Appendix I4
Hydraulic Analysis

Contents

This appendix outlines the hydrologic and hydraulic analysis that was conducted for the proposed NFTA crossing of Bizer Creek in the Town of Amherst, Erie County. The proposed culvert is located between the crossings of Service Center Road and Rensch Road to the west the University at Buffalo's North Campus. A cross section of the LRT Build Alternative culvert is included in this appendix.

I.4 HYDROLOGY

According to USGS Stream Stats, the project site has a drainage area of 5.86 sq. mi. The drainage area is largely developed (urban). The topography of the area is generally flat.

The project area is depicted on FEMA Flood Insurance Rate Map (FIRM) 36029C0078H, effective June 7, 2019. The project site is just upstream of the detailed FEMA Study limits, therefore, there is no available FEMA flood data. Although water surface elevations gathered from this study – just downstream from our project site - were used as a boundary condition/known water surface and input into our model.

The project watershed is located in USGS Stream Stats Region 5. The Stream Stats discharges were used for modeling purposes. In accordance with New York State Department of Transportation (NYSDOT) guidance, the estimated peak discharges have been increased by 10% to account for future changes as a result of development and climate change.

Table I-1 Estimated Peak Discharges

Recurrence Interval (Year)	Annual Exceedance Probability (%)	Q = Flow (cu. ft./sec.)	Q with 10% Increase per section 3.2.3.1 of the NYS Bridge Manual (cu. ft./sec.)
1.25 yr	80	186	205
1.5 yr	66.7	217	239
2 yr	50	254	280
2.33 yr	43	273	301
5 yr	20	337	371
10 yr	10	388	427
25 yr	4	448	493
50 yr	2	490	539
100 yr	1	528	581
200 yr	0.5	569	626
500 yr	0.2	616	678

I.5 HYDRAULICS

A hydraulic analysis was conducted for both the existing conditions and with the proposed culvert using the United States Army Corp of Engineer, Hydrologic Engineering Center's River Analysis System (HEC-RAS) hydraulics program, version 6.4.1.

The proposed structure shall not raise the water surface elevations anywhere when compared to the existing conditions for both the Q50 and Q100 flows.

- A minimum of 2.0 ft of freeboard for the projected Q50 is required for the proposed structure. The freeboard shall be measured at the lowest point of the superstructure between the two edges of the bottom angle for all structures.
- The projected Q100 flow shall pass below the proposed low chord without touching it.
- 0.00 ft Increase in 100 yr water surface elevations (WSEL)
- Minimum span = 1.25 x active channel width

I.5.1 Existing Conditions

The creek flows north in a relatively deep, confined, man-made channel. (This creek was relocated when the University at Buffalo North Campus construction began.) The stream channel is roughly 20 ft below the roadway elevation at the two bridges located upstream and downstream of the project site. The channel is relatively straight and uniformly shaped with a concrete invert lining transitioning up to stone filling then to grass and brush as you proceed up the banks. The channel lacks riffle/pool development due to the concrete invert.

I.5.2 Proposed Conditions

The initial plan for this Bizer Creek crossing was a bridge but a request was made to investigate the feasibility of a three-sided, precast concrete, rigid frame as a viable option.

Both the upstream and downstream bridges from the project site are three-span, concrete bridge structures, both have a center span of 25 ft and two approach spans of 19 ft each.

Based on field observations, it can be said that the Ordinary High-Water (OHW) wide/active channel width is within the confines of the center span of both the Rensch Road bridge and the Service Center Road bridge. These bridges both have a center span length of 25 ft. If we conservatively take the OHW/active channel width to be 25 ft, the minimum span length for the proposed three-sided, precast concrete, rigid frame would be 31.25 ft.

Based on the active channel width and size and configuration of these two adjacent structures, a determination to model the largest three-sided, precast concrete, rigid frame was made. This maximum length rigid frame typically available from precast manufactures is 35 ft.

The hydraulic analysis was performed in accordance with the current section 3.2.3.1 of the NYSDOT Bridge Manual dated 2021 using HEC-RAS for two conditions – “Existing” without the rigid frame and “Proposed” with the 35 ft span, rigid frame.

Table I-2 Hydraulic Results Comparison

Proposed Bizer Ck Water Surface Elev			
River Sta	**Profile**	**Q Total (cfs)**	**W.S. Elev (ft)**
0	100 YR	581	575.0
0	50 YR	539	574.0
499.6	100 YR	581	575.0
499.6	50 YR	539	574.0
779.6	100 YR	581	575.0
779.6	50 YR	539	574.0
899.6	100 YR	581	575.0
899.6	50 YR	539	574.0
949.6	100 YR	581	575.0
949.6	50 YR	539	574.0
999.5	100 YR	581	575.0
999.5	50 YR	539	574.0
1000	**Rensch**	**Bridge**	**= 84' wide**
1084.7	100 YR	581	575.0
1084.7	50 YR	539	574.0
1135.5	100 YR	581	575.0
1135.5	50 YR	539	574.0
1259.3	100 YR	581	575.0
1259.3	50 YR	539	574.0
1309.9	100 YR	581	574.9
1309.9	50 YR	539	573.9
1359.7	100 YR	581	574.9
1359.7	50 YR	539	573.9
1383.7	100 YR	581	575.0
1383.7	50 YR	539	574.0
1388.7	Proposed	Bridge	=227'

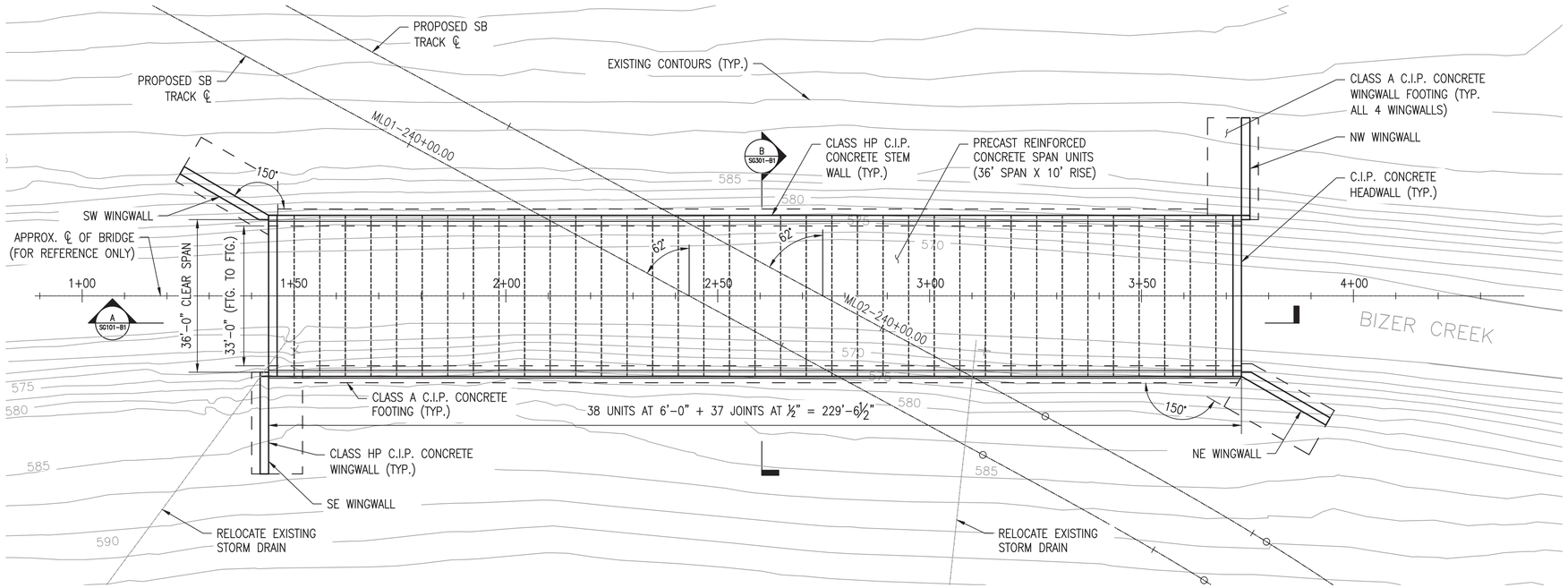
Existing Bizer Ck Water Surface Elev			
River Sta	**Profile**	**Q Total (cfs)**	**W.S. Elev (ft)**
0	100 YR	581	575.0
0	50 YR	539	574.0
499.6	100 YR	581	575.0
499.6	50 YR	539	574.0
779.6	100 YR	581	575.0
779.6	50 YR	539	574.0
899.6	100 YR	581	575.0
899.6	50 YR	539	574.0
949.6	100 YR	581	575.0
949.6	50 YR	539	574.0
999.5	100 YR	581	575.0
999.5	50 YR	539	574.0
1000	**Rensch**	**Bridge**	**= 84' wide**
1084.7	100 YR	581	575.0
1084.7	50 YR	539	574.0
1135.5	100 YR	581	575.0
1135.5	50 YR	539	574.0
1259.3	100 YR	581	575.0
1259.3	50 YR	539	574.0
1309.9	100 YR	581	574.9
1309.9	50 YR	539	573.9
1359.7	100 YR	581	574.9
1359.7	50 YR	539	573.9
1383.7	100 YR	581	575.0
1383.7	50 YR	539	574.0
1409.7	100 YR	581	575.0
1409.7	50 YR	539	574.0
1434.2	100 YR	581	575.0
1434.2	50 YR	539	574.0
1499.6	100 YR	581	574.9
1499.6	50 YR	539	573.9
1562.3	100 YR	581	574.9
1562.3	50 YR	539	573.9
1587.1	100 YR	581	575.0

				1587.1	50 YR	539	574.0
1612.3	100 YR	581	574.9	1612.3	100 YR	581	574.9
1612.3	50 YR	539	573.9	1612.3	50 YR	539	573.9
1637.3	100 YR	581	574.9	1637.3	100 YR	581	575.0
1637.3	50 YR	539	573.9	1637.3	50 YR	539	574.0
1686.9	100 YR	581	575.0	1686.9	100 YR	581	575.0
1686.9	50 YR	539	574.0	1686.9	50 YR	539	574.0
1736.9	100 YR	581	575.0	1736.9	100 YR	581	575.0
1736.9	50 YR	539	574.0	1736.9	50 YR	539	574.0
1836.2	100 YR	581	575.0	1836.2	100 YR	581	575.0
1836.2	50 YR	539	574.0	1836.2	50 YR	539	574.0
1847.5	100 YR	581	575.0	1847.5	100 YR	581	575.0
1847.5	50 YR	539	574.0	1847.5	50 YR	539	574.0
1947.1	100 YR	581	575.0	1947.1	100 YR	581	575.0
1947.1	50 YR	539	574.0	1947.1	50 YR	539	574.1
2353.2	100 YR	581	575.0	2353.2	100 YR	581	575.0
2353.2	50 YR	539	574.1	2353.2	50 YR	539	574.1
2353.7	**Service**	**Bridge**	**= 42' wide**	**2353.7**	**Service**	**Bridge**	**= 42' wide**
2396.2	100 YR	581	575.0	2396.2	100 YR	581	575.0
2396.2	50 YR	539	574.1	2396.2	50 YR	539	574.1
2452.6	100 YR	581	575.0	2452.6	100 YR	581	575.1
2452.6	50 YR	539	574.1	2452.6	50 YR	539	574.1
2809.6	100 YR	581	575.1	2809.6	100 YR	581	575.1
2809.6	50 YR	539	574.1	2809.6	50 YR	539	574.2

I.5.3 Summary

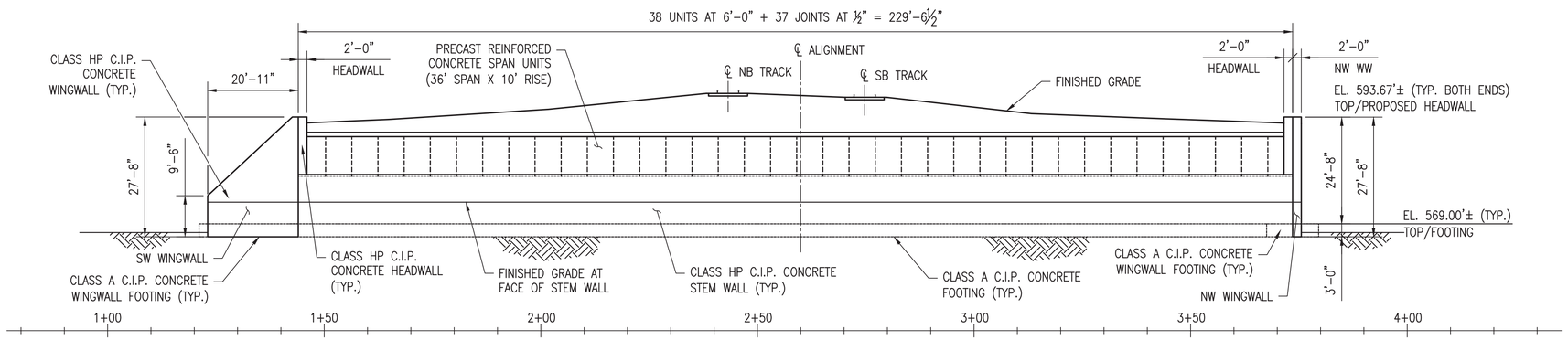
Based on the analyses conducted, the proposed 227 ft wide, 35 ft long (clear span), 10 ft rise three-sided, precast concrete, rigid frame meets the NYSDOT culvert design criteria as shown above and is sized to be hydraulically sufficient.

See the attached Existing and Proposed cross sections for a visual display of the table above.



BIZER CREEK PLAN

3/4" = 1'-0"



A BIZER CREEK LONGITUDINAL SECTION (LOOKING WEST)

3/4" = 1'-0"

WSP USA Inc.
40 LA RIVIERE DR.
BUFFALO, NY
TEL: 1 716-853-1220
FAX: 1 716 853-1332

NFTA
Niagara Frontier Transportation Authority
Serving Buffalo Niagara

METRO RAIL EXTENSION
EIS & PRELIMINARY ENGINEERING

MARK	DATE	DESCRIPTION
P1	04/11/25	15% SUBMISSION
ISSUE:		

NFTA PROJECT NO:	34LZ1725
DESIGNER PROJECT NO:	187880
CAD DWG FILE:	SG101-B1.DWG
DRAWN BY:	D.J.H.
CHECKED BY:	A.O.
SCALE:	AS NOTED
COPYRIGHT:	

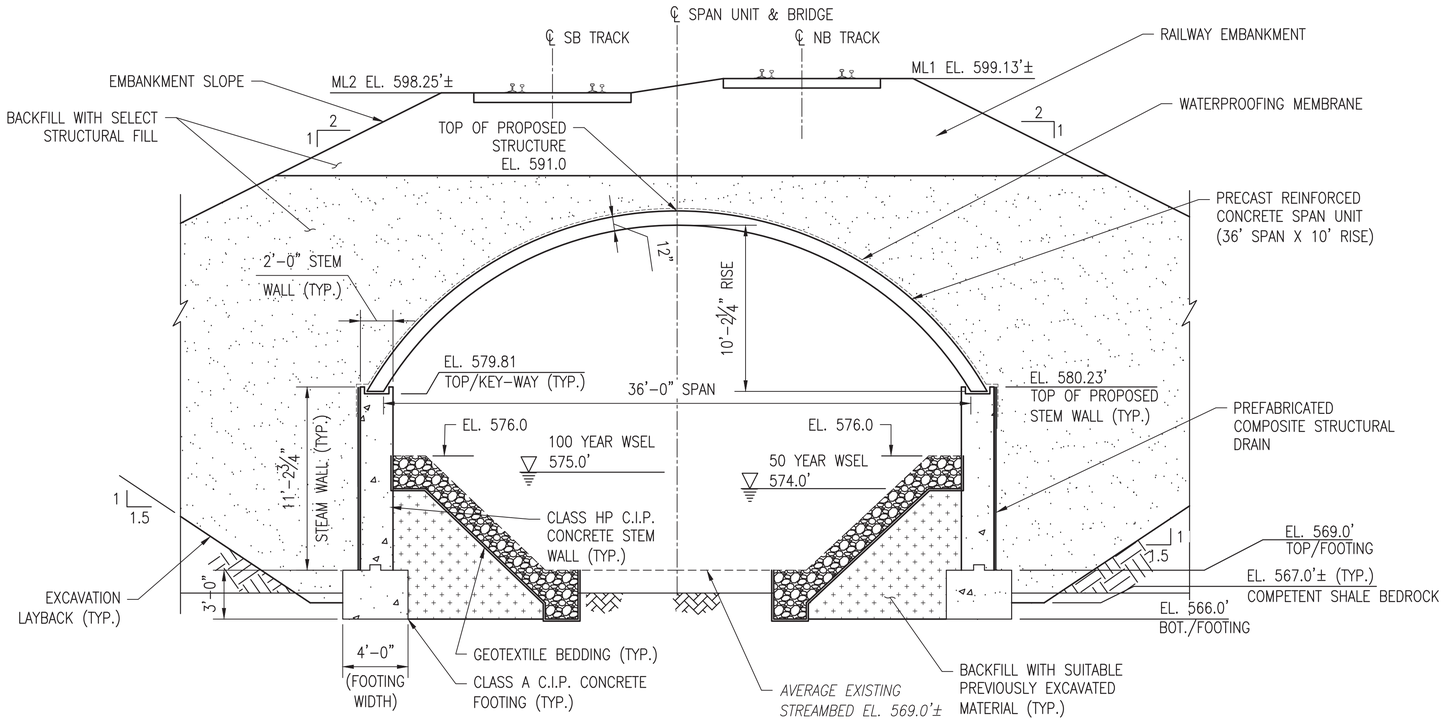
SHEET TITLE

BIZER CREEK – PLAN AND ELEVATION

DRAWING#

SG101-B1

SHEET# 214 OF 458



B BIZER CREEK TRANSVERSE SECTION (LOOKING NORTH)

3/16" = 1'-0"

WSP USA Inc.
40 LA RIVIERE DR.
BUFFALO, NY
TEL: 1 716-853-1220
FAX: 1 716 853-1332

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Serving Buffalo Niagara

METRO RAIL EXTENSION EIS & PRELIMINARY ENGINEERING

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SHEET TITLE
BIZER CREEK – TRANSVERSE SECTION

DRAWING#
SG301-B1