QUINTE CONSERVATION

Consecon Lake and Creek Flood and Erosion Hazard Mapping

Floodplain Mapping Report

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STATEMENT OF LIMITATIONS AND CONDITIONS

Limitations

This report has been prepared for the Quinte Conservation in accordance with the agreement between KGS Group and Quinte Conservation (the "Agreement"). This report represents KGS Group's professional judgment and exercising due care consistent with the preparation of similar reports. The information, data, recommendations, and conclusions in this report are subject to the constraints and limitations in the Agreement and the qualifications in this report. This report must be read as a whole, and sections or parts should not be read out of context.

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1.0 INTRODUCTION

1.1 Objectives of the Study

KGS Group was retained by Quinte Conservation (QC) to update the regulatory floodplain for Consecon Lake and Creek from Melville Road, upstream of Consecon Lake, to the mouth of Consecon Creek at Wellers Bay. The study includes the collection of topographic data, site inspections, hydrologic assessments, hydraulic modeling and analyses, and mapping of the Regulatory Floodplain. The study also includes the preparation of erosion hazard mapping for Consecon Lake.

A draft version of the floodplain maps was presented in a Public Information Centre (February 12, 2024 – Consecon United Church, Consecon, Ontario) to discuss and receive feedback from the public, that was taken into consideration for the preparation of the final version of the floodplain maps. Aspects discussed in that PIC included: the role of the Whitney Dam on the Consecon Lake levels and how conditions used to be in the past, based on neighbours' recollections; locations that neighbours remembered as prone to flooding; conditions at the culverts on Highway 33 and on the areas west of the highway.

The study was conducted in accordance with the requirements outlined in the Ontario Ministry of Natural Resources and Forestry (MNRF), and within the Flood Hazard Identification and Mapping Program (FHIMP) – Project Eligibility and Requirements. The technical guidelines used were the following:

- Natural Resources Canada Federal Flood Mapping Guidelines Series
- OMNR (2011) Technical Bulletins associated with the Lakes and Rivers Improvement Act (LRIA)
- OMNR Technical Guide – River & Stream Systems: Flooding Hazard Limit (2002)
- OMNR Technical Guide – River & Stream Systems: Erosion Hazard Limit (2002)
- USACE HEC-HMS and HEC-RAS User's Manual and Technical Reference Manual

Following guidance from Environment and Climate Change Canada (ECCC), in this study, recurrent events are referred to with both return periods and AEPs. This is to provide clarity to users of the report, and to the public, regarding the likelihood of a flood event happening in any given year. It highlights the fact that the event referred to as the 100-year flood has a 1% probability of occurring or being exceeded in any given year. The correspondence between return periods and AEPs is provided in Table 1-1. The two approaches are interchangeable in this report.

TABLE 1-1: RETURN PERIODS AND AEPS

Return Period	Annual Exceedance Probability (AEP)
2 years	50%
5 years	20%
10 years	10%
20 years	5%
25 years	4%
50 years	2%
100 years	1%
200 years	0.5%

Return Period	Annual Exceedance Probability (AEP)
500 years	0.2%

1.2 Previous Studies and Data Provided

The data and study reports that were available for this study include:

- Previous Studies:
    - Consecon Creek Water Management Study (LATHEM, 1985)
    - Consecon Creek Flood Risk Map (LATHEM, 1982)
    - Whitney Dam DSR Report (D.M. WILLS, 2021)
- 2019-2022 Inspection Reports and Photos for Consecon Mill Dam and Whitney Memorial Dam
- Consecon Lake Bathymetry Contour Map (Dated October 5, 1971)
- Ortho-imagery (Dated 2018)
- Elevation: LiDAR Data, EPSG:2959 – NAD83(CSRS) / UTM Zone 18N (Dated 2022)

LATHEM (1985). Included hydrologic and hydraulics analysis as well as definition of the floodplain. The 100-year Flood event (1% AEP) was selected for definition of the floodplain.

D.M. WILLS (2021) was a study conducted for dam safety analysis for the Whitney Memorial Dam. As part of the study, the flood flows for the 100-year recurrent event (1% AEP) were simulated and included in an inundation map, along with other flood events that were relevant for the dam safety analysis.

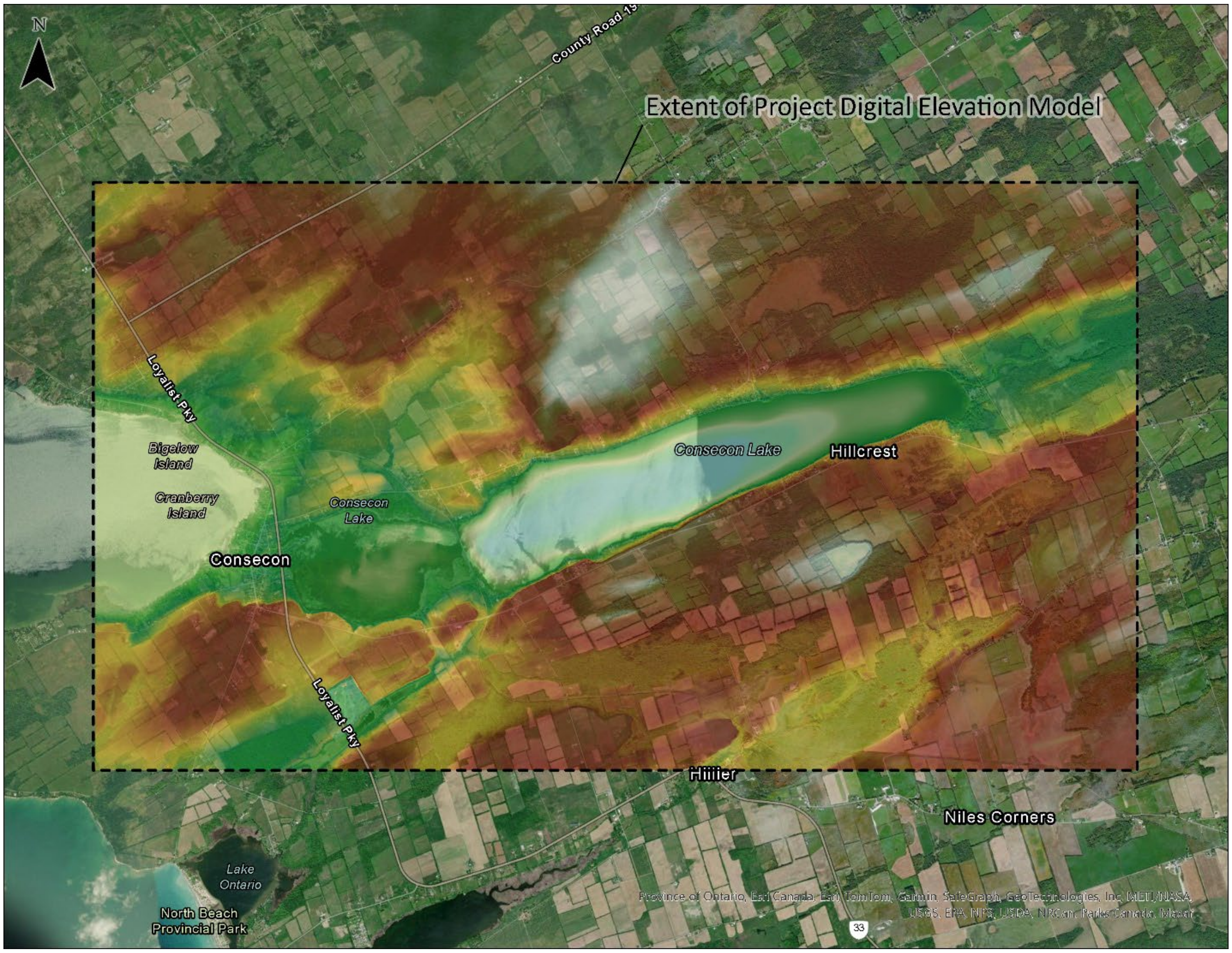
1.3 Topographic Data

The topographic data used in this study is referenced to the EPSG:2959 – NAD83(CSRS) / UTM Zone 18N projection system and Canadian Geodetic Vertical Datum CGVD2013.

The project floodplain DEM that served as the basis for the study was developed based on the HRDEM (High Resolution Digital Elevation Model), collected by Natural Resources Canada (NRCAN) in 2022 as part of the Belleville/Prince Edward County 2022 LiDAR project. It was supplemented with bathymetric data at structures and crossings, collected by KGS Group, as well as information obtained from available Nautical Charts. Historic bathymetric contours (Dated October 5, 1971) provided by Quinte Conservation provided limited useful information that was also used.

The extent of the Digital Elevation Model (DEM) used for this study is shown in Figure 1-1.

FIGURE 1-1: EXTENT OF DIGITAL ELEVATION MODEL



1.4 Criteria for Flood Hazard Limit

Consecon Lake and Consecon Creek are located within Zone 3 in Ontario, as defined in the "Technical Guide – River and Stream Systems: Flood Hazard Limit" (MNRF 2002). Based on that guideline, the Regulatory Flood Event for this watershed is the greater of the 100-year Flood or the flood resulting from the Timmins Storm.

Based on the results obtained as part of this study (KGS Group, 2024a) the 100-year Flood (1% annual exceedance probability, AEP[1]) spring (rain plus snowmelt) event is the governing event, and, therefore, it was selected for defining the floodplain (flood hazard limit) for Consecon Lake and Consecon Creek.

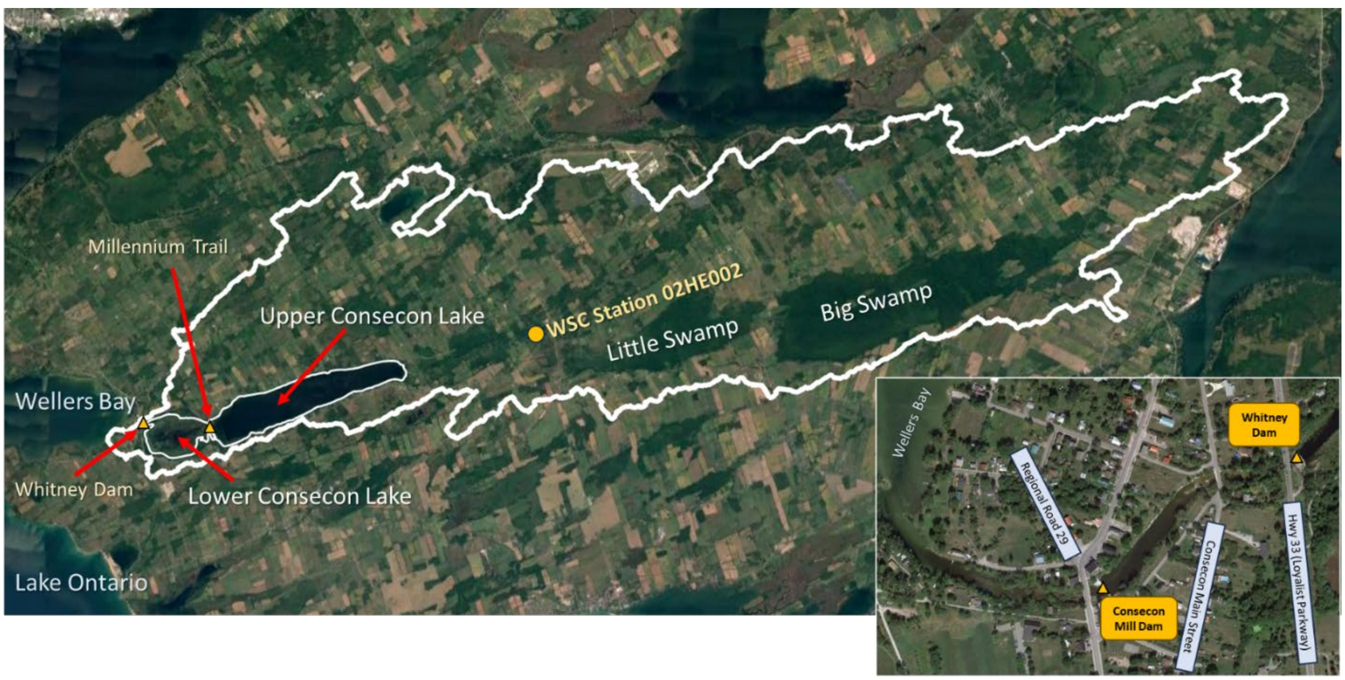
[1] This flood has a 1% probability of occurring on any given year.

2.0 HYDROLOGY

2.1 General Description of the Watershed

The Consecon Lake and Creek watershed is located within the jurisdiction of Quinte Conservation with a drainage area of approximately 186 km^2. The Consecon Creek watercourse spans 37 km and begins just north of Picton. It continuous towards the west through several large swamp bodies (Big Swamp and Little Swamp), Consecon Lake, and the hamlet of Consecon, before the creek flows into Lake Ontario at Wellers Bay. The creek features several structures along its path including Melville Road Bridge, Whitney Dam, Loyalist Parkway Road Bridge (Highway 33), Consecon Main Street Bridge, Consecon Mill Dam, and Regional Rd 29 Bridge. A general view of the watershed is shown in Figure 2-1. The floodplain mapping area subject of this study is the reach of Consecon Creek from Melville Road (at the upstream end of Consecon Lake) to Wellers Bay.

FIGURE 2-1: STUDY AREA CONSECON LAKE AND CONSECON CREEK



The largest water body in the watershed is Consecon Lake. The Millenium Trail Causeway crosses the lake from north to south and separates the clearer eastern portion of the lake, referred to in this report as “Upper Consecon Lake”, from its marshy western portion, referred to in this report as “Lower Consecon Lake”. This causeway was originally a railway trestle bridge which was converted into a hiking trail in 1995. The water levels of Consecon Lake are influenced by the Millennium Trail Causeway and the Whitney Memorial Dam, which was constructed in 1969 for the purpose of managing water levels for recreation (LATHEM, 1985). A short distance below the Whitney Dam, and upstream of Regional Rd 29, there is a small pond, created by the Consecon Mill Dam.

The Big Swamp and the Little Swamp, that are located in the eastern (upstream) portions of the watershed, upstream of Consecon Lake, feature depressions of porous organic soils, which provide additional water storage within the watershed and are known to attenuate flows during flood events. These swamps were studied in detail in LATHEM (1985), which found that the swamps would greatly reduce peak flows during flood events, particularly those that occur in the summer. As described in KGS Group (2024a), the effect of the swamps on the hydrologic response of the watershed was considered in the preparation of the hydrologic model developed in this study.

2.2 Hydrologic Analysis

Details of the hydrologic analyses carried out as part of this study are provided in KGS Group (2024a).

The study included hydrologic modeling and analysis using the program HEC-HMS to assess the magnitude of recurrent summer and spring flood events ranging from 2 to 500-year return periods (events with 50% to 0.2% AEP), and the flood that would result from the occurrence of the Timmins (Regional) Storm in the watershed.

Historically, the majority of the historical peak values (recorded at the Water Survey of Canada Station 02HE002, Allisonville, shown in Figure 2-1) were recorded in spring, suggesting that the largest floods could be produced by rain plus snowmelt events. The hydrologic model was calibrated using the limited hourly precipitation data available and flow data from the WSC at Allisonville.

The maximum flows and flood volumes obtained with the hydrologic model, shown in Table 2-1, indicated that the 100-year (1% AEP) spring event produced larger floods than the Timmins Storm, and therefore, the 100-year (1% AEP) spring flood was adopted as the Regulatory Flood, to be used for definition of the floodplain for the Consecon Creek Watershed. As agreed in the scope of work, the 200-year (0.5% AEP) and the 500-year (0.2% AEP) spring floods were used for a sensitivity analysis used for climate change considerations.

TABLE 2-1: HYDROLOGIC MODEL RESULTS FOR THE TIMMINS STORM AND THE 100-YEAR (1% AEP) FLOOD

	at Allisonville		at the Watershed Outlet	
	100 Year (1% AEP) Spring Storm	Timmins Storm	100 Year (1% AEP) Spring Storm	Timmins Storm
Peak Flow (m^3/s)	54.4	35.4	117	85.7
Volume ($x10^3$)	10,820	7,793	17,169	15,080

It must be noted that the flood routing that naturally occurs in Consecon Lake was not included in the hydrologic model. Instead, it was included in the hydraulic model, because the hydraulic model has capabilities to perform this routing more accurately than the hydrologic model.

The hydraulic model is capable of adjusting the rating curve for the crossing at the Millennium Trail Causeway with any submergence effects caused by the levels at the Lower Consecon Lake, which, in turn, are controlled at the Whitney Memorial Dam, as described in Section 3.0.

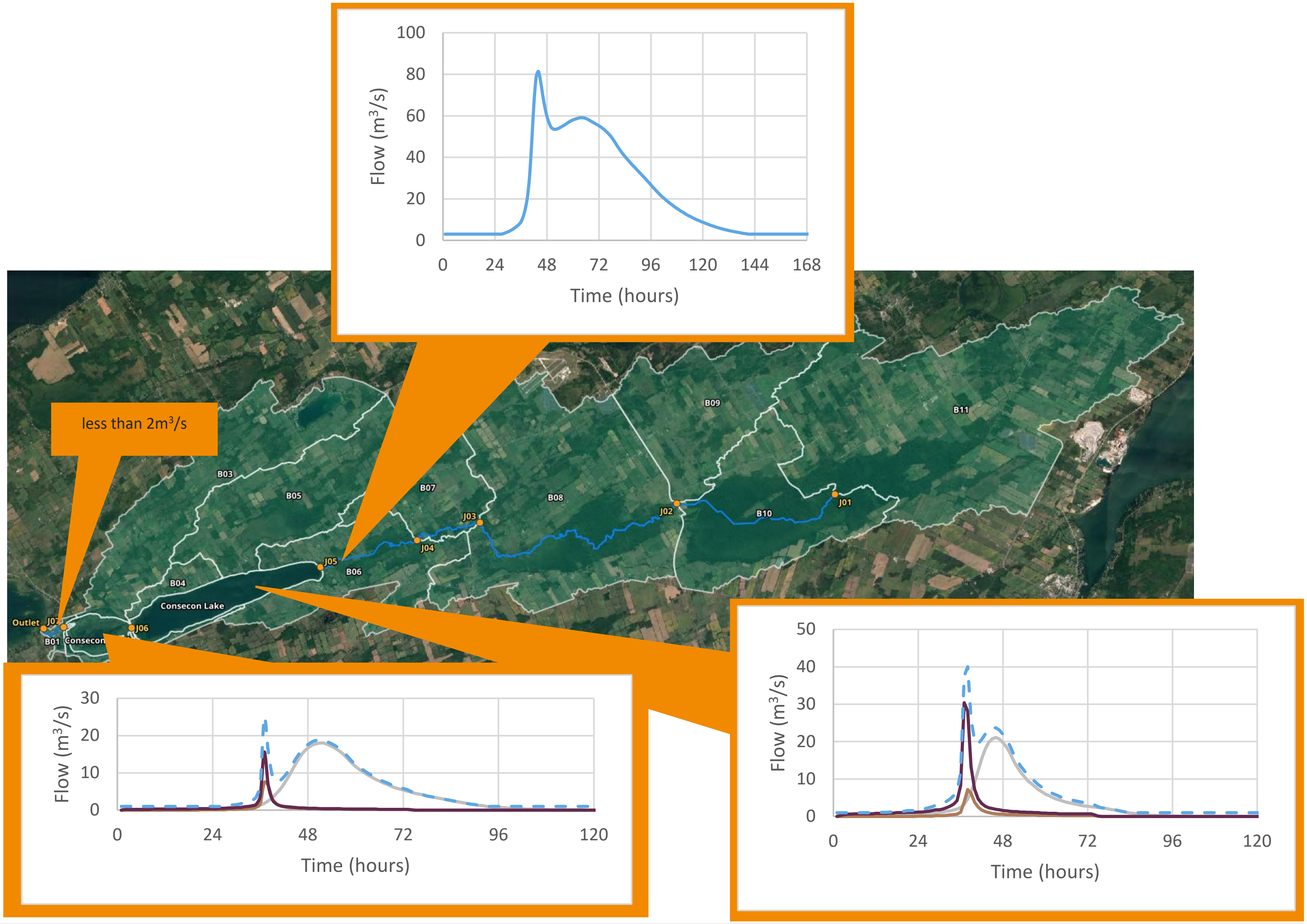
2.3 Hydrologic Analysis Outputs/Hydraulic Analysis Inputs

The input flows for the hydraulic analysis were the results obtained with the hydrologic model described in KGS Group (2024a). Figure 2-2 shows the values that correspond to the 100-year (1% AEP) flood, which was adopted as the Regulatory Flood. These include:

- Consecon Creek flow hydrographs upstream of Consecon Lake. The peak flow value for 100-year (1% AEP) flood was 81 m^3/s (time 43 hours), with a second peak flow of 60 m^3/s (time 64 hours).
- Hydrograph for local inflows to Upper Consecon Lake. This hydrograph combines the outflows obtained with HEC-HMS for two sub-catchments adjacent to the lake plus those from the sub-catchment used to represent direct precipitation on Upper Consecon Lake. The peak flow value for the 100-year (1% AEP) flood was 40 m^3/s (time 38 hours) and there is a second peak of 23 m^3/s (time 47 hours).
- Hydrograph for local inflows to Lower Consecon Lake. This hydrograph combines the outflows obtained with HEC-HMS for two adjacent sub-catchments plus those representing direct precipitation on Lower Consecon Lake. The peak flow value for the 100-year (1% AEP) flood was 25 m^3/s (time 37 hours) and there is a second peak of 19 m^3/s (time 52 hours).
- Local inflows to downstream of the Whitney Dam were less than 2 m^3/s at its peak and were divided with a portion applied to the ditch west of Hwy 33 and an equal portion applied at the pond upstream of the Consecon Mill Dam.

Corresponding values were obtained from the hydrologic model and input to the hydraulic model for other recurrent flood events. Those are provided in KGS Group (2024a and 2024b). This report is focussed on the preparation of the floodplain maps with the Regulatory Flood.

FIGURE 2-2: HYDROLOGIC INFLOWS 100-YEAR (1% AEP) FLOOD



3.0 HYDRAULIC ANALYSIS

3.1 Hydraulic Analysis and Modelling

Details of the hydraulic analyses carried out as part of this study are provided in KGS Group (2024b). That report includes description of the hydraulic model used, and its various inputs, and assumptions made for the analysis.

A hydraulic model, prepared with HEC-RAS, was used to simulate recurrent events corresponding to the 2, 10, 20, 50, 100, 200, and 500-Year return periods (See Table 1-1 for corresponding AEPs). The model was prepared following the guidelines from the HEC-RAS manuals (USACE, 2016) for the definition in the model of cross sections, storage areas, in-line and lateral structures, crossings, roughness parameters, boundary conditions. The model included:

- Consecon Creek upstream of Consecon Lake
- Consecon Lake divided into two separate storage areas: Upper Consecon Lake and Lower Consecon Lake.
- Small reach of Consecon Creek between the two portions of Consecon Lake, to include the crossing on the Millennium Trail Causeway
- Consecon Creek downstream of Lower Consecon Lake and upstream of Consecon Main Street, including the Whitney Memorial Dam and the crossing on Hwy 33.
- Ditch and low areas west of Hwy 33. The reach representing the ditch is connected to Consecon Creek with a junction, upstream of Consecon Main St.
- Lateral structure representing Hwy 33 and separating Lower Consecon Lake with the reach representing the ditch. The culverts under the highway were added to the model.
- Junction between Consecon Creek and the ditch west of Hwy 33, located upstream of the Consecon Main St crossing on Consecon Creek
- Consecon Creek downstream of the junction with the ditch, represented as a river reach that includes the Consecon Mill Dam and all the street crossings along the creek from Consecon Main Street o the mouth at Wellers Bay.

3.1.1 BOUNDARY CONDITIONS

The downstream boundary condition for the model was the water level at Wellers Bay, which was considered to be constant, independently of the flows in Consecon Creek. The water level assigned at the downstream end of the model was 74.8 m, which is representative of average levels at WSC Station 02HD015 (Lake Ontario at Cobourg). This is the same level that both LATHEM and D. M. WILLS adopted for the mouth of Consecon Creek in their respective studies.

The upstream boundary condition consisted of the input flow hydrographs obtained from the hydrologic analysis (KGS Group, 2024a).

3.1.2 MANNING'S N-VALUES

The Manning's n-values were selected based on photos of the study area obtained from the field survey conducted by KGS Group in 2023. Table 3-1 shows the Manning's n values selected for the hydraulic model.

TABLE 3-1: MANNING'S N-VALUES FOR CONSECON CREEK

Reach	River Station	n Channel	n Overbanks
Melville	**RS_10120 to RS_9012**	0.045	0.070
Millennium	**RS_2984**	0.030	0.030
Millennium	**RS_2967 to RS_2943**	0.030	0.050
Consecon Mill	**RS_943 to RS_727**	0.050	0.080
Downstream	**RS_715 to RS_8**	0.030	0.060

3.1.3 BRIDGES AND DAMS

For the study area from Melville to the mouth of Consecon, there are five bridges and two dams. KGS Group surveyed and prepared crossing data sheets for each of the structures (KGS Group, 2024b). These included the Consecon Mill Dam, Whitney Memorial Dam, and the bridges at Melville Rd, Millennium Trail, Hwy 33, Consecon Main St, and Road 29.

The two dams were simulated in the model as in-line structures, using geometric data obtained from the survey and from the drawings provided by QC.

3.1.4 FLOWS UNDER HIGHWAY 33

Highway 33 was included in the model as a lateral structure that separates the west portion of Consecon Lake (referred to in this study as Lower Consecon Lake) from the reach that represents the low areas and the ditch to the west of the highway.

The culverts across Hwy 33 were included in the model based on the initial information available (three CSP culvers with a diameter of 30") in the low terrain approximately 180 m south of the bridge. The model was run with this configuration. A separate simulation was carried out in which the model was run as if the highway embankment was washed out in that area of low terrain, allowing direct connection to the high lake levels. This simulation was important because as per Ontario policies and guidelines, embankments are not considered permanent solutions and the areas protected by them are still considered part of the floodplain.

It must be noted that there are more culverts across Hwy 33, nearby (there is a set of culverts, one 0.95 m CSP and one 0.76 m CSP, closer to the bridge over Consecon Creek) but those would not act as a connection from the lake to the ditch during the simulated events.

A comparison of the results with the highway embankment and without it showed that the flooded area west of Hwy 33 would be very similar for those two conditions.

After those simulations had been completed, a visual inspection was conducted by KGS Group. Figure 3-1 shows the culverts along Hwy 33 as inspected at the site. In the low area, where flows from the lake pass to the west of Hwy 33, there are two CSP culverts with a diameter of 0.95 m. The cross-sectional area of the two CSP pipes found on the site is 1.42 m^2, while the equivalent area of the three CSP pipes included in the initial model is 1.37 m^2. While the model was adjusted, to provide a corrected model to QC, the difference between the initial assumption and the conditions found on site are so small that they would not change the results obtained with the initial simulations. Furthermore, the adjustment to the model does not affect the floodline definition because, to comply with Provincial guidance, the floodline was prepared based on the conditions in which the embankment of Hwy 33 was removed (i.e. as if the embankment in the low area was washed out).

FIGURE 3-1: CULVERTS ALONG HWY 33-WEST SIDE OF THE ROAD

It is important to note, however, that the ditch in that area west of Hwy 33 was found to be overgrown. For it to properly operate, it needs to be cleaned of vegetation and obstacles and properly maintained. Figure 3-2 shows the ditch looking from Hwy 33 in the downstream direction. There is a crossing on the ditch that has only a small pipe, not properly installed and currently blocked. This crossing, shown more closely in Figure 3-3, is effectively a blockage for flow along the ditch. It needs to be removed. Further downstream along the ditch, Figure 3-4 and Figure 3-5 show the conditions at the driveway crossing, adjacent to Consecon Main Street. This crossing is in poor condition, and the ditch is overgrown with vegetation both upstream and downstream of the crossing.

It must be noted that for estimation of the floodplain, the ditch was assumed to be maintained and free of those obstacles. Otherwise, the maps would represent a preventable condition, caused by poor maintenance.

FIGURE 3-2: DITCH WEST OF HWY 33

FIGURE 3-3: CROSSING ON DITCH WEST OF HWY 33

FIGURE 3-4: DRIVEWAY NEAR CONSECON MAIN ST

FIGURE 3-5: OVERGROWN DITCH NEAR DRIVEWAY CROSSING

3.2 Hydraulic Analysis Results

The hydraulic model performed flood routing through Upper Consecon Lake and Lower Consecon Lake. The results for the regulatory flood are shown in the following figures:

- Figure 3-6 shows the total inflows going into upper Consecon Lake and the total outflows and water levels obtained with the HEC-RAS model for the 100-year (1% AEP) Flood.

- Figure 3-7 shows the total inflows (hydrologic inputs from the hydrologic model plus routed outflows on upper Consecon Lake), and the outflows and water levels for lower Consecon Lake obtained with the HEC-RAS model for the 100-year (1% AEP) Flood.

The water levels in these figures were obtained from the simulation assuming existing conditions of the Whitney Memorial Dam (the embankment that does not exist anymore was not included in the model). The figures were annotated to add the corresponding values with the removed embankment.

FIGURE 3-6: ROUTING OF THE REGULATORY FLOOD THROUGH UPPER CONSECON LAKE-EXISTING CONDITIONS (WHITNEY DAM EMBANKMENT REMOVED)

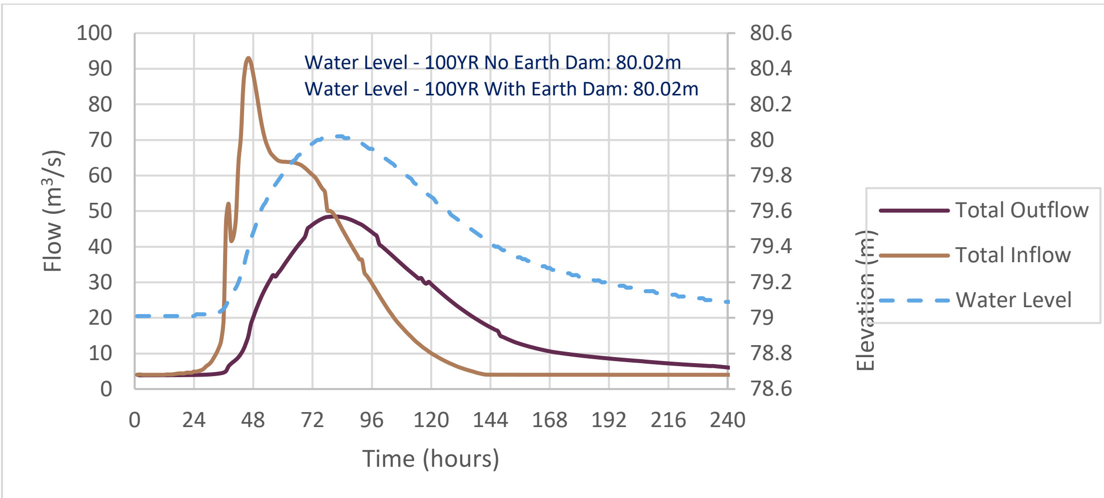
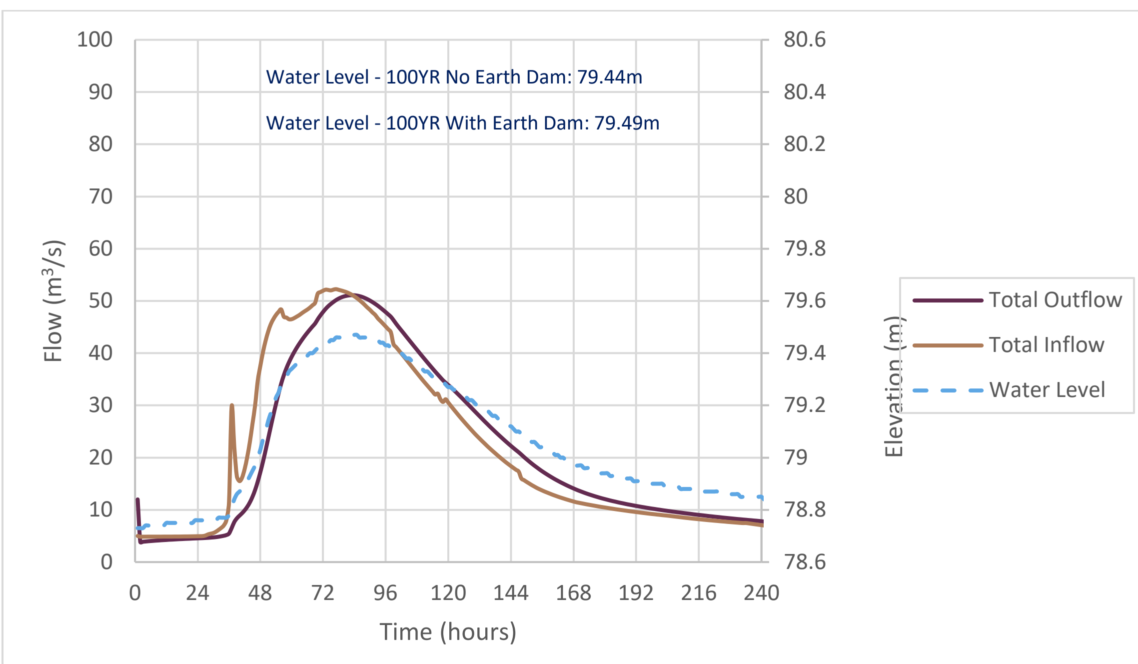


FIGURE 3-7: ROUTING OF THE REGULATORY FLOOD THROUGH LOWER CONSECON LAKE-EXISTING CONDITIONS (WHITNEY DAM EMBANKMENT REMOVED)



Details about the results for all events investigated are provided in KGS Group (2024b). Table 3-2 shows the water levels obtained with the HEC-RAS model for the Regulatory Flood (100-Year event of 1% AEP). The table shows two results at each location: present conditions and conditions as they would have been without removing the earth embankment at the Whitney Memorial Dam.

TABLE 3-2: SUMMARY OF WATER LEVELS OBTAINED IN THE HYDRAULIC ANALYSIS FOR THE 100-YEAR (1% AEP) FLOOD

Water Surface Elevation (m)			
Scenario	**Lower Consecon Lake**	**Upper Consecon Lake**	**Area Between Hwy 33 and Consecon Main Street**
2YR Present Conditions	79.05	79.42	79.05
2YR Former Conditions	79.10	79.42	79.10
10YR Present Conditions	79.23	79.68	79.23
10YR Former Conditions	79.27	79.69	79.27
25YR Present Conditions	79.31	79.84	79.31
25YR Former Conditions	79.36	79.84	79.36
50YR Present Conditions	79.37	79.94	79.37
50YR Former Conditions	79.43	79.94	79.43
100YR Present Conditions	79.44	80.02	79.44
100YR Former Conditions	79.49	80.02	79.49
200YR Present Conditions	79.50	80.13	79.50
200YR Former Conditions	79.54	80.13	79.54
500YR Present Conditions	79.56	80.25	79.56
500YR Former Conditions	79.60	80.26	79.60

In this table, present conditions are without the embankment at the Whitney Dam that was removed. Former conditions are with the embankment that was removed.

4.0 FLOODPLAIN MAPPING

4.1 Public Information Centre

A draft version of the floodplain maps was presented in a Public Information Centre (February 12, 2024 – Consecon United Church, Consecon, Ontario) to discuss and receive feedback from the public, that was taken into consideration for the preparation of the final version of the floodplain maps. Aspects discussed in that PIC included: the role of the Whitney Dam on the Consecon Lake levels and how conditions used to be in the past, based on neighbours' recollections; locations that neighbours remembered as prone to flooding; conditions at the culverts on Highway 33 and on the areas west of the highway.

4.2 Floodplain Mapping Definition and Comparison with Previous Estimates

Floodplain maps were prepared using the results obtained from the simulation of the 100-year (1% AEP) Flood. The Regulatory Floodplain maps (with the 100-year or 1% AEP Flood) as well as maps showing flood lines with other lower and greater events are provided to QC as separate deliverables of this project.

In general, the results obtained for the Regulatory Flood show that the flood would be contained within the banks of Consecon Creek, at all locations along Consecon Creek downstream of the Whitney Memorial Dam. There would be no overtopping of crossings over the creek throughout the study area (there was overtopping of a driveway crossing, as discussed in Section 4.2. These results are consistent with the results shown in the dam safety review study by D.M. Wills.

The water levels obtained at the lower Consecon Lake did not overtop Hwy 33. However, the flow that passed through culverts towards the west side of the highway was found to fill the low areas west of the highway. In this area, the water level obtained with the HEC-RAS model (Table 3-2 for condition without the removed embankment at Whitney Dam) was El. 79.33 m, while the water level for lower Consecon Lake was El. 79.46 m.

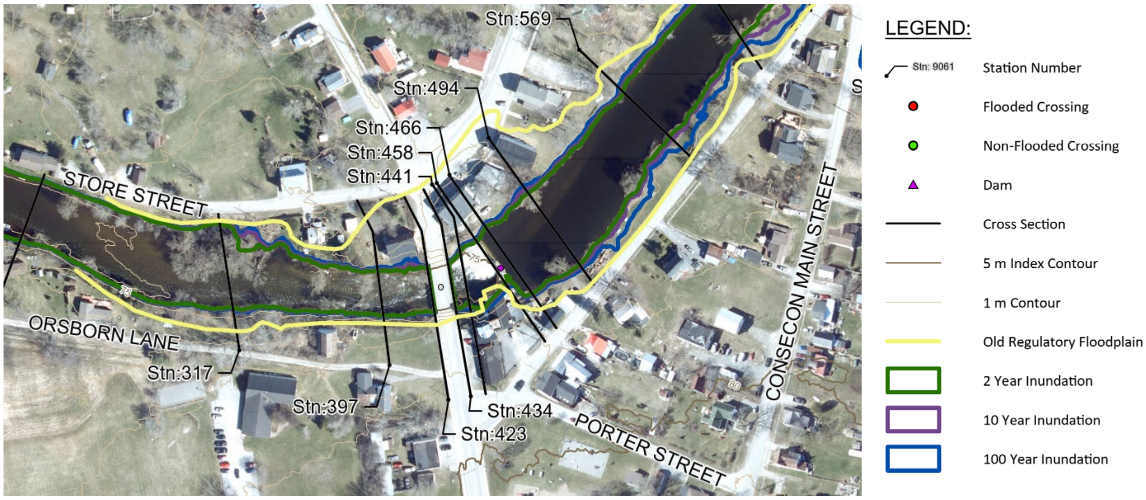
With either level (79.33 m or 79.46 m) the extent of the flooding would reach the backyards of some properties along Consecon Main Street and even one existing house. The water levels did not overtop Consecon Main Street.

For definition of the floodplain, and following provincial policy, the adopted floodline for the area between Main Street and Hwy 33 is based on the level of lower Consecon Lake, to acknowledge that the embankment of Hwy 33 is not considered a permanent flood protection. This area is shown in Figure 4-1. It must be noted that the previous floodplain map did show flooding reaching the buildings in this area. Based on the new results, two buildings in this area are within the new floodplain line, and a small crossing of a driveway is shown as flooded.

FIGURE 4-1: AREAS WEST OF HWY 33 FLOODED BY THE REGULATORY FLOOD

Another area in which the floodline obtained in this study differs from the previous floodline is within Consecon. The floodline obtained in this study corresponds to lower water levels and less flooding. The results obtained in this study indicate that some properties, upstream of the Hwy 29 crossing, that were shown within the previous floodline would now be out of the floodline, as shown in Figure 4-2. There are, however, buildings upstream and downstream of the crossing that are adjacent to, and touched by, the new floodline. The flooding obtained in this study for the 100-year Flood (which is the Regulatory Flood) is consistent in that area with the findings of D.M. Wills (2021).

FIGURE 4-2: AREAS UPSTREAM OF HWY 29



The results obtained in this study are consistent with the previous floodline in the areas around Consecon Lake. However, there is an area on the south side of upper Consecon Lake, just east of the causeway, in which the floodline obtained in this study extends farther inland than the previous one, and in doing so it would include one building in the floodplain. Since the lines are consistent elsewhere around the lake (and in some cases even reflect higher levels for the previous floodplain than with these new results) it seems that this is due to differences in the terrain model used for the two studies. This area is shown in Figure 4-3.

FIGURE 4-3: UPPER CONSECON LAKE UPSTREAM OF THE CAUSEWAY

At the upstream end of Consecon Lake, some buildings are close to or within the floodplain (both previous and new floodplain limits). This area is shown in Figure 4-4.

FIGURE 4-4: UPSTREAM END OF CONSECON LAKE

4.3 Impacted Buildings

There were approximately four buildings that were found to be adjacent to or within the floodplain within the study domain. These are shown in Figure 4-1, Figure 4-2, Figure 4-3 and Figure 4-4. There were no overtopped crossings except for the driveway from Consecon Main St over the ditch west of Hwy 33. Access by road to the two houses that share that driveway would be limited during the Regulatory Flood.

4.4 Climate Change Considerations

As indicated in KGS Group (2024b) to investigate the potential effects of climate change, the hydraulic conditions were simulated for the 200-year (0.5 % AEP) and 500-year (0.2 % AEP) flood events. The results with these greater events show more flooding on those areas already identified in Section 4.1.

For the area west of Hwy 33, the flooding associated with the 200-year (0.5 % AEP), assuming that the Hwy 33 embankment is washed out, would result in a slight overtopping of Consecon Main St, so that the flooding could extend even beyond the limits of the model domain, as shown in Figure 4-5. The overtopping obtained with the model was less than 0.1 m, so that the flooding would be minor and flow paths would be hard to define even if the model was extended, or if, for instance a 2D model was used. A conservatively broad area of where potential flow paths could exist has been shown as “potential flooding” in Figure 4-5. Further definition of this area was not attempted. Making this area part of the floodplain is considered excessive, even when recognizing the uncertainty associated with climate change.

It must be noted that the levels of Consecon Lake would not reach the top of Hwy 33, so that it is not likely that the highway embankment would be washed out; but the analysis was done assuming that it would for consistency with the Provincial guidance. The conditions with the embankment in place and flow only through the culverts under the highway were also simulated, and the results showed that, in that case, Consecon Main St. would not be overtopped.

The simulation of the 500-year (0.2 % AEP) Flood showed that even for that event Hwy 33 would not be overtopped, so that the conditions would be similar to those obtained for the 200-year Flood, with higher water levels.

FIGURE 4-5: FLOODING WEST OF HWY 33 FOR THE 200-YEAR (0.5 % AEP) FLOOD EVENT

Another area in which a building would be affected by the 200-year (0.5 % AEP) Flood scenario is upstream of Melville Rd, as shown in Figure 4-6.

FIGURE 4-6: FLOODING UPSTREAM OF MELVILLE RD FOR THE 200-YEAR (0.5 % AEP) FLOOD EVENT

4.5 Recommendations

The following recommendations are general in nature since the main purpose of the study has been to characterize the overall flooding for definition of the flood hazard.

There were no major structures or roads that were found to be within the floodplain. There are some buildings within the floodplain, as previously identified. For these, the alternative would be floodproofing, of which multiple options are provided in Appendix 6 of the Ontario Flood Hazard Guidelines (MNRF, 2002). The options available range from restricted use of areas (i.e. basements) to structural measures to ensure building stability, and the cost varies on a site-specific basis.

New developments in areas within the flooding hazard would be limited as per provincial policies and the directives of the various government and agency levels. Critical infrastructure would not be permitted in these areas. Given the conditions in those areas within the floodplain, new critical infrastructure there is unlikely.

The flooding in the low areas west of Hwy 33, and the potential flooding past Consecon Main St, is an aspect to monitor in case an increasing trend of future flood flows becomes evident. It is not considered reasonable at this time that the areas west of Consecon Main St be included in the floodplain, based on the information available; but this might merit consideration in the long-term future.

A critical recommendation is to maintain the ditch west of Hwy 33, that drains into Consecon Creek upstream of Consecon Main St, clean of obstacles (such as the blocked crossing shown in Figure 3-3) and overgrown vegetation. An initial cleaning of the ditch could cost approximately $10,000 to $15,000. After that, routine maintenance is recommended. Maintenance of the pipes across Hwy 33, including those in low terrain and those near the bridge, is also recommended as a general measure.

5.0 REFERENCES

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