.633 No_date   25:25   76.01  n/a
   *  [RDT= 5.00] out<- 05:C2          3052.88   14.156 No_date   37:55   76.01  n/a
      [L/S/n= 4708./ .018/.050]
      {Vmax=  .078:Dmax= 1.498}
 245:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           05:C2          3052.88   14.156 No_date   37:55   76.01  n/a
      fname :C:\UJSYMH~1\H-C2.245
      remark:Routing Hydrograph for C2
 245:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       06:TB1         1396.83   16.928 No_date   20:05   67.99 .505
      [CN= 68.8: N= 3.00]
      [Tp= 6.94:DT= 5.00]
 245:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           06:TB1         1396.83   16.928 No_date   20:05   67.99  n/a
      fname :C:\UJSYMH~1\H-TB1.245
      remark:Runoff Hydrograph for TB1
 245:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            05:C2          3052.88   14.156 No_date   37:55   76.01  n/a
                      + 06:TB1         1396.83   16.928 No_date   20:05   67.99  n/a
      [DT= 5.00]  SUM=  07:N3          4449.71   23.001 No_date   23:05   73.49  n/a
 245:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           07:N3          4449.71   23.001 No_date   23:05   73.49  n/a
      fname :C:\UJSYMH~1\H-N3.245
      remark:Confluence Hydrograph for N3
 245:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 07:N3         4449.71   23.001 No_date   23:05   73.49  n/a
      [RDT= 5.00] out<- 08:C3          4449.71   20.262 No_date   29:05   73.49  n/a
      [L/S/n= 2255./ .043/.050]
      {Vmax=  .126:Dmax= 1.601}
 245:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           08:C3          4449.71   20.262 No_date   29:05   73.49  n/a
      fname :C:\UJSYMH~1\H-C3.245
      remark:Routing Hydrograph for C3
 245:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       09:UJ2         3783.71   22.629 No_date   35:45   88.75 .660
      [CN= 80.1: N= 3.00]
      [Tp=22.14:DT= 5.00]
 245:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           09:UJ2         3783.71   22.629 No_date   35:45   88.75  n/a
      fname :C:\UJSYMH~1\H-UJ2.245
      remark:Runoff Hydrograph for UJ2
 245:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            08:C3          4449.71   20.262 No_date   29:05   73.49  n/a
                      + 09:UJ2         3783.71   22.629 No_date   35:45   88.75  n/a
      [DT= 5.00]  SUM=  10:N4          8233.42   41.839 No_date   32:45   80.50  n/a
 245:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           10:N4          8233.42   41.839 No_date   32:45   80.50  n/a
      fname :C:\UJSYMH~1\H-N4.245
      remark:Confluence Hydrograph for N4
 245:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 10:N4         8233.42   41.839 No_date   32:45   80.50  n/a
      [RDT= 5.00] out<- 01:C4          8233.42   40.885 No_date   36:10   80.50  n/a
      [L/S/n= 5183./ .067/.035]
      {Vmax=  .418:Dmax= 1.080}
 245:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD           01:C4          8233.42   40.885 No_date   36:10   80.50  n/a
      fname :C:\UJSYMH~1\H-C4.245
      remark:Routing Hydrograph for C4
 245:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:UJ3         1810.89   28.574 No_date   18:20   74.62 .555
      [CN= 72.6: N= 3.00]
```

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      [Tp= 5.62:DT= 5.00]
 245:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            02:UJ3         1810.89   28.574 No_date   18:20    74.62  n/a
      fname :C:\UJSYMH~1\H-UJ3.245
      remark:Runoff Hydrograph for UJ3
 245:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:C4          8233.42   40.885 No_date   36:10    80.50  n/a
                       + 02:UJ3         1810.89   28.574 No_date   18:20    74.62  n/a
      [DT= 5.00]  SUM=   03:N5         10044.31   45.483 No_date   28:55    79.44  n/a
 245:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            03:N5         10044.31   45.483 No_date   28:55    79.44  n/a
      fname :C:\UJSYMH~1\H-N5.245
      remark:Confluence Hydrograph for N5
  ** END OF RUN : 245

*******************************************************************************



 RUN:COMMAND#
 246:0001------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  = 246 ]
#******************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date         : 21 Oct 2019
#  Modeller     : [ Calvin Paul ]
#  Company      : Rideau Valley Conservation Authority
#  License #    :  5329846
#******************************************************************************
 246:0002------------------------------------------------------------------------------
     READ STORM
      Filename = storm.001
      Comment  =
      [SDT=30.00:SDUR=  24.00:PTOT= 144.23]
 246:0003------------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = C:\UJSYMH~1\uppe_val.val
      ICASEdv  = 1 (read and print data)
      FileTitle= File comment: [Bilberry Creek Default Value File]
                 THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN STANDHYD COM
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=   4.67 mm] [LGP=90.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .045]
      Parameters used in NASHYD:
      [Ia=   1.50 mm] [N= 3.00]
# Main Channel
 246:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:UJ1         2048.43   19.671 No_date   26:15    84.91 .589
      [CN= 73.8: N= 3.00]
      [Tp=12.36:DT= 5.00]
 246:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            01:UJ1         2048.43   19.671 No_date   26:15    84.91  n/a
      fname :C:\UJSYMH~1\H-UJ1.246
      remark:Runoff Hydrograph for UJ1
 246:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 01:UJ1         2048.43   19.671 No_date   26:15    84.91  n/a
      [RDT= 5.00] out<- 02:C1           2048.43   16.799 No_date   32:50    84.91  n/a
      [L/S/n= 3496./ .059/.050]
      {Vmax=  .157:Dmax=  .960}
 246:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            02:C1          2048.43   16.799 No_date   32:50    84.91  n/a
      fname :C:\UJSYMH~1\H-C1.246
      remark:Routing Hydrograph for C1
 246:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        03:TA1         1004.45   14.584 No_date   20:10    82.43 .572
      [CN= 72.5: N= 3.00]
      [Tp= 7.08:DT= 5.00]
 246:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            03:TA1         1004.45   14.584 No_date   20:10    82.43  n/a
      fname :C:\UJSYMH~1\H-TA1.246
      remark:Runoff Hydrograph for TA1
 246:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             02:C1          2048.43   16.799 No_date   32:50    84.91  n/a
                       + 03:TA1         1004.45   14.584 No_date   20:10    82.43  n/a
      [DT= 5.00]  SUM=   04:N2          3052.88   24.860 No_date   25:15    84.09  n/a
 246:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            04:N2          3052.88   24.860 No_date   25:15    84.09  n/a
      fname :C:\UJSYMH~1\H-N2.246
      remark:Confluence Hydrograph for N2
 246:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 04:N2          3052.88   24.860 No_date   25:15    84.09  n/a
   *  [RDT= 5.00] out<- 05:C2           3052.88   15.635 No_date   37:55    84.09  n/a
      [L/S/n= 4708./ .018/.050]
      {Vmax=  .079:Dmax= 1.513}
 246:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            05:C2          3052.88   15.635 No_date   37:55    84.09  n/a
      fname :C:\UJSYMH~1\H-C2.246
      remark:Routing Hydrograph for C2
 246:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        06:TB1         1396.83   18.839 No_date   20:00    75.59 .524
      [CN= 68.8: N= 3.00]
      [Tp= 6.94:DT= 5.00]
 246:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            06:TB1         1396.83   18.839 No_date   20:00    75.59  n/a
      fname :C:\UJSYMH~1\H-TB1.246
      remark:Runoff Hydrograph for TB1
 246:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             05:C2          3052.88   15.635 No_date   37:55    84.09  n/a
                       + 06:TB1         1396.83   18.839 No_date   20:00    75.59  n/a
      [DT= 5.00]  SUM=   07:N3          4449.71   25.538 No_date   22:55    81.42  n/a
 246:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            07:N3          4449.71   25.538 No_date   22:55    81.42  n/a
      fname :C:\UJSYMH~1\H-N3.246
      remark:Confluence Hydrograph for N3
 246:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 07:N3          4449.71   25.538 No_date   22:55    81.42  n/a
      [RDT= 5.00] out<- 08:C3           4449.71   22.574 No_date   28:45    81.42  n/a
      [L/S/n= 2255./ .043/.050]
      {Vmax=  .129:Dmax= 1.626}
 246:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            08:C3          4449.71   22.574 No_date   28:45    81.42  n/a
      fname :C:\UJSYMH~1\H-C3.246
      remark:Routing Hydrograph for C3
 246:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        09:UJ2         3783.71   24.849 No_date   35:45    97.46 .676
      [CN= 80.1: N= 3.00]
      [Tp=22.14:DT= 5.00]
 246:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            09:UJ2         3783.71   24.849 No_date   35:45    97.46  n/a
      fname :C:\UJSYMH~1\H-UJ2.246
      remark:Runoff Hydrograph for UJ2
 246:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             08:C3          4449.71   22.574 No_date   28:45    81.42  n/a
                       + 09:UJ2         3783.71   24.849 No_date   35:45    97.46  n/a
      [DT= 5.00]  SUM=   10:N4          8233.42   46.133 No_date   32:40    88.80  n/a
 246:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            10:N4          8233.42   46.133 No_date   32:40    88.80  n/a
      fname :C:\UJSYMH~1\H-N4.246
      remark:Confluence Hydrograph for N4
 246:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 10:N4          8233.42   46.133 No_date   32:40    88.80  n/a
      [RDT= 5.00] out<- 01:C4           8233.42   45.124 No_date   35:50    88.80  n/a
      [L/S/n= 5183./ .067/.035]
      {Vmax=  .429:Dmax= 1.110}
 246:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            01:C4          8233.42   45.124 No_date   35:50    88.80  n/a
      fname :C:\UJSYMH~1\H-C4.246
      remark:Routing Hydrograph for C4
 246:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        02:UJ3         1810.89   31.672 No_date   18:20    82.63 .573
      [CN= 72.6: N= 3.00]
      [Tp= 5.62:DT= 5.00]
 246:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            02:UJ3         1810.89   31.672 No_date   18:20    82.63  n/a
      fname :C:\UJSYMH~1\H-UJ3.246
      remark:Runoff Hydrograph for UJ3
 246:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:C4          8233.42   45.124 No_date   35:50    88.80  n/a
                       + 02:UJ3         1810.89   31.672 No_date   18:20    82.63  n/a
      [DT= 5.00]  SUM=   03:N5         10044.31   50.652 No_date   27:45    87.68  n/a
 246:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            03:N5         10044.31   50.652 No_date   27:45    87.68  n/a
      fname :C:\UJSYMH~1\H-N5.246
      remark:Confluence Hydrograph for N5
  ** END OF RUN : 246

*******************************************************************************



 RUN:COMMAND#
 247:0001------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  = 247 ]
#******************************************************************************
#  Project Name: [Upperjock]    Project Number: [10485]
#  Date         : 21 Oct 2019
#  Modeller     : [ Calvin Paul ]
#  Company      : Rideau Valley Conservation Authority
#  License #    :  5329846
#******************************************************************************
 247:0002------------------------------------------------------------------------------
     READ STORM
      Filename = storm.001
      Comment  =
      [SDT=30.00:SDUR=  24.00:PTOT= 150.87]
 247:0003------------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = C:\UJSYMH~1\uppe_val.val
      ICASEdv  = 1 (read and print data)
      FileTitle= File comment: [Bilberry Creek Default Value File]
                 THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN STANDHYD COM
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=   4.67 mm] [LGP=90.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .045]
      Parameters used in NASHYD:
      [Ia=   1.50 mm] [N= 3.00]
# Main Channel
 247:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:UJ1         2048.43   20.983 No_date   26:15    90.56 .600
      [CN= 73.8: N= 3.00]
      [Tp=12.36:DT= 5.00]
 247:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            01:UJ1         2048.43   20.983 No_date   26:15    90.56  n/a
      fname :C:\UJSYMH~1\H-UJ1.247
      remark:Runoff Hydrograph for UJ1
 247:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 01:UJ1         2048.43   20.983 No_date   26:15    90.56  n/a
      [RDT= 5.00] out<- 02:C1           2048.43   17.857 No_date   32:55    90.56  n/a
      [L/S/n= 3496./ .059/.050]
      {Vmax=  .153:Dmax=  .979}
 247:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            02:C1          2048.43   17.857 No_date   32:55    90.56  n/a
      fname :C:\UJSYMH~1\H-C1.247
      remark:Routing Hydrograph for C1
 247:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        03:TA1         1004.45   15.579 No_date   20:05    87.99 .583
      [CN= 72.5: N= 3.00]
      [Tp= 7.08:DT= 5.00]
 247:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            03:TA1         1004.45   15.579 No_date   20:05    87.99  n/a
      fname :C:\UJSYMH~1\H-TA1.247
      remark:Runoff Hydrograph for TA1
 247:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             02:C1          2048.43   17.857 No_date   32:55    90.56  n/a
                       + 03:TA1         1004.45   15.579 No_date   20:05    87.99  n/a
      [DT= 5.00]  SUM=   04:N2          3052.88   26.395 No_date   25:15    89.72  n/a
 247:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            04:N2          3052.88   26.395 No_date   25:15    89.72  n/a
      fname :C:\UJSYMH~1\H-N2.247
      remark:Confluence Hydrograph for N2
 247:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL    -> 04:N2          3052.88   26.395 No_date   25:15    89.72  n/a
   *  [RDT= 5.00] out<- 05:C2           3052.88   16.662 No_date   37:50    89.72  n/a
      [L/S/n= 4708./ .018/.050]
      {Vmax=  .080:Dmax= 1.523}
 247:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     SAVE HYD            05:C2          3052.88   16.662 No_date   37:50    89.72  n/a
      fname :C:\UJSYMH~1\H-C2.247
```

```
     remark:Routing Hydrograph for C2
 247:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       06:TB1         1396.83   20.179 No_date   20:00   80.90 .536
     [CN= 68.8: N= 3.00]
     [Tp= 6.94:DT= 5.00]
 247:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           06:TB1         1396.83   20.179 No_date   20:00   80.90  n/a
     fname :C:\UJSYMH~1\H-TB1.247
     remark:Runoff Hydrograph for TB1
 247:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            05:C2          3052.88   16.662 No_date   37:50   89.72  n/a
                     + 06:TB1         1396.83   20.179 No_date   20:00   80.90  n/a
     [DT= 5.00]  SUM=  07:N3          4449.71   27.310 No_date   22:50   86.95  n/a
 247:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           07:N3          4449.71   27.310 No_date   22:50   86.95  n/a
     fname :C:\UJSYMH~1\H-N3.247
     remark:Confluence Hydrograph for N3
 247:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 07:N3          4449.71   27.310 No_date   22:50   86.95  n/a
     [RDT= 5.00] out<- 08:C3          4449.71   24.239 No_date   28:25   86.95  n/a
     [L/S/n= 2255./ .043/.050]
     {Vmax=  .131:Dmax= 1.638}
 247:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           08:C3          4449.71   24.239 No_date   28:25   86.95  n/a
     fname :C:\UJSYMH~1\H-C3.247
     remark:Routing Hydrograph for C3
 247:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       09:UJ2         3783.71   26.387 No_date   35:40  103.50 .686
     [CN= 80.1: N= 3.00]
     [Tp=22.14:DT= 5.00]
 247:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           09:UJ2         3783.71   26.387 No_date   35:40  103.50  n/a
     fname :C:\UJSYMH~1\H-UJ2.247
     remark:Runoff Hydrograph for UJ2
 247:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            08:C3          4449.71   24.239 No_date   28:25   86.95  n/a
                     + 09:UJ2         3783.71   26.387 No_date   35:40  103.50  n/a
     [DT= 5.00]  SUM=  10:N4          8233.42   49.128 No_date   32:25   94.55  n/a
 247:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           10:N4          8233.42   49.128 No_date   32:25   94.55  n/a
     fname :C:\UJSYMH~1\H-N4.247
     remark:Confluence Hydrograph for N4
 247:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 10:N4          8233.42   49.128 No_date   32:25   94.55  n/a
     [RDT= 5.00] out<- 01:C4          8233.42   48.096 No_date   35:35   94.55  n/a
     [L/S/n= 5183./ .067/.035]
     {Vmax=  .437:Dmax= 1.131}
 247:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           01:C4          8233.42   48.096 No_date   35:35   94.55  n/a
     fname :C:\UJSYMH~1\H-C4.247
     remark:Routing Hydrograph for C4
 247:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:UJ3         1810.89   33.838 No_date   18:20   88.20 .585
     [CN= 72.6: N= 3.00]
     [Tp= 5.62:DT= 5.00]
 247:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           02:UJ3         1810.89   33.838 No_date   18:20   88.20  n/a
     fname :C:\UJSYMH~1\H-UJ3.247
     remark:Runoff Hydrograph for UJ3
 247:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:C4          8233.42   48.096 No_date   35:35   94.55  n/a
                     + 02:UJ3         1810.89   33.838 No_date   18:20   88.20  n/a
     [DT= 5.00]  SUM=  03:N5         10044.31   54.213 No_date   27:55   93.41  n/a
 247:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    SAVE HYD           03:N5         10044.31   54.213 No_date   27:55   93.41  n/a
     fname :C:\UJSYMH~1\H-N5.247
     remark:Confluence Hydrograph for N5
 247:0002-----------------------------------------------------------------------------
     FINISH
-------------------------------------------------------------------------------------
*************************************************************************************
    WARNINGS / ERRORS / NOTES
    -------------------------
   Simulation ended on 2020-05-11     at 11:42:02
=====================================================================================
```

Appendix E

Road Crossings - Photographs

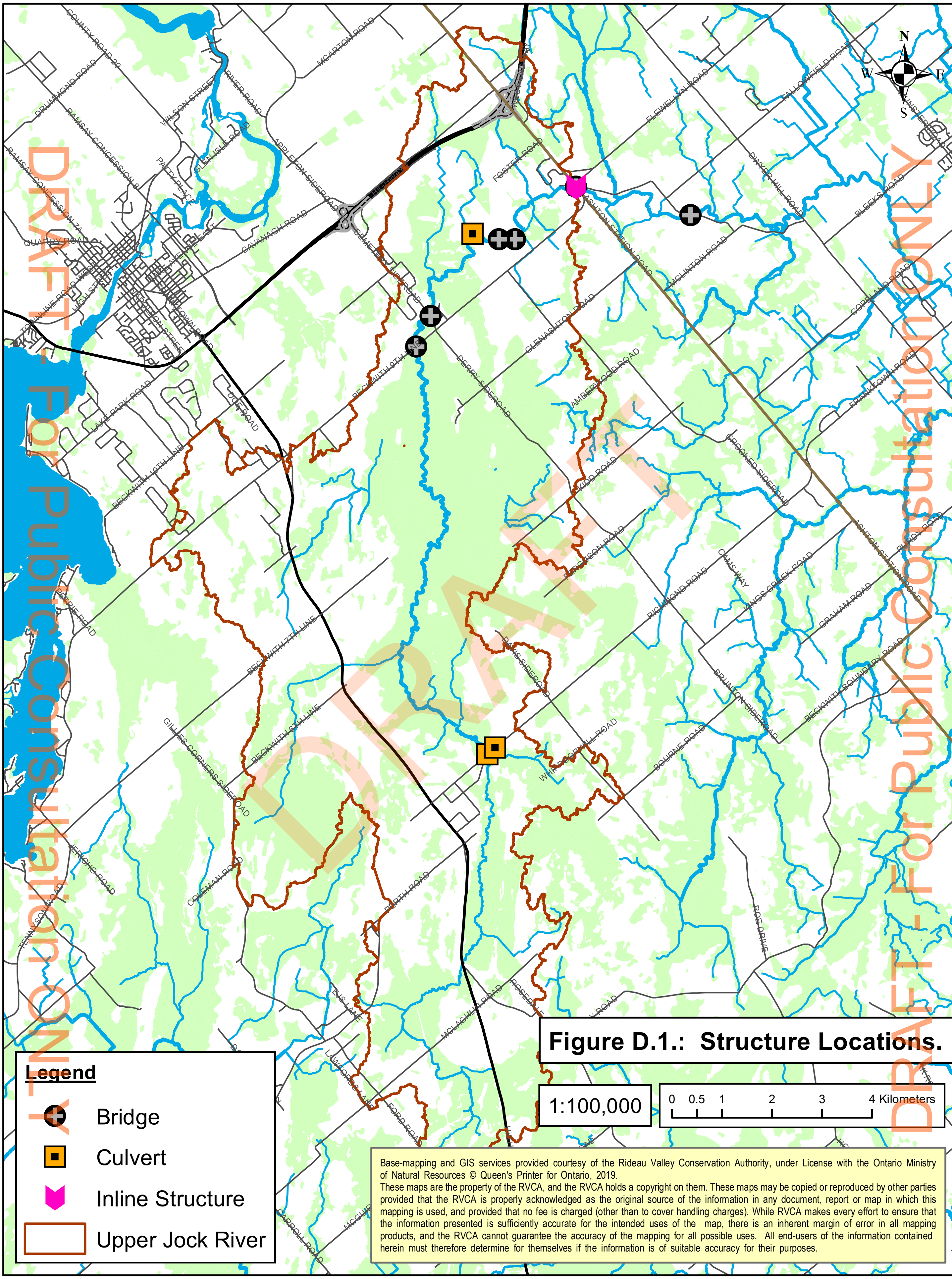


Figure D.1.: Structure Locations.

McCafferey Trail Bridge (Upstream)

McCafferey Trail Bridge (Downstream)

Ashton Station Bridge (Upstream)

Ashton Station Bridge (Downstream)

Ashton Station Dam (Upstream)

Ashton Station Dam (Downstream)


442 Beckwith 9 Line (Upstream)


442 Beckwith 9 Line (Downstream)


500 Beckwith 9 Line (Upstream)


500 Beckwith 9 Line (Downstream)


562 Beckwith 9 Line (Upstream)


562 Beckwith 9 Line (Downstream)

Cemetery Side Road Bridge (Upstream)

Cemetery Side Road Bridge (Downstream)

Beckwith 9 Line Bridge (Upstream)

Beckwith 9 Line Bridge (Downstream)

Richmond Rd Culvert (Upstream)

Richmond Rd Culvert (Downstream)

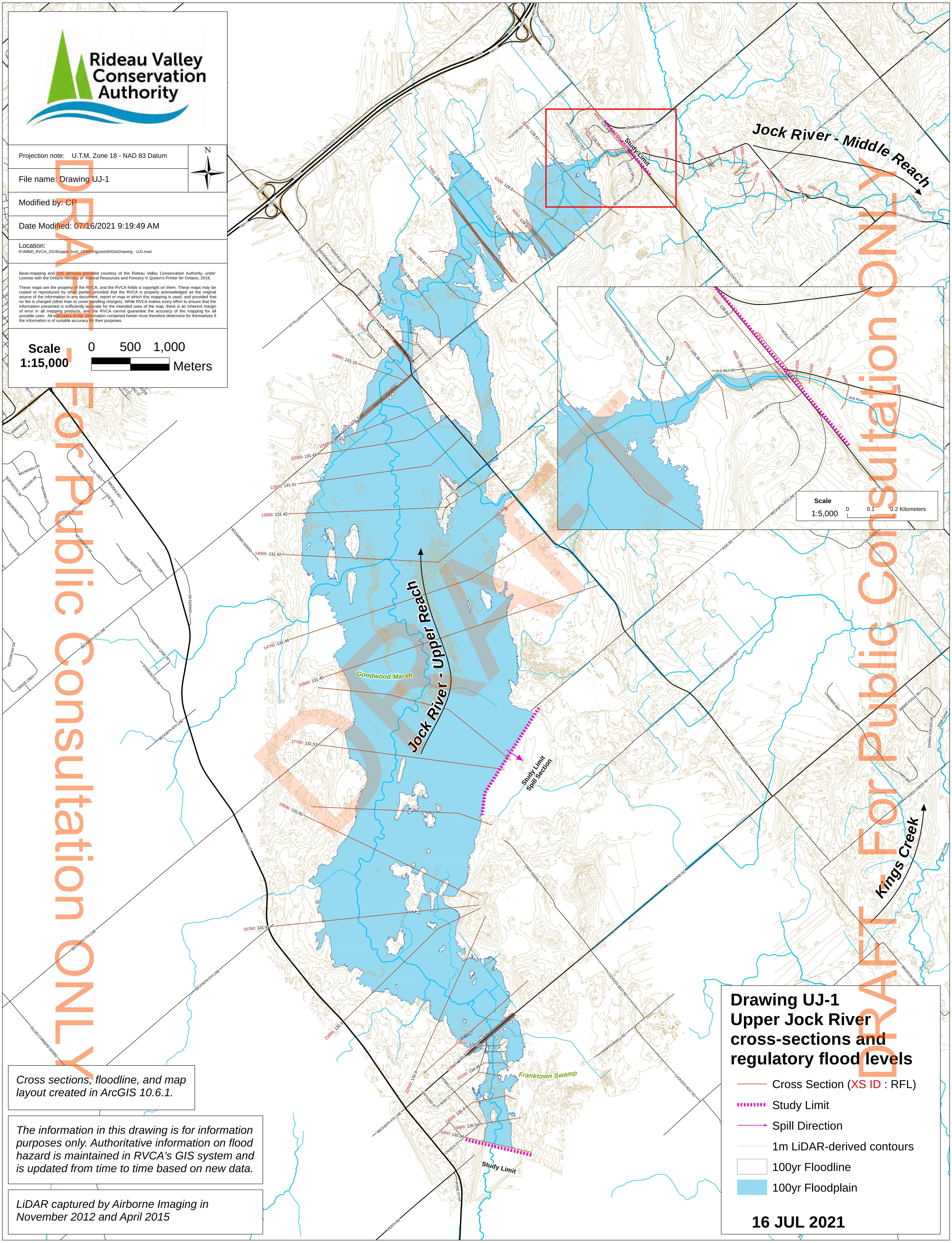
Franktown Swamp Culvert (Upstream)

Franktown Swamp Culvert (Downstream)

Appendix F

Full-Size Drawings

(Drawings UJ-1 and UJ-2)



Rideau Valley Conservation Authority

Projection note: U.T.M. Zone 18 - NAD 83 Datum

N

File name: Drawing UJ-1

Modified by: CP

Date Modified: 07/16/2021 9:19:49 AM

Location:
R:\M800_RVCA_2019\Upper Jock_10485\Figures\MXDs\Drawing - UJ1.mxd

Scale 1:15,000
0 500 1,000 Meters

Cross sections, floodline, and map layout created in ArcGIS 10.6.1.

The information in this drawing is for information purposes only. Authoritative information on flood hazard is maintained in RVCA's GIS system and is updated from time to time based on new data.

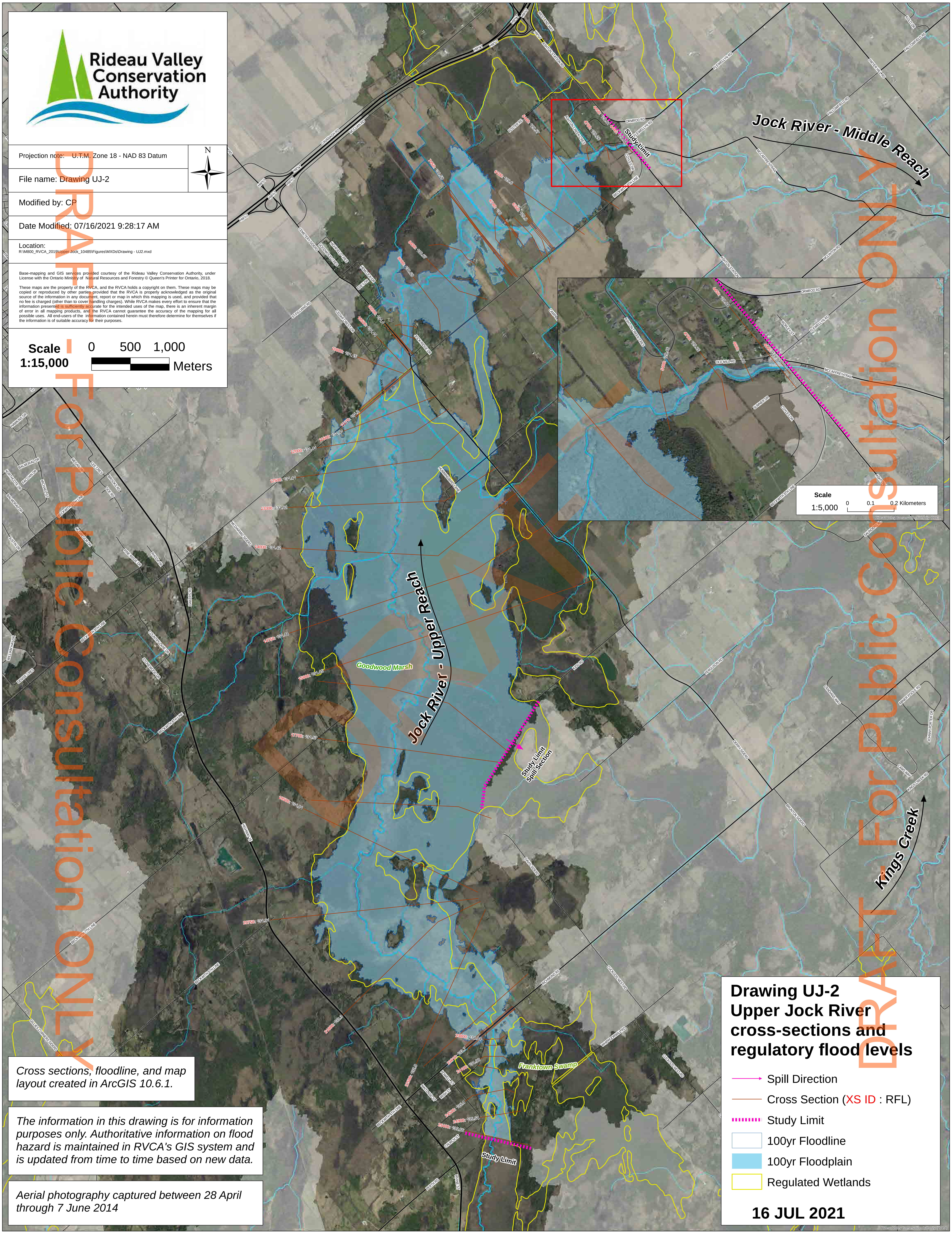
LiDAR captured by Airborne Imaging in November 2012 and April 2015

Drawing UJ-1
Upper Jock River cross-sections and regulatory flood levels

- Cross Section (XS ID : RFL)
- Study Limit
- Spill Direction
- 1m LiDAR-derived contours
- 100yr Floodline
- 100yr Floodplain

16 JUL 2021

Export Date: 16 JUL 2021 9:23:14 AM



Rideau Valley Conservation Authority

Projection note: U.T.M. Zone 18 - NAD 83 Datum

File name: Drawing UJ-2

Modified by: CP

Date Modified: 07/16/2021 9:28:17 AM

Location:
R:\M800_RVCA_2019\Upper Jock_10485\Figures\MXDs\Drawing - UJ2.mxd

Scale 1:15,000 — 0 500 1,000 Meters

Drawing UJ-2
Upper Jock River cross-sections and regulatory flood levels

- Spill Direction
- Cross Section (XS ID : RFL)
- Study Limit
- 100yr Floodline
- 100yr Floodplain
- Regulated Wetlands

16 JUL 2021

Cross sections, floodline, and map layout created in ArcGIS 10.6.1.

The information in this drawing is for information purposes only. Authoritative information on flood hazard is maintained in RVCA's GIS system and is updated from time to time based on new data.

Aerial photography captured between 28 April through 7 June 2014

Export Date: 16 JUL 2021 9:37:59 AM