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NCDOT ACCEPTANCE

BRIDGE SURVEY & HYDRAULIC DESIGN REPORT

N. C. DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
HYDRAULICS UNIT
RALEIGH, N. C.

State Proj. Reference No. BP7.R009.1 WBS Project No. BP7.R009.1 Proj. Station –L– 15+27

County ORANGE Bridge Over ENO RIVER Bridge Inv. No. 670011

On Highway SR 1336 (HALLS MILL RD.) Between SR 1004 (EFLAND – CEDAR GROVE RD.) and SR 1332 (HIGHLAND FARM RD.)

Recommended Structure 1 @ 35'–0", 1 @ 70'–0", 1 @ 35'–0"; 24" CORED SLAB BRIDGE W/4'–0" CAPS

Recommended Width of Roadway 36'–6" CLEAR ROADWAY Skew 90°

Recommended Location is (Up, (At) Down) Stream from Existing Crossing,

Longitude –79.155054 Latitude 36.123683

Statewide Tier ☐ Regional Tier ☐ Sub–Regional Tier ☒

Bench Mark is BENCHMARK IS "BM1", 60D NAIL IN AN 12" ASH, 73.9' LT OF –L– 17+84.54, EL =575.57'

Northing 864146 Easting 1954371 Elev. 575.57 ft. Datum: NAD 83 /NA2011

Temporary Crossing NOT REQUIRED; OFF SITE DETOUR PROVIDED

Designed by: MATTHEW D. STRATTON, EI

Assisted by: ROGER S. WEADON, PE

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 40801 PAUL H. CAMERON

Date 2/17/2023

DocuSigned by: Paul Cameron E9B339B26CDF4AC...

QA Review by: Date

Drainage Area 26.8 SQ. MI. Source USGS /STREAM STATS

River Basin NEUSE Character REGION 1 – PIEDMONT

Stream Classification (Such as Trout, High Quality Water, etc.) WS–II, HQW, NSW

Data on Existing Structure 1 @ 30'–8", 2 @ 30'–0", 1 @ 30'–8" BRIDGE W/TIMBER DECK ON STEEL I–BEAMS

Total Waterway Opening 988 s.f.

Waterway Opening Below 100yr. WS EL. 988 s.f.

Debris Potential: Low Moderate X High

Data on Structures Up and Down Stream UPSTREAM: 3 @ 7'X8' RCBC; HEIGHT CROWN–TO–BED = 12'

DOWNSTREAM: 1 @ 31'–6", 1 @ 32'–6", 1 @ 32'–0" BRIDGE W/RC DECK ON STEEL I–BEAMS;

HEIGHT CROWN–TO–BED = 19'

Design Control Elev. *571.4, **573.4 ft. * EX. USGS 25 YR AT RS 201325
** EX. FEMA 100 YR AT RS 201325

Gage Station No. NA Period of Records NA

Max. Discharge NA c.f.s. Date NA Frequency NA

Historical Flood Information:

Date Elev. ft. Est. Freq. yr. Source Period of Knowledge yrs.

Date Elev. ft. Est. Freq. yr. Source Period of Knowledge yrs.

Date Elev. ft. Est. Freq. yr. Source Period of Knowledge yrs.

Historical Scour Info: General NA ft. Contraction NA ft. Local NA ft.

Channel Slope 0.001765 ft/ft Source FIELD SURVEY/LIDAR Normal Water Surface Elev. 558.6 ft.

Manning's n: Left O.B. 0.04–0.20 Channel 0.038–0.065 Right O.B. 0.04–0.20 Source ORANGE COUNTY FIS

Flood Study /Status FEMA DETAILED STUDY EFFECTIVE DATE: 2/2/2007 REVISED DATE: 10/19/2018

Flood Study 100yr. Discharge 5480 c.f.s. WS Elev.: With Floodway 573.6 ft. Without Floodway 573.5 ft.

DESIGN DATA

Hydrological Method USGS RURAL SIR 2009–5158

Hydraulic Design Method HEC–RAS 5.0.7 (BP7.R009.1_EnoRiver_SR–1336.PRJ)

Floods Evaluated: @ River Station 201325 40.4 FT. FROM US FACE OF PROP. BRIDGE

Freq. (yr.)	Q (c.f.s)	Elev. (ft.)	Backwater (ft.)	Bridge Opening Velocity (f.p.s.)
10	3000	570.3	0.1	3.6
25	3900	571.4	0.0	4.1
50	4800	572.5	0.1	4.5
100	5500	573.3	0.1	4.8
500	7300	575.0	0.0	5.4

Waterway Opening Provided Below: Design W.S. Elev. 950 s.f., 100yr W.S. Elev. 1151 s.f., Total 1916 s.f.,

Average Channel Velocity (Design) 4.7 f.p.s. Average Overbank Velocity (Design) LT = 1.2 RT = 1.1 f.p.s.

Computed Scour : General NA ft. Contraction 100YR : 0.3 ft. Local PIER1 : 5.51 PIER2 : 5.03 ft.

State Floodway Compliance Type SFC TYPE B WITH MAX DECREASE OF 0.06' @ RS 201325

INFORMATION TO BE SHOWN ON PLANS

HYDRAULIC DATA	
DESIGN DISCHARGE	= 3900 C.F.S.
FREQUENCY OF DESIGN FLOOD	= 25 YRS.
DESIGN HIGH WATER ELEVATION	= 571.4
DRAINAGE AREA	= 26.8 SQ. MI.
BASIC DISCHARGE (Q100)	= 5500 C.F.S.
BASIC HIGH WATER ELEVATION	= 573.3
OVERTOPPING FLOOD DATA	
OVERTOPPING DISCHARGE	= >17000 C.F.S.
FREQUENCY OF OVERTOPPING FLOOD	= >500 YRS.
OVERTOPPING FLOOD ELEVATION	= 581.98*

*OVERTOPPING OCCURS @ RT SHOULDER PT @ –L– 13+43.62 RT

WS EL. Taken @ River Station 201325

ADDITIONAL INFORMATION AND COMPUTATIONS

DISCHARGE CALCS. BY NCDOT GUIDELINES FOR DRAINAGE STUDIES & HYDRAULIC DESIGN & SIR 2009–5158

DRAINAGE AREA (DA) = 26.8 SQ. MI.; 100% IN HYDRAULIC REGION 1 – RIDGE AND VALLEY–PIEDMONT

SIR 2009–5158 RURAL PIEDMONT:			FEMA DISCHARGES
$Q_{10} = 398(DA)^{0.617}$	= 3027 cfs	SAY 3000 cfs	Q_{10} = 3030 cfs
$Q_{25} = 537(DA)^{0.606}$	= 3939 cfs	SAY 3900 cfs	Q_{25} = 3940 cfs
$Q_{50} = 661(DA)^{0.718}$	= 4754 cfs	SAY 4800 cfs	Q_{50} = 4760 cfs
$Q_{100} = 776(DA)^{0.594}$	= 5472 cfs	SAY 5500 cfs	Q_{100} = 5480 cfs
$Q_{500} = 1072(DA)^{0.583}$	= 7291 cfs	SAY 7300 cfs	Q_{500} = 7290 cfs

SINCE FEMA AND USGS FLOWS CLOSELY MATCH, USGS FLOWS USED FOR DESIGNS

SCOUR ANALYSIS

Q_1 & W_1 ⇒ RS 201417 Q_2 & W_2 ⇒ RS 201263 BR U

CONTRACTION SCOUR: $Y_2/Y_1 = (Q_2/Q_1)^{6/7} \times (W_1/W_2)^{K_1}$; $Y_s = Y_2 - Y_0$ K=0.69

100 YR: Q_1 =4412.60 cfs, Q_2 =3460.34 cfs, W_1 =47.98 ft, W_2 =36.91 ft, Y_1 =15.66 ft, Y_0 =14.94 ft,

100 YR: Y_s =15.24 ft –14.94 ft, Y_s=0.30 ft

LOCAL SCOUR: a = 3.0 ft, K_1 = 1.0, K_2 = 1.0, K_3 = 1.1, g = 32.2 ft/s

$Y_s = Y_1 [2.0 \times K_1 \times K_2 \times K_3 \times (\frac{a}{Y_1})^{0.65} \times Fr^{0.43}]$ $Fr = V / \sqrt{(g)(Y_1)}$

100 YR:	V [ft/s]:	Y_1 [ft]:	F_r:	Y_s [ft]:
BENT 1	3.66	9.05	0.2144	5.51
BENT 2	2.99	8.71	0.1785	5.03

DESIGN NOTES:

BP7.R009.1 RESULTS IN NO ADVERSE IMPACTS TO ANY INSURABLE STRUCTURES IN THE ENO RIVER FLOODPLAIN.

TYPICAL SECTION NO. (NTS)
–L– SR 1336 (HALLS MILL RD)
CORED SLAB BRIDGE

NCDOT PERFORMANCE TABLE					
	FREQUENCY				
	10yr.	25yr.	50yr.	100yr.	500yr.
NATURAL	570.2	571.4	572.4	573.2	575.0
EXISTING	570.3	571.4	572.5	573.3	575.5
PROPOSED	570.3	571.4	572.5	573.3	575.0

@ RS 201325
EXISTING 69.3 FT. FROM US FACE OF BRIDGE
PROPOSED 40.4 FT. FROM US FACE OF BRIDGE

FEMA PERFORMANCE TABLE	
	100yr.
DUPLICATE EFFECTIVE	573.49
CORRECTED EFFECTIVE	573.39
REVISED	573.33

@SECTION 201292
DUPLICATE EFFECTIVE 36.2 FT. FROM US FACE OF BRIDGE
@SECTION 201325
CORRECTED EFFECTIVE 69.3 FT. FROM US FACE OF BRIDGE
REVISED 40.4 FT. FROM US FACE OF BRIDGE