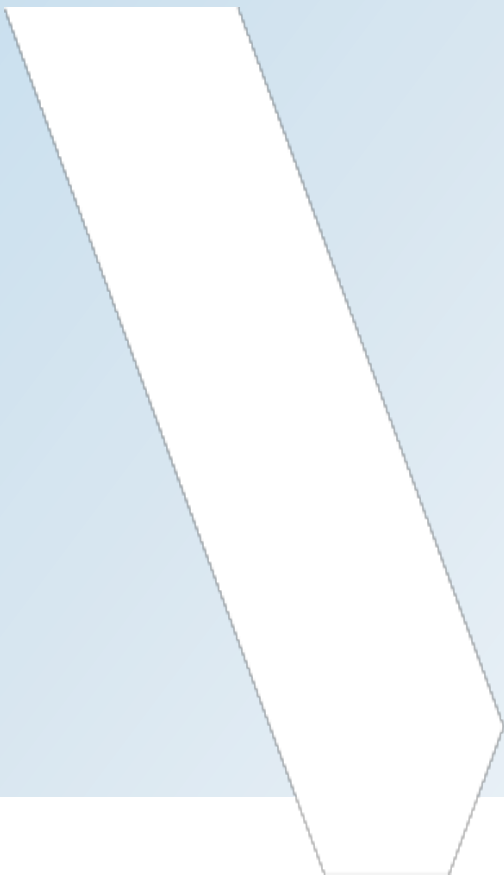


APPENDIX

D HYDRAULIC ANALYSIS



County of Wellington

Bosworth Bridge (B007028) Replacement EA, Wellington Road 7

Hydrology and Hydraulics Report

November 08, 2021

Final





Bosworth Bridge (B007028) Replacement EA, Wellington Road 7 Hydrology and Hydraulics Report

County of Wellington

Final

Project No.: 20M-01326-00

Date: November 08, 2021

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November 08, 2021

Final

County of Wellington
74 Woolwich Street
Guelph, ON N1H 3T9

Attention: Joe de Koning, P. Eng.

Dear Madam/Sir:

**Subject: Final Hydrology and Hydraulics Report for Bosworth Bridge (B007028)
Replacement at Wellington Road 7**

We are pleased to submit one electronic copy of the **Final** Hydrology and Hydraulics Report for the replacement of the Bosworth Bridge (B007028) located at Wellington Road 7. This report details the hydrologic and hydraulic calculations used to assess the existing bridge and proposed bridge replacement options. This report documents the summary of the analysis of hydrologic and hydraulic assessments under existing and proposed conditions and proposed recommendation for the replacement of structure.

We trust the submission of this document meets your requirements. Should you have any comments we look forward to your response.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Sherif Iskandar'.

Sherif Iskandar, M.Sc., P.Eng., PMP
Senior Project Manager, Water Resources

Encl.

WSP ref.: 20M-01326-00

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November 8, 2021	Final			
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Prepared by



Ray Zhao, P.Eng.

Project Engineer, Water Resources

09 November 2021

Date

Approved¹ by (must be reviewed for technical accuracy prior to



Sherif Iskandar, M.Sc., P.Eng., PMP

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Date

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Appendices

- A** Site Visit Photographs
- B** MTO IDF and Hydrologic Analysis
- C** Hydraulic Analysis

1 INTRODUCTION

WSP was retained by the County of Wellington to undertake the Class EA study and preliminary design for the replacement of Bosworth Bridge (B007028) on Wellington Road 7, approximately 0.90 km east of Wellington Road 11. The location of the bridge site is shown on **Figure 1-1**. The bridge provides drainage for the Conestogo River.

As part of this project, hydrologic and hydraulic assessments were completed for the existing structures. This Hydrology and Hydraulics Report outlines the required performance standards, documents design flows, and details the development of the hydrologic methodology and hydraulic model used to evaluate the existing bridge as well as proposed replacement options.

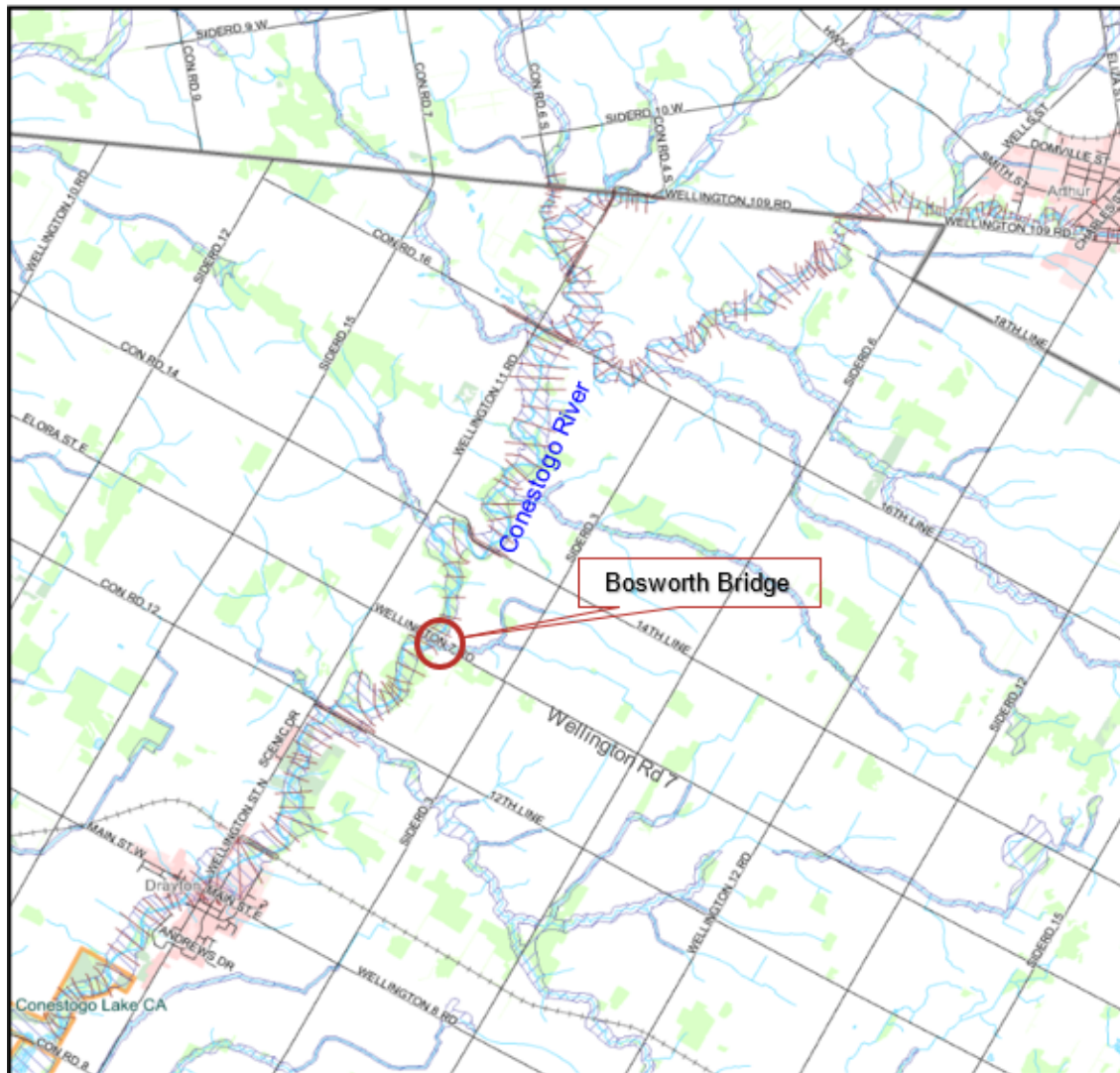


Figure 1-1: Location Map of Bosworth Bridge

(Map Source: GRCA Website)

2 BACKGROUND

2.1 Study Area and Existing Structure

Figure 1-1 illustrates the location of the bridge structure at Wellington Road 7. The Bosworth Bridge structure was constructed in 1949 and is a two lane, single span steel truss structure. The structure consists of cast-in-place, reinforced concrete abutments, wingwalls and deck with an asphalt paving surface and concrete railings at the bridge approach. The bridge was rehabilitated in 1987, 2008 and 2013. As per the general arrangement drawing prepared for the rehabilitation work by McCormack Rankin Corporation (MRC) in 1987, the span of the bridge from centre to centre of abutments is 40.97 m. The bridge has a 7.5 m curb to curb width and an overall structure width of about 8.6 m. Embankments on either end of the bridge consist of soil and overgrown, low lying vegetation.

A photo inventory of the bridge is provided in **Appendix A**.

2.2 Study Scope

This Hydrology and Hydraulics Report includes the following:

- Development of a hydrologic model for estimation of design peak flows
- Development of a hydraulic model for calculating existing conditions water surface elevations
- Updated hydraulic modelling for the proposed bridge options and determine future water surface elevations
- A presentation of design requirements for a new structure based on the applicable hydraulic performance standards

3 PERFORMANCE STANDARDS

Performance standards are based on the MTO Highway Drainage Design Standards (HDDS) (Jan. 2008). The applicable standards are summarized in the following table.

Table 3.1: MTO Drainage Design Standards

Item	Design Standard	Description	Standard	Section
1	Design Flow Storm	50-Year	WC-1	1.1.1
2	Top of Road Freeboard (Minimum)	>1.0 m (Top of Road Low Point Elevation - Design Flow Water Surface Elevation)	WC-7	3.1.2
3	Top of Road Freeboard (Desired)	>1.0 m (Top of Road Low Point Elevation - Design Flow Energy Grade Line Elevation)	WC-2	3.1.1
4	Relief Flow (Max. Depth over roadway)	Max. depth over roadway should not exceed 0.3 m for Regulatory Storm	WC-13	3.2.1
5	Relief Flow (Velocity x Depth)	Velocity x Depth should not exceed 0.80 m ² /s for the Regulatory Storm	WC-13	3.2.2
6	Soffit Clearance	Soffit Elevation - Design Flow Water Surface Elevation ≥1.0 m	WC-2	3.2.1

3.1 Design Storms

Wellington Road 7 is a rural arterial road. In accordance with the requirements of the MTO Highway Drainage Design Standards (HDDS), a new structure with an opening width of more than 6.0 metres should be designed to convey a minimum of the 50-year design storm for a rural arterial / collector road. The HDDS also provides an option for increasing the design storm to the Regulatory event "...for unusually large structures, or for vital routes which must remain useable during Regulatory Flow conditions. Use of Regulatory Flow criteria in the latter case shall be justified by a cost-benefit analysis". The 50-year storm will be used as the design storm.

3.2 Check Storm

The check flow is characterized in the HDDS as "a flow greater than the design flow, used to check that a waterway designed for the design flow will withstand a larger flow without embankment failure or structural collapse". In addition, the water level

generated by the check flow “...shall not exceed the elevation of the edge of the travelled lane for Arterial and Collector Roads”. The check flow is the 100-year storm. The check flow for the scour analysis would be 115% of the 100-year flow.

3.3 Top of Road Freeboard

The MTO HDDS recommends a minimum freeboard of 1.0 metre “...measured vertically from the High Water Level for the Design Flow to the edge of the travelled lane at the road low point.” The HDDS also recommends a desirable freeboard of 1.0 metre “...measured vertically from the Energy Grade Line elevation for the Design Flow to the edge of the travelled lane.” These freeboards are recommended values although it is recognized that, due to site-specific considerations, it is not always feasible to meet this objective.

3.4 Relief Flow

According to the MTO HDDS “...design of a water crossing shall incorporate passage of the Relief Flow over the Roadway in cases where the Regulatory Flow exceeds the Design Flow of the bridge or the culvert.” The HDDS recommends that if the Regulatory Storm overtops the road, two parameters shall not be exceeded:

- the maximum depth of flow on the roadway should not exceed 0.3 metres
- the product of the velocity and depth on the roadway shall not exceed 0.8 m²/s

These parameters are recommended values although it is recognized that, due to site-specific considerations, it is not always feasible to meet this objective.

3.5 Changes in Upstream Water Levels

The MTO Highway Drainage Design Standard (HDDS) does not quantify a maximum increase in flood elevations however “...any risk to public safety or potential damage to adjacent properties as a result of impact on the flood elevations associated with the Regulatory Flow ...shall be determined in consultation with the Municipality, Conservation Authority or the Ministry of the Natural Resources given their responsibilities under the Conservation Authorities Act and Lakes and Rivers Improvement Act.” In accordance with the Grand River Conservation Authority (GRCA) requirements, any increase in the upstream flood elevation resulting from the construction of a new structure should be kept to a minimum in order to prevent increased flood risk to upstream properties.

4 HYDROLOGY

This section details the hydrologic simulation employed in the study including the development of the hydrologic model and the generation of design peak flow rates.

4.1 Approach

The Conestogo River watershed has a drainage area of 276 km² (27,600 ha) at the Wellington Road 7 Bosworth Bridge location. Conestogo River flows from north-east to south-west and ultimately outlets to the Grand River.

There is a stream flow gauge station *02GA039 Conestogo River above Drayton* for this watercourse. For this gauge station, Flood Frequency Analysis (FFA) results were obtained from the Grand River Conservation Authority (GRCA).

In addition to the FFA, Ontario Flow Assessment Tools (OFAT) and SWMHYMO hydrologic model were also used for flow assessments and comparison. The following summarizes the steps involved for SWMHYMO hydrologic modelling:

- Define the subcatchment area draining to the culvert crossing as well as subcatchment slopes, lengths, and land use using 1:10,000 scale Ontario base topographical mapping
 - Define the soil characteristics using the Soil Map of Wellington County, South Sheet, Ontario Soil Survey Report # 35
 - Develop a hydrologic model to generate peak flows
-

4.2 Design Storms

The 2 to 100-year design storm hyetographs were generated for the 12-hour SCS Type II storm distribution. The rainfall depths used to generate these design storm events were estimated from the MTO IDF online tool. Refer to **Appendix B** for the IDF values from the MTO IDF online look-up tool generated at the Bosworth Bridge location.

The Regional Storm event was generated using the historic Hurricane Hazel Storm Distribution.

Table 4.1 provides the rainfall depth for the 12-hour storm duration.

Table 4.1: Design Rainfalls

Storm	Rainfall Depth (mm)
2-year	49.4
5-year	65.5
10-year	75.8
25-year	89.2
50-year	99.10
100-year	108.8
Hurricane Hazel (12 hours)	212.0

4.3 Hydrologic Model

Exhibit 4.1 (located at the end of the report) illustrates the drainage subcatchment delineated for the Wellington Road 7 Bosworth Bridge. Modelling parameters representing the existing characteristics of the subcatchment were selected based on the soil type, land-use and topography. **Table 4.2** presents Curve Number, Initial Abstraction and Time to Peak for the subcatchment which were used for hydrologic modelling.

Table 4.2: Hydrology Modelling Parameters

Catchment Area (ha)	CN for AMC II for Frequency Storms	CN for AMC III for Regional Storm Hazel	Initial Abstraction (mm)	Time to Peak (hrs)
27,600	78	90	7.4	8.50

4.4 Design Peak Flows

Table 4.3 summarizes the peak flows generated by the SCS 12-hour storm distribution for the 2-year to 100-year return periods in addition to the Regional Storm event. The table compares the flows obtained by different methodologies. Additional details of flow estimation as well as communication with the GRCA regarding FFA flows are included in **Appendix B**.

Table 4.3: Summary of Peak Flows

Methodology	Flow (m ³ /s)								
	1.25-Yr	2-yr	5-yr	10-yr	20-yr	25-yr	50-yr	100-yr	Regional Storm
OFAT Index Flood Method		80.9	106	127	152		183	213	
OFAT Primary Multiple Regression		99.9	141	168	194		210	234	
GRCA, FFA	86.0	133	204	256	309	326	381	438	
SWMHYMO SCS 12-Hour		73.8	124	159		208	245	283	741
Flow used in Existing HEC-RAS Model Station 17.225 (At Bosworth Bridge)		135.0	191.0	230.0	272.0	272.0	325.0	360.0	738

The results in **Table 4.3** clearly shows the FFA results provided by the GRCA are the most conservative flows values and are carried forward for the hydraulic analysis of the bridge.

5 HYDRAULIC MODELLING

5.1 Overview

The Hydraulic Engineering Centre's River Analysis System modelling software package (HEC-RAS) was used to generate flood elevations and to determine the impact of the proposed replacement of the culvert.

5.2 Model Setup

WSP has received from GRCA the HEC-RAS hydraulic model "*UpperCon2011.prj*" prepared for the Conestogo River. The following modifications are made in the existing model to match with present conditions:

- Two sections 17.199 and 17.191, upstream and downstream of the bridge, respectively, are updated as per the latest survey information.
- Flows at Sections 18.335 and 17.225 are updated as per the Flood Frequency Analysis results provided by the GRCA.
- Road profile of Wellington Road 7 is updated as per latest survey information.
- Existing bridge section is updated as per existing General Arrangement drawing prepared for 1987 rehabilitation work.

Detailed HEC-RAS output tables for existing and future conditions are provided in **Appendix C**.

Exhibit 5.1 shows the HEC-RAS cross-section locations in the vicinity of Bosworth Bridge.

5.3 Existing Conditions Assessment

The existing bridge has a single span of 40.97 m from centre to centre of the abutments which provides a clear opening of 39.40 m. The hydraulic assessment is carried out for this clear opening. Based on the survey information, the road low point elevation is 411.28 m amsl. The 2-year through 100-year storm events were analysed in the HEC-RAS model; the 50-year storm event is the design storm for the existing bridge.

The existing top of road freeboard, flood depth, and other hydraulic performance parameters for Bridge B007028, as they pertain to the MTO HDDS are identified in

Table 5.1. **Table 5.2** illustrates whether the existing structure meets current hydraulic performance standards.

Table 5.1: Hydraulic Performance Analysis for the Existing Bridge

Description (Upstream Face, Section 17.199)	50-Year (Design)	100-Year	Regional
Clear span (m)	39.4	39.4	39.4
Water Surface Elevation (m)	409.21	409.44	411.34
Energy Gradeline Elevation (m)	409.62	409.91	411.79
Top of Road (Low Point) (m)	411.28	411.28	411.28
Minimum Soffit Elevation (m)	410.32	410.32	410.32
(2+4) Top of Road Freeboard (Min.) (m)	2.07	1.84	-0.06
(3) Top of Road Freeboard (Desired) (m)	1.66	1.37	n/a
Top of Road Velocity (m/s)	n/a	n/a	0.23
(5) Relief Flow depth (Top of Road Velocity x Depth) (m ² /s)	n/a	n/a	0.12
(6) Soffit Clearance (m)	1.11	0.88	-1.02

Table 5.2: Summary of Hydraulic Performance of the Existing Bridge

Criteria Description	Criteria Storm Event	Meets Criteria (Yes or No)
(2) Top of Road Freeboard (Min.)	50-year	Yes
(3) Top of Road Freeboard (Desired)	50-year	Yes
(4) Relief Flow (Max. Depth over roadway)	Regional	No
(5) Relief Flow (Velocity x Depth)	Regional	Yes
(6) Soffit Clearance	50-year	Yes

The results show that the existing bridge meets the freeboard and soffit clearance requirements. However, the Regional storm overtops Wellington Road 7 by 0.06 m, but it meets the relief flow depth.

The hydraulic analysis summary of the existing bridge is included in **Appendix C**.

5.4 Proposed Replacement Options

Since the existing Bridge is in very poor condition, it is proposed to replace with a new bridge. Three options were analysed to review the hydraulic performance of the proposed bridge, which is discussed below:

Option 1: 50 m single span with soffit lower than existing condition

- A 50 m single span bridge structure with clear opening 48.8 m
- Soffit elevation at left and right abutments considered as 409.31 m and 409.06 m, respectively. Road low point is considered as 411.35 m.

The hydraulic analysis result for Option 1 shows that:

- The 2-year to the 100-year water levels are lower than existing conditions.
- Option 1 generates the Regional flood level upstream of the bridge as 411.45 m which is higher than the existing Regional flood elevation by 0.11 m. This option will create some flooding impact to the private property upstream of the bridge.
- The flooding depth over the road is also increased to 0.10 m.

Option 2: 45 m single span with soffit higher than Option 1 but lower than existing condition, raised road profile

- A 45 m single span bridge structure with clear opening 43.8 m
- Soffit elevation at left and right abutments is increased to 409.97 m and 409.75 m, respectively, which is higher than Option 1. Road low point is also increased to 411.70 m.

The hydraulic analysis result for Option 2 shows that:

- The 2-year to the 100-year water levels are lower than existing conditions.
- Option 2 generates the Regional flood level upstream of the bridge as 411.67 m which is higher than the existing Regional flood elevation by 0.33 m. This option will create significant flooding impact upstream of the bridge.
- The Regional water level does not over top Wellington Road 7.

Option 3: 50 m span with adjusted soffit and road profile

- A 50 m single span bridge structure with clear opening 48.8 m
- Soffit elevations at left and right abutments are considered as 409.69 m and 409.45 m, respectively. Road low point is set to 411.50 m, which is only 0.15 m higher than Option 1.

The hydraulic analysis result for Option 3 shows that:

- The 2-year to the 100-year water levels are lower than existing conditions.
- Option 3 generates the Regional flood level upstream of the bridge as 411.14 m which is lower than the existing Regional flood elevation by 0.20 m. This option will not create any flooding impact upstream of the bridge and is hydraulically efficient than the existing bridge.
- The Regional water level does not over top Wellington Road 7.

Based on the analysis above, Option 3 is the most hydraulically efficient option and does not create any flooding impact upstream of the bridge. With this option, Wellington Road 7 will also be free from flooding during the Regional Storm event. Therefore, this option is considered as the Preferred Option.

The hydraulic analysis summary for all three options are included in **Appendix C**.

The hydraulic performance evaluation for the preferred alternative (Option 3) is discussed in the following section.

5.4.1 Hydraulic Performance of Preferred Option

A 50 m single span bridge structure with clear opening 48.8 m is considered as the preferred bridge option. Soffit elevation at left and right abutments is considered as 409.69 m and 409.45 m, respectively. Road low point is set to 411.50 m.

Table 5.3 illustrates the hydraulic performance analysis for the preferred option and **Table 5.4** illustrates whether the preferred bridge alternative meets current hydraulic performance standards.

Table 5.3 Hydraulic Performance Analysis for the Preferred Bridge Option

Description (Upstream Face, Section 17.199)	50-Year (Design)	100-Year	Regional
Clear span (m)	48.8	48.8	48.8
Water Surface Elevation (m)	409.15	409.36	411.14
Energy Gradeline Elevation (m)	409.52	409.78	411.62
Top of Road (Low Point) (m)	411.50	411.50	411.50
Minimum Soffit Elevation (m)	410.32	410.32	410.32
(2+4) Top of Road Freeboard (Min.) (m)	2.35	2.14	0.36
(3) Top of Road Freeboard (Desired) (m)	1.98	1.72	n/a
Top of Road Velocity (m/s)	n/a	n/a	n/a
(5) Relief Flow depth (Top of Road Velocity x Depth) (m ² /s)	n/a	n/a	n/a
(6) Soffit Clearance (m)	1.17	0.96	-0.82

Table 5.4: Summary of Hydraulic Performance for the Preferred Bridge Option

Criteria Description	Criteria Storm Event	Meets Criteria (Yes or No)
(2) Top of Road Freeboard (Min.)	50-year	Yes
(3) Top of Road Freeboard (Desired)	50-year	Yes
(4) Relief Flow (Max. Depth over roadway)	Regional	Yes
(5) Relief Flow (Velocity x Depth)	Regional	Yes
(6) Soffit Clearance	50-year	Yes

As summarized the results in **Table 5.3** and **5.4**, the preferred bridge option meets all design standards. **Exhibit 5.1** illustrates the HEC-RAS cross-section location and the Regional Storm water surface elevations for the existing conditions as well as for the preferred option. **Exhibit 5.2** shows the preliminary GA of the preferred bridge.

5.4.2 Comparison of Water Surface Elevations

Table 5.5 compares flood elevations and flow velocity between existing condition and proposed conditions for preferred option (Option 3).

Table 5.5: Comparison of Flood Elevation and Velocity between Existing Bridge and Preferred Bridge Option

River Station	Profile	Flow	Existing Bridge		Preferred Bridge (Option 3)		Difference	
			W.S. Elevation	Flow Velocity	W.S. Elevation	Flow Velocity	W.S. Elevation	Flow Velocity
		(m ³ /s)	A (m)	B (m/s)	C (m)	D (m/s)	(C-A) m	(D-B) m/s
19.100	Reg	726.00	413.39	1.61	413.36	1.62	-0.03	0.01
19.100	100-yr	391.80	412.42	1.47	412.42	1.47	0.00	0.00
19.100	50-yr	355.30	412.25	1.48	412.25	1.48	0.00	0.00
19.100	20-yr	319.80	412.06	1.54	412.06	1.54	0.00	0.00
19.100	10-yr	251.60	411.85	1.42	411.85	1.42	0.00	0.00
19.100	5-yr	218.80	411.70	1.40	411.70	1.40	0.00	0.00
19.100	2-yr	143.40	411.42	1.17	411.42	1.17	0.00	0.00
18.355	Reg	738.00	412.59	2.28	412.52	2.33	-0.07	0.05
18.355	100-yr	438.00	411.42	2.06	411.41	2.07	-0.01	0.01
18.355	50-yr	381.00	411.21	1.97	411.20	1.97	-0.01	0.00
18.355	20-yr	309.00	410.93	1.83	410.93	1.83	0.00	0.00
18.355	10-yr	256.00	410.70	1.72	410.70	1.72	0.00	0.00
18.355	5-yr	204.00	410.43	1.63	410.43	1.63	0.00	0.00
18.355	2-yr	133.00	409.98	1.53	409.98	1.53	0.00	0.00
18.135	Reg	738.00	412.42	2.56	412.33	2.64	-0.09	0.08
18.135	100-yr	438.00	411.02	2.69	411.00	2.72	-0.02	0.03
18.135	50-yr	381.00	410.77	2.66	410.76	2.67	-0.01	0.01
18.135	20-yr	309.00	410.43	2.60	410.43	2.61	0.00	0.01
18.135	10-yr	256.00	410.16	2.53	410.16	2.54	0.00	0.01
18.135	5-yr	204.00	409.88	2.37	409.88	2.37	0.00	0.00
18.135	2-yr	133.00	409.41	2.07	409.41	2.07	0.00	0.00
17.83	Reg	738.00	412.08	2.63	411.96	2.72	-0.12	0.09
17.83	100-yr	438.00	410.62	2.44	410.58	2.48	-0.04	0.04
17.83	50-yr	381.00	410.36	2.34	410.33	2.36	-0.03	0.02
17.83	20-yr	309.00	410.00	2.20	409.98	2.21	-0.02	0.01
17.83	10-yr	256.00	409.70	2.08	409.70	2.09	0.00	0.01
17.83	5-yr	204.00	409.38	1.96	409.37	1.96	-0.01	0.00
17.83	2-yr	133.00	408.83	1.81	408.83	1.80	0.00	-0.01

River Station	Profile	Flow	Existing Bridge		Preferred Bridge (Option 3)		Difference	
			W.S. Elevation	Flow Velocity	W.S. Elevation	Flow Velocity	W.S. Elevation	Flow Velocity
		(m³/s)	A (m)	B (m/s)	C (m)	D (m/s)	(C-A) m	(D-B) m/s
17.58	Reg	738.00	411.81	3.14	411.65	3.29	-0.16	0.15
17.58	100-yr	438.00	410.05	3.31	409.92	3.48	-0.13	0.17
17.58	50-yr	381.00	409.77	3.22	409.68	3.34	-0.09	0.12
17.58	20-yr	309.00	409.37	3.08	409.31	3.16	-0.06	0.08
17.58	10-yr	256.00	409.06	2.93	409.03	2.97	-0.03	0.04
17.58	5-yr	204.00	408.74	2.72	408.73	2.73	-0.01	0.01
17.58	2-yr	133.00	408.23	2.31	408.23	2.30	0.00	-0.01
17.36	Reg	738.00	411.83	2.08	411.66	2.17	-0.17	0.09
17.36	100-yr	438.00	410.02	2.13	409.89	2.22	-0.13	0.09
17.36	50-yr	381.00	409.74	2.03	409.64	2.09	-0.10	0.06
17.36	20-yr	309.00	409.34	1.87	409.28	1.91	-0.06	0.04
17.36	10-yr	256.00	409.04	1.71	409.01	1.73	-0.03	0.02
17.36	5-yr	204.00	408.71	1.54	408.70	1.54	-0.01	0.00
17.36	2-yr	133.00	408.18	1.26	408.18	1.25	0.00	-0.01
17.30	Reg	738.00	411.78	2.08	411.60	2.19	-0.18	0.11
17.30	100-yr	438.00	409.86	2.39	409.68	2.57	-0.18	0.18
17.30	50-yr	381.00	409.55	2.36	409.41	2.50	-0.14	0.14
17.30	20-yr	309.00	409.13	2.27	409.05	2.35	-0.08	0.08
17.30	10-yr	256.00	408.82	2.16	408.78	2.21	-0.04	0.05
17.30	5-yr	204.00	408.50	2.01	408.49	2.03	-0.01	0.02
17.30	2-yr	133.00	407.99	1.75	407.99	1.75	0.00	0.00
17.225	Reg	741.00	411.79	1.73	411.61	1.82	-0.18	0.09
17.225	100-yr	438.00	409.85	1.96	409.67	2.12	-0.18	0.16
17.225	50-yr	381.00	409.54	1.95	409.39	2.08	-0.15	0.13
17.225	20-yr	309.00	409.09	1.96	409.00	2.06	-0.09	0.10
17.225	10-yr	256.00	408.76	1.94	408.70	1.99	-0.06	0.05
17.225	5-yr	204.00	408.42	1.87	408.39	1.90	-0.03	0.03
17.225	2-yr	133.00	407.87	1.73	407.88	1.72	0.01	-0.01
17.199	Reg	741.00	411.34	2.98	411.14	3.09	-0.20	0.11
17.199	100-yr	438.00	409.44	3.05	409.36	2.89	-0.08	-0.16
17.199	50-yr	381.00	409.21	2.84	409.15	2.70	-0.06	-0.14

River Station	Profile	Flow	Existing Bridge		Preferred Bridge (Option 3)		Difference	
			W.S. Elevation	Flow Velocity	W.S. Elevation	Flow Velocity	W.S. Elevation	Flow Velocity
		(m ³ /s)	A (m)	B (m/s)	C (m)	D (m/s)	(C-A) m	(D-B) m/s
17.199	20-yr	309.00	408.86	2.58	408.83	2.45	-0.03	-0.13
17.199	10-yr	256.00	408.60	2.34	408.59	2.24	-0.01	-0.10
17.199	5-yr	204.00	408.33	2.09	408.33	2.01	0.00	-0.08
17.199	2-yr	133.00	407.84	1.71	407.85	1.69	0.01	-0.02
17.195	Bosworth Bridge							
17.191	Reg	741.00	409.78	4.86	409.82	4.40	0.04	-0.46
17.191	100-yr	438.00	409.12	3.50	409.14	3.25	0.02	-0.25
17.191	50-yr	381.00	408.95	3.23	408.96	3.02	0.01	-0.21
17.191	20-yr	309.00	408.66	2.92	408.67	2.77	0.01	-0.15
17.191	10-yr	256.00	408.44	2.64	408.45	2.54	0.01	-0.10
17.191	5-yr	204.00	408.20	2.35	408.21	2.29	0.01	-0.06
17.191	2-yr	133.00	407.75	1.95	407.75	1.94	0.00	-0.01
17.14	Reg	741.00	409.93	2.11	409.93	2.11	0.00	0.00
17.14	100-yr	438.00	409.16	1.92	409.16	1.92	0.00	0.00
17.14	50-yr	381.00	408.97	1.90	408.97	1.90	0.00	0.00
17.14	20-yr	309.00	408.65	1.95	408.65	1.95	0.00	0.00
17.14	10-yr	256.00	408.41	1.97	408.41	1.97	0.00	0.00
17.14	5-yr	204.00	408.14	1.98	408.14	1.98	0.00	0.00
17.14	2-yr	133.00	407.68	1.74	407.68	1.74	0.00	0.00
16.76	Reg	741.00	409.24	3.53	409.24	3.53	0.00	0.00
16.76	100-yr	438.00	408.29	3.44	408.29	3.44	0.00	0.00
16.76	50-yr	381.00	408.09	3.32	408.09	3.32	0.00	0.00
16.76	20-yr	309.00	407.85	2.96	407.85	2.96	0.00	0.00
16.76	10-yr	256.00	407.63	2.74	407.63	2.74	0.00	0.00
16.76	5-yr	204.00	407.40	2.48	407.40	2.48	0.00	0.00
16.76	2-yr	133.00	406.98	2.08	406.98	2.08	0.00	0.00

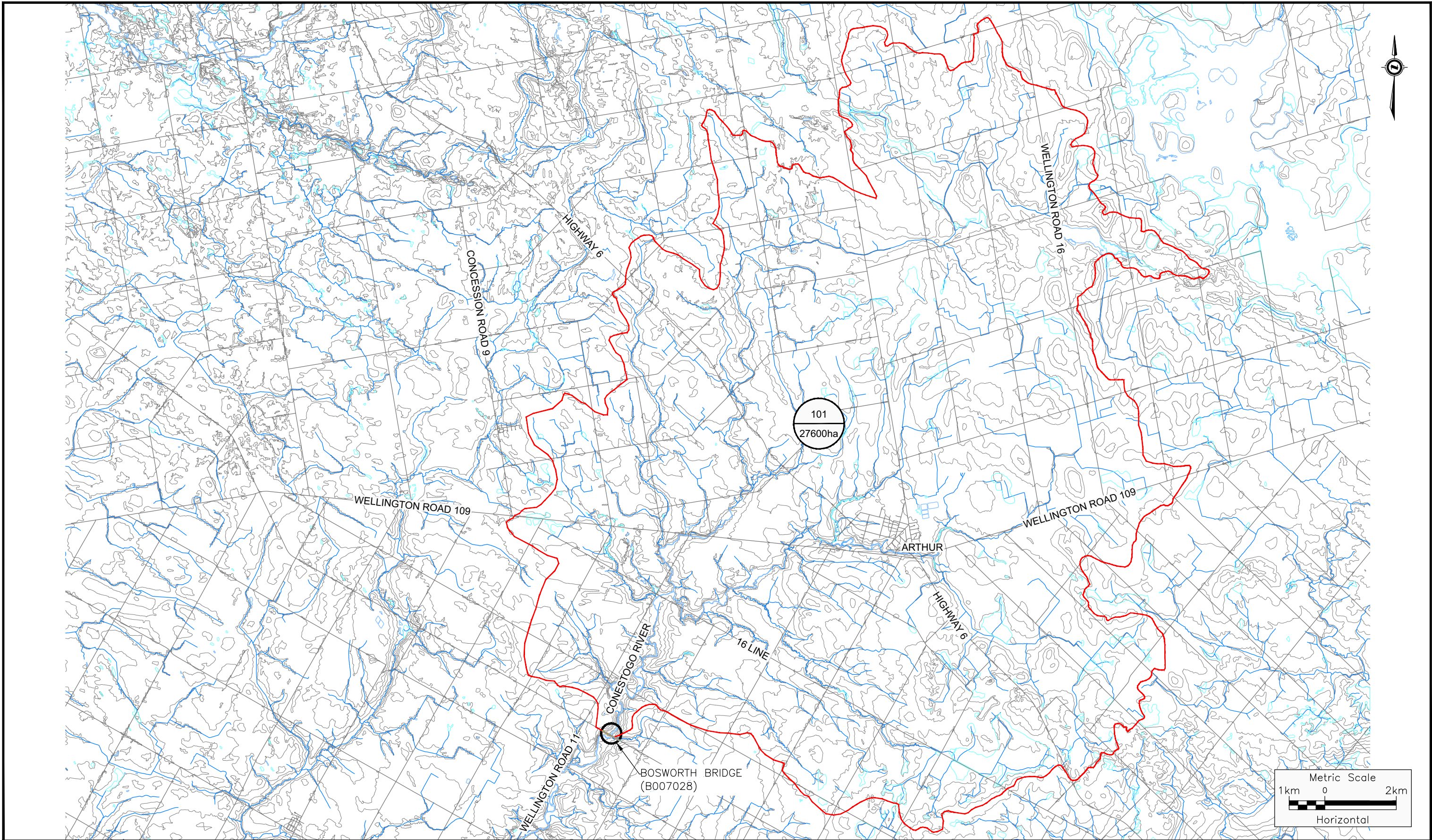
The results provided in **Tables 5.5** show that the flood elevation under proposed conditions for the preferred option (Option 3) are less than existing conditions. Minor increase in flow velocities on the upstream was observed which is due to the decrease in water surface elevations.

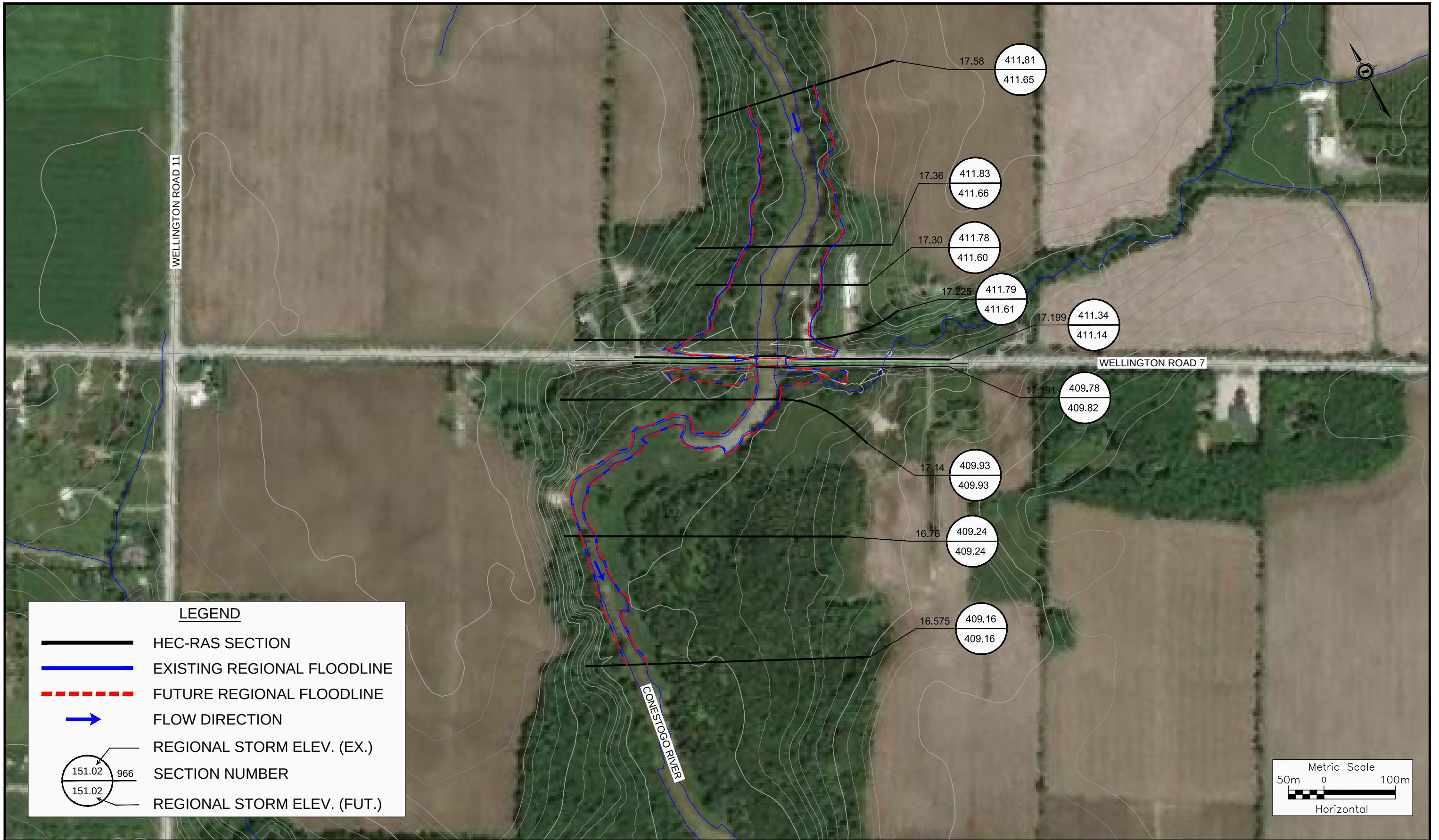
6 CONCLUSIONS

This Hydrology and Hydraulics Report has been prepared to document the hydraulic performance for the proposed replacement bridge options for the Bosworth Bridge (B007028) on Wellington Road 7. Bridge replacement Option 3 met the MTO Highway Drainage Design Standards and is hydraulically more efficient than the existing bridge. There will be no flooding impact on the upstream and no overtopping on Wellington Road 7 during the Regional Storm event.

Therefore, it is recommended that Option 3 (50 m single span bridge structure with clear opening 48.8 m, Soffit elevation at left and right abutments at 409.69 m and 409.45 m, respectively, road low point elevation set to 411.50 m) is carried forward for the replacement of the existing Bosworth Bridge (B007028).

Exhibits





HEC-RAS SECTION LOCATIONS - REGIONAL FLOODLINES

BOSWORTH BRIDGE (B007028) REPLACEMENT EA

EXHIBIT

5.1

APPENDIX

A

Site Visit Photographs

Photo Inventory of Bosworth Bridge, Wellington Road 7, County of Wellington



Photo 1: Upstream (north) face of the structure



Photo 2: Looking upstream from the bridge

Photo Inventory of Bosworth Bridge, Wellington Road 7, County of Wellington



Photo 3: Upstream face looking east



Photo 4: Downstream (south) face of the structure

Photo Inventory of Bosworth Bridge, Wellington Road 7, County of Wellington



Photo 5: Looking downstream channel of the river



Photo 6: Downstream face looking east

Photo Inventory of Bosworth Bridge, Wellington Road 7, County of Wellington



Photo 7: Top of road (Wellington Road 7) looking west

APPENDIX

B

MTO IDF and Hydrologic Analysis

Active coordinate

43° 46' 45" N, 80° 38' 15" W (43.779167,-80.637500)

Retrieved: Fri, 22 Jan 2021 18:50:19 GMT



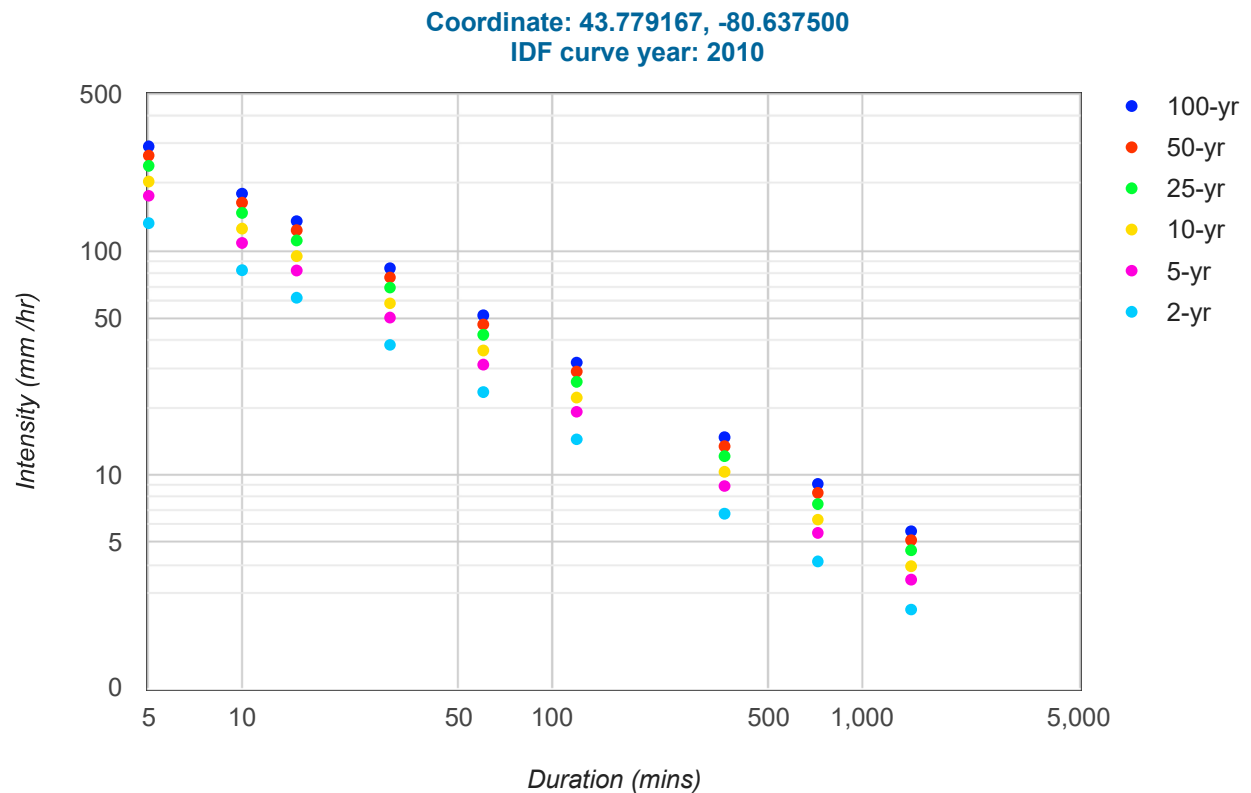
Location summary

These are the locations in the selection.

IDF Curve: 43° 46' 45" N, 80° 38' 15" W (43.779167,-80.637500)

Results

An IDF curve was found.



Coefficient summary**IDF Curve:** 43° 46' 45" N, 80° 38' 15" W (43.779167,-80.637500)

Retrieved: Fri, 22 Jan 2021 18:50:19 GMT

Data year: 2010**IDF curve year:** 2010

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
A	23.4	31.0	35.9	42.2	46.9	51.5
B	-0.699	-0.699	-0.699	-0.699	-0.699	-0.699

Statistics**Rainfall intensity (mm hr⁻¹)**

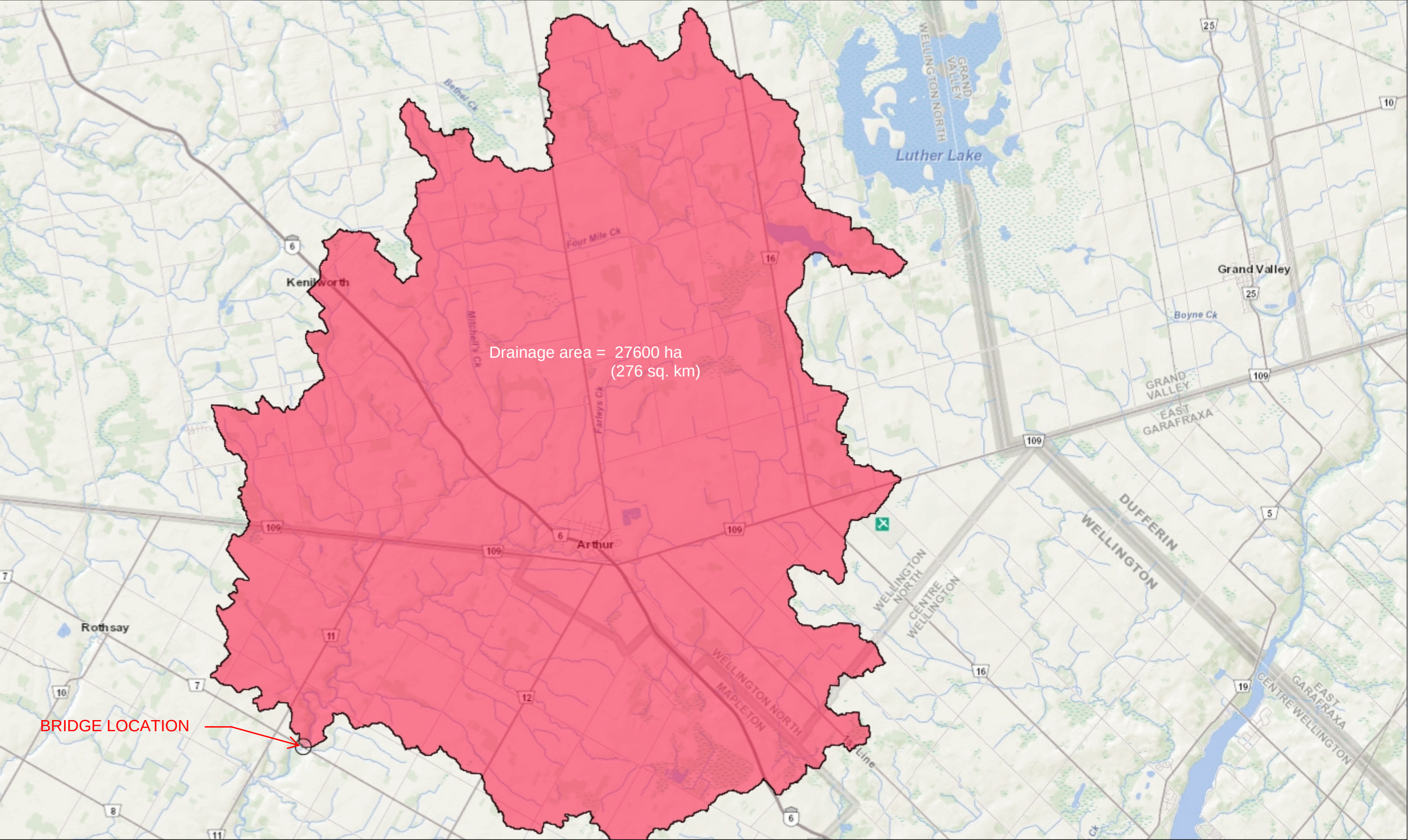
Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	132.9	81.9	61.7	38.0	23.4	14.4	6.7	4.1	2.5
5-yr	176.1	108.5	81.7	50.3	31.0	19.1	8.9	5.5	3.4
10-yr	203.9	125.6	94.6	58.3	35.9	22.1	10.3	6.3	3.9
25-yr	239.7	147.7	111.2	68.5	42.2	26.0	12.1	7.4	4.6
50-yr	266.4	164.1	123.6	76.1	46.9	28.9	13.4	8.3	5.1
100-yr	292.5	180.2	135.7	83.6	51.5	31.7	14.7	9.1	5.6

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	11.1	13.6	15.4	19.0	23.4	28.8	40.1	49.4	60.9
5-yr	14.7	18.1	20.4	25.2	31.0	38.2	53.2	65.5	80.7
10-yr	17.0	20.9	23.7	29.1	35.9	44.2	61.6	75.8	93.4
25-yr	20.0	24.6	27.8	34.3	42.2	52.0	72.4	89.2	109.8
50-yr	22.2	27.3	30.9	38.1	46.9	57.8	80.4	99.1	122.1
100-yr	24.4	30.0	33.9	41.8	51.5	63.4	88.3	108.8	134.0

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Last Modified: September 2016



Legend

Assessment Parcel

Secondary Watershed

Tertiary Watershed

Quaternary Watershed

Great Lakes - St. Lawrence Basin

Hudson - James Bay Basin

Nelson River Basin

Diversions

Waterbody Outlet

Conservation Authority Dam

Provincial Dam

Federal Dam

OPG Dam

Other Dam

HYDAT Gauge

HYDAT Gauge (RHBN)

Virtual Flow Segment

Land Cover Compilation

Other

Cloud/Shadow

Clear Open Water

Turbid Water

Shoreline

Mudflats

Marsh

Swamp

Fen

Bog

Heath

Sparse Treed

Treed Upland

Deciduous Treed

Mixed Treed

Coniferous Treed

Plantations - Treed Cultivated

Hedge Rows

Disturbance

Open Cliff and Talus

Alvar

Sand Barren and Dune

Open Tallgrass Prairie

Tallgrass Savannah

Tallgrass Woodland

Sand/Gravel/Mine

Tailings/Extraction

Bedrock

Community/Infrastructure

Agriculture and Undifferentiated Rural Land Use

Scale: 1 : 104,146

Projection: Web Mercator

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Conestoga River at Wellington County Road 7, Bosworth Bridge

Watershed Characterization

Drainage Area (km ²)	276.948
Shape Factor (I)	5.627
Length of Main Channel (km)	39.478
Maximum Channel Elevation (m)	502.190
Minimum Channel Elevation (m)	404.480
Slope of Main Channel (m/km)	2.470
Slope of Main Channel (%)	0.247
Area Lakes/Wetlands (km ²)	10.144
Area - Lakes (km ²)	1.439
Area - Wetlands (km ²)	8.705
Mean Elevation (m)	461.519
Maximum Elevation (m)	506.602
Mean Slope (%)	2.260
Annual Mean Temperature (°C)	6.025
Annual Precipitation (mm)	978.000

Hydrology Models

Flood Flow: Index Flood Method with EPA
(Moin & Shaw 1985)

Flow	Results (m ³ /s)
Q _{1.25}	72.770000
Q ₂	80.860000
Q ₅	106.490000
Q ₁₀	126.710000
Q ₂₀	152.260000
Q ₅₀	183.310000
Q ₁₀₀	212.900000
Q ₂₀₀	237.160000
Q ₅₀₀	268.210000

Low Flow: Regression Method (MOEE 1995)

Flow	Results (m ³ /s)
3Q ₂	0.12
3Q ₂₀	0.03
3Q ₅₀	0.01
7Q ₂	0.14
7Q ₂₀	0.04

Flood Flow: Primary Multiple Regression
(Moin & Shaw 1985)

Flow	Results (m ³ /s)
Q ₂	99.934175
Q ₅	141.309853
Q ₁₀	168.321443
Q ₂₀	193.956243
Q ₅₀	209.917421
Q ₁₀₀	233.968850

Bosworth Bridge Replacement, WR7

SSSSS W W M M H H Y Y M M 000 999 999 =====
S W W W M M M H H Y Y M M M 0 0 9 9 9 9
SSSSS W W W M M M H H H H Y Y M M M 0 0 ## 9 9 9 9 Ver 4.05
S W W M M M H H Y Y M M M 0 0 9999 9999 Sept 2011
SSSSS W W M M H H Y Y M M 000 9 9 9 # 4313781

StormWater Management Hydrologic Model 999 999 =====

***** SWMHYMO Ver4.05 *****
***** 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 *****

+++++ PROGRAM ARRAY DIMENSIONS +++++

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

***** D E T A I L E D O U T P U T *****

***** DATE: 2021-01-27 TIME: 10:47:52 RUN COUNTER: 000326 *****
* * * * *
* Input filename: C:\SWM\Bosworth\Boswo_Ex.dat *
* Output filename: C:\SWM\Bosworth\Boswo_Ex.out *
* Summary filename: C:\SWM\Bosworth\Boswo_Ex.sum *
* User comments: *
* 1: *
* 2: *
* 3: *
* * * * *

001:0001-----
Project Name: CONESTOGO R. AT RD 7 AT BOSWORTH JOB NUMBER: [20M-01326-00]*
*#

Page 1

Bosworth Bridge Replacement, WR7

*# Date : JAN 2021 *
*# Modeller : [JZ/MB] *
*# Company : WSP *
*# *
***** HYDROLOGIC ASSESSMENT - EXISTING CONDITIONS *****
*# 2-YEAR TO 100-YEAR DESIGN STORMS *
*# 12-hour SCS II STORM DISTRIBUTION *
*# REGIONAL STORM IN SEPARATE FILE *
*# *

| START | Project dir.: C:\SWM\Bosworth\
----- Rainfall dir.: C:\SWM\Bosworth\

TZERO = .00 hrs on 0
METOUT= 2 (output = METRIC)
NRUN = 001
NSTORM= 1
1=12SCS002.stm

001:0002-----
| READ STORM | Filename: IDF_WellingtonRd 7, 12-hr SCS-II, 2-yr
| Ptotal= 49.40 mm | Comments: IDF_WellingtonRd 7, 12-hr SCS-II, 2-yr

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.25	1.235	3.25	1.976	6.25	8.892	9.25	1.729
.50	1.235	3.50	1.976	6.50	8.892	9.50	1.729
.75	1.235	3.75	1.976	6.75	3.952	9.75	1.729
1.00	1.235	4.00	1.976	7.00	3.952	10.00	1.729
1.25	1.235	4.25	2.964	7.25	2.964	10.25	.988
1.50	1.235	4.50	2.964	7.50	2.964	10.50	.988
1.75	1.235	4.75	3.952	7.75	2.964	10.75	.988
2.00	1.235	5.00	3.952	8.00	2.964	11.00	.988
2.25	1.482	5.25	5.928	8.25	1.729	11.25	.988
2.50	1.482	5.50	5.928	8.50	1.729	11.50	.988
2.75	1.482	5.75	23.712	8.75	1.729	11.75	.988
3.00	1.482	6.00	65.208	9.00	1.729	12.00	.988

001:0003-----
*#*****|
| CALIB NASHYD | Area (ha)=27600.04 Curve Number (CN)=78.00
| 01:C101 DT= 2.00 | Ia (mm)= 7.400 # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= 8.500

Unit Hyd Qpeak (cms)= 124.022

PEAK FLOW (cms)= 73.818 (i)

Page 2

Bosworth Bridge Replacement, WR7

TIME TO PEAK (hrs)= 15.679
RUNOFF VOLUME (mm)= 15.523
TOTAL RAINFALL (mm)= 49.400
RUNOFF COEFFICIENT = .314

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

001:0004-----
** END OF RUN : 1

| START | Project dir.: C:\SWM\Bosworth\
----- Rainfall dir.: C:\SWM\Bosworth\

TZERO = .00 hrs on 0
METOUT= 2 (output = METRIC)
NRUN = 002
NSTORM= 1
1=12SCS005.stm

002:0002-----
Project Name: CONESTOGO R. AT RD 7 AT BOSWORTH JOB NUMBER: [20M-01326-00]*
*# *
*# Date : JAN 2021 *
*# Modeller : [JZ/MB] *
*# Company : WSP *
*# *
***** HYDROLOGIC ASSESSMENT - EXISTING CONDITIONS *****
*# 2-YEAR TO 100-YEAR DESIGN STORMS *
*# 12-hour SCS II STORM DISTRIBUTION *
*# REGIONAL STORM IN SEPARATE FILE *
*# *

002:0002-----
| READ STORM | Filename: IDF_WellingtonRd 7, 12-hr SCS-II, 5-yr
| Ptotal= 65.50 mm | Comments: IDF_WellingtonRd 7, 12-hr SCS-II, 5-yr

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.25	1.638	3.25	2.620	6.25	11.790	9.25	2.293
.50	1.638	3.50	2.620	6.50	11.790	9.50	2.293

Page 3

Bosworth Bridge Replacement, WR7

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.75	1.638	3.75	2.620	6.75	5.240	9.75	2.293
1.00	1.638	4.00	2.620	7.00	5.240	10.00	2.293
1.25	1.638	4.25	3.930	7.25	3.930	10.25	1.310
1.50	1.638	4.50	3.930	7.50	3.930	10.50	1.310
1.75	1.638	4.75	5.240	7.75	3.930	10.75	1.310
2.00	1.638	5.00	5.240	8.00	3.930	11.00	1.310
2.25	1.965	5.25	7.860	8.25	2.293	11.25	1.310
2.50	1.965	5.50	7.860	8.50	2.293	11.50	1.310
2.75	1.965	5.75	31.440	8.75	2.293	11.75	1.310
3.00	1.965	6.00	86.460	9.00	2.293	12.00	1.310

002:0003-----
*#*****|
| CALIB NASHYD | Area (ha)=27600.04 Curve Number (CN)=78.00
| 01:C101 DT= 2.00 | Ia (mm)= 7.400 # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= 8.500

Unit Hyd Qpeak (cms)= 124.022

PEAK FLOW (cms)= 123.859 (i)

TIME TO PEAK (hrs)= 15.571
RUNOFF VOLUME (mm)= 26.019
TOTAL RAINFALL (mm)= 65.502
RUNOFF COEFFICIENT = .397

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

002:0004-----
002:0002-----
** END OF RUN : 2

| START | Project dir.: C:\SWM\Bosworth\
----- Rainfall dir.: C:\SWM\Bosworth\

TZERO = .00 hrs on 0
METOUT= 2 (output = METRIC)
NRUN = 003
NSTORM= 1
1=12SCS010.stm

003:0002-----

Page 4

Bosworth Bridge Replacement, WR7
Project Name: CONESTOGO R. AT RD 7 AT BOSWORTH JOB NUMBER: [20M-01326-00]
*#
*# Date : JAN 2021
*# Modeller : [JZ/MB]
*# Company : WSP
*#
*#
*# HYDROLOGIC ASSESSMENT - EXISTING CONDITIONS
*# 2-YEAR TO 100-YEAR DESIGN STORMS
*# 12-hour SCS II STORM DISTRIBUTION
*# REGIONAL STORM IN SEPARATE FILE
*#
*#

003:0002-----

| READ STORM | Filename: IDF_WellingtonRd 7, 12-hr SCS-II, 10-yr
| Ptotal= 75.80 mm | Comments: IDF_WellingtonRd 7, 12-hr SCS-II, 10-yr

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.25	1.895	3.25	3.032	6.25	13.644	9.25	2.653
.50	1.895	3.50	3.032	6.50	13.644	9.50	2.653
.75	1.895	3.75	3.032	6.75	6.064	9.75	2.653
1.00	1.895	4.00	3.032	7.00	6.064	10.00	2.653
1.25	1.895	4.25	4.548	7.25	4.548	10.25	1.516
1.50	1.895	4.50	4.548	7.50	4.548	10.50	1.516
1.75	1.895	4.75	6.064	7.75	4.548	10.75	1.516
2.00	1.895	5.00	6.064	8.00	4.548	11.00	1.516
2.25	2.274	5.25	9.096	8.25	2.653	11.25	1.516
2.50	2.274	5.50	9.096	8.50	2.653	11.50	1.516
2.75	2.274	5.75	36.384	8.75	2.653	11.75	1.516
3.00	2.274	6.00	100.056	9.00	2.653	12.00	1.516

003:0003-----

| CALIB NASHYD | Area (ha)=27600.04 Curve Number (CN)=78.00
| 01:C101 DT= 2.00 | Ia (mm)= 7.400 # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= 8.500

Unit Hyd Qpeak (cms)= 124.022

PEAK FLOW (cms)= 159.097 (i)
TIME TO PEAK (hrs)= 15.500
RUNOFF VOLUME (mm)= 33.409
TOTAL RAINFALL (mm)= 75.800
RUNOFF COEFFICIENT = .441

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

Bosworth Bridge Replacement, WR7

003:0004-----

003:0002-----

003:0002-----

** END OF RUN : 3

| START | Project dir.: C:\SWM\Bosworth\

----- Rainfall dir.: C:\SWM\Bosworth\

TZERO = .00 hrs on 0
METOUT= 2 (output = METRIC)
NRUN = 004
NSTORM= 1
1=12SCS025.stm

004:0002-----

Project Name: CONESTOGO R. AT RD 7 AT BOSWORTH JOB NUMBER: [20M-01326-00]

*#

*# Date : JAN 2021

*# Modeller : [JZ/MB]

*# Company : WSP

*#

*# HYDROLOGIC ASSESSMENT - EXISTING CONDITIONS

*# 2-YEAR TO 100-YEAR DESIGN STORMS

*# 12-hour SCS II STORM DISTRIBUTION

*# REGIONAL STORM IN SEPARATE FILE

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Bosworth Bridge Replacement, WR7

005:0004-----

005:0002-----

005:0002-----

005:0002-----

005:0002-----

** END OF RUN : 5

| START | Project dir.: C:\SWM\Bosworth\

----- Rainfall dir.: C:\SWM\Bosworth\

TZERO = .00 hrs on 0
METOUT= 2 (output = METRIC)
NRUN = 006
NSTORM= 1
1=12SCS100.stm

006:0002-----

Project Name: CONESTOGO R. AT RD 7 AT BOSWORTH JOB NUMBER: [20M-01326-00]
*#
*# Date : JAN 2021 *
*# Modeller : [JZ/MB] *
*# Company : WSP *
*#
*# HYDROLOGIC ASSESSMENT - EXISTING CONDITIONS *
*# 2-YEAR TO 100-YEAR DESIGN STORMS *
*# 12-hour SCS II STORM DISTRIBUTION *
*# REGIONAL STORM IN SEPARATE FILE *
*#

006:0002-----
| READ STORM | Filename: IDF_WellingtonRd 7, 12-hr SCS-II,100-yr
| Ptotal= 108.80 mm | Comments: IDF_WellingtonRd 7, 12-hr SCS-II,100-yr

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr

Page 9

Bosworth Bridge Replacement, WR7

.25	2.720	3.25	4.352	6.25	19.584	9.25	3.808
.50	2.720	3.50	4.352	6.50	19.584	9.50	3.808
.75	2.720	3.75	4.352	6.75	8.704	9.75	3.808
1.00	2.720	4.00	4.352	7.00	8.704	10.00	3.808
1.25	2.720	4.25	6.528	7.25	6.528	10.25	2.176
1.50	2.720	4.50	6.528	7.50	6.528	10.50	2.176
1.75	2.720	4.75	8.704	7.75	6.528	10.75	2.176
2.00	2.720	5.00	8.704	8.00	6.528	11.00	2.176
2.25	3.264	5.25	13.056	8.25	3.808	11.25	2.176
2.50	3.264	5.50	13.056	8.50	3.808	11.50	2.176
2.75	3.264	5.75	52.224	8.75	3.808	11.75	2.176
3.00	3.264	6.00	143.616	9.00	3.808	12.00	2.176

006:0003-----

*#*****|

CALIB NASHYD	Area (ha)=27600.04	Curve Number (CN)=78.00
Ia (mm)= 7.400	# of Linear Res. (N)= 3.00	
U.H. Tp(hrs)= 8.500		

Unit Hyd Qpeak (cms)= 124.022

PEAK FLOW (cms)= 283.151 (i)
TIME TO PEAK (hrs)= 15.393
RUNOFF VOLUME (mm)= 59.419
TOTAL RAINFALL (mm)= 108.800
RUNOFF COEFFICIENT = .546

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

006:0004-----

006:0002-----

006:0002-----

006:0002-----

006:0002-----

006:0002-----

FINISH

WARNINGS / ERRORS / NOTES

Simulation ended on 2021-01-27 at 10:47:54

Page 10

Bosworth Bridge Replacement, WR7

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StormWater Management HYDrologic Model 999 999 # 4313781

***** SMHYMO 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: smhymo@jfsa.com *****

+++++++ Licensed user: McCormick Rankin Corporation +++++++
+++++++ Kitchener SERIAL#:4313781 +++++++

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

***** D E T A I L E D O U T P U T *****

* DATE: 2021-01-27 TIME: 10:50:00 RUN COUNTER: 000327 *

* Input filename: C:\SWM\Bosworth\Bosw_Exr.dat *
* Output filename: C:\SWM\Bosworth\Bosw_Exr.out *
* Summary filename: C:\SWM\Bosworth\Bosw_Exr.sum *
* User comments: *

* 1: _____ *
* 2: _____ *
* 3: _____ *

001:0001-----

Project Name: CONESTOGO R. AT RD 7 AT BOSWORTH JOB NUMBER: [20M-01326-00]
*#

Page 11

Bosworth Bridge Replacement, WR7

*# Date : JAN 2021 *
*# Modeller : [JZ/MB] *
*# Company : WSP *
*#

*# HYDROLOGIC ASSESSMENT - EXISTING CONDITIONS *
*# REGIONAL STORM (HAZEL) *
*#

| START | Project dir.: C:\SWM\Bosworth\

----- Rainfall dir.: C:\SWM\Bosworth\

TZERO = .00 hrs on 0
METOUT= 2 (output = METRIC)
NRUN = 001
NSTORM= 1
1=Hazel12.stm

001:0002-----

READ STORM	Filename: Hazel 12hrs duration in 1-hr interval
Ptotal= 212.00 mm	Comments: Hazel 12hrs duration in 1-hr interval

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
1.00	6.000	4.00	13.000	7.00	23.000	10.00	53.000
2.00	4.000	5.00	17.000	8.00	13.000	11.00	38.000
3.00	6.000	6.00	13.000	9.00	13.000	12.00	13.000

001:0003-----

*
* Applying Aerial Reduction Factor for a equivalent circular Area of 407 km2
* which is 89.4 percent. Therefore,a reduction factor of 0.90 is used in model.
*

MODIFY STORM	MODIFYING PARAMETERS:
ICASEms= 1	Multiplication Factor, RFACT= .90
NSHIFT = 1 x SDT	Corresponding time shift (min)= 60.00

New rainfall volume = 190.80 (mm)

----- TRANSFORMED HYETOGRAPH -----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
1.00	1.00	5.00	11.70	9.00	11.70	13.00	11.70
2.00	5.40	6.00	15.30	10.00	11.70		
3.00	3.60	7.00	11.70	11.00	47.70		
4.00	5.40	8.00	20.70	12.00	34.20		

Page 12

Bosworth Bridge Replacement, WR7

001:0004-----

*

*&*****|

CALIB NASHYD	Area	(ha)=27600.04	Curve Number	(CN)=90.00
01:C101 DT= 2.00	Ia	(mm)= 7.400	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)=	8.500		

Unit Hyd Qpeak (cms)= 124.022

PEAK FLOW (cms)= 741.307 (i)

TIME TO PEAK (hrs)= 18.500

RUNOFF VOLUME (mm)= 158.941

TOTAL RAINFALL (mm)= 190.800

RUNOFF COEFFICIENT = .833

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

001:0005-----

*

FINISH

WARNINGS / ERRORS / NOTES

Simulation ended on 2021-01-27 at 10:50:00

=====

Baral, Madhav

From:
Sent:
To:
Cc:
Subject:

Hi Madhav,

The flows in this HEC-RAS model were based on the Grand River Hydrology Study, a calibrated and validated model approved by the GRCA. I would just like to confirm that your proposal is to change the flows that are in **GRHS 98 FlowsJP.f03** to new values based on your flood frequency analysis, and change the Regional flows based on your SWMHYMO model at all upstream river stations or at River Station 17.225 (Wellington Rd 7)?

The Grand River Hydrology Study reduced the flows at Drayton by 15%-29%. If different flows than what are currently approved in this model for the Regional flows are being proposed then a full hydrologic study of the upstream catchment will be required, including calibration and validation, along with a report to be reviewed and approved by GRCA for use.

Feel free to call me to discuss if that is easier to clarify anything – my cell # is (519) 242-6692.

Our in-house flood-frequency analysis was last updated in 2018 for Gauge 02GA039 (Conestogo River above Drayton) (based on data to 2018). As you are aware, this gauge is located at the bridge on Wellington Rd 7.

Station Alias WSC	Station	Period of Flow Record Analyzed	Drainage Area (km ²)	Distributio n Type				
02GA039	Conestogo River at Above Drayton	1951 to 2018	272	LN				

Based on this FFA, the June 2017 flow is estimated to be a 1:95 year return period.

If you wish to use the flows based on your analysis for the 1.25-Yr through the 100-Yr as shown in your attachment “Bosworth Bridge Replacement, Wellington County Flow of Conestogo River at Welling Road 7 (Bosworth Bridge)”, that will be acceptable.

At this time we can not recommend approval of changes to the Regional flow at the river stations through the model without a supporting hydrologic study, calibration/validation and GRCA review and approval of the report.

Please let me know if you would like to discuss further.

Regards,

Katelyn Lynch, P.Eng.
Water Resources Engineer
Grand River Conservation Authority

From: Baral, Madhav <Madhav.Baral@wsp.com>
Sent: February 22, 2021 7:58 PM

Baral, Madhav

Sent:
To:
Cc:
Subject:

Hi Madhav,

The flows in this HEC-RAS model were based on the Grand River Hydrology Study, a calibrated and validated model approved by the GRCA. I would just like to confirm that your proposal is to change the flows that are in **GRHS 98 FlowsJP.f03** to new values based on your flood frequency analysis, and change the Regional flows based on your SWMHYMO model at all upstream river stations or at River Station 17.225 (Wellington Rd 7)?

The Grand River Hydrology Study reduced the flows at Drayton by 15%-29%. If different flows than what are currently approved in this model for the Regional flows are being proposed then a full hydrologic study of the upstream catchment will be required, including calibration and validation, along with a report to be reviewed and approved by GRCA for use.

Feel free to call me to discuss if that is easier to clarify anything – my cell # is (519) 242-6692.

Our in-house flood-frequency analysis was last updated in 2018 for Gauge 02GA039 (Conestogo River above Drayton) (based on data to 2018). As you are aware, this gauge is located at the bridge on Wellington Rd 7.

Station Alias WSC	Station	Period of Flow Record Analyzed	Drainage Area (km ²)	Distributio n Type													
02GA039	Conestogo River at Above Drayton	1951 to 2018	272	LN													

Based on this FFA, the June 2017 flow is estimated to be a 1:95 year return period.

If you wish to use the flows based on your analysis for the 1.25-Yr through the 100-Yr as shown in your attachment “Bosworth Bridge Replacement, Wellington County Flow of Conestogo River at Welling Road 7 (Bosworth Bridge)”, that will be acceptable.

At this time we can not recommend approval of changes to the Regional flow at the river stations through the model without a supporting hydrologic study, calibration/validation and GRCA review and approval of the report.

Please let me know if you would like to discuss further.

Regards,

Flood Frequency Unit Area Flows (m ³ /s/km ²)											Max Recore d			Links	Max Measure d		
1.25	1.5	2	5	10	20	25	50	100	200	500	m ³ /s	Year	RP		m ³ /s	Year	%+
0.32	0.39	0.49	0.75	0.94	1.14	1.20	1.40	1.61	1.83	2.14	433	2017	95		237	1976	55%

To: Katelyn Lynch <klynch@grandriver.ca>
Cc: Van Ruyven, William <William.VanRuyven@wsp.com>; Laura Warner <lwarner@grandriver.ca>
Subject: RE: Wellington County Road 7 - Bosworth Bridge-Flow confirmation for HEC-RAS Model

Hi Katelyn,

This is just the follow up of our Feb 3rd 2021 email regarding flow confirmation for HEC-RAS model at Bosworth bridge location and at upstream sections.

We would like to have your feedback soon to carry out further analysis.

Please let us know if you need any further information.

Thank you.

Regards,

Madhav Baral, M.A.Sc., P.Eng.
Senior Project Manager, M.A.Sc., P.Eng.



T+ 1 289 825 0206

From: Baral, Madhav
Sent: February 3, 2021 1:26 PM
To: Katelyn Lynch <klynch@grandriver.ca>
Cc: Van Ruyven, William <William.VanRuyven@wsp.com>; Laura Warner <lwarner@grandriver.ca>
Subject: RE: Wellington County Road 7 - Bosworth Bridge-Flow confirmation for HEC-RAS Model

Hi Katelyn,

We would like to confirm the flow to be used in the Conestogo River Hydraulic Model (*upperCon2011.prj*) at Wellington Road 7 Bridge (Bosworth Bridge – B007028) before doing further analysis.

The total Drainage area of Conestogo River at Bosworth bridge location is 276 km². We have used following methodology to determine the flow at Bridge location which are:

- Consolidated Flood Frequency (CFA) of Station 02GA039 using Maximum Instantaneous Flow Data
- CFA of Station 02GA039 using Maximum Daily Flow Data
- SWMHYMO Modelling using SCS-12-hour Distribution
- Index Flood Method from OFAT Tool
- Primary Multiple Regression Using OFAT Tool
- Regional Storm Hazel using SWMHYMO

These flows are compared with the flow used in the existing HEC-RAS Model.

In SWMHYMO Modelling, no aerial reduction is applied for the 2-year to the 100-year storm, but 0.90 reduction factor is applied for the Regional Storm Hazel as per MNRF guideline based on the Equivalent Circular Area of the watershed. The Regional Flow result (741 m³/s) is comparable with the Regional Flow used in Existing HEC-RAS Model.

Regarding the frequency flow (2-year to 100-year), an instantaneous flow of 433 m³/s was measured at Station 02GA039 on 2017 June 23 as per Environment Canada Flow data. Other large flow events were 388 m³/s in 1975 and 317 m³/s in 2018. Because of these frequent large flow events, flood frequency analysis with Instantaneous maximum flow is more reasonable. The results from Log Person Type III is more appropriate and can be used for the hydraulic analysis.

The highlighted flow data in the attached table will be used at River Station 17.225 in the HEC-RAS Model. Please confirm if GRCA agrees with this flow values to be used in the HEC-RAS model.

We have noticed in the HEC-RAS model that Regional flow used in Stations 20.66, 23.17, 23.768 and 24.025 are larger then the estimated flow at Station 17.225. Please see below the flow data clipped from the model.

Conestogo River											
Flow from Existing HEC-RAS Model											
	River	Reach	RS	Reg	100-yr	50-yr	20-yr	10-yr	5-yr	2-yr	
10	RIVER-1	Reach-1	24.025	1039.3	379.9	345.6	312.7	248.5	217.5	144.8	Upstream of Line 16
11	RIVER-1	Reach-1	23.768	997.6	390.3	355.2	321.5	255.6	223.7	149.2	
12	RIVER-1	Reach-1	23.17	981.6	389.3	353.2	318.3	251.4	219.2	144.9	
13	RIVER-1	Reach-1	20.66	974.7	388.9	352.3	317	249.6	217.2	142.7	
14	RIVER-1	Reach-1	19.85	726	391.8	355.3	319.8	251.6	218.8	143.4	
15	RIVER-1	Reach-1	18.355	738	360	325	272	230	191	135	Wellington Road 7
16	RIVER-1	Reach-1	17.225	738	360	325	272	230	191	135	
17	RIVER-1	Reach-1	15.685	749	432	389	327	277	229	160	
18	RIVER-1	Reach-1	15.07	804	432	389	327	277	229	160	

Station 24.025 is located upstream of Line 16 which is approximately 6.5 km upstream of Bosworth Bridge. Drainage area at this location is about 243 km².

The Regional flow of 974 m³/s to 1039 m³/s seems quite high at these locations. We have tried to plot the frequency flow with regular probability plot and Weibull probability plot. It seems line 1039 m³/s of flow is above 10000-year return frequency.

Sudden increase or decrease in flow could happen if there is a dam. It does not look like there is any dam on the upstream. A dam is located approximately 11 km down stream.

Therefore, please confirm if GRCA would like to continue with flow values used in the existing HEC-RAS model or use the new estimated flow data same as for Station 17.225.

Thank you.

Regards,

Madhav Baral, M.A.Sc., P.Eng.

Senior Project Manager, M.A.Sc., P.Eng.



T+ 1 289 825 0206

From: Katelyn Lynch <klynch@grandriver.ca>

Sent: January 27, 2021 11:59 AM

To: Baral, Madhav <Madhav.Baral@wsp.com>

Cc: Van Ruyven, William <William.VanRuyven@wsp.com>; Laura Warner <lwerner@grandriver.ca>

Subject: RE: Wellington County Road 7 - Bosworth Bridge Replacement on Conestogo River

Hi Madhav,

I have reviewed the location for Bosworth Bridge B007028 and can confirm the model previously sent as per my below emails (upperCon2011.prj) is the current model for this location as well.

The approach presented in your email below is agreeable. Please let me know if you require any further information.

Regards,

Katelyn Lynch, P.Eng.

Water Resources Engineer

Grand River Conservation Authority

From: Baral, Madhav <Madhav.Baral@wsp.com>

Sent: January 27, 2021 10:22 AM

To: Katelyn Lynch <klynch@grandriver.ca>

Cc: Van Ruyven, William <William.VanRuyven@wsp.com>; Laura Warner <lwerner@grandriver.ca>

Subject: RE: Wellington County Road 7 - Bosworth Bridge Replacement on Conestogo River

Hi Katelyn,

We have another Bridge Replacement EA Project (Bosworth Bridge B007028) on Wellington County located on Wellington County Road 7 over Conestogo River.

We have received Conestogo River Hydraulic Modelling data from GRCA for Wellington County Road 109 EA Project (per email below).

Bosworth Bridge is located on the middle reach of the Conestogo River.

We will use the same hydraulic model for this bridge too.

We will carry out the hydrologic analysis at the bridge site.

There is a flow gauge station (O2GA039) near the bridge location. Along with the flood frequency analysis, we will also use modelling tools and compare the flow.

Flow in the hydraulic model will be updated at the bridge site, if required, comparing to the flow used in the existing hydraulic model.

Please let us know if you agree with this approach.

Thank you.

Regards,

Madhav Baral, M.A.Sc., P.Eng.

Senior Project Manager, M.A.Sc., P.Eng.



APPENDIX

C

Hydraulic Analysis

Wellington Road 7, Bosworth Bridge Replacement

Existing Conditions Hydraulic Modelling Summary

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
Reach-1	19.849	Reg	726.00	408.90	413.92	412.95	414.37	3.38	382.32	308.85	0.52
Reach-1	19.849	100-yr	391.80	408.90	413.55	411.84	413.76	2.20	294.49	291.15	0.35
Reach-1	19.849	50-yr	355.30	408.90	413.29	411.69	413.53	2.29	235.15	278.59	0.38
Reach-1	19.849	20-yr	319.80	408.90	412.63	411.57	413.02	2.77	117.47	123.90	0.51
Reach-1	19.849	10-yr	251.60	408.90	413.01	411.28	413.18	1.88	175.30	265.36	0.33
Reach-1	19.849	5-yr	218.80	408.90	412.76	411.13	412.92	1.82	122.50	127.69	0.33
Reach-1	19.849	2-yr	143.40	408.90	412.26	410.75	412.36	1.42	102.65	112.73	0.28
Reach-1	19.845	Bridge									
Reach-1	19.841	Reg	726.00	408.90	413.87	413.51	414.36	3.49	367.10	306.45	0.54
Reach-1	19.841	100-yr	391.80	408.90	413.02	411.84	413.44	2.93	175.00	265.78	0.51
Reach-1	19.841	50-yr	355.30	408.90	412.91	411.70	413.24	2.63	163.45	136.83	0.46
Reach-1	19.841	20-yr	319.80	408.90	412.31	411.56	412.81	3.14	101.82	114.34	0.61
Reach-1	19.841	10-yr	251.60	408.90	412.85	411.27	413.06	2.06	122.07	130.41	0.37
Reach-1	19.841	5-yr	218.80	408.90	412.68	411.12	412.87	1.89	115.89	125.51	0.34
Reach-1	19.841	2-yr	143.40	408.90	412.21	410.75	412.32	1.46	98.13	111.41	0.29
Reach-1	19.84	Reg	726.00	408.90	413.91	412.90	414.18	2.82	508.40	308.38	0.43
Reach-1	19.84	100-yr	391.80	408.90	413.05	411.84	413.30	2.44	259.19	267.25	0.42
Reach-1	19.84	50-yr	355.30	408.90	412.94	411.70	413.14	2.24	236.69	143.79	0.39
Reach-1	19.84	20-yr	319.80	408.90	411.56	411.56	412.53	4.35	73.52	76.57	1.00
Reach-1	19.84	10-yr	251.60	408.90	412.84	411.27	413.06	2.06	121.97	130.33	0.37
Reach-1	19.84	5-yr	218.80	408.90	412.68	411.12	412.86	1.89	115.81	125.44	0.34
Reach-1	19.84	2-yr	143.40	408.90	412.21	410.75	412.32	1.46	98.07	111.36	0.29
Reach-1	19.825	Reg	726.00	408.90	413.94	412.26	413.99	1.46	1008.81	439.06	0.22
Reach-1	19.825	100-yr	391.80	408.90	413.07	411.32	413.12	1.26	633.26	426.04	0.21
Reach-1	19.825	50-yr	355.30	408.90	412.95	411.20	413.00	1.24	582.53	424.25	0.21
Reach-1	19.825	20-yr	319.80	408.90	411.08	411.08	411.89	3.97	80.47	59.90	1.00
Reach-1	19.825	10-yr	251.60	408.90	412.84	410.83	412.96	1.49	168.53	422.65	0.26
Reach-1	19.825	5-yr	218.80	408.90	412.68	410.69	412.77	1.36	160.32	420.19	0.24
Reach-1	19.825	2-yr	143.40	408.90	412.21	410.35	412.26	1.05	136.77	413.13	0.20
Reach-1	19.100	Reg	726.00	408.20	413.39		413.47	1.61	832.74	432.50	0.27
Reach-1	19.100	100-yr	391.80	408.20	412.42		412.50	1.47	453.68	345.29	0.29
Reach-1	19.100	50-yr	355.30	408.20	412.25		412.34	1.48	398.09	330.39	0.30
Reach-1	19.100	20-yr	319.80	408.20	412.06		412.15	1.54	335.45	312.76	0.32
Reach-1	19.100	10-yr	251.60	408.20	411.85		411.93	1.42	271.96	292.34	0.32
Reach-1	19.100	5-yr	218.80	408.20	411.70		411.79	1.40	229.25	277.34	0.32
Reach-1	19.100	2-yr	143.40	408.20	411.42		411.48	1.17	158.37	232.01	0.29
Reach-1	18.355	Reg	738.00	407.10	412.59		412.85	2.28	368.15	138.71	0.38
Reach-1	18.355	100-yr	438.00	407.10	411.42		411.63	2.06	225.54	108.65	0.42
Reach-1	18.355	50-yr	381.00	407.10	411.21		411.40	1.97	203.26	105.17	0.42
Reach-1	18.355	20-yr	309.00	407.10	410.93		411.10	1.83	174.43	100.49	0.42
Reach-1	18.355	10-yr	256.00	407.10	410.70		410.85	1.72	152.26	96.74	0.42
Reach-1	18.355	5-yr	204.00	407.10	410.43		410.56	1.63	126.31	92.15	0.43
Reach-1	18.355	2-yr	133.00	407.10	409.98		410.10	1.53	87.02	84.11	0.48

Existing Conditions Hydraulic Modelling Summary

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
Reach-1	18.135	Reg	738.00	406.60	412.42		412.67	2.56	450.03	160.15	0.39
Reach-1	18.135	100-yr	438.00	406.60	411.02		411.33	2.69	235.09	145.87	0.50
Reach-1	18.135	50-yr	381.00	406.60	410.77		411.09	2.66	199.63	138.87	0.51
Reach-1	18.135	20-yr	309.00	406.60	410.43		410.75	2.60	154.52	128.87	0.54
Reach-1	18.135	10-yr	256.00	406.60	410.16		410.48	2.53	120.94	120.90	0.56
Reach-1	18.135	5-yr	204.00	406.60	409.88		410.16	2.37	92.97	67.28	0.55
Reach-1	18.135	2-yr	133.00	406.60	409.41		409.63	2.07	65.55	50.01	0.54
Reach-1	17.83	Reg	738.00	406.00	412.08		412.41	2.63	331.18	102.69	0.40
Reach-1	17.83	100-yr	438.00	406.00	410.62		410.91	2.44	194.21	83.08	0.45
Reach-1	17.83	50-yr	381.00	406.00	410.36		410.63	2.34	173.40	78.44	0.45
Reach-1	17.83	20-yr	309.00	406.00	410.00		410.24	2.20	146.29	71.95	0.45
Reach-1	17.83	10-yr	256.00	406.00	409.70		409.92	2.08	125.84	67.05	0.45
Reach-1	17.83	5-yr	204.00	406.00	409.38		409.57	1.96	104.87	61.61	0.46
Reach-1	17.83	2-yr	133.00	406.00	408.83		408.99	1.81	73.68	51.44	0.48
Reach-1	17.58	Reg	738.00	405.00	411.81		412.18	3.14	380.62	116.11	0.43
Reach-1	17.58	100-yr	438.00	405.00	410.05		410.53	3.31	190.44	95.70	0.55
Reach-1	17.58	50-yr	381.00	405.00	409.77		410.23	3.22	164.40	89.38	0.55
Reach-1	17.58	20-yr	309.00	405.00	409.37		409.81	3.08	130.83	79.86	0.56
Reach-1	17.58	10-yr	256.00	405.00	409.06		409.48	2.93	107.49	72.50	0.56
Reach-1	17.58	5-yr	204.00	405.00	408.74		409.11	2.72	85.97	60.93	0.56
Reach-1	17.58	2-yr	133.00	405.00	408.23		408.50	2.31	59.79	40.87	0.53
Reach-1	17.36	Reg	738.00	405.40	411.83		412.00	2.08	563.94	168.65	0.27
Reach-1	17.36	100-yr	438.00	405.40	410.02		410.23	2.13	281.58	143.31	0.33
Reach-1	17.36	50-yr	381.00	405.40	409.74		409.93	2.03	243.28	124.35	0.33
Reach-1	17.36	20-yr	309.00	405.40	409.34		409.51	1.87	199.43	96.10	0.32
Reach-1	17.36	10-yr	256.00	405.40	409.04		409.18	1.71	173.56	74.57	0.31
Reach-1	17.36	5-yr	204.00	405.40	408.71		408.83	1.54	150.54	68.67	0.29
Reach-1	17.36	2-yr	133.00	405.40	408.18		408.26	1.26	115.54	62.53	0.26
Reach-1	17.30	Reg	738.00	405.30	411.78		411.95	2.08	562.50	177.85	0.29
Reach-1	17.30	100-yr	438.00	405.30	409.86		410.12	2.39	247.59	143.45	0.41
Reach-1	17.30	50-yr	381.00	405.30	409.55		409.81	2.36	205.67	128.95	0.42
Reach-1	17.30	20-yr	309.00	405.30	409.13		409.38	2.27	157.98	96.13	0.44
Reach-1	17.30	10-yr	256.00	405.30	408.82		409.05	2.16	130.87	81.38	0.44
Reach-1	17.30	5-yr	204.00	405.30	408.50		408.71	2.01	106.90	68.95	0.44
Reach-1	17.30	2-yr	133.00	405.30	407.99		408.15	1.75	76.11	51.07	0.45
Reach-1	17.225	Reg	741.00	405.10	411.79		411.91	1.73	656.76	218.10	0.24
Reach-1	17.225	100-yr	438.00	405.10	409.85		410.03	1.96	299.16	156.37	0.35
Reach-1	17.225	50-yr	381.00	405.10	409.54		409.71	1.95	251.21	146.17	0.37
Reach-1	17.225	20-yr	309.00	405.10	409.09		409.28	1.96	189.21	131.82	0.40
Reach-1	17.225	10-yr	256.00	405.10	408.76		408.94	1.94	148.18	112.12	0.42
Reach-1	17.225	5-yr	204.00	405.10	408.42		408.59	1.87	113.99	87.41	0.44
Reach-1	17.225	2-yr	133.00	405.10	407.87		408.02	1.73	76.98	54.62	0.46
Reach-1	17.199	Reg	741.00	404.98	411.34	409.16	411.79	2.98	262.80	127.41	0.43

Wellington Road 7, Bosworth Bridge Replacement
Existing Conditions Hydraulic Modelling Summary

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
Reach-1	17.199	100-yr	438.00	404.98	409.44	408.22	409.91	3.05	143.75	48.93	0.52
Reach-1	17.199	50-yr	381.00	404.98	409.21	408.01	409.62	2.84	134.07	47.90	0.50
Reach-1	17.199	20-yr	309.00	404.98	408.86	407.74	409.20	2.58	119.89	46.30	0.48
Reach-1	17.199	10-yr	256.00	404.98	408.60	407.51	408.88	2.34	109.17	45.21	0.46
Reach-1	17.199	5-yr	204.00	404.98	408.33	407.25	408.55	2.09	97.63	44.07	0.43
Reach-1	17.199	2-yr	133.00	404.98	407.84	406.74	407.99	1.71	77.66	42.13	0.40
Reach-1	17.195		Bosworth Bridge		Wellington Road 7						
Reach-1	17.191	Reg	741.00	405.11	409.78	409.30	410.99	4.86	152.35	48.03	0.81
Reach-1	17.191	100-yr	438.00	405.11	409.12	408.36	409.75	3.50	125.00	46.56	0.64
Reach-1	17.191	50-yr	381.00	405.11	408.95	408.16	409.48	3.23	117.91	46.21	0.61
Reach-1	17.191	20-yr	309.00	405.11	408.66	407.88	409.09	2.92	105.84	45.60	0.58
Reach-1	17.191	10-yr	256.00	405.11	408.44	407.66	408.80	2.64	96.86	45.15	0.55
Reach-1	17.191	5-yr	204.00	405.11	408.20	407.34	408.48	2.35	86.81	44.06	0.52
Reach-1	17.191	2-yr	133.00	405.11	407.75	406.90	407.94	1.95	68.19	40.97	0.48
Reach-1	17.14	Reg	741.00	405.10	409.93		410.06	2.11	630.80	289.03	0.36
Reach-1	17.14	100-yr	438.00	405.10	409.16		409.29	1.92	412.41	278.77	0.36
Reach-1	17.14	50-yr	381.00	405.10	408.97		409.10	1.90	359.50	275.57	0.37
Reach-1	17.14	20-yr	309.00	405.10	408.65		408.80	1.95	272.58	264.85	0.40
Reach-1	17.14	10-yr	256.00	405.10	408.41		408.58	1.97	210.25	256.88	0.42
Reach-1	17.14	5-yr	204.00	405.10	408.14		408.33	1.98	143.38	248.06	0.45
Reach-1	17.14	2-yr	133.00	405.10	407.68		407.83	1.74	83.33	72.43	0.44
Reach-1	16.76	Reg	741.00	404.00	409.24		409.68	3.53	394.51	218.43	0.56
Reach-1	16.76	100-yr	438.00	404.00	408.29	407.79	408.80	3.44	202.04	172.23	0.62
Reach-1	16.76	50-yr	381.00	404.00	408.09	407.57	408.59	3.32	169.83	151.58	0.62
Reach-1	16.76	20-yr	309.00	404.00	407.85		408.25	2.96	141.23	100.90	0.58
Reach-1	16.76	10-yr	256.00	404.00	407.63		407.99	2.74	120.61	91.52	0.56
Reach-1	16.76	5-yr	204.00	404.00	407.40		407.70	2.48	100.64	81.42	0.53
Reach-1	16.76	2-yr	133.00	404.00	406.98		407.20	2.08	70.22	62.80	0.50
Reach-1	16.575	Reg	741.00	403.50	409.16		409.38	2.46	491.34	221.37	0.40
Reach-1	16.575	100-yr	438.00	403.50	408.20		408.41	2.24	291.47	185.31	0.42
Reach-1	16.575	50-yr	381.00	403.50	407.99		408.19	2.16	254.53	169.47	0.42
Reach-1	16.575	20-yr	309.00	403.50	407.70		407.88	2.05	207.03	153.28	0.43
Reach-1	16.575	10-yr	256.00	403.50	407.45		407.63	1.97	170.72	139.65	0.43
Reach-1	16.575	5-yr	204.00	403.50	407.18		407.35	1.87	135.70	125.10	0.44
Reach-1	16.575	2-yr	133.00	403.50	406.74		406.88	1.68	87.60	84.74	0.42
Reach-1	16.37	Reg	741.00	403.20	408.92		409.18	2.65	423.41	159.64	0.43
Reach-1	16.37	100-yr	438.00	403.20	407.96		408.18	2.30	278.85	144.13	0.43
Reach-1	16.37	50-yr	381.00	403.20	407.75		407.95	2.21	248.72	138.95	0.43
Reach-1	16.37	20-yr	309.00	403.20	407.45		407.63	2.11	207.42	131.52	0.43
Reach-1	16.37	10-yr	256.00	403.20	407.18		407.36	2.04	172.75	124.94	0.44
Reach-1	16.37	5-yr	204.00	403.20	406.87		407.05	1.98	135.94	119.23	0.45
Reach-1	16.37	2-yr	133.00	403.20	406.36		406.55	1.90	77.98	95.58	0.49
Reach-1	16.25	Reg	741.00	403.10	408.78		409.07	2.67	440.11	185.66	0.39

Existing Conditions Hydraulic Modelling Summary

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
Reach-1	16.25	100-yr	438.00	403.10	407.88		408.07	2.09	297.60	133.67	0.33
Reach-1	16.25	50-yr	381.00	403.10	407.68		407.85	1.95	271.21	127.10	0.32
Reach-1	16.25	20-yr	309.00	403.10	407.39		407.53	1.76	235.62	117.65	0.30
Reach-1	16.25	10-yr	256.00	403.10	407.13		407.25	1.61	206.27	109.24	0.29
Reach-1	16.25	5-yr	204.00	403.10	406.84		406.94	1.45	176.24	99.34	0.27
Reach-1	16.25	2-yr	133.00	403.10	406.36		406.43	1.17	132.50	81.97	0.24
Reach-1	16.16	Reg	741.00	403.00	407.97	407.78	408.88	4.68	254.36	142.48	0.75
Reach-1	16.16	100-yr	438.00	403.00	407.39		407.94	3.50	180.27	113.54	0.60
Reach-1	16.16	50-yr	381.00	403.00	407.26		407.73	3.22	165.34	106.77	0.57
Reach-1	16.16	20-yr	309.00	403.00	407.04		407.43	2.87	143.74	96.12	0.52
Reach-1	16.16	10-yr	256.00	403.00	406.83		407.16	2.61	124.78	85.69	0.49
Reach-1	16.16	5-yr	204.00	403.00	406.60		406.86	2.31	106.15	74.03	0.46
Reach-1	16.16	2-yr	133.00	403.00	406.20		406.36	1.82	80.40	53.91	0.39
Reach-1	16.1	Reg	741.00	402.90	407.70	407.70	408.66	4.70	228.89	139.33	0.84
Reach-1	16.1	100-yr	438.00	402.90	407.15	406.90	407.77	3.63	158.49	120.35	0.72
Reach-1	16.1	50-yr	381.00	402.90	407.04	406.66	407.58	3.36	145.30	116.45	0.68
Reach-1	16.1	20-yr	309.00	402.90	406.85	406.34	407.29	3.02	123.76	103.83	0.63
Reach-1	16.1	10-yr	256.00	402.90	406.64		407.03	2.81	103.70	88.61	0.62
Reach-1	16.1	5-yr	204.00	402.90	406.42		406.74	2.53	86.10	72.68	0.59
Reach-1	16.1	2-yr	133.00	402.90	406.05		406.27	2.08	64.12	45.54	0.54
Reach-1	15.98	Reg	741.00	402.80	407.37	407.19	408.05	3.89	275.52	222.00	0.76
Reach-1	15.98	100-yr	438.00	402.80	407.00	406.42	407.37	2.81	202.05	162.52	0.59
Reach-1	15.98	50-yr	381.00	402.80	406.90		407.21	2.58	186.77	151.93	0.55
Reach-1	15.98	20-yr	309.00	402.80	406.70	406.03	406.96	2.34	158.52	130.10	0.53
Reach-1	15.98	10-yr	256.00	402.80	406.46		406.70	2.23	130.59	105.99	0.53
Reach-1	15.98	5-yr	204.00	402.80	406.20		406.42	2.11	105.40	89.77	0.55
Reach-1	15.98	2-yr	133.00	402.80	405.78		405.97	1.92	72.66	67.81	0.56
Reach-1	15.85	Reg	741.00	402.60	407.17		407.61	3.56	401.60	294.61	0.64
Reach-1	15.85	100-yr	438.00	402.60	406.46	406.46	406.99	3.50	203.83	258.09	0.71
Reach-1	15.85	50-yr	381.00	402.60	406.30	406.30	406.84	3.45	164.23	235.48	0.73
Reach-1	15.85	20-yr	309.00	402.60	405.92	405.79	406.55	3.57	100.61	81.44	0.82
Reach-1	15.85	10-yr	256.00	402.60	405.78	405.54	406.30	3.25	88.99	74.44	0.77
Reach-1	15.85	5-yr	204.00	402.60	405.63		406.03	2.84	78.73	67.65	0.69
Reach-1	15.85	2-yr	133.00	402.60	405.39		405.63	2.17	63.97	56.47	0.56
Reach-1	15.685	Reg	749.00	402.40	407.33		407.37	1.35	1180.91	579.41	0.23
Reach-1	15.685	100-yr	432.00	402.40	406.63		406.66	1.15	804.04	503.08	0.22
Reach-1	15.685	50-yr	389.00	402.40	406.44		406.47	1.18	708.00	483.62	0.23
Reach-1	15.685	20-yr	327.00	402.40	406.17		406.21	1.19	584.48	457.36	0.24
Reach-1	15.685	10-yr	277.00	402.40	405.93		405.97	1.24	475.50	433.45	0.26
Reach-1	15.685	5-yr	229.00	402.40	405.68		405.73	1.33	368.85	410.19	0.29
Reach-1	15.685	2-yr	160.00	402.40	405.29		405.37	1.47	218.65	358.55	0.34
Reach-1	15.38	Reg	749.00	401.90	407.10		407.23	1.74	610.98	339.81	0.31
Reach-1	15.38	100-yr	432.00	401.90	406.45		406.54	1.37	405.88	287.68	0.28
Reach-1	15.38	50-yr	389.00	401.90	406.24		406.33	1.39	346.26	268.83	0.29

Existing Conditions Hydraulic Modelling Summary

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
Reach-1	15.38	20-yr	327.00	401.90	405.95		406.04	1.38	273.25	238.10	0.31
Reach-1	15.38	10-yr	277.00	401.90	405.68		405.77	1.38	215.36	182.17	0.33
Reach-1	15.38	5-yr	229.00	401.90	405.39		405.48	1.38	170.13	139.29	0.37
Reach-1	15.38	2-yr	160.00	401.90	404.89		405.00	1.47	109.10	106.89	0.46
Reach-1	15.285	Reg	749.00	402.00	407.02	405.90	407.16	2.08	674.95	348.95	0.36
Reach-1	15.285	100-yr	432.00	402.00	406.38	404.94	406.48	1.65	469.35	298.87	0.31
Reach-1	15.285	50-yr	389.00	402.00	406.16	404.79	406.26	1.69	403.00	281.73	0.33
Reach-1	15.285	20-yr	327.00	402.00	405.56	404.54	405.88	2.50	130.54	221.33	0.52
Reach-1	15.285	10-yr	277.00	402.00	405.32	404.33	405.60	2.35	117.78	190.23	0.50
Reach-1	15.285	5-yr	229.00	402.00	405.07	404.10	405.31	2.19	104.56	154.62	0.49
Reach-1	15.285	2-yr	160.00	402.00	404.63	403.75	404.82	1.93	83.11	105.76	0.46
Reach-1	15.264	Reg	749.00	402.00	406.91	406.13	407.13	2.53	620.08	534.67	0.40
Reach-1	15.264	100-yr	432.00	402.00	405.90	404.90	406.36	3.01	145.51	336.99	0.55
Reach-1	15.264	50-yr	389.00	402.00	405.74	404.76	406.15	2.86	137.71	292.63	0.53
Reach-1	15.264	20-yr	327.00	402.00	405.48	404.54	405.83	2.64	125.11	208.97	0.52
Reach-1	15.264	10-yr	277.00	402.00	405.26	404.34	405.56	2.44	114.78	176.74	0.50
Reach-1	15.264	5-yr	229.00	402.00	405.02	404.11	405.28	2.24	103.19	140.58	0.48
Reach-1	15.264	2-yr	160.00	402.00	404.59	403.75	404.78	1.95	82.14	48.67	0.47
Reach-1	15.26		Bridge								
Reach-1	15.256	Reg	749.00	402.00	406.83	406.13	407.07	2.65	588.16	529.71	0.42
Reach-1	15.256	100-yr	432.00	402.00	405.94	404.89	406.22	2.55	294.59	348.64	0.46
Reach-1	15.256	50-yr	389.00	402.00	405.72	404.76	406.03	2.60	233.63	288.35	0.49
Reach-1	15.256	20-yr	327.00	402.00	405.36	404.53	405.76	2.77	117.92	191.88	0.56
Reach-1	15.256	10-yr	277.00	402.00	405.17	404.33	405.50	2.54	109.01	162.92	0.53
Reach-1	15.256	5-yr	229.00	402.00	404.95	404.11	405.22	2.32	98.64	54.22	0.51
Reach-1	15.256	2-yr	160.00	402.00	404.53	403.75	404.73	2.02	79.05	47.78	0.49
Reach-1	15.24	Reg	749.00	402.00	406.85	406.15	407.00	2.18	765.27	530.93	0.36
Reach-1	15.24	100-yr	432.00	402.00	405.66	404.94	406.14	3.07	140.79	261.47	0.61
Reach-1	15.24	50-yr	389.00	402.00	405.54	404.78	405.97	2.90	134.27	225.31	0.59
Reach-1	15.24	20-yr	327.00	402.00	405.35	404.54	405.70	2.65	123.48	189.24	0.56
Reach-1	15.24	10-yr	277.00	402.00	405.15	404.31	405.46	2.46	112.72	159.70	0.55
Reach-1	15.24	5-yr	229.00	402.00	404.92	404.09	405.19	2.28	100.25	53.84	0.53
Reach-1	15.24	2-yr	160.00	402.00	404.49	403.73	404.71	2.04	78.54	47.41	0.51
Reach-1	15.07	Reg	804.00	401.30	406.67		406.87	2.12	485.04	322.52	0.35
Reach-1	15.07	100-yr	432.00	401.30	405.72		405.84	1.63	310.77	153.61	0.32
Reach-1	15.07	50-yr	389.00	401.30	405.57		405.69	1.57	288.58	151.87	0.31
Reach-1	15.07	20-yr	327.00	401.30	405.34		405.44	1.48	253.32	149.05	0.31
Reach-1	15.07	10-yr	277.00	401.30	405.11		405.21	1.42	219.25	146.29	0.31
Reach-1	15.07	5-yr	229.00	401.30	404.84		404.94	1.37	181.94	134.51	0.32
Reach-1	15.07	2-yr	160.00	401.30	404.35		404.44	1.32	123.56	102.63	0.35
Reach-1	14.93	Reg	804.00	401.00	406.21	405.11	406.70	3.29	384.15	285.73	0.52
Reach-1	14.93	100-yr	432.00	401.00	405.50		405.73	2.22	251.16	134.48	0.39
Reach-1	14.93	50-yr	389.00	401.00	405.37		405.58	2.10	234.46	128.98	0.38

Existing Conditions Hydraulic Modelling Summary

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
Reach-1	14.93	20-yr	327.00	401.00	405.16		405.34	1.92	208.55	119.95	0.35
Reach-1	14.93	10-yr	277.00	401.00	404.95		405.10	1.78	183.88	111.55	0.34
Reach-1	14.93	5-yr	229.00	401.00	404.70		404.83	1.65	156.82	104.80	0.33
Reach-1	14.93	2-yr	160.00	401.00	404.21		404.32	1.46	111.62	72.95	0.33
Reach-1	14.82	Reg	804.00	400.80	405.83	405.60	406.46	3.86	334.99	222.57	0.71
Reach-1	14.82	100-yr	432.00	400.80	404.99	404.77	405.52	3.34	169.15	168.64	0.72
Reach-1	14.82	50-yr	389.00	400.80	404.87	404.60	405.38	3.23	149.79	155.19	0.71
Reach-1	14.82	20-yr	327.00	400.80	404.69	404.12	405.15	3.04	123.60	134.86	0.70
Reach-1	14.82	10-yr	277.00	400.80	404.50	403.90	404.93	2.89	100.86	103.92	0.66
Reach-1	14.82	5-yr	229.00	400.80	404.31		404.67	2.66	86.15	48.64	0.62
Reach-1	14.82	2-yr	160.00	400.80	403.86		404.15	2.40	66.69	40.77	0.60
Reach-1	14.67	Reg	804.00	400.50	405.60		406.03	3.33	382.57	183.73	0.58
Reach-1	14.67	100-yr	432.00	400.50	404.77		405.08	2.68	237.85	168.26	0.53
Reach-1	14.67	50-yr	389.00	400.50	404.64		404.94	2.60	216.09	167.29	0.53
Reach-1	14.67	20-yr	327.00	400.50	404.44		404.72	2.48	183.04	165.80	0.52
Reach-1	14.67	10-yr	277.00	400.50	404.24		404.52	2.39	150.71	164.33	0.52
Reach-1	14.67	5-yr	229.00	400.50	404.02	403.10	404.28	2.30	113.38	162.62	0.53
Reach-1	14.67	2-yr	160.00	400.50	403.58		403.80	2.07	77.35	43.97	0.50
Reach-1	14.45	Reg	804.00	400.20	405.36		405.69	2.78	395.79	166.48	0.46
Reach-1	14.45	100-yr	432.00	400.20	404.61		404.79	2.01	277.38	146.42	0.37
Reach-1	14.45	50-yr	389.00	400.20	404.49		404.65	1.91	259.87	143.15	0.36
Reach-1	14.45	20-yr	327.00	400.20	404.30		404.44	1.75	233.97	138.18	0.34
Reach-1	14.45	10-yr	277.00	400.20	404.11		404.24	1.63	208.18	133.05	0.33
Reach-1	14.45	5-yr	229.00	400.20	403.88		403.99	1.53	177.64	127.07	0.32
Reach-1	14.45	2-yr	160.00	400.20	403.38		403.49	1.44	118.50	105.34	0.35
Reach-1	14.4	Reg	804.00	400.10	404.88	404.74	405.56	4.21	301.82	180.39	0.76
Reach-1	14.4	100-yr	432.00	400.10	404.01	404.01	404.66	3.81	158.93	145.94	0.79
Reach-1	14.4	50-yr	389.00	400.10	403.93	403.93	404.53	3.63	147.09	144.82	0.76
Reach-1	14.4	20-yr	327.00	400.10	403.72	403.72	404.32	3.53	117.40	142.48	0.77
Reach-1	14.4	10-yr	277.00	400.10	403.58	403.24	404.12	3.31	97.42	140.88	0.74
Reach-1	14.4	5-yr	229.00	400.10	403.46	402.97	403.89	2.92	83.81	67.52	0.67
Reach-1	14.4	2-yr	160.00	400.10	403.03		403.38	2.65	60.50	40.09	0.67
Reach-1	14.3	Reg	804.00	400.10	404.83		405.27	3.31	367.07	172.60	0.54
Reach-1	14.3	100-yr	432.00	400.10	404.08		404.35	2.45	244.78	153.08	0.44
Reach-1	14.3	50-yr	389.00	400.10	403.98		404.22	2.32	229.37	150.02	0.43
Reach-1	14.3	20-yr	327.00	400.10	403.82		404.02	2.10	206.35	142.95	0.40
Reach-1	14.3	10-yr	277.00	400.10	403.68		403.85	1.91	186.68	136.62	0.37
Reach-1	14.3	5-yr	229.00	400.10	403.53		403.67	1.72	166.10	129.66	0.34
Reach-1	14.3	2-yr	160.00	400.10	403.05		403.16	1.53	115.69	80.23	0.34

Proposed Conditions Hydraulic Modelling Summary**Option 1**

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	Vel Chnl	Flow Area	Top Width	Froude #
			(m3/s)	(m)	(m)	(m)	(m)	(m/s)	(m2)	(m)	
Reach-1	19.849	Reg	726.00	408.90	413.93	412.95	414.38	3.38	383.17	309.02	0.52
Reach-1	19.849	100-yr	391.80	408.90	413.55	411.84	413.76	2.20	294.48	291.15	0.35
Reach-1	19.849	50-yr	355.30	408.90	413.29	411.69	413.53	2.29	235.15	278.59	0.38
Reach-1	19.849	20-yr	319.80	408.90	412.63	411.57	413.02	2.77	117.47	123.90	0.51
Reach-1	19.849	10-yr	251.60	408.90	413.01	411.28	413.18	1.88	175.30	265.36	0.33
Reach-1	19.849	5-yr	218.80	408.90	412.76	411.13	412.92	1.82	122.50	127.69	0.33
Reach-1	19.849	2-yr	143.40	408.90	412.26	410.75	412.36	1.42	102.65	112.73	0.28
Reach-1	19.845	Bridge									
Reach-1	19.841	Reg	726.00	408.90	413.88	413.51	414.36	3.48	368.46	306.72	0.54
Reach-1	19.841	100-yr	391.80	408.90	413.02	411.84	413.44	2.93	174.97	265.77	0.51
Reach-1	19.841	50-yr	355.30	408.90	412.91	411.70	413.24	2.63	163.45	136.83	0.46
Reach-1	19.841	20-yr	319.80	408.90	412.31	411.56	412.81	3.14	101.82	114.34	0.61
Reach-1	19.841	10-yr	251.60	408.90	412.85	411.27	413.06	2.06	122.07	130.41	0.37
Reach-1	19.841	5-yr	218.80	408.90	412.68	411.12	412.87	1.89	115.89	125.51	0.34
Reach-1	19.841	2-yr	143.40	408.90	412.21	410.75	412.32	1.46	98.13	111.41	0.29
Reach-1	19.84	Reg	726.00	408.90	413.92	412.90	414.18	2.81	510.07	308.63	0.43
Reach-1	19.84	100-yr	391.80	408.90	413.05	411.84	413.30	2.44	259.15	267.24	0.42
Reach-1	19.84	50-yr	355.30	408.90	412.94	411.70	413.14	2.24	236.69	143.79	0.39
Reach-1	19.84	20-yr	319.80	408.90	411.56	411.56	412.53	4.35	73.52	76.57	1.00
Reach-1	19.84	10-yr	251.60	408.90	412.84	411.27	413.06	2.06	121.97	130.33	0.37
Reach-1	19.84	5-yr	218.80	408.90	412.68	411.12	412.86	1.89	115.81	125.44	0.34
Reach-1	19.84	2-yr	143.40	408.90	412.21	410.75	412.32	1.46	98.07	111.36	0.29
Reach-1	19.825	Reg	726.00	408.90	413.94	412.26	414.00	1.46	1011.10	439.14	0.22
Reach-1	19.825	100-yr	391.80	408.90	413.07	411.32	413.12	1.26	633.20	426.03	0.21
Reach-1	19.825	50-yr	355.30	408.90	412.95	411.20	413.00	1.24	582.53	424.25	0.21
Reach-1	19.825	20-yr	319.80	408.90	411.08	411.08	411.89	3.97	80.47	59.90	1.00
Reach-1	19.825	10-yr	251.60	408.90	412.84	410.83	412.96	1.49	168.53	422.65	0.26
Reach-1	19.825	5-yr	218.80	408.90	412.68	410.69	412.77	1.36	160.32	420.19	0.24
Reach-1	19.825	2-yr	143.40	408.90	412.21	410.35	412.26	1.05	136.77	413.13	0.20
Reach-1	19.100	Reg	726.00	408.20	413.40		413.48	1.60	837.70	433.46	0.27
Reach-1	19.100	100-yr	391.80	408.20	412.42		412.50	1.47	453.52	345.24	0.29
Reach-1	19.100	50-yr	355.30	408.20	412.25		412.34	1.48	398.10	330.39	0.30
Reach-1	19.100	20-yr	319.80	408.20	412.06		412.15	1.54	335.15	312.67	0.33
Reach-1	19.100	10-yr	251.60	408.20	411.85		411.93	1.42	271.98	292.34	0.32
Reach-1	19.100	5-yr	218.80	408.20	411.70		411.79	1.40	229.27	277.34	0.32
Reach-1	19.100	2-yr	143.40	408.20	411.42		411.48	1.17	158.37	232.01	0.29
Reach-1	18.355	Reg	738.00	407.10	412.62		412.87	2.26	372.22	139.71	0.38
Reach-1	18.355	100-yr	438.00	407.10	411.41		411.62	2.06	224.80	108.54	0.42
Reach-1	18.355	50-yr	381.00	407.10	411.20		411.40	1.97	202.79	105.10	0.42
Reach-1	18.355	20-yr	309.00	407.10	410.93		411.10	1.83	174.28	100.47	0.42
Reach-1	18.355	10-yr	256.00	407.10	410.70		410.85	1.72	152.21	96.73	0.42
Reach-1	18.355	5-yr	204.00	407.10	410.43		410.56	1.63	126.29	92.15	0.43

Proposed Conditions Hydraulic Modelling Summary**Option 1**

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	Vel Chnl	Flow Area	Top Width	Froude #
			(m3/s)	(m)	(m)	(m)	(m)	(m/s)	(m2)	(m)	
Reach-1	18.355	2-yr	133.00	407.10	409.98		410.10	1.53	87.02	84.11	0.48
Reach-1	18.135	Reg	738.00	406.60	412.46		412.70	2.53	455.79	160.51	0.38
Reach-1	18.135	100-yr	438.00	406.60	411.00		411.32	2.71	232.56	145.69	0.50
Reach-1	18.135	50-yr	381.00	406.60	410.76		411.08	2.67	197.81	138.48	0.52
Reach-1	18.135	20-yr	309.00	406.60	410.43		410.75	2.61	153.75	128.69	0.54
Reach-1	18.135	10-yr	256.00	406.60	410.16		410.48	2.54	120.66	120.83	0.56
Reach-1	18.135	5-yr	204.00	406.60	409.88		410.16	2.37	92.93	67.26	0.55
Reach-1	18.135	2-yr	133.00	406.60	409.41		409.63	2.07	65.56	50.02	0.54
Reach-1	17.83	Reg	738.00	406.00	412.13		412.45	2.61	335.97	103.66	0.39
Reach-1	17.83	100-yr	438.00	406.00	410.58		410.89	2.47	191.65	82.52	0.46
Reach-1	17.83	50-yr	381.00	406.00	410.33		410.61	2.36	171.40	77.98	0.46
Reach-1	17.83	20-yr	309.00	406.00	409.98		410.23	2.21	145.31	71.73	0.46
Reach-1	17.83	10-yr	256.00	406.00	409.70		409.92	2.09	125.40	66.94	0.46
Reach-1	17.83	5-yr	204.00	406.00	409.37		409.57	1.96	104.71	61.57	0.46
Reach-1	17.83	2-yr	133.00	406.00	408.83		409.00	1.80	73.72	51.46	0.48
Reach-1	17.58	Reg	738.00	405.00	411.88		412.23	3.09	387.88	116.58	0.42
Reach-1	17.58	100-yr	438.00	405.00	409.95		410.47	3.44	181.37	93.83	0.58
Reach-1	17.58	50-yr	381.00	405.00	409.68		410.18	3.33	156.75	87.30	0.58
Reach-1	17.58	20-yr	309.00	405.00	409.31		409.78	3.16	126.39	78.51	0.58
Reach-1	17.58	10-yr	256.00	405.00	409.03		409.46	2.97	105.28	71.76	0.58
Reach-1	17.58	5-yr	204.00	405.00	408.73		409.10	2.73	85.28	60.48	0.56
Reach-1	17.58	2-yr	133.00	405.00	408.23		408.50	2.30	59.94	41.02	0.53
Reach-1	17.36	Reg	738.00	405.40	411.89		412.06	2.05	574.50	169.53	0.27
Reach-1	17.36	100-yr	438.00	405.40	409.92		410.15	2.20	267.38	137.43	0.35
Reach-1	17.36	50-yr	381.00	405.40	409.65		409.85	2.09	232.26	117.89	0.34
Reach-1	17.36	20-yr	309.00	405.40	409.28		409.46	1.91	193.94	91.95	0.33
Reach-1	17.36	10-yr	256.00	405.40	409.00		409.15	1.73	171.23	72.32	0.31
Reach-1	17.36	5-yr	204.00	405.40	408.70		408.81	1.54	149.69	68.53	0.29
Reach-1	17.36	2-yr	133.00	405.40	408.18		408.26	1.25	115.82	62.59	0.26
Reach-1	17.30	Reg	738.00	405.30	411.85		412.01	2.05	574.17	178.70	0.28
Reach-1	17.30	100-yr	438.00	405.30	409.72		410.02	2.52	228.53	137.04	0.44
Reach-1	17.30	50-yr	381.00	405.30	409.42		409.72	2.49	189.35	122.83	0.46
Reach-1	17.30	20-yr	309.00	405.30	409.05		409.32	2.35	150.27	91.20	0.46
Reach-1	17.30	10-yr	256.00	405.30	408.78		409.02	2.21	127.19	79.60	0.46
Reach-1	17.30	5-yr	204.00	405.30	408.49		408.69	2.03	105.70	68.27	0.45
Reach-1	17.30	2-yr	133.00	405.30	407.99		408.15	1.75	76.43	51.20	0.44
Reach-1	17.225	Reg	741.00	405.10	411.85		411.97	1.70	671.08	219.99	0.24
Reach-1	17.225	100-yr	438.00	405.10	409.71		409.91	2.08	277.53	151.86	0.38
Reach-1	17.225	50-yr	381.00	405.10	409.40		409.60	2.08	231.33	141.73	0.40
Reach-1	17.225	20-yr	309.00	405.10	408.99		409.20	2.06	176.75	128.54	0.43
Reach-1	17.225	10-yr	256.00	405.10	408.70		408.90	1.99	142.11	108.31	0.44
Reach-1	17.225	5-yr	204.00	405.10	408.39		408.58	1.90	112.10	85.77	0.45
Reach-1	17.225	2-yr	133.00	405.10	407.88		408.03	1.72	77.44	54.71	0.46

Proposed Conditions Hydraulic Modelling Summary**Option 1**

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	Vel Chnl	Flow Area	Top Width	Froude #
			(m3/s)	(m)	(m)	(m)	(m)	(m/s)	(m2)	(m)	
Reach-1	17.199	Reg	741.00	404.98	411.45	409.14	411.86	2.88	290.36	142.07	0.40
Reach-1	17.199	100-yr	438.00	404.98	409.41	408.26	409.82	2.84	155.40	53.18	0.51
Reach-1	17.199	50-yr	381.00	404.98	409.15	408.06	409.52	2.69	142.50	51.71	0.50
Reach-1	17.199	20-yr	309.00	404.98	408.83	407.76	409.14	2.46	126.22	50.39	0.49
Reach-1	17.199	10-yr	256.00	404.98	408.59	407.53	408.85	2.24	114.26	49.54	0.47
Reach-1	17.199	5-yr	204.00	404.98	408.33	407.24	408.54	2.02	101.25	48.31	0.44
Reach-1	17.199	2-yr	133.00	404.98	407.85	406.73	407.99	1.69	78.81	44.47	0.40
Reach-1	17.195		Bosworth Bridge		Wellington Road 7						
Reach-1	17.191	Reg	741.00	405.11	409.82	409.25	410.81	4.40	170.37	54.38	0.76
Reach-1	17.191	100-yr	438.00	405.11	409.14	408.40	409.68	3.25	135.51	51.78	0.63
Reach-1	17.191	50-yr	381.00	405.11	408.96	408.21	409.43	3.02	126.64	51.11	0.60
Reach-1	17.191	20-yr	309.00	405.11	408.67	407.92	409.06	2.77	111.75	49.99	0.59
Reach-1	17.191	10-yr	256.00	405.11	408.45	407.67	408.78	2.54	100.90	49.06	0.56
Reach-1	17.191	5-yr	204.00	405.11	408.20	407.34	408.47	2.29	89.08	47.65	0.53
Reach-1	17.191	2-yr	133.00	405.11	407.75	406.89	407.94	1.94	68.39	42.25	0.49
Reach-1	17.14	Reg	741.00	405.10	409.93		410.06	2.11	630.80	289.03	0.36
Reach-1	17.14	100-yr	438.00	405.10	409.16		409.29	1.92	412.41	278.77	0.36
Reach-1	17.14	50-yr	381.00	405.10	408.97		409.10	1.90	359.50	275.57	0.37
Reach-1	17.14	20-yr	309.00	405.10	408.65		408.80	1.95	272.58	264.85	0.40
Reach-1	17.14	10-yr	256.00	405.10	408.41		408.58	1.97	210.25	256.88	0.42
Reach-1	17.14	5-yr	204.00	405.10	408.14		408.33	1.98	143.38	248.06	0.45
Reach-1	17.14	2-yr	133.00	405.10	407.68		407.83	1.74	83.33	72.43	0.44
Reach-1	16.76	Reg	741.00	404.00	409.24		409.68	3.53	394.51	218.43	0.56
Reach-1	16.76	100-yr	438.00	404.00	408.29	407.79	408.80	3.44	202.04	172.23	0.62
Reach-1	16.76	50-yr	381.00	404.00	408.09	407.57	408.59	3.32	169.83	151.58	0.62
Reach-1	16.76	20-yr	309.00	404.00	407.85		408.25	2.96	141.23	100.90	0.58
Reach-1	16.76	10-yr	256.00	404.00	407.63		407.99	2.74	120.61	91.52	0.56
Reach-1	16.76	5-yr	204.00	404.00	407.40		407.70	2.48	100.64	81.42	0.53
Reach-1	16.76	2-yr	133.00	404.00	406.98		407.20	2.08	70.22	62.80	0.50
Reach-1	16.575	Reg	741.00	403.50	409.16		409.38	2.46	491.34	221.37	0.40
Reach-1	16.575	100-yr	438.00	403.50	408.20		408.41	2.24	291.47	185.31	0.42
Reach-1	16.575	50-yr	381.00	403.50	407.99		408.19	2.16	254.53	169.47	0.42
Reach-1	16.575	20-yr	309.00	403.50	407.70		407.88	2.05	207.03	153.28	0.43
Reach-1	16.575	10-yr	256.00	403.50	407.45		407.63	1.97	170.72	139.65	0.43
Reach-1	16.575	5-yr	204.00	403.50	407.18		407.35	1.87	135.70	125.10	0.44
Reach-1	16.575	2-yr	133.00	403.50	406.74		406.88	1.68	87.60	84.74	0.42
Reach-1	16.37	Reg	741.00	403.20	408.92		409.18	2.65	423.41	159.64	0.43
Reach-1	16.37	100-yr	438.00	403.20	407.96		408.18	2.30	278.85	144.13	0.43
Reach-1	16.37	50-yr	381.00	403.20	407.75		407.95	2.21	248.72	138.95	0.43
Reach-1	16.37	20-yr	309.00	403.20	407.45		407.63	2.11	207.42	131.52	0.43
Reach-1	16.37	10-yr	256.00	403.20	407.18		407.36	2.04	172.75	124.94	0.44
Reach-1	16.37	5-yr	204.00	403.20	406.87		407.05	1.98	135.94	119.23	0.45

Proposed Conditions Hydraulic Modelling Summary**Option 1**

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
Reach-1	16.37	2-yr	133.00	403.20	406.36		406.55	1.90	77.98	95.58	0.49
Reach-1	16.25	Reg	741.00	403.10	408.78		409.07	2.67	440.11	185.66	0.39
Reach-1	16.25	100-yr	438.00	403.10	407.88		408.07	2.09	297.60	133.67	0.33
Reach-1	16.25	50-yr	381.00	403.10	407.68		407.85	1.95	271.21	127.10	0.32
Reach-1	16.25	20-yr	309.00	403.10	407.39		407.53	1.76	235.62	117.65	0.30
Reach-1	16.25	10-yr	256.00	403.10	407.13		407.25	1.61	206.27	109.24	0.29
Reach-1	16.25	5-yr	204.00	403.10	406.84		406.94	1.45	176.24	99.34	0.27
Reach-1	16.25	2-yr	133.00	403.10	406.36		406.43	1.17	132.50	81.97	0.24
Reach-1	16.16	Reg	741.00	403.00	407.97	407.78	408.88	4.68	254.36	142.48	0.75
Reach-1	16.16	100-yr	438.00	403.00	407.39		407.94	3.50	180.27	113.54	0.60
Reach-1	16.16	50-yr	381.00	403.00	407.26		407.73	3.22	165.34	106.77	0.57
Reach-1	16.16	20-yr	309.00	403.00	407.04		407.43	2.87	143.74	96.12	0.52
Reach-1	16.16	10-yr	256.00	403.00	406.83		407.16	2.61	124.78	85.69	0.49
Reach-1	16.16	5-yr	204.00	403.00	406.60		406.86	2.31	106.15	74.03	0.46
Reach-1	16.16	2-yr	133.00	403.00	406.20		406.36	1.82	80.40	53.91	0.39
Reach-1	16.1	Reg	741.00	402.90	407.70	407.70	408.66	4.70	228.89	139.33	0.84
Reach-1	16.1	100-yr	438.00	402.90	407.15	406.90	407.77	3.63	158.49	120.35	0.72
Reach-1	16.1	50-yr	381.00	402.90	407.04	406.66	407.58	3.36	145.30	116.45	0.68
Reach-1	16.1	20-yr	309.00	402.90	406.85	406.34	407.29	3.02	123.76	103.83	0.63
Reach-1	16.1	10-yr	256.00	402.90	406.64		407.03	2.81	103.70	88.61	0.62
Reach-1	16.1	5-yr	204.00	402.90	406.42		406.74	2.53	86.10	72.68	0.59
Reach-1	16.1	2-yr	133.00	402.90	406.05		406.27	2.08	64.12	45.54	0.54
Reach-1	15.98	Reg	741.00	402.80	407.37	407.19	408.05	3.89	275.52	222.00	0.76
Reach-1	15.98	100-yr	438.00	402.80	407.00	406.42	407.37	2.81	202.05	162.52	0.59
Reach-1	15.98	50-yr	381.00	402.80	406.90		407.21	2.58	186.77	151.93	0.55
Reach-1	15.98	20-yr	309.00	402.80	406.70	406.03	406.96	2.34	158.52	130.10	0.53
Reach-1	15.98	10-yr	256.00	402.80	406.46		406.70	2.23	130.59	105.99	0.53
Reach-1	15.98	5-yr	204.00	402.80	406.20		406.42	2.11	105.40	89.77	0.55
Reach-1	15.98	2-yr	133.00	402.80	405.78		405.97	1.92	72.66	67.81	0.56
Reach-1	15.85	Reg	741.00	402.60	407.17		407.61	3.56	401.60	294.61	0.64
Reach-1	15.85	100-yr	438.00	402.60	406.46	406.46	406.99	3.50	203.83	258.09	0.71
Reach-1	15.85	50-yr	381.00	402.60	406.30	406.30	406.84	3.45	164.23	235.48	0.73
Reach-1	15.85	20-yr	309.00	402.60	405.92	405.79	406.55	3.57	100.61	81.44	0.82
Reach-1	15.85	10-yr	256.00	402.60	405.78	405.54	406.30	3.25	88.99	74.44	0.77
Reach-1	15.85	5-yr	204.00	402.60	405.63		406.03	2.84	78.73	67.65	0.69
Reach-1	15.85	2-yr	133.00	402.60	405.39		405.63	2.17	63.97	56.47	0.56
Reach-1	15.685	Reg	749.00	402.40	407.33		407.37	1.35	1180.91	579.41	0.23
Reach-1	15.685	100-yr	432.00	402.40	406.63		406.66	1.15	804.04	503.08	0.22
Reach-1	15.685	50-yr	389.00	402.40	406.44		406.47	1.18	708.00	483.62	0.23
Reach-1	15.685	20-yr	327.00	402.40	406.17		406.21	1.19	584.48	457.36	0.24
Reach-1	15.685	10-yr	277.00	402.40	405.93		405.97	1.24	475.50	433.45	0.26
Reach-1	15.685	5-yr	229.00	402.40	405.68		405.73	1.33	368.85	410.19	0.29
Reach-1	15.685	2-yr	160.00	402.40	405.29		405.37	1.47	218.65	358.55	0.34

Proposed Conditions Hydraulic Modelling Summary**Option 1**

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	Vel Chnl	Flow Area	Top Width	Froude #
			(m3/s)	(m)	(m)	(m)	(m)	(m/s)	(m2)	(m)	
Reach-1	15.38	Reg	749.00	401.90	407.10		407.23	1.74	610.98	339.81	0.31
Reach-1	15.38	100-yr	432.00	401.90	406.45		406.54	1.37	405.88	287.68	0.28
Reach-1	15.38	50-yr	389.00	401.90	406.24		406.33	1.39	346.26	268.83	0.29
Reach-1	15.38	20-yr	327.00	401.90	405.95		406.04	1.38	273.25	238.10	0.31
Reach-1	15.38	10-yr	277.00	401.90	405.68		405.77	1.38	215.36	182.17	0.33
Reach-1	15.38	5-yr	229.00	401.90	405.39		405.48	1.38	170.13	139.29	0.37
Reach-1	15.38	2-yr	160.00	401.90	404.89		405.00	1.47	109.10	106.89	0.46
Reach-1	15.285	Reg	749.00	402.00	407.02	405.90	407.16	2.08	674.95	348.95	0.36
Reach-1	15.285	100-yr	432.00	402.00	406.38	404.94	406.48	1.65	469.35	298.87	0.31
Reach-1	15.285	50-yr	389.00	402.00	406.16	404.79	406.26	1.69	403.00	281.73	0.33
Reach-1	15.285	20-yr	327.00	402.00	405.56	404.54	405.88	2.50	130.54	221.33	0.52
Reach-1	15.285	10-yr	277.00	402.00	405.32	404.33	405.60	2.35	117.78	190.23	0.50
Reach-1	15.285	5-yr	229.00	402.00	405.07	404.10	405.31	2.19	104.56	154.62	0.49
Reach-1	15.285	2-yr	160.00	402.00	404.63	403.75	404.82	1.93	83.11	105.76	0.46
Reach-1	15.264	Reg	749.00	402.00	406.91	406.13	407.13	2.53	620.08	534.67	0.40
Reach-1	15.264	100-yr	432.00	402.00	405.90	404.90	406.36	3.01	145.51	336.99	0.55
Reach-1	15.264	50-yr	389.00	402.00	405.74	404.76	406.15	2.86	137.71	292.63	0.53
Reach-1	15.264	20-yr	327.00	402.00	405.48	404.54	405.83	2.64	125.11	208.97	0.52
Reach-1	15.264	10-yr	277.00	402.00	405.26	404.34	405.56	2.44	114.78	176.74	0.50
Reach-1	15.264	5-yr	229.00	402.00	405.02	404.11	405.28	2.24	103.19	140.58	0.48
Reach-1	15.264	2-yr	160.00	402.00	404.59	403.75	404.78	1.95	82.14	48.67	0.47
Reach-1	15.26		Bridge								
Reach-1	15.256	Reg	749.00	402.00	406.83	406.13	407.07	2.65	588.16	529.71	0.42
Reach-1	15.256	100-yr	432.00	402.00	405.94	404.89	406.22	2.55	294.59	348.64	0.46
Reach-1	15.256	50-yr	389.00	402.00	405.72	404.76	406.03	2.60	233.63	288.35	0.49
Reach-1	15.256	20-yr	327.00	402.00	405.36	404.53	405.76	2.77	117.92	191.88	0.56
Reach-1	15.256	10-yr	277.00	402.00	405.17	404.33	405.50	2.54	109.01	162.92	0.53
Reach-1	15.256	5-yr	229.00	402.00	404.95	404.11	405.22	2.32	98.64	54.22	0.51
Reach-1	15.256	2-yr	160.00	402.00	404.53	403.75	404.73	2.02	79.05	47.78	0.49
Reach-1	15.24	Reg	749.00	402.00	406.85	406.15	407.00	2.18	765.27	530.93	0.36
Reach-1	15.24	100-yr	432.00	402.00	405.66	404.94	406.14	3.07	140.79	261.47	0.61
Reach-1	15.24	50-yr	389.00	402.00	405.54	404.78	405.97	2.90	134.27	225.31	0.59
Reach-1	15.24	20-yr	327.00	402.00	405.35	404.54	405.70	2.65	123.48	189.24	0.56
Reach-1	15.24	10-yr	277.00	402.00	405.15	404.31	405.46	2.46	112.72	159.70	0.55
Reach-1	15.24	5-yr	229.00	402.00	404.92	404.09	405.19	2.28	100.25	53.84	0.53
Reach-1	15.24	2-yr	160.00	402.00	404.49	403.73	404.71	2.04	78.54	47.41	0.51
Reach-1	15.07	Reg	804.00	401.30	406.67		406.87	2.12	485.04	322.52	0.35
Reach-1	15.07	100-yr	432.00	401.30	405.72		405.84	1.63	310.77	153.61	0.32
Reach-1	15.07	50-yr	389.00	401.30	405.57		405.69	1.57	288.58	151.87	0.31
Reach-1	15.07	20-yr	327.00	401.30	405.34		405.44	1.48	253.32	149.05	0.31
Reach-1	15.07	10-yr	277.00	401.30	405.11		405.21	1.42	219.25	146.29	0.31
Reach-1	15.07	5-yr	229.00	401.30	404.84		404.94	1.37	181.94	134.51	0.32

Proposed Conditions Hydraulic Modelling Summary**Option 1**

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	Vel Chnl	Flow Area	Top Width	Froude #
			(m3/s)	(m)	(m)	(m)	(m)	(m/s)	(m2)	(m)	
Reach-1	15.07	2-yr	160.00	401.30	404.35		404.44	1.32	123.56	102.63	0.35
Reach-1	14.93	Reg	804.00	401.00	406.21	405.11	406.70	3.29	384.15	285.73	0.52
Reach-1	14.93	100-yr	432.00	401.00	405.50		405.73	2.22	251.16	134.48	0.39
Reach-1	14.93	50-yr	389.00	401.00	405.37		405.58	2.10	234.46	128.98	0.38
Reach-1	14.93	20-yr	327.00	401.00	405.16		405.34	1.92	208.55	119.95	0.35
Reach-1	14.93	10-yr	277.00	401.00	404.95		405.10	1.78	183.88	111.55	0.34
Reach-1	14.93	5-yr	229.00	401.00	404.70		404.83	1.65	156.82	104.80	0.33
Reach-1	14.93	2-yr	160.00	401.00	404.21		404.32	1.46	111.62	72.95	0.33
Reach-1	14.82	Reg	804.00	400.80	405.83	405.60	406.46	3.86	334.99	222.57	0.71
Reach-1	14.82	100-yr	432.00	400.80	404.99	404.77	405.52	3.34	169.15	168.64	0.72
Reach-1	14.82	50-yr	389.00	400.80	404.87	404.60	405.38	3.23	149.79	155.19	0.71
Reach-1	14.82	20-yr	327.00	400.80	404.69	404.12	405.15	3.04	123.60	134.86	0.70
Reach-1	14.82	10-yr	277.00	400.80	404.50	403.90	404.93	2.89	100.86	103.92	0.66
Reach-1	14.82	5-yr	229.00	400.80	404.31		404.67	2.66	86.15	48.64	0.62
Reach-1	14.82	2-yr	160.00	400.80	403.86		404.15	2.40	66.69	40.77	0.60
Reach-1	14.67	Reg	804.00	400.50	405.60		406.03	3.33	382.57	183.73	0.58
Reach-1	14.67	100-yr	432.00	400.50	404.77		405.08	2.68	237.85	168.26	0.53
Reach-1	14.67	50-yr	389.00	400.50	404.64		404.94	2.60	216.09	167.29	0.53
Reach-1	14.67	20-yr	327.00	400.50	404.44		404.72	2.48	183.04	165.80	0.52
Reach-1	14.67	10-yr	277.00	400.50	404.24		404.52	2.39	150.71	164.33	0.52
Reach-1	14.67	5-yr	229.00	400.50	404.02	403.10	404.28	2.30	113.38	162.62	0.53
Reach-1	14.67	2-yr	160.00	400.50	403.58		403.80	2.07	77.35	43.97	0.50
Reach-1	14.45	Reg	804.00	400.20	405.36		405.69	2.78	395.79	166.48	0.46
Reach-1	14.45	100-yr	432.00	400.20	404.61		404.79	2.01	277.38	146.42	0.37
Reach-1	14.45	50-yr	389.00	400.20	404.49		404.65	1.91	259.87	143.15	0.36
Reach-1	14.45	20-yr	327.00	400.20	404.30		404.44	1.75	233.97	138.18	0.34
Reach-1	14.45	10-yr	277.00	400.20	404.11		404.24	1.63	208.18	133.05	0.33
Reach-1	14.45	5-yr	229.00	400.20	403.88		403.99	1.53	177.64	127.07	0.32
Reach-1	14.45	2-yr	160.00	400.20	403.38		403.49	1.44	118.50	105.34	0.35
Reach-1	14.4	Reg	804.00	400.10	404.88	404.74	405.56	4.21	301.82	180.39	0.76
Reach-1	14.4	100-yr	432.00	400.10	404.01	404.01	404.66	3.81	158.93	145.94	0.79
Reach-1	14.4	50-yr	389.00	400.10	403.93	403.93	404.53	3.63	147.09	144.82	0.76
Reach-1	14.4	20-yr	327.00	400.10	403.72	403.72	404.32	3.53	117.40	142.48	0.77
Reach-1	14.4	10-yr	277.00	400.10	403.58	403.24	404.12	3.31	97.42	140.88	0.74
Reach-1	14.4	5-yr	229.00	400.10	403.46	402.97	403.89	2.92	83.81	67.52	0.67
Reach-1	14.4	2-yr	160.00	400.10	403.03		403.38	2.65	60.50	40.09	0.67
Reach-1	14.3	Reg	804.00	400.10	404.83		405.27	3.31	367.07	172.60	0.54
Reach-1	14.3	100-yr	432.00	400.10	404.08		404.35	2.45	244.78	153.08	0.44
Reach-1	14.3	50-yr	389.00	400.10	403.98		404.22	2.32	229.37	150.02	0.43
Reach-1	14.3	20-yr	327.00	400.10	403.82		404.02	2.10	206.35	142.95	0.40
Reach-1	14.3	10-yr	277.00	400.10	403.68		403.85	1.91	186.68	136.62	0.37
Reach-1	14.3	5-yr	229.00	400.10	403.53		403.67	1.72	166.10	129.66	0.34
Reach-1	14.3	2-yr	160.00	400.10	403.05		403.16	1.53	115.69	80.23	0.34

Wellington Road 7, Bosworth Bridge Replacement
Proposed Conditions Hydraulic Modelling Summary

Option 2

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
Reach-1	19.849	Reg	726.00	408.90	413.94	412.95	414.39	3.35	387.55	309.88	0.51
Reach-1	19.849	100-yr	391.80	408.90	413.55	411.84	413.76	2.20	294.64	291.18	0.35
Reach-1	19.849	50-yr	355.30	408.90	413.29	411.70	413.53	2.29	235.24	278.61	0.38
Reach-1	19.849	20-yr	319.80	408.90	412.63	411.56	413.02	2.77	117.60	124.00	0.51
Reach-1	19.849	10-yr	251.60	408.90	413.01	411.28	413.18	1.88	175.33	265.37	0.33
Reach-1	19.849	5-yr	218.80	408.90	412.76	411.13	412.92	1.82	122.49	127.69	0.33
Reach-1	19.849	2-yr	143.40	408.90	412.26	410.75	412.36	1.42	102.65	112.73	0.28
Reach-1	19.845	Bridge									
Reach-1	19.841	Reg	726.00	408.90	413.90	413.51	414.37	3.45	373.23	307.66	0.53
Reach-1	19.841	100-yr	391.80	408.90	413.02	411.84	413.44	2.93	174.97	265.77	0.51
Reach-1	19.841	50-yr	355.30	408.90	412.91	411.70	413.24	2.63	163.44	136.79	0.46
Reach-1	19.841	20-yr	319.80	408.90	412.32	411.56	412.82	3.13	102.22	114.65	0.61
Reach-1	19.841	10-yr	251.60	408.90	412.85	411.27	413.06	2.06	122.07	130.41	0.37
Reach-1	19.841	5-yr	218.80	408.90	412.68	411.12	412.87	1.89	115.89	125.51	0.34
Reach-1	19.841	2-yr	143.40	408.90	412.21	410.75	412.32	1.46	98.13	111.41	0.29
Reach-1	19.84	Reg	726.00	408.90	413.94	412.90	414.20	2.78	515.93	309.53	0.43
Reach-1	19.84	100-yr	391.80	408.90	413.05	411.84	413.30	2.44	259.16	267.24	0.42
Reach-1	19.84	50-yr	355.30	408.90	412.94	411.70	413.14	2.24	236.68	143.77	0.39
Reach-1	19.84	20-yr	319.80	408.90	411.56	411.56	412.53	4.36	73.28	76.17	1.00
Reach-1	19.84	10-yr	251.60	408.90	412.84	411.27	413.06	2.06	121.97	130.33	0.37
Reach-1	19.84	5-yr	218.80	408.90	412.68	411.12	412.86	1.89	115.80	125.44	0.34
Reach-1	19.84	2-yr	143.40	408.90	412.21	410.75	412.32	1.46	98.07	111.36	0.29
Reach-1	19.825	Reg	726.00	408.90	413.96	412.26	414.02	1.44	1019.19	439.41	0.22
Reach-1	19.825	100-yr	391.80	408.90	413.07	411.32	413.12	1.26	633.23	426.03	0.21
Reach-1	19.825	50-yr	355.30	408.90	412.95	411.20	413.00	1.24	582.53	424.25	0.21
Reach-1	19.825	20-yr	319.80	408.90	411.09	411.09	411.89	3.96	80.70	60.46	1.00
Reach-1	19.825	10-yr	251.60	408.90	412.84	410.83	412.96	1.49	168.53	422.65	0.26
Reach-1	19.825	5-yr	218.80	408.90	412.68	410.69	412.77	1.36	160.32	420.19	0.24
Reach-1	19.825	2-yr	143.40	408.90	412.21	410.35	412.26	1.05	136.77	413.13	0.20
Reach-1	19.100	Reg	726.00	408.20	413.44		413.52	1.57	854.70	436.72	0.26
Reach-1	19.100	100-yr	391.80	408.20	412.42		412.50	1.47	453.59	345.26	0.29
Reach-1	19.100	50-yr	355.30	408.20	412.25		412.34	1.48	398.11	330.40	0.30
Reach-1	19.100	20-yr	319.80	408.20	412.06		412.15	1.54	335.12	312.66	0.33
Reach-1	19.100	10-yr	251.60	408.20	411.85		411.93	1.42	271.98	292.34	0.32
Reach-1	19.100	5-yr	218.80	408.20	411.70		411.79	1.40	229.25	277.34	0.32
Reach-1	19.100	2-yr	143.40	408.20	411.42		411.48	1.17	158.36	232.01	0.29
Reach-1	18.355	Reg	738.00	407.10	412.72		412.95	2.20	385.39	142.90	0.36
Reach-1	18.355	100-yr	438.00	407.10	411.41		411.63	2.06	225.05	108.58	0.42
Reach-1	18.355	50-yr	381.00	407.10	411.21		411.40	1.97	203.01	105.13	0.42
Reach-1	18.355	20-yr	309.00	407.10	410.93		411.10	1.83	174.37	100.48	0.42
Reach-1	18.355	10-yr	256.00	407.10	410.70		410.85	1.72	152.24	96.73	0.42
Reach-1	18.355	5-yr	204.00	407.10	410.43		410.56	1.63	126.31	92.15	0.43

Wellington Road 7, Bosworth Bridge Replacement
Proposed Conditions Hydraulic Modelling Summary

Option 2

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
Reach-1	18.355	2-yr	133.00	407.10	409.98		410.10	1.53	87.03	84.12	0.48
Reach-1	18.135	Reg	738.00	406.60	412.57		412.79	2.44	473.82	161.65	0.37
Reach-1	18.135	100-yr	438.00	406.60	411.01		411.33	2.71	233.40	145.75	0.50
Reach-1	18.135	50-yr	381.00	406.60	410.76		411.08	2.67	198.63	138.65	0.52
Reach-1	18.135	20-yr	309.00	406.60	410.43		410.75	2.60	154.12	128.78	0.54
Reach-1	18.135	10-yr	256.00	406.60	410.16		410.48	2.53	120.78	120.86	0.56
Reach-1	18.135	5-yr	204.00	406.60	409.88		410.16	2.37	92.94	67.27	0.55
Reach-1	18.135	2-yr	133.00	406.60	409.41		409.63	2.07	65.56	50.01	0.54
Reach-1	17.83	Reg	738.00	406.00	412.27		412.57	2.52	350.83	106.63	0.37
Reach-1	17.83	100-yr	438.00	406.00	410.59		410.90	2.46	192.50	82.71	0.45
Reach-1	17.83	50-yr	381.00	406.00	410.34		410.62	2.35	172.31	78.19	0.45
Reach-1	17.83	20-yr	309.00	406.00	409.99		410.24	2.20	145.79	71.84	0.45
Reach-1	17.83	10-yr	256.00	406.00	409.70		409.92	2.09	125.60	66.99	0.46
Reach-1	17.83	5-yr	204.00	406.00	409.38		409.57	1.96	104.79	61.59	0.46
Reach-1	17.83	2-yr	133.00	406.00	408.83		409.00	1.80	73.70	51.46	0.48
Reach-1	17.58	Reg	738.00	405.00	412.06		412.38	2.95	408.83	118.89	0.39
Reach-1	17.58	100-yr	438.00	405.00	409.98		410.49	3.40	184.42	94.60	0.57
Reach-1	17.58	50-yr	381.00	405.00	409.72		410.21	3.28	160.37	88.29	0.57
Reach-1	17.58	20-yr	309.00	405.00	409.34		409.80	3.12	128.57	79.17	0.57
Reach-1	17.58	10-yr	256.00	405.00	409.05		409.47	2.95	106.27	72.10	0.57
Reach-1	17.58	5-yr	204.00	405.00	408.74		409.10	2.73	85.59	60.68	0.56
Reach-1	17.58	2-yr	133.00	405.00	408.23		408.50	2.30	59.87	40.94	0.53
Reach-1	17.36	Reg	738.00	405.40	412.07		412.22	1.96	605.17	172.78	0.25
Reach-1	17.36	100-yr	438.00	405.40	409.96		410.17	2.18	272.14	139.87	0.34
Reach-1	17.36	50-yr	381.00	405.40	409.69		409.89	2.06	237.48	120.99	0.34
Reach-1	17.36	20-yr	309.00	405.40	409.31		409.48	1.89	196.64	94.01	0.32
Reach-1	17.36	10-yr	256.00	405.40	409.02		409.16	1.72	172.29	73.34	0.31
Reach-1	17.36	5-yr	204.00	405.40	408.70		408.82	1.54	150.09	68.59	0.29
Reach-1	17.36	2-yr	133.00	405.40	408.18		408.26	1.25	115.70	62.56	0.26
Reach-1	17.30	Reg	738.00	405.30	412.03		412.18	1.95	607.81	184.58	0.26
Reach-1	17.30	100-yr	438.00	405.30	409.77		410.05	2.47	235.10	139.28	0.43
Reach-1	17.30	50-yr	381.00	405.30	409.48		409.76	2.42	197.23	125.82	0.44
Reach-1	17.30	20-yr	309.00	405.30	409.09		409.35	2.31	154.08	93.67	0.45
Reach-1	17.30	10-yr	256.00	405.30	408.80		409.04	2.18	128.86	80.41	0.45
Reach-1	17.30	5-yr	204.00	405.30	408.49		408.70	2.02	106.25	68.58	0.45
Reach-1	17.30	2-yr	133.00	405.30	407.99		408.15	1.75	76.28	51.14	0.44
Reach-1	17.225	Reg	741.00	405.10	412.04		412.14	1.62	712.63	224.83	0.22
Reach-1	17.225	100-yr	438.00	405.10	409.76		409.95	2.04	285.07	153.45	0.37
Reach-1	17.225	50-yr	381.00	405.10	409.47		409.66	2.02	241.05	143.92	0.38
Reach-1	17.225	20-yr	309.00	405.10	409.04		409.24	2.01	183.01	130.30	0.41
Reach-1	17.225	10-yr	256.00	405.10	408.73		408.92	1.97	144.89	110.07	0.43
Reach-1	17.225	5-yr	204.00	405.10	408.40		408.58	1.89	112.96	86.53	0.45
Reach-1	17.225	2-yr	133.00	405.10	407.87		408.03	1.72	77.23	54.66	0.46

Wellington Road 7, Bosworth Bridge Replacement
Proposed Conditions Hydraulic Modelling Summary

Option 2

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
Reach-1	17.199	Reg	741.00	404.98	411.67	409.16	412.05	2.74	314.81	178.01	0.39
Reach-1	17.199	100-yr	438.00	404.98	409.40	408.24	409.85	2.97	147.44	48.89	0.53
Reach-1	17.199	50-yr	381.00	404.98	409.18	408.03	409.57	2.77	137.45	48.06	0.51
Reach-1	17.199	20-yr	309.00	404.98	408.85	407.75	409.17	2.52	122.61	46.90	0.49
Reach-1	17.199	10-yr	256.00	404.98	408.60	407.52	408.87	2.30	111.30	46.11	0.47
Reach-1	17.199	5-yr	204.00	404.98	408.32	407.25	408.54	2.06	99.18	45.09	0.44
Reach-1	17.199	2-yr	133.00	404.98	407.84	406.73	407.99	1.70	78.17	42.40	0.40
Reach-1	17.195		Bosworth Bridge		Wellington Road 7						
Reach-1	17.191	Reg	741.00	405.11	409.80	409.29	410.90	4.64	159.62	48.82	0.79
Reach-1	17.191	100-yr	438.00	405.11	409.13	408.38	409.71	3.39	129.33	47.38	0.64
Reach-1	17.191	50-yr	381.00	405.11	408.96	408.19	409.46	3.13	121.56	47.00	0.61
Reach-1	17.191	20-yr	309.00	405.11	408.66	407.90	409.08	2.85	108.40	46.35	0.59
Reach-1	17.191	10-yr	256.00	405.11	408.45	407.66	408.79	2.60	98.62	45.86	0.56
Reach-1	17.191	5-yr	204.00	405.11	408.20	407.34	408.48	2.33	87.73	44.66	0.53
Reach-1	17.191	2-yr	133.00	405.11	407.75	406.89	407.94	1.95	68.21	41.01	0.48
Reach-1	17.14	Reg	741.00	405.10	409.93		410.06	2.11	630.89	289.03	0.36
Reach-1	17.14	100-yr	438.00	405.10	409.16		409.29	1.92	412.47	278.77	0.36
Reach-1	17.14	50-yr	381.00	405.10	408.97		409.10	1.90	359.56	275.58	0.37
Reach-1	17.14	20-yr	309.00	405.10	408.65		408.80	1.95	272.64	264.86	0.40
Reach-1	17.14	10-yr	256.00	405.10	408.41		408.58	1.97	210.29	256.89	0.42
Reach-1	17.14	5-yr	204.00	405.10	408.14		408.33	1.98	143.40	248.06	0.45
Reach-1	17.14	2-yr	133.00	405.10	407.68		407.83	1.74	83.33	72.43	0.44
Reach-1	16.76	Reg	741.00	404.00	409.24		409.68	3.53	394.56	218.44	0.56
Reach-1	16.76	100-yr	438.00	404.00	408.29	407.79	408.80	3.44	202.03	172.22	0.62
Reach-1	16.76	50-yr	381.00	404.00	408.09	407.57	408.59	3.32	169.80	151.56	0.62
Reach-1	16.76	20-yr	309.00	404.00	407.85		408.25	2.96	141.23	100.90	0.58
Reach-1	16.76	10-yr	256.00	404.00	407.63		407.99	2.74	120.61	91.52	0.56
Reach-1	16.76	5-yr	204.00	404.00	407.40		407.70	2.48	100.64	81.41	0.53
Reach-1	16.76	2-yr	133.00	404.00	406.98		407.20	2.08	70.22	62.80	0.50
Reach-1	16.575	Reg	741.00	403.50	409.16		409.38	2.46	491.43	221.38	0.40
Reach-1	16.575	100-yr	438.00	403.50	408.20		408.41	2.24	291.51	185.32	0.42
Reach-1	16.575	50-yr	381.00	403.50	407.99		408.19	2.16	254.55	169.48	0.42
Reach-1	16.575	20-yr	309.00	403.50	407.70		407.88	2.05	207.06	153.29	0.43
Reach-1	16.575	10-yr	256.00	403.50	407.45		407.63	1.97	170.74	139.66	0.43
Reach-1	16.575	5-yr	204.00	403.50	407.18		407.35	1.87	135.72	125.11	0.44
Reach-1	16.575	2-yr	133.00	403.50	406.74		406.88	1.68	87.60	84.74	0.42
Reach-1	16.37	Reg	741.00	403.20	408.92		409.18	2.65	423.50	159.65	0.43
Reach-1	16.37	100-yr	438.00	403.20	407.96		408.18	2.30	278.91	144.14	0.43
Reach-1	16.37	50-yr	381.00	403.20	407.75		407.95	2.21	248.75	138.96	0.43
Reach-1	16.37	20-yr	309.00	403.20	407.45		407.63	2.11	207.46	131.53	0.43
Reach-1	16.37	10-yr	256.00	403.20	407.18		407.36	2.04	172.78	124.95	0.44
Reach-1	16.37	5-yr	204.00	403.20	406.87		407.05	1.98	135.97	119.23	0.45

Wellington Road 7, Bosworth Bridge Replacement
Proposed Conditions Hydraulic Modelling Summary

Option 2

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
Reach-1	16.37	2-yr	133.00	403.20	406.36		406.55	1.90	77.99	95.59	0.49
Reach-1	16.25	Reg	741.00	403.10	408.78		409.07	2.67	440.23	185.70	0.39
Reach-1	16.25	100-yr	438.00	403.10	407.88		408.07	2.09	297.65	133.69	0.33
Reach-1	16.25	50-yr	381.00	403.10	407.68		407.85	1.95	271.25	127.11	0.32
Reach-1	16.25	20-yr	309.00	403.10	407.39		407.53	1.76	235.66	117.66	0.30
Reach-1	16.25	10-yr	256.00	403.10	407.13		407.25	1.61	206.29	109.24	0.29
Reach-1	16.25	5-yr	204.00	403.10	406.84		406.94	1.45	176.27	99.35	0.27
Reach-1	16.25	2-yr	133.00	403.10	406.36		406.43	1.17	132.51	81.98	0.24
Reach-1	16.16	Reg	741.00	403.00	407.97	407.78	408.88	4.68	254.34	142.47	0.75
Reach-1	16.16	100-yr	438.00	403.00	407.39		407.94	3.50	180.29	113.55	0.60
Reach-1	16.16	50-yr	381.00	403.00	407.26		407.73	3.22	165.35	106.77	0.57
Reach-1	16.16	20-yr	309.00	403.00	407.04		407.43	2.87	143.75	96.13	0.52
Reach-1	16.16	10-yr	256.00	403.00	406.83		407.16	2.61	124.79	85.70	0.49
Reach-1	16.16	5-yr	204.00	403.00	406.60		406.86	2.31	106.16	74.04	0.46
Reach-1	16.16	2-yr	133.00	403.00	406.20		406.36	1.82	80.40	53.91	0.39
Reach-1	16.1	Reg	741.00	402.90	407.70	407.70	408.66	4.70	228.96	139.34	0.84
Reach-1	16.1	100-yr	438.00	402.90	407.15	406.90	407.77	3.63	158.46	120.34	0.72
Reach-1	16.1	50-yr	381.00	402.90	407.04	406.66	407.58	3.36	145.28	116.45	0.68
Reach-1	16.1	20-yr	309.00	402.90	406.85	406.34	407.29	3.02	123.76	103.83	0.63
Reach-1	16.1	10-yr	256.00	402.90	406.64		407.03	2.81	103.70	88.61	0.62
Reach-1	16.1	5-yr	204.00	402.90	406.42		406.74	2.53	86.10	72.68	0.59
Reach-1	16.1	2-yr	133.00	402.90	406.05		406.27	2.08	64.12	45.54	0.54
Reach-1	15.98	Reg	741.00	402.80	407.37	407.19	408.05	3.89	275.46	221.98	0.76
Reach-1	15.98	100-yr	438.00	402.80	407.00	406.42	407.37	2.81	202.04	162.52	0.59
Reach-1	15.98	50-yr	381.00	402.80	406.90		407.21	2.58	186.77	151.93	0.55
Reach-1	15.98	20-yr	309.00	402.80	406.70	406.03	406.96	2.34	158.57	130.14	0.53
Reach-1	15.98	10-yr	256.00	402.80	406.46		406.70	2.23	130.62	106.00	0.53
Reach-1	15.98	5-yr	204.00	402.80	406.20		406.42	2.11	105.41	89.78	0.55
Reach-1	15.98	2-yr	133.00	402.80	405.78		405.97	1.92	72.66	67.81	0.56
Reach-1	15.85	Reg	741.00	402.60	407.17		407.61	3.56	401.45	294.59	0.64
Reach-1	15.85	100-yr	438.00	402.60	406.46	406.46	406.99	3.50	203.93	258.15	0.71
Reach-1	15.85	50-yr	381.00	402.60	406.30	406.30	406.84	3.45	164.32	235.54	0.73
Reach-1	15.85	20-yr	309.00	402.60	405.92	405.79	406.55	3.57	100.59	81.43	0.82
Reach-1	15.85	10-yr	256.00	402.60	405.78	405.53	406.30	3.25	88.97	74.43	0.77
Reach-1	15.85	5-yr	204.00	402.60	405.63		406.03	2.84	78.72	67.64	0.69
Reach-1	15.85	2-yr	133.00	402.60	405.39		405.63	2.17	63.96	56.47	0.56
Reach-1	15.685	Reg	749.00	402.40	407.33		407.37	1.35	1180.89	579.40	0.23
Reach-1	15.685	100-yr	432.00	402.40	406.63		406.66	1.15	804.32	503.14	0.22
Reach-1	15.685	50-yr	389.00	402.40	406.44		406.47	1.17	708.11	483.64	0.23
Reach-1	15.685	20-yr	327.00	402.40	406.17		406.21	1.19	584.63	457.40	0.24
Reach-1	15.685	10-yr	277.00	402.40	405.93		405.97	1.24	475.58	433.47	0.26
Reach-1	15.685	5-yr	229.00	402.40	405.68		405.73	1.33	368.92	410.20	0.29
Reach-1	15.685	2-yr	160.00	402.40	405.29		405.37	1.47	218.67	358.58	0.34

Wellington Road 7, Bosworth Bridge Replacement
Proposed Conditions Hydraulic Modelling Summary

Option 2

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
Reach-1	15.38	Reg	749.00	401.90	407.10		407.23	1.74	610.93	339.80	0.31
Reach-1	15.38	100-yr	432.00	401.90	406.45		406.54	1.37	406.08	287.74	0.28
Reach-1	15.38	50-yr	389.00	401.90	406.24		406.33	1.39	346.33	268.85	0.29
Reach-1	15.38	20-yr	327.00	401.90	405.95		406.05	1.37	273.35	238.19	0.31
Reach-1	15.38	10-yr	277.00	401.90	405.68		405.77	1.38	215.41	182.22	0.33
Reach-1	15.38	5-yr	229.00	401.90	405.39		405.48	1.38	170.16	139.30	0.37
Reach-1	15.38	2-yr	160.00	401.90	404.89		405.00	1.47	109.12	106.90	0.46
Reach-1	15.285	Reg	749.00	402.00	407.02	405.90	407.16	2.08	674.87	348.91	0.36
Reach-1	15.285	100-yr	432.00	402.00	406.39	404.94	406.48	1.65	469.58	298.93	0.31
Reach-1	15.285	50-yr	389.00	402.00	406.16	404.78	406.26	1.69	403.08	281.75	0.33
Reach-1	15.285	20-yr	327.00	402.00	405.56	404.54	405.88	2.50	130.56	221.36	0.52
Reach-1	15.285	10-yr	277.00	402.00	405.32	404.32	405.61	2.35	117.78	190.24	0.50
Reach-1	15.285	5-yr	229.00	402.00	405.07	404.11	405.31	2.19	104.56	154.63	0.49
Reach-1	15.285	2-yr	160.00	402.00	404.63	403.75	404.82	1.93	83.11	105.77	0.46
Reach-1	15.264	Reg	749.00	402.00	406.91	406.13	407.13	2.53	619.93	534.64	0.40
Reach-1	15.264	100-yr	432.00	402.00	405.90	404.90	406.36	3.01	145.53	337.10	0.55
Reach-1	15.264	50-yr	389.00	402.00	405.74	404.76	406.15	2.86	137.70	292.59	0.54
Reach-1	15.264	20-yr	327.00	402.00	405.48	404.54	405.83	2.64	125.13	209.01	0.52
Reach-1	15.264	10-yr	277.00	402.00	405.26	404.33	405.57	2.44	114.78	176.74	0.50
Reach-1	15.264	5-yr	229.00	402.00	405.02	404.11	405.28	2.24	103.19	140.59	0.48
Reach-1	15.264	2-yr	160.00	402.00	404.59	403.75	404.78	1.95	82.14	48.68	0.47
Reach-1	15.26	Bridge									
Reach-1	15.256	Reg	749.00	402.00	406.83	406.13	407.07	2.65	588.29	529.74	0.42
Reach-1	15.256	100-yr	432.00	402.00	405.94	404.89	406.23	2.55	294.72	348.76	0.46
Reach-1	15.256	50-yr	389.00	402.00	405.72	404.76	406.03	2.60	233.69	288.41	0.49
Reach-1	15.256	20-yr	327.00	402.00	405.36	404.53	405.76	2.77	117.92	191.89	0.56
Reach-1	15.256	10-yr	277.00	402.00	405.17	404.34	405.50	2.54	109.01	162.91	0.53
Reach-1	15.256	5-yr	229.00	402.00	404.95	404.11	405.22	2.32	98.64	54.22	0.51
Reach-1	15.256	2-yr	160.00	402.00	404.53	403.75	404.73	2.02	79.05	47.78	0.49
Reach-1	15.24	Reg	749.00	402.00	406.85	406.15	407.00	2.17	765.47	530.95	0.36
Reach-1	15.24	100-yr	432.00	402.00	405.66	404.94	406.14	3.07	140.79	261.48	0.61
Reach-1	15.24	50-yr	389.00	402.00	405.54	404.79	405.97	2.90	134.26	225.30	0.59
Reach-1	15.24	20-yr	327.00	402.00	405.35	404.53	405.70	2.65	123.48	189.24	0.56
Reach-1	15.24	10-yr	277.00	402.00	405.15	404.31	405.46	2.46	112.72	159.70	0.55
Reach-1	15.24	5-yr	229.00	402.00	404.92	404.08	405.19	2.28	100.25	53.84	0.53
Reach-1	15.24	2-yr	160.00	402.00	404.49	403.73	404.71	2.04	78.54	47.41	0.51
Reach-1	15.07	Reg	804.00	401.30	406.67		406.87	2.12	485.16	322.61	0.35
Reach-1	15.07	100-yr	432.00	401.30	405.72		405.84	1.63	310.82	153.61	0.32
Reach-1	15.07	50-yr	389.00	401.30	405.57		405.69	1.57	288.61	151.87	0.31
Reach-1	15.07	20-yr	327.00	401.30	405.34		405.44	1.48	253.36	149.06	0.31
Reach-1	15.07	10-yr	277.00	401.30	405.11		405.21	1.42	219.29	146.29	0.31
Reach-1	15.07	5-yr	229.00	401.30	404.84		404.94	1.37	181.97	134.52	0.32

Wellington Road 7, Bosworth Bridge Replacement
Proposed Conditions Hydraulic Modelling Summary

Option 2

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
Reach-1	15.07	2-yr	160.00	401.30	404.35		404.44	1.32	123.57	102.63	0.35
Reach-1	14.93	Reg	804.00	401.00	406.21	405.11	406.70	3.29	384.22	285.74	0.52
Reach-1	14.93	100-yr	432.00	401.00	405.50		405.73	2.22	251.20	134.50	0.39
Reach-1	14.93	50-yr	389.00	401.00	405.37		405.58	2.10	234.49	129.00	0.38
Reach-1	14.93	20-yr	327.00	401.00	405.16		405.34	1.92	208.58	119.96	0.35
Reach-1	14.93	10-yr	277.00	401.00	404.95		405.10	1.78	183.91	111.56	0.34
Reach-1	14.93	5-yr	229.00	401.00	404.70		404.83	1.65	156.84	104.80	0.33
Reach-1	14.93	2-yr	160.00	401.00	404.21		404.32	1.46	111.63	72.96	0.33
Reach-1	14.82	Reg	804.00	400.80	405.83	405.60	406.46	3.86	334.98	222.57	0.71
Reach-1	14.82	100-yr	432.00	400.80	404.99	404.76	405.52	3.34	169.14	168.64	0.72
Reach-1	14.82	50-yr	389.00	400.80	404.87	404.60	405.38	3.23	149.79	155.18	0.71
Reach-1	14.82	20-yr	327.00	400.80	404.69	404.12	405.15	3.04	123.59	134.86	0.70
Reach-1	14.82	10-yr	277.00	400.80	404.50	403.90	404.93	2.89	100.86	103.92	0.66
Reach-1	14.82	5-yr	229.00	400.80	404.31		404.67	2.66	86.15	48.64	0.62
Reach-1	14.82	2-yr	160.00	400.80	403.86		404.16	2.40	66.69	40.77	0.60
Reach-1	14.67	Reg	804.00	400.50	405.60		406.03	3.33	382.61	183.73	0.58
Reach-1	14.67	100-yr	432.00	400.50	404.77		405.08	2.68	237.88	168.27	0.53
Reach-1	14.67	50-yr	389.00	400.50	404.64		404.94	2.60	216.12	167.29	0.53
Reach-1	14.67	20-yr	327.00	400.50	404.44		404.73	2.48	183.07	165.80	0.52
Reach-1	14.67	10-yr	277.00	400.50	404.24		404.52	2.39	150.76	164.34	0.52
Reach-1	14.67	5-yr	229.00	400.50	404.02	403.10	404.28	2.30	113.39	162.62	0.53
Reach-1	14.67	2-yr	160.00	400.50	403.58		403.80	2.07	77.35	43.97	0.50
Reach-1	14.45	Reg	804.00	400.20	405.36		405.69	2.78	395.86	166.48	0.46
Reach-1	14.45	100-yr	432.00	400.20	404.61		404.79	2.01	277.43	146.43	0.37
Reach-1	14.45	50-yr	389.00	400.20	404.49		404.65	1.91	259.93	143.16	0.36
Reach-1	14.45	20-yr	327.00	400.20	404.30		404.44	1.75	234.02	138.19	0.34
Reach-1	14.45	10-yr	277.00	400.20	404.11		404.24	1.63	208.24	133.06	0.33
Reach-1	14.45	5-yr	229.00	400.20	403.88		403.99	1.53	177.67	127.07	0.33
Reach-1	14.45	2-yr	160.00	400.20	403.39		403.49	1.44	118.52	105.36	0.35
Reach-1	14.4	Reg	804.00	400.10	404.88	404.74	405.56	4.21	301.77	180.38	0.77
Reach-1	14.4	100-yr	432.00	400.10	404.01	404.01	404.66	3.80	159.03	145.97	0.79
Reach-1	14.4	50-yr	389.00	400.10	403.93	403.93	404.53	3.63	147.16	144.83	0.76
Reach-1	14.4	20-yr	327.00	400.10	403.72	403.72	404.32	3.53	117.51	142.49	0.77
Reach-1	14.4	10-yr	277.00	400.10	403.58	403.24	404.12	3.31	97.37	140.88	0.74
Reach-1	14.4	5-yr	229.00	400.10	403.46	402.97	403.89	2.92	83.80	67.51	0.67
Reach-1	14.4	2-yr	160.00	400.10	403.03		403.38	2.65	60.50	40.09	0.67
Reach-1	14.3	Reg	804.00	400.10	404.83		405.28	3.31	367.06	172.60	0.54
Reach-1	14.3	100-yr	432.00	400.10	404.08		404.35	2.45	244.78	153.08	0.44
Reach-1	14.3	50-yr	389.00	400.10	403.98		404.22	2.32	229.38	150.02	0.43
Reach-1	14.3	20-yr	327.00	400.10	403.82		404.02	2.10	206.35	142.95	0.40
Reach-1	14.3	10-yr	277.00	400.10	403.68		403.85	1.91	186.68	136.62	0.37
Reach-1	14.3	5-yr	229.00	400.10	403.53		403.67	1.72	166.10	129.66	0.34
Reach-1	14.3	2-yr	160.00	400.10	403.05		403.16	1.53	115.69	80.24	0.34

Proposed Conditions Hydraulic Modelling Summary**Preferred Option 3**

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
Reach-1	19.849	Reg	726.00	408.90	413.91	412.95	414.37	3.41	378.05	308.02	0.53
Reach-1	19.849	100-yr	391.80	408.90	413.55	411.84	413.76	2.20	294.60	291.17	0.35
Reach-1	19.849	50-yr	355.30	408.90	413.29	411.70	413.53	2.29	235.24	278.61	0.38
Reach-1	19.849	20-yr	319.80	408.90	412.63	411.56	413.02	2.77	117.60	124.00	0.51
Reach-1	19.849	10-yr	251.60	408.90	413.01	411.28	413.18	1.88	175.33	265.37	0.33
Reach-1	19.849	5-yr	218.80	408.90	412.76	411.13	412.92	1.82	122.49	127.69	0.33
Reach-1	19.849	2-yr	143.40	408.90	412.26	410.75	412.36	1.42	102.65	112.73	0.28
Reach-1	19.845	Bridge									
Reach-1	19.841	Reg	726.00	408.90	413.86	413.51	414.36	3.51	363.99	305.83	0.54
Reach-1	19.841	100-yr	391.80	408.90	413.02	411.84	413.44	2.93	174.96	265.77	0.51
Reach-1	19.841	50-yr	355.30	408.90	412.91	411.70	413.24	2.63	163.44	136.79	0.46
Reach-1	19.841	20-yr	319.80	408.90	412.32	411.56	412.82	3.13	102.22	114.65	0.61
Reach-1	19.841	10-yr	251.60	408.90	412.85	411.27	413.06	2.06	122.07	130.41	0.37
Reach-1	19.841	5-yr	218.80	408.90	412.68	411.12	412.87	1.89	115.89	125.51	0.34
Reach-1	19.841	2-yr	143.40	408.90	412.21	410.75	412.32	1.46	98.13	111.41	0.29
Reach-1	19.84	Reg	726.00	408.90	413.90	412.90	414.17	2.83	504.62	307.79	0.44
Reach-1	19.84	100-yr	391.80	408.90	413.05	411.84	413.30	2.44	259.14	267.24	0.42
Reach-1	19.84	50-yr	355.30	408.90	412.94	411.70	413.14	2.24	236.68	143.77	0.39
Reach-1	19.84	20-yr	319.80	408.90	411.56	411.56	412.53	4.36	73.28	76.17	1.00
Reach-1	19.84	10-yr	251.60	408.90	412.84	411.27	413.06	2.06	121.97	130.33	0.37
Reach-1	19.84	5-yr	218.80	408.90	412.68	411.12	412.86	1.89	115.80	125.44	0.34
Reach-1	19.84	2-yr	143.40	408.90	412.21	410.75	412.32	1.46	98.07	111.36	0.29
Reach-1	19.825	Reg	726.00	408.90	413.93	412.26	413.98	1.47	1003.60	438.88	0.22
Reach-1	19.825	100-yr	391.80	408.90	413.07	411.32	413.12	1.26	633.20	426.03	0.21
Reach-1	19.825	50-yr	355.30	408.90	412.95	411.20	413.00	1.24	582.53	424.25	0.21
Reach-1	19.825	20-yr	319.80	408.90	411.09	411.09	411.89	3.96	80.70	60.46	1.00
Reach-1	19.825	10-yr	251.60	408.90	412.84	410.83	412.96	1.49	168.53	422.65	0.26
Reach-1	19.825	5-yr	218.80	408.90	412.68	410.69	412.77	1.36	160.32	420.19	0.24
Reach-1	19.825	2-yr	143.40	408.90	412.21	410.35	412.26	1.05	136.77	413.13	0.20
Reach-1	19.100	Reg	726.00	408.20	413.36		413.45	1.62	821.31	430.29	0.27
Reach-1	19.100	100-yr	391.80	408.20	412.42		412.50	1.47	453.52	345.24	0.29
Reach-1	19.100	50-yr	355.30	408.20	412.25		412.34	1.48	398.11	330.40	0.30
Reach-1	19.100	20-yr	319.80	408.20	412.06		412.15	1.54	335.16	312.67	0.33
Reach-1	19.100	10-yr	251.60	408.20	411.85		411.93	1.42	271.99	292.34	0.32
Reach-1	19.100	5-yr	218.80	408.20	411.70		411.79	1.40	229.27	277.34	0.32
Reach-1	19.100	2-yr	143.40	408.20	411.42		411.49	1.17	158.38	232.01	0.29
Reach-1	18.355	Reg	738.00	407.10	412.52		412.79	2.33	358.23	136.24	0.39
Reach-1	18.355	100-yr	438.00	407.10	411.41		411.62	2.07	224.63	108.51	0.42
Reach-1	18.355	50-yr	381.00	407.10	411.20		411.40	1.97	202.79	105.10	0.42
Reach-1	18.355	20-yr	309.00	407.10	410.93		411.10	1.83	174.29	100.47	0.42
Reach-1	18.355	10-yr	256.00	407.10	410.70		410.85	1.72	152.22	96.73	0.42
Reach-1	18.355	5-yr	204.00	407.10	410.43		410.56	1.63	126.30	92.15	0.43

Proposed Conditions Hydraulic Modelling Summary**Preferred Option 3**

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
Reach-1	18.355	2-yr	133.00	407.10	409.98		410.10	1.53	87.02	84.11	0.48
Reach-1	18.135	Reg	738.00	406.60	412.33		412.60	2.64	435.61	159.23	0.41
Reach-1	18.135	100-yr	438.00	406.60	411.00		411.32	2.72	231.93	145.60	0.51
Reach-1	18.135	50-yr	381.00	406.60	410.76		411.08	2.67	197.77	138.47	0.52
Reach-1	18.135	20-yr	309.00	406.60	410.43		410.75	2.61	153.76	128.70	0.54
Reach-1	18.135	10-yr	256.00	406.60	410.16		410.48	2.54	120.66	120.83	0.56
Reach-1	18.135	5-yr	204.00	406.60	409.88		410.16	2.37	92.93	67.26	0.55
Reach-1	18.135	2-yr	133.00	406.60	409.41		409.63	2.07	65.56	50.02	0.54
Reach-1	17.83	Reg	738.00	406.00	411.96		412.31	2.72	318.96	100.56	0.42
Reach-1	17.83	100-yr	438.00	406.00	410.58		410.88	2.48	191.00	82.38	0.46
Reach-1	17.83	50-yr	381.00	406.00	410.33		410.61	2.36	171.35	77.97	0.46
Reach-1	17.83	20-yr	309.00	406.00	409.98		410.23	2.21	145.34	71.73	0.46
Reach-1	17.83	10-yr	256.00	406.00	409.70		409.92	2.09	125.41	66.94	0.46
Reach-1	17.83	5-yr	204.00	406.00	409.37		409.57	1.96	104.72	61.57	0.46
Reach-1	17.83	2-yr	133.00	406.00	408.83		409.00	1.80	73.72	51.46	0.48
Reach-1	17.58	Reg	738.00	405.00	411.65		412.06	3.29	361.08	114.84	0.46
Reach-1	17.58	100-yr	438.00	405.00	409.92		410.46	3.48	178.77	93.16	0.58
Reach-1	17.58	50-yr	381.00	405.00	409.68		410.18	3.34	156.49	87.23	0.58
Reach-1	17.58	20-yr	309.00	405.00	409.31		409.78	3.16	126.45	78.53	0.58
Reach-1	17.58	10-yr	256.00	405.00	409.03		409.46	2.97	105.30	71.77	0.58
Reach-1	17.58	5-yr	204.00	405.00	408.73		409.10	2.73	85.28	60.49	0.56
Reach-1	17.58	2-yr	133.00	405.00	408.23		408.50	2.30	59.94	41.01	0.53
Reach-1	17.36	Reg	738.00	405.40	411.66		411.85	2.17	535.57	166.28	0.29
Reach-1	17.36	100-yr	438.00	405.40	409.89		410.12	2.22	263.41	135.36	0.35
Reach-1	17.36	50-yr	381.00	405.40	409.64		409.85	2.09	231.92	117.69	0.34
Reach-1	17.36	20-yr	309.00	405.40	409.28		409.46	1.91	194.03	92.02	0.33
Reach-1	17.36	10-yr	256.00	405.40	409.01		409.15	1.73	171.27	72.36	0.31
Reach-1	17.36	5-yr	204.00	405.40	408.70		408.81	1.54	149.71	68.53	0.29
Reach-1	17.36	2-yr	133.00	405.40	408.18		408.26	1.25	115.82	62.59	0.26
Reach-1	17.30	Reg	738.00	405.30	411.60		411.79	2.19	530.87	175.52	0.31
Reach-1	17.30	100-yr	438.00	405.30	409.68		409.99	2.57	222.87	135.08	0.45
Reach-1	17.30	50-yr	381.00	405.30	409.41		409.72	2.50	188.81	122.63	0.46
Reach-1	17.30	20-yr	309.00	405.30	409.05		409.32	2.35	150.39	91.27	0.46
Reach-1	17.30	10-yr	256.00	405.30	408.78		409.02	2.21	127.24	79.63	0.46
Reach-1	17.30	5-yr	204.00	405.30	408.49		408.69	2.03	105.72	68.28	0.45
Reach-1	17.30	2-yr	133.00	405.30	407.99		408.15	1.75	76.43	51.20	0.44
Reach-1	17.225	Reg	741.00	405.10	411.61		411.74	1.82	618.20	212.96	0.26
Reach-1	17.225	100-yr	438.00	405.10	409.67		409.88	2.12	270.97	150.46	0.39
Reach-1	17.225	50-yr	381.00	405.10	409.39		409.60	2.08	230.67	141.58	0.40
Reach-1	17.225	20-yr	309.00	405.10	409.00		409.20	2.06	176.95	128.65	0.43
Reach-1	17.225	10-yr	256.00	405.10	408.70		408.90	1.99	142.20	108.37	0.44
Reach-1	17.225	5-yr	204.00	405.10	408.39		408.58	1.90	112.13	85.80	0.45
Reach-1	17.225	2-yr	133.00	405.10	407.88		408.03	1.72	77.45	54.71	0.46

Proposed Conditions Hydraulic Modelling Summary**Preferred Option 3**

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	Vel Chnl	Flow Area	Top Width	Froude #
			(m ³ /s)	(m)	(m)	(m)	(m)	(m/s)	(m ²)	(m)	
Reach-1	17.199	Reg	741.00	404.98	411.14	409.12	411.62	3.09	243.19	74.55	0.45
Reach-1	17.199	100-yr	438.00	404.98	409.36	408.25	409.78	2.89	152.75	52.97	0.52
Reach-1	17.199	50-yr	381.00	404.98	409.15	408.06	409.52	2.70	142.21	51.67	0.51
Reach-1	17.199	20-yr	309.00	404.98	408.83	407.77	409.14	2.45	126.29	50.40	0.49
Reach-1	17.199	10-yr	256.00	404.98	408.59	407.53	408.85	2.24	114.29	49.54	0.47
Reach-1	17.199	5-yr	204.00	404.98	408.33	407.25	408.54	2.01	101.27	48.31	0.44
Reach-1	17.199	2-yr	133.00	404.98	407.85	406.73	407.99	1.69	78.81	44.47	0.40
Reach-1	17.195		Bosworth Bridge		Wellington Road 7						
Reach-1	17.191	Reg	741.00	405.11	409.82	409.25	410.81	4.40	170.38	54.38	0.76
Reach-1	17.191	100-yr	438.00	405.11	409.14	408.39	409.68	3.25	135.52	51.78	0.63
Reach-1	17.191	50-yr	381.00	405.11	408.96	408.21	409.43	3.02	126.65	51.11	0.60
Reach-1	17.191	20-yr	309.00	405.11	408.67	407.92	409.06	2.77	111.76	49.99	0.59
Reach-1	17.191	10-yr	256.00	405.11	408.45	407.67	408.78	2.54	100.91	49.06	0.56
Reach-1	17.191	5-yr	204.00	405.11	408.21	407.34	408.47	2.29	89.09	47.65	0.53
Reach-1	17.191	2-yr	133.00	405.11	407.75	406.89	407.94	1.94	68.39	42.25	0.49
Reach-1	17.14	Reg	741.00	405.10	409.93		410.06	2.11	630.89	289.03	0.36
Reach-1	17.14	100-yr	438.00	405.10	409.16		409.29	1.92	412.47	278.77	0.36
Reach-1	17.14	50-yr	381.00	405.10	408.97		409.10	1.90	359.56	275.58	0.37
Reach-1	17.14	20-yr	309.00	405.10	408.65		408.80	1.95	272.64	264.86	0.40
Reach-1	17.14	10-yr	256.00	405.10	408.41		408.58	1.97	210.29	256.89	0.42
Reach-1	17.14	5-yr	204.00	405.10	408.14		408.33	1.98	143.40	248.06	0.45
Reach-1	17.14	2-yr	133.00	405.10	407.68		407.83	1.74	83.33	72.43	0.44
Reach-1	16.76	Reg	741.00	404.00	409.24		409.68	3.53	394.56	218.44	0.56
Reach-1	16.76	100-yr	438.00	404.00	408.29	407.79	408.80	3.44	202.03	172.22	0.62
Reach-1	16.76	50-yr	381.00	404.00	408.09	407.57	408.59	3.32	169.80	151.56	0.62
Reach-1	16.76	20-yr	309.00	404.00	407.85		408.25	2.96	141.23	100.90	0.58
Reach-1	16.76	10-yr	256.00	404.00	407.63		407.99	2.74	120.61	91.52	0.56
Reach-1	16.76	5-yr	204.00	404.00	407.40		407.70	2.48	100.64	81.41	0.53
Reach-1	16.76	2-yr	133.00	404.00	406.98		407.20	2.08	70.22	62.80	0.50
Reach-1	16.575	Reg	741.00	403.50	409.16		409.38	2.46	491.43	221.38	0.40
Reach-1	16.575	100-yr	438.00	403.50	408.20		408.41	2.24	291.51	185.32	0.42
Reach-1	16.575	50-yr	381.00	403.50	407.99		408.19	2.16	254.55	169.48	0.42
Reach-1	16.575	20-yr	309.00	403.50	407.70		407.88	2.05	207.06	153.29	0.43
Reach-1	16.575	10-yr	256.00	403.50	407.45		407.63	1.97	170.74	139.66	0.43
Reach-1	16.575	5-yr	204.00	403.50	407.18		407.35	1.87	135.72	125.11	0.44
Reach-1	16.575	2-yr	133.00	403.50	406.74		406.88	1.68	87.60	84.74	0.42
Reach-1	16.37	Reg	741.00	403.20	408.92		409.18	2.65	423.50	159.65	0.43
Reach-1	16.37	100-yr	438.00	403.20	407.96		408.18	2.30	278.91	144.14	0.43
Reach-1	16.37	50-yr	381.00	403.20	407.75		407.95	2.21	248.75	138.96	0.43
Reach-1	16.37	20-yr	309.00	403.20	407.45		407.63	2.11	207.46	131.53	0.43
Reach-1	16.37	10-yr	256.00	403.20	407.18		407.36	2.04	172.78	124.95	0.44
Reach-1	16.37	5-yr	204.00	403.20	406.87		407.05	1.98	135.97	119.23	0.45

Proposed Conditions Hydraulic Modelling Summary**Preferred Option 3**

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
Reach-1	16.37	2-yr	133.00	403.20	406.36		406.55	1.90	77.99	95.59	0.49
Reach-1	16.25	Reg	741.00	403.10	408.78		409.07	2.67	440.23	185.70	0.39
Reach-1	16.25	100-yr	438.00	403.10	407.88		408.07	2.09	297.65	133.69	0.33
Reach-1	16.25	50-yr	381.00	403.10	407.68		407.85	1.95	271.25	127.11	0.32
Reach-1	16.25	20-yr	309.00	403.10	407.39		407.53	1.76	235.66	117.66	0.30
Reach-1	16.25	10-yr	256.00	403.10	407.13		407.25	1.61	206.29	109.24	0.29
Reach-1	16.25	5-yr	204.00	403.10	406.84		406.94	1.45	176.27	99.35	0.27
Reach-1	16.25	2-yr	133.00	403.10	406.36		406.43	1.17	132.51	81.98	0.24
Reach-1	16.16	Reg	741.00	403.00	407.97	407.78	408.88	4.68	254.34	142.47	0.75
Reach-1	16.16	100-yr	438.00	403.00	407.39		407.94	3.50	180.29	113.55	0.60
Reach-1	16.16	50-yr	381.00	403.00	407.26		407.73	3.22	165.35	106.77	0.57
Reach-1	16.16	20-yr	309.00	403.00	407.04		407.43	2.87	143.75	96.13	0.52
Reach-1	16.16	10-yr	256.00	403.00	406.83		407.16	2.61	124.79	85.70	0.49
Reach-1	16.16	5-yr	204.00	403.00	406.60		406.86	2.31	106.16	74.04	0.46
Reach-1	16.16	2-yr	133.00	403.00	406.20		406.36	1.82	80.40	53.91	0.39
Reach-1	16.1	Reg	741.00	402.90	407.70	407.70	408.66	4.70	228.96	139.34	0.84
Reach-1	16.1	100-yr	438.00	402.90	407.15	406.90	407.77	3.63	158.46	120.34	0.72
Reach-1	16.1	50-yr	381.00	402.90	407.04	406.66	407.58	3.36	145.28	116.45	0.68
Reach-1	16.1	20-yr	309.00	402.90	406.85	406.34	407.29	3.02	123.76	103.83	0.63
Reach-1	16.1	10-yr	256.00	402.90	406.64		407.03	2.81	103.70	88.61	0.62
Reach-1	16.1	5-yr	204.00	402.90	406.42		406.74	2.53	86.10	72.68	0.59
Reach-1	16.1	2-yr	133.00	402.90	406.05		406.27	2.08	64.12	45.54	0.54
Reach-1	15.98	Reg	741.00	402.80	407.37	407.19	408.05	3.89	275.46	221.98	0.76
Reach-1	15.98	100-yr	438.00	402.80	407.00	406.42	407.37	2.81	202.04	162.52	0.59
Reach-1	15.98	50-yr	381.00	402.80	406.90		407.21	2.58	186.77	151.93	0.55
Reach-1	15.98	20-yr	309.00	402.80	406.70	406.03	406.96	2.34	158.57	130.14	0.53
Reach-1	15.98	10-yr	256.00	402.80	406.46		406.70	2.23	130.62	106.00	0.53
Reach-1	15.98	5-yr	204.00	402.80	406.20		406.42	2.11	105.41	89.78	0.55
Reach-1	15.98	2-yr	133.00	402.80	405.78		405.97	1.92	72.66	67.81	0.56
Reach-1	15.85	Reg	741.00	402.60	407.17		407.61	3.56	401.45	294.59	0.64
Reach-1	15.85	100-yr	438.00	402.60	406.46	406.46	406.99	3.50	203.93	258.15	0.71
Reach-1	15.85	50-yr	381.00	402.60	406.30	406.30	406.84	3.45	164.32	235.54	0.73
Reach-1	15.85	20-yr	309.00	402.60	405.92	405.79	406.55	3.57	100.59	81.43	0.82
Reach-1	15.85	10-yr	256.00	402.60	405.78	405.53	406.30	3.25	88.97	74.43	0.77
Reach-1	15.85	5-yr	204.00	402.60	405.63		406.03	2.84	78.72	67.64	0.69
Reach-1	15.85	2-yr	133.00	402.60	405.39		405.63	2.17	63.96	56.47	0.56
Reach-1	15.685	Reg	749.00	402.40	407.33		407.37	1.35	1180.89	579.40	0.23
Reach-1	15.685	100-yr	432.00	402.40	406.63		406.66	1.15	804.32	503.14	0.22
Reach-1	15.685	50-yr	389.00	402.40	406.44		406.47	1.17	708.11	483.64	0.23
Reach-1	15.685	20-yr	327.00	402.40	406.17		406.21	1.19	584.63	457.40	0.24
Reach-1	15.685	10-yr	277.00	402.40	405.93		405.97	1.24	475.58	433.47	0.26
Reach-1	15.685	5-yr	229.00	402.40	405.68		405.73	1.33	368.92	410.20	0.29
Reach-1	15.685	2-yr	160.00	402.40	405.29		405.37	1.47	218.67	358.58	0.34

Proposed Conditions Hydraulic Modelling Summary**Preferred Option 3**

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
Reach-1	15.38	Reg	749.00	401.90	407.10		407.23	1.74	610.93	339.80	0.31
Reach-1	15.38	100-yr	432.00	401.90	406.45		406.54	1.37	406.08	287.74	0.28
Reach-1	15.38	50-yr	389.00	401.90	406.24		406.33	1.39	346.33	268.85	0.29
Reach-1	15.38	20-yr	327.00	401.90	405.95		406.05	1.37	273.35	238.19	0.31
Reach-1	15.38	10-yr	277.00	401.90	405.68		405.77	1.38	215.41	182.22	0.33
Reach-1	15.38	5-yr	229.00	401.90	405.39		405.48	1.38	170.16	139.30	0.37
Reach-1	15.38	2-yr	160.00	401.90	404.89		405.00	1.47	109.12	106.90	0.46
Reach-1	15.285	Reg	749.00	402.00	407.02	405.90	407.16	2.08	674.87	348.91	0.36
Reach-1	15.285	100-yr	432.00	402.00	406.39	404.94	406.48	1.65	469.58	298.93	0.31
Reach-1	15.285	50-yr	389.00	402.00	406.16	404.78	406.26	1.69	403.08	281.75	0.33
Reach-1	15.285	20-yr	327.00	402.00	405.56	404.54	405.88	2.50	130.56	221.36	0.52
Reach-1	15.285	10-yr	277.00	402.00	405.32	404.32	405.61	2.35	117.78	190.24	0.50
Reach-1	15.285	5-yr	229.00	402.00	405.07	404.11	405.31	2.19	104.56	154.63	0.49
Reach-1	15.285	2-yr	160.00	402.00	404.63	403.75	404.82	1.93	83.11	105.77	0.46
Reach-1	15.264	Reg	749.00	402.00	406.91	406.13	407.13	2.53	619.93	534.64	0.40
Reach-1	15.264	100-yr	432.00	402.00	405.90	404.90	406.36	3.01	145.53	337.10	0.55
Reach-1	15.264	50-yr	389.00	402.00	405.74	404.76	406.15	2.86	137.70	292.59	0.54
Reach-1	15.264	20-yr	327.00	402.00	405.48	404.54	405.83	2.64	125.13	209.01	0.52
Reach-1	15.264	10-yr	277.00	402.00	405.26	404.33	405.57	2.44	114.78	176.74	0.50
Reach-1	15.264	5-yr	229.00	402.00	405.02	404.11	405.28	2.24	103.19	140.59	0.48
Reach-1	15.264	2-yr	160.00	402.00	404.59	403.75	404.78	1.95	82.14	48.68	0.47
Reach-1	15.26	Bridge									
Reach-1	15.256	Reg	749.00	402.00	406.83	406.13	407.07	2.65	588.29	529.74	0.42
Reach-1	15.256	100-yr	432.00	402.00	405.94	404.89	406.23	2.55	294.72	348.76	0.46
Reach-1	15.256	50-yr	389.00	402.00	405.72	404.76	406.03	2.60	233.69	288.41	0.49
Reach-1	15.256	20-yr	327.00	402.00	405.36	404.53	405.76	2.77	117.92	191.89	0.56
Reach-1	15.256	10-yr	277.00	402.00	405.17	404.34	405.50	2.54	109.01	162.91	0.53
Reach-1	15.256	5-yr	229.00	402.00	404.95	404.11	405.22	2.32	98.64	54.22	0.51
Reach-1	15.256	2-yr	160.00	402.00	404.53	403.75	404.73	2.02	79.05	47.78	0.49
Reach-1	15.24	Reg	749.00	402.00	406.85	406.15	407.00	2.17	765.47	530.95	0.36
Reach-1	15.24	100-yr	432.00	402.00	405.66	404.94	406.14	3.07	140.79	261.48	0.61
Reach-1	15.24	50-yr	389.00	402.00	405.54	404.79	405.97	2.90	134.26	225.30	0.59
Reach-1	15.24	20-yr	327.00	402.00	405.35	404.53	405.70	2.65	123.48	189.24	0.56
Reach-1	15.24	10-yr	277.00	402.00	405.15	404.31	405.46	2.46	112.72	159.70	0.55
Reach-1	15.24	5-yr	229.00	402.00	404.92	404.08	405.19	2.28	100.25	53.84	0.53
Reach-1	15.24	2-yr	160.00	402.00	404.49	403.73	404.71	2.04	78.54	47.41	0.51
Reach-1	15.07	Reg	804.00	401.30	406.67		406.87	2.12	485.16	322.61	0.35
Reach-1	15.07	100-yr	432.00	401.30	405.72		405.84	1.63	310.82	153.61	0.32
Reach-1	15.07	50-yr	389.00	401.30	405.57		405.69	1.57	288.61	151.87	0.31
Reach-1	15.07	20-yr	327.00	401.30	405.34		405.44	1.48	253.36	149.06	0.31
Reach-1	15.07	10-yr	277.00	401.30	405.11		405.21	1.42	219.29	146.29	0.31
Reach-1	15.07	5-yr	229.00	401.30	404.84		404.94	1.37	181.97	134.52	0.32

Proposed Conditions Hydraulic Modelling Summary**Preferred Option 3**

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude #
Reach-1	15.07	2-yr	160.00	401.30	404.35		404.44	1.32	123.57	102.63	0.35
Reach-1	14.93	Reg	804.00	401.00	406.21	405.11	406.70	3.29	384.22	285.74	0.52
Reach-1	14.93	100-yr	432.00	401.00	405.50		405.73	2.22	251.20	134.50	0.39
Reach-1	14.93	50-yr	389.00	401.00	405.37		405.58	2.10	234.49	129.00	0.38
Reach-1	14.93	20-yr	327.00	401.00	405.16		405.34	1.92	208.58	119.96	0.35
Reach-1	14.93	10-yr	277.00	401.00	404.95		405.10	1.78	183.91	111.56	0.34
Reach-1	14.93	5-yr	229.00	401.00	404.70		404.83	1.65	156.84	104.80	0.33
Reach-1	14.93	2-yr	160.00	401.00	404.21		404.32	1.46	111.63	72.96	0.33
Reach-1	14.82	Reg	804.00	400.80	405.83	405.60	406.46	3.86	334.98	222.57	0.71
Reach-1	14.82	100-yr	432.00	400.80	404.99	404.76	405.52	3.34	169.14	168.64	0.72
Reach-1	14.82	50-yr	389.00	400.80	404.87	404.60	405.38	3.23	149.79	155.18	0.71
Reach-1	14.82	20-yr	327.00	400.80	404.69	404.12	405.15	3.04	123.59	134.86	0.70
Reach-1	14.82	10-yr	277.00	400.80	404.50	403.90	404.93	2.89	100.86	103.92	0.66
Reach-1	14.82	5-yr	229.00	400.80	404.31		404.67	2.66	86.15	48.64	0.62
Reach-1	14.82	2-yr	160.00	400.80	403.86		404.16	2.40	66.69	40.77	0.60
Reach-1	14.67	Reg	804.00	400.50	405.60		406.03	3.33	382.61	183.73	0.58
Reach-1	14.67	100-yr	432.00	400.50	404.77		405.08	2.68	237.88	168.27	0.53
Reach-1	14.67	50-yr	389.00	400.50	404.64		404.94	2.60	216.12	167.29	0.53
Reach-1	14.67	20-yr	327.00	400.50	404.44		404.73	2.48	183.07	165.80	0.52
Reach-1	14.67	10-yr	277.00	400.50	404.24		404.52	2.39	150.76	164.34	0.52
Reach-1	14.67	5-yr	229.00	400.50	404.02	403.10	404.28	2.30	113.39	162.62	0.53
Reach-1	14.67	2-yr	160.00	400.50	403.58		403.80	2.07	77.35	43.97	0.50
Reach-1	14.45	Reg	804.00	400.20	405.36		405.69	2.78	395.86	166.48	0.46
Reach-1	14.45	100-yr	432.00	400.20	404.61		404.79	2.01	277.43	146.43	0.37
Reach-1	14.45	50-yr	389.00	400.20	404.49		404.65	1.91	259.93	143.16	0.36
Reach-1	14.45	20-yr	327.00	400.20	404.30		404.44	1.75	234.02	138.19	0.34
Reach-1	14.45	10-yr	277.00	400.20	404.11		404.24	1.63	208.24	133.06	0.33
Reach-1	14.45	5-yr	229.00	400.20	403.88		403.99	1.53	177.67	127.07	0.33
Reach-1	14.45	2-yr	160.00	400.20	403.39		403.49	1.44	118.52	105.36	0.35
Reach-1	14.4	Reg	804.00	400.10	404.88	404.74	405.56	4.21	301.77	180.38	0.77
Reach-1	14.4	100-yr	432.00	400.10	404.01	404.01	404.66	3.80	159.03	145.97	0.79
Reach-1	14.4	50-yr	389.00	400.10	403.93	403.93	404.53	3.63	147.16	144.83	0.76
Reach-1	14.4	20-yr	327.00	400.10	403.72	403.72	404.32	3.53	117.51	142.49	0.77
Reach-1	14.4	10-yr	277.00	400.10	403.58	403.24	404.12	3.31	97.37	140.88	0.74
Reach-1	14.4	5-yr	229.00	400.10	403.46	402.97	403.89	2.92	83.80	67.51	0.67
Reach-1	14.4	2-yr	160.00	400.10	403.03		403.38	2.65	60.50	40.09	0.67
Reach-1	14.3	Reg	804.00	400.10	404.83		405.28	3.31	367.06	172.60	0.54
Reach-1	14.3	100-yr	432.00	400.10	404.08		404.35	2.45	244.78	153.08	0.44
Reach-1	14.3	50-yr	389.00	400.10	403.98		404.22	2.32	229.38	150.02	0.43
Reach-1	14.3	20-yr	327.00	400.10	403.82		404.02	2.10	206.35	142.95	0.40
Reach-1	14.3	10-yr	277.00	400.10	403.68		403.85	1.91	186.68	136.62	0.37
Reach-1	14.3	5-yr	229.00	400.10	403.53		403.67	1.72	166.10	129.66	0.34
Reach-1	14.3	2-yr	160.00	400.10	403.05		403.16	1.53	115.69	80.24	0.34

Bosworth Bridge at Wellington Road 7

