# PRELIMINARY HYDRAULICS STUDY FOR ENVIRONMENTAL IMPACT

### TIP PROJECT NO. R-2721, R-2828, & R-2829 WAKE AND JOHNSTON COUNTIES COMPLETE 540 TRIANGLE EXPRESSWAY SOUTHEAST EXTENSION



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I.	<b>Hydraulic Aspec</b>	ts of Environmenta	al Impact

# HYDRAULIC ASPECTS OF ENVIRONMENTAL IMPACT OF THE TRIANGLE EXPRESSWAY PROTECTED CORRIDOR BETWEEN NC 55 BYPASS (HOLLY SPRINGS) AND US 64 BYPASS (KNIGHTDALE) TIP PROJECT NO. R-2721, R-2828, AND R-2829

The North Carolina Turnpike Authority (NCTA) proposes to construct a multi-lane facility on new location between NC 55 in Apex and US 64 Bypass in Knightdale. The proposed typical section that is being considered for the project is a 6 lane median divided facility. The length of the proposed protected corridor is approximately 13.4 miles. There are 18 major stream crossings involved with this portion of the project. See the attached quad map for specific locations of the sites. All of the crossings are located in the Neuse River Basin. All of the proposed culverts are buried 1 foot in order to provide for fish passage.

The staff of Mulkey, Inc. recently conducted a field investigation and preliminary hydraulic study for the subject stream crossings. In consideration of all aspects noted below, the hydraulic recommendations are summarized as follows:

Site 1 is a crossing of Middle Creek on new location. The normal water depth at the proposed site is 1.8 feet. The channel has a base width of 13.1 feet and a depth of 5.2 feet. Top of bank to top of bank measures approximately 22 feet. Recent drift was observed to be 6.0 feet above the stream bed. The drainage area for this crossing is 3,446 acres (5.38 square miles). A majority of the area is zoned as either Industrial or Residential. This crossing is located below headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 3@11'x11' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 2 is a crossing of an unnamed tributary to Middle Creek on new location. The normal water depth at the proposed site is 3.7 feet. The channel has a base width of 7.4 feet and a depth of 5.1 feet. Top of bank to top of bank measures approximately 12 feet. There was no recent drift observed at this site. The drainage area for this crossing is 705 acres (1.10 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@8'x8' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 3 is a crossing of Rocky Branch on new location. The normal water depth at the proposed site is 1.8 feet. The channel has a base width of 7.2 feet and a depth of 4.5 feet. Top of bank to top of bank measures approximately 13.2 feet. Recent drift was observed

to be 4.5 feet above the stream bed. The drainage area for this crossing is 647 acres (1.01 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@6'x9' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 4 is a crossing of Camp Branch on new location. The normal water depth at the proposed site is 1.4 feet. The channel has a base width of 9.5 feet and a depth of 4.7 feet. Top of bank to top of bank measures approximately 17 feet. Recent drift was observed to be 3.1 feet above the stream bed. The drainage area for this crossing is 1,083 acres (1.69 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@8'x9' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 5 is a crossing of an unnamed tributary to Camp Branch on new location. The normal water depth at the proposed site is 1.3 feet. The channel has a base width of 4.9 feet and a depth of 2.9 feet. Top of bank to top of bank measures approximately 11.2 feet. Recent drift was observed to be 3.0 feet above the stream bed. The drainage area for this crossing is 325 acres (0.51 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@7'x7' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 6 is a crossing of an unnamed tributary to Middle Creek on new location. The normal water depth at the proposed site is 2.8 feet. The channel has a base width of 8.6 feet and a depth of 3.6 feet. Top of bank to top of bank measures approximately 13.9 feet. Recent drift was observed to be 3.2 feet above the stream bed. The drainage area for this crossing is 160 acres (0.25 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@7'x5' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for

impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 7 is a crossing of the Bells Lake connecting stream to Middle Creek on new location. The normal water depth at the proposed site is 1.2 foot. The channel has a base width of 2.2 feet and a depth of 1.6 feet. Top of bank to top of bank measures approximately 4.5 feet. There was no recent drift observed at this site. The drainage area for this crossing is 99 acres (0.15 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@6'x5' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 8 is a crossing of an unnamed tributary to Middle Creek on new location. The normal water depth at the proposed site is 0.8 foot. The channel has a base width of 6.0 feet and a depth of 1.5 feet. Top of bank to top of bank measures approximately 9 feet. Recent drift was observed to be 1.5 feet above the stream bed. The drainage area for this crossing is 93 acres (0.15 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@5'x5' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 9 is a crossing of an unnamed tributary to Middle Creek on new location. This site is a pond. The normal water depth at the downstream channel is 1.1 foot. The channel has a base width of 4.4 feet and a depth of 1.3 feet. Top of bank to top of bank measures approximately 8.5 feet. Recent drift was observed to be 1.3 feet above the stream bed. The drainage area for this crossing is 112 acres (0.17 square miles). The entire area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@6'x5' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 10 is a crossing of Mills Branch on new location. This site is a pond. The normal water depth at the downstream channel is 1.1 feet. The channel has a base width of 3.0

feet and a depth of 2.7 feet. Top of bank to top of bank measures approximately 9.4 feet. There was no recent drift observed at this site. The drainage area for this crossing is 485 acres (0.76 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@8'x7' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 11 is a crossing of an unnamed tributary to Mills Branch on new location. The normal water depth at the proposed site is 1.4 feet. The channel has a base width of 4.4 feet and a depth of 2.3 feet. Top of bank to top of bank measures approximately 9 feet. Recent drift was observed to be 2.1 feet above the stream bed. The drainage area for this crossing is 135 acres (0.21 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@7'x5' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 12 is a crossing of an unnamed tributary to Mills Branch on new location. The normal water depth at the proposed site is 0.8 foot. The channel has a base width of 4.2 feet and a depth of 1.9 feet. Top of bank to top of bank measures approximately 7 feet. Recent drift was observed to be 1.9 feet above the stream bed. The drainage area for this crossing is 124 acres (0.19 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@6'x5' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 13 is a crossing of an unnamed tributary to Panther Branch on new location. The normal water depth at the proposed site is 1.6 feet. The channel has a base width of 5.4 feet and a depth of 3.3 feet. Top of bank to top of bank measures approximately 11.7 feet. Recent drift was observed to be 2.4 feet above the stream bed. The drainage area for this crossing is 97 acres (0.15 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@5'x5' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a

FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 14 is a crossing of Panther Branch on new location. The normal water depth at the proposed site is 1.6 feet. The channel has a base width of 5.2 feet and a depth of 2.4 feet. Top of bank to top of bank measures approximately 10.1 feet. Recent drift was observed to be 2.4 feet above the stream bed. The drainage area for this crossing is 326 acres (0.51 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 3@8'x5' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 15 is a crossing of Little Creek on new location. The normal water depth at the proposed site is 1.0 foot. The channel has a base width of 3.5 feet and a depth of 1.8 feet. Top of bank to top of bank measures approximately 8.2 feet. Recent drift was observed to be 1.8 feet above the stream bed. The drainage area for this crossing is 152 acres (0.24 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@7'x5' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 16 is a crossing of Juniper Branch on new location. The normal water depth at the proposed site is 1.6 feet. The channel has a base width of 3.6 feet and a depth of 2.5 feet. Top of bank to top of bank measures approximately 9.5 feet. Recent drift was observed to be 3.0 feet above the stream bed. The drainage area for this crossing is 426 acres (0.67 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@9'x6' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 17 is a crossing of an unnamed tributary to Guffy Branch on new location. The normal water depth at the proposed site is 0.7 foot. The channel has a base width of 2.9 feet and a depth of 1.1 feet. Top of bank to top of bank measures approximately 6.0 feet. Recent drift was observed to be 1.1 feet above the stream bed. The drainage area for this

crossing is 153 acres (0.24 square miles). The entire area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@7'x5' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 18 is a crossing of Guffy Branch on new location. The normal water depth at the proposed site is 1.8 feet. The channel has a base width of 6.5 feet and a depth of 4.1 feet. Top of bank to top of bank measures approximately 14.5 feet. Recent drift was observed to be 3.6 feet above the stream bed. The drainage area for this crossing is 594 acres (0.93 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@9'x7' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE without a floodway. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 19 is a crossing of Buffalo Creek on new location. The normal water depth at the proposed site is 0.8 foot. The channel has a base width of 5.0 feet and a depth of 2.4 feet. Top of bank to top of bank measures approximately 10 feet. Recent drift was observed to be 1.8 feet above the stream bed. The drainage area for this crossing is 282 acres (0.44 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@8'x6' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 20 is a crossing of an unnamed tributary to Swift Creek on new location. The normal water depth at the proposed site is 0.9 foot. The channel has a base width of 5.6 feet and a depth of 2.6 feet. Top of bank to top of bank measures approximately 9.6 feet. Recent drift was observed to be 1.3 feet above the stream bed. The drainage area for this crossing is 110 acres (0.17 square miles). The entire area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@6'x5' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this

site.

Site 21 is a crossing of an unnamed tributary to Swift Creek on new location. The normal water depth at the proposed site is 1.8 feet. The channel has a base width of 8.5 feet and a depth of 2.6 feet. Top of bank to top of bank measures approximately 13.5 feet. There was no recent drift observed at this site. The drainage area for this crossing is 332 acres (0.52 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 3@7'x5' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 22 is a crossing of Swift Creek on new location. The normal water depth at the proposed site is 3.1 feet. The channel has a base width of 43 feet and a depth of 7.0 feet. Top of bank to top of bank measures approximately 65 feet. Recent drift was observed to be 7.8 feet above the stream bed. The drainage area for this crossing is 49,411 acres (77.20 square miles). A majority of the area is zoned as Residential. This crossing is located below headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be dual 825 feet long bridges; based off spanning the floodway. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 23 is a crossing of an unnamed tributary to Swift Creek on new location. The normal water depth at the proposed site is 0.4 foot. The channel has a base width of 2.6 feet and a depth of 1.7 feet. Top of bank to top of bank measures approximately 9.2 feet. Recent drift was observed to be 2.0 feet above the stream bed. The drainage area for this crossing is 120 acres (0.19 square miles). The entire area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@6'x5' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE, due to the flooding effects of Swift Creek. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 24 is a crossing of an unnamed tributary to Swift Creek on new location. The normal water depth at the proposed site is 2.0 feet. The channel has a base width of 10.1 feet and a depth of 2.3 feet. Top of bank to top of bank measures approximately 12.9

feet. Recent drift was observed to be 2.6 feet above the stream bed. The drainage area for this crossing is 487 acres (0.76 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 3@9'x5' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 25 was removed due to location of the final alignment.

Site 26 is a crossing of White Oak Creek on new location. The normal water depth at the proposed site is 1.5 foot. The channel has a base width of 5.8 feet and a depth of 5.9 feet. Top of bank to top of bank measures approximately 31.0 feet. Recent drift was observed to be 7.6 feet above the stream bed. The drainage area for this crossing is 4,067 acres (6.35 square miles). A majority of the area is zoned as Residential (R-30 & HD). This crossing is located below headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be dual 320 feet long bridges. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 27 is a crossing of an unnamed tributary to White Oak Creek on new location. The normal water depth at the proposed site is 1.3 foot. The channel has a base width of 8.0 feet and a depth of 3.4 feet. Top of bank to top of bank measures approximately 9.7 feet. Recent drift was observed to be 4.3 feet above the stream bed. The drainage area for this crossing is 253 acres (0.40 square miles). A majority of the area is zoned as Residential (HD). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@7'x6' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 28 is a crossing of an unnamed tributary to White Oak Creek on new location. The normal water depth at the proposed site is 1.4 foot. The channel has a base width of 2.6 feet and a depth of 5.1 feet. Top of bank to top of bank measures approximately 8.3 feet. Recent drift was observed to be 4.3 feet above the stream bed. The drainage area for this crossing is 104 acres (0.16 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 1@6'x7' RCBC. Further detailed analysis will be required during final design in order to adequately

address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 29 is a crossing of an unnamed tributary to Neuse River on new location. The normal water depth at the proposed site is 1.3 foot. The channel has a base width of 4.0 feet and a depth of 4.4 feet. Top of bank to top of bank measures approximately 11.2 feet. Recent drift was observed to be 2.4 feet above the stream bed. The drainage area for this crossing is 121 acres (0.19 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 1@8'x6' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 30 is a crossing of the Neuse River on new location. The drainage area for this crossing is 695,041 acres (1,086 square miles). This crossing is located below headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be either dual 545' bridges (Cor-R), dual 590' bridges (Cor-T), or dual 635' bridges (Cor-MG). Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The river is in a FEMA detailed study Special Flood Hazard Zone AE. This stretch of the river is listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of river is located in Class C and NSW per NCDWQ classifications for this site.

Site 31 is a crossing of an unnamed tributary to Neuse River on new location. The normal water depth at the proposed site is 1.3 foot. The channel has a base width of 11.8 feet and a depth of 3.5 feet. Top of bank to top of bank measures approximately 17.0 feet. Recent drift was observed to be 1.6 feet above the stream bed. The drainage area for this crossing is 2,946 acres (4.6 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located below headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 3@10'x8' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The unnamed tributary is in a FEMA detailed study Special Flood Hazard Zone AE. This stretch of the unnamed tributary is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of unnamed tributary is located in Class C and NSW per NCDWQ classifications for this site.

Site 32 is a crossing of an unnamed tributary to Neuse River on new location. The normal water depth at the proposed site is 0.6 foot. The channel has a base width of 3.6 feet and a depth of 1.8 feet. Top of bank to top of bank measures approximately 8.2 feet.

No recent drift was observed at this site. The drainage area for this crossing is 84 acres (0.13 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 72"RCP. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. This stretch of the river is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 33 is a crossing of an unnamed tributary to Neuse River on new location. The normal water depth at the proposed site is 1.3 feet. The channel has a base width of 4.7 feet and a depth of 1.8 feet. Top of bank to top of bank measures approximately 7.6 feet. Recent drift was observed to be 1.3 feet above the stream bed. The drainage area for this crossing is 199 acres (0.31 square miles). A majority of the area is zoned as Residential and Open Space Preserve. A large part of the Open Space Preserve is contained in the interchange. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@7'x6' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. This stretch of the river is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 33A is a crossing of an unnamed tributary to Neuse River on new location. The normal water depth at the proposed site is 0.7 foot. The channel has a base width of 3.0 feet and a depth of 2.0 feet. Top of bank to top of bank measures approximately 6.0 feet. Recent drift was observed to be 0.7 feet above the stream bed. The drainage area for this crossing is 100 acres (0.16 square miles). A majority of the area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@5'x6' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. This stretch of the river is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 34 is a crossing of Swift Creek on new location. The proposed site consists of multiple braided streams and does not have a single well defined main channel. The drainage area for this crossing is 24,800 acres (38.8 square miles). A majority of the area is zoned as Residential. This crossing is located below headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a dual 1105' length bridges. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class WS-III and NSW per NCDWQ classifications for this

site.

Site 35 is a crossing of Yates Branch on new location. The proposed site consists of multiple braided streams and does not have a single well defined main channel. The alignment crosses over approximately 1500 feet of wetland and has bridges for up and down stream structures. The drainage area for this crossing is 8,378 acres (13.09 square miles). A majority of the area is zoned as Residential. This crossing is located below headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure on the main line be a dual 600' length bridges, the Ramp B proposed structure be a 480' length bridge, and the Ramp C proposed structure be a 605' length structure. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class WS-III; NSW and CA per NCDWQ classifications for this site.

Site 36 is a crossing of Unnamed Tributary to Yates Branch on new location. The normal water depth at the proposed site is 1.5 feet. The channel has a base width of 3.0 feet and a depth of 6.0 feet. Top of bank to top of bank measures approximately 21.0 feet. Recent drift was observed to be 3.0 feet above the stream bed. The drainage area for this crossing is 106 acres (0.17 square miles). A majority of the area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@5'x6' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class WS-III; NSW and CA per NCDWQ classifications for this site.

Site 37 is a crossing of Buck Branch on new location. The normal water depth at the proposed site is 1.5 feet. The channel has a base width of 5.0 feet and a depth of 4.0 feet. Top of bank to top of bank measures approximately 17.0 feet. Recent drift was observed to be 4.0 feet above the stream bed. The drainage area for this crossing is 1,011 acres (1.58 square miles). A majority of the area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 3@8'x8' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class WS-III; NSW and CA per NCDWQ classifications for this site.

Site 38 is a crossing of Reedy Creek on new location. The normal water depth at the proposed site is 3.3 feet. The channel has a base width of 17.0 feet and a depth of 5.0 feet. Top of bank to top of bank measures approximately 23.0 feet. Recent drift was observed to be 4.3 feet above the stream bed. The drainage area for this crossing is 611 acres (0.95 square miles). A majority of the area is zoned as Residential. This crossing is

located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@9'x8' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 39 is a crossing of Reedy Creek Tributary on new location. The normal water depth at the proposed site is 0.9 foot. The channel has a base width of 14.5 feet and a depth of 4.9 feet. Top of bank to top of bank measures approximately 23.2 feet. Recent drift was observed to be 3.1 feet above the stream bed. The drainage area for this crossing is 477 acres (0.75 square miles). A majority of the area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@8'x8' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 40 is a crossing of Bagwell Branch on new location. The normal water depth at the proposed site is 1.1 feet. The channel has a base width of 10.0 feet and a depth of 5.0 feet. Top of bank to top of bank measures approximately 16.0 feet. Recent drift was observed to be 5.4 feet above the stream bed. The drainage area for this crossing is 830 acres (1.30 square miles). A majority of the area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@10'x9' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class WS-III, NSW and CA per NCDWQ classifications for this site.

Site 41 is a crossing of Mahlers Creek on new location. The proposed site consists of multiple braided streams and does not have a single well defined main channel. The alignment crosses over approximately 310 feet of wetland and has bridges for up and down stream structures. The drainage area for this crossing is 1,114 acres (1.74 square miles). A majority of the area is zoned as either Residential or Commercial. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a dual 315' length bridges. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 42 is a crossing of Unnamed Tributary to Mahlers Creek on new location. The

normal water depth at the proposed site is 1.2 feet. The channel has a base width of 4.0 feet and a depth of 3.6 feet. Top of bank to top of bank measures approximately 10.0 feet. Recent drift was observed to be 4.0 feet above the stream bed. The drainage area for this crossing is 97 acres (0.15 square miles). A majority of the area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@5'x6' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The unnamed tributary is in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The unnamed tributary is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of unnamed tributary is located in Class C and NSW per NCDWQ classifications for this site.

Site 43 is a crossing of White Oak Creek on new location. The normal water depth at the proposed site is 1.8 feet. The channel has a base width of 14.0 feet and a depth of 3.0 feet. Top of bank to top of bank measures approximately 19.0 feet. Recent drift was observed to be 4.0 feet above the stream bed. The drainage area for this crossing is 1,152 acres (1.80 square miles). A majority of the area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 3@11'x7' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 44 is a crossing of Unnamed Tributary to White Oak Creek on new location. The proposed site consists of multiple braided streams and does not have a single well defined main channel. The following dimensions represent the typical dimensions of one of the sites channels. The normal water depth is 1.0 foot. The channel has a base width of 3.8 feet and a depth of 1.3 feet. Top of bank to top of bank measures approximately 4.4 feet. Recent drift was observed to be 2.4 feet above the stream bed. The drainage area for this crossing is 151 acres (0.24 square miles). A majority of the area is zoned as Industrial. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@7'x6' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 45 is a crossing of White Oak Creek on new location. The normal water depth at the proposed site is 5.0 feet. The channel has a base width of 16.0 feet and a depth of 6.2 feet. Top of bank to top of bank measures approximately 18.0 feet. Recent drift was observed to be 8.2 feet above the stream bed. The drainage area for this crossing is 5,123 acres (8.00 square miles). A majority of the area is zoned as Residential. This crossing is located below headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a dual 280' length bridges. Further detailed

analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 46 is a crossing of Little Creek on new location. The proposed site consists of multiple braided streams and does not have a single well defined main channel. The following dimensions represent the typical dimensions of one of the sites channels. The normal water depth at the proposed site is 1.7 feet. The channel has a base width of 6.0 feet and a depth of 1.8 feet. Top of bank to top of bank measures approximately 7.2 feet. No recent drift was observed. The drainage area for this crossing is 407 acres (0.64 square miles). A majority of the area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 3@8'x6' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 47 is a crossing of Beddingfield Creek on new location. The normal water depth at the proposed site is 1.6 feet. The channel has a base width of 13.0 feet and a depth of 3.5 feet. Top of bank to top of bank measures approximately 20.0 feet. Recent drift was observed to be 4.1 feet above the stream bed. The drainage area for this crossing is 627 acres (0.98 square miles). A majority of the area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@11'x6' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 48 is a crossing of Neuse River on new location. The drainage area for this crossing is 696,960 acres (1089 square miles). This crossing is located below headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be dual 675' length bridges. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The river is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of river is located in Class C and NSW per NCDWQ classifications for this site.

Site 49 is a crossing of Unnamed Tributary to Neuse River on new location. The normal water depth at the proposed site is 1.3 feet. The channel has a base width of 10.2 feet and a depth of 3.1 feet. Top of bank to top of bank measures approximately 15.0 feet. Recent drift was observed to be 1.4 feet above the stream bed. The drainage area for this crossing

is 2,763 acres (4.32 square miles). A majority of the area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 3@12'x8' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 50 is a crossing of Beddingfield Creek on new location. The normal water depth at the proposed site is 3.5 feet. The channel has a base width of 13.0 feet and a depth of 6.4 feet. Top of bank to top of bank measures approximately 22.5 feet. Recent drift was observed to be 4.0 feet above the stream bed. The drainage area for this crossing is 521 acres (0.81 square miles). A majority of the area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@10'x6' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 51 is a crossing of Unnamed Tributary to Neuse River on new location. The normal water depth at the proposed site is 2.0 feet. The channel has a base width of 6.0 feet and a depth of 4.2 feet. Top of bank to top of bank measures approximately 14.5 feet. Recent drift was observed to be 4.3 feet above the stream bed. The drainage area for this crossing is 221 acres (0.35 square miles). A majority of the area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 1@12'x6' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 52 is a crossing of Unnamed Tributary to Neuse River on new location. The normal water depth at the proposed site is 2.3 feet. The channel has a base width of 5.2 feet and a depth of 4.5 feet. Top of bank to top of bank measures approximately 20.0 feet. Recent drift was observed to be 2.6 feet above the stream bed. The drainage area for this crossing is 600 acres (0.94 square miles). A majority of the area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 3@5'x8' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE due to it being in the backwater of the Neuse River. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 52B is a crossing of Unnamed Tributary to Neuse River on new location. The normal water depth at the proposed site is 2.7 feet. The channel has a base width of 5.0 feet and a depth of 5.0 feet. Top of bank to top of bank measures approximately 18.0 feet. Recent drift was observed to be 3.8 feet above the stream bed. The drainage area for this crossing is 572 acres (0.89 square miles). A majority of the area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 3@6'x7' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 53 is a crossing of Guffy Branch on new location. The normal water depth at the proposed site is 0.8 foot. The channel has a base width of 5.3 feet and a depth of 2.4 feet. Top of bank to top of bank measures approximately 10.0 feet. Recent drift was observed to be 2.4 feet above the stream bed. The drainage area for this crossing is 471 acres (0.74 square miles). The majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@11'x6' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA limited detailed study and is included in a Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 54 is a crossing of Swift Creek on new location. The normal water depth at the proposed site is 3.2 feet. The channel has a base width of 38 feet and a depth of 9.2 feet. Top of bank to top of bank measures approximately 55 feet. Recent drift was observed to be 5.3 feet above the stream bed. The drainage area for this crossing is 48,631 acres (76.0 square miles). The majority of the area is zoned as Residential (R-30). This crossing is located below headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be dual 710' long bridges. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 55 is a crossing of an unnamed tributary to Swift Creek on new location. The normal water depth at the proposed site is 2.3 foot. The channel has a base width of 3.0 feet and a depth of 5.3 feet. Top of bank to top of bank measures approximately 11 feet. Recent drift was observed to be 3.8 feet above the stream bed. The drainage area for this crossing is 102 acres (0.16 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 1@7'x7' RCBC. Further detailed analysis will be required during final design in order to adequately

address all the impacts associated with the floodplain. The creek is in a FEMA Limited Detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site and its junction with Swift Creek.

Site 56 is a crossing of an unnamed tributary to Swift Creek along the existing alignment of I-40. Currently, there is an existing single 66" CMP at this crossing. The normal water depth at the proposed site is 2.5 foot. The channel has a base width of 2.5 feet and a depth of 3.0 feet. Top of bank to top of bank measures approximately 8.5 feet. Recent drift was observed to be 5.4 feet above the stream bed. The drainage area for this crossing is 272 acres (0.43 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 1@11'x7' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site and its junction with Swift Creek.

Site 57 is a crossing of an unnamed tributary to Swift Creek along the existing alignment of I-40. Currently, there is an existing single 72" RCP at this crossing. The normal water depth at the proposed site is 2.4 foot. The channel has a base width of 3.2 feet and a depth of 2.9 feet. Top of bank to top of bank measures approximately 10.0 feet. Recent drift was observed to be 3.5 feet above the stream bed. The drainage area for this crossing is 316 acres (0.49 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@7'x7' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site and its junction with Swift Creek.

Site 58 is a crossing of an unnamed tributary to Swift Creek on new location. The normal water depth at the proposed site is 0.8 foot. The channel has a base width of 7.6 feet and a depth of 4.0 feet. Top of bank to top of bank measures approximately 14 feet. Recent drift was observed to be 5.5 feet above the stream bed. The drainage area for this crossing is 1,045 acres (1.63 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@10'x8' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for

impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site and its junction with Swift Creek.

Site 59 is a crossing of an unnamed tributary to Swift Creek on new location. The normal water depth at the proposed site is 1.2 foot. The channel has a base width of 4.6 feet and a depth of 3.5 feet. Top of bank to top of bank measures approximately 8.3 feet. Recent drift was observed to be 3.8 feet above the stream bed. The drainage area for this crossing is 321 acres (0.50 square miles). The entire area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@8'x6' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site and its junction with Swift Creek.

### Site 60 – Site eliminated.

Site 61 is a crossing of Swift Creek along existing alignment of I-40. Currently, there are dual 200' reinforced concrete girder bridges at this crossing. The channel has a base width of 42 feet and a depth of 10 feet. Top of bank to top of bank measures approximately 60 feet. There was no recent drift was observed at this site. The drainage area for this crossing is 51,348 acres (80.2 square miles). The entire area is zoned as Agricultural and Residential. This crossing is located below headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be dual 260' length bridges. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of swift Creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 62 is a crossing of an unnamed tributary to Swift Creek along the existing alignment of US 70. Currently, there are dual 595' reinforced concrete girder bridges at this crossing. The channel is braided at this location and, therefore, no typical channel measurements were able to be taken. Recent drift was not observed at this site. The drainage area for this crossing is 2,450 acres (3.83 square miles). The entire area is zoned as Agricultural and Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the existing 595' dual bridges be retained and construct an additional 595' bridge for the proposed ramp. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This creek is located in Class C and NSW per NCDWQ classifications as a tributary of Swift Creek.

Site 63 is a crossing of an unnamed tributary to Swift Creek on new location. The

channel is braided at this location and, therefore, no typical channel measurements were able to be taken. There are also significant wetlands present at this site as well. Recent drift was not observed at this site. The drainage area for this crossing is 1,692 acres (2.64 square miles). The entire area is zoned as Agricultural and Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be dual 425' length bridges along the proposed mainline alignment and construct an additional two 425' bridges one for each of the two proposed ramps. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, but is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This creek is located in Class C and NSW per NCDWQ classifications as a tributary of Swift Creek.

Site 64 is a crossing of Middle Creek on new location. The normal water depth at the proposed site is 4.0 feet. The channel has a base width of 35.5 feet and a depth of 5.5 feet. Top of bank to top of bank measures approximately 44.0 feet. Recent drift was observed to be 5.5 feet above the stream bed. The drainage area for this crossing is 15,925 acres (24.9 square miles). A majority of the area is zoned as Residential. This crossing is located below headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structures be one 1030' length bridge and one 1050' length bridge. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 65 is a crossing of an unnamed tributary to Middle Creek on new location. The normal water depth at the proposed site is 1.2 feet. The channel has a base width of 12.0 feet and a depth of 3.4 feet. Top of bank to top of bank measures approximately 16.8 feet. Recent drift was observed to be 1.8 feet above the stream bed. The drainage area for this crossing is 770 acres (1.2 square miles). A majority of the area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@10'x7' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA Special Flood Hazard Zone AE but is in the backwater of Middle Creek. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 66 is a crossing of an unnamed tributary to Middle Creek on new location. The normal water depth at the proposed site is 0.8 foot. The channel has a base width of 4.8 feet and a depth of 2.1 feet. Top of bank to top of bank measures approximately 5.2 feet. Recent drift was observed to be 1.8 feet above the stream bed. The drainage area for this crossing is 103 acres (0.16 square miles). A majority of the area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 1@8'x6' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts

associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone and is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 67 is a crossing of an unnamed tributary to Terrible Creek on new location. The normal water depth at the proposed site is 0.5 foot. The channel has a base width 2.5 feet and a depth of 1.25 feet. Top of bank to top of bank measures approximately 6.0 feet. Recent drift was observed to be 0.5 feet above the stream bed. The drainage area for this crossing is 100 acres (0.16 square miles). A majority of the area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 1@11'x5' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone and is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 68 is a crossing of Terrible Creek on new location. The normal water depth at the proposed site is 1.8 foot. The channel has a base width of 11.0 feet and a depth of 2.5 feet. Top of bank to top of bank measures approximately 16.0 feet. Recent drift was observed to be 3.3 feet above the stream bed. The drainage area for this crossing is 4,112 acres (6.43 square miles). A majority of the area is zoned as Planning Jurisdiction. This crossing is located below headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be dual 505' length bridges. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 69 is a crossing of an unnamed tributary to Terrible Creek on new location. The normal water depth at the proposed site is 2.0 foot. The channel has a base width of 12.0 feet and a depth of 3.7 feet. Top of bank to top of bank measures approximately 25.0 feet. Recent drift was observed to be 3.7 feet above the stream bed. The drainage area for this crossing is 1,278 acres (2.0 square miles). A majority of the area is zoned as under Planning Jurisdiction and is adjacent to a residential zoning. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 3@9'x8' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 70 is a crossing of an unnamed tributary to Terrible Creek on new location. The normal water depth at the proposed site is 1.7 feet. The channel has a base width of 6.5

feet and a depth of 4.0 feet. Top of bank to top of bank measures approximately 12.0 feet. Recent drift was observed to be 4.5 feet above the stream bed. The drainage area for this crossing is 140 acres (0.22 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@7'x5' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone and is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 71 is a crossing of an unnamed tributary to Terrible Creek on new location. The normal water depth at the proposed site is 1.2 foot. The channel has a base width of 7.0 feet and a depth of 4.2 feet. Top of bank to top of bank measures approximately 16.0 feet. Recent drift was observed to be 3.3 feet above the stream bed. The drainage area for this crossing is 141 acres (0.22 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@7'x5' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone, and is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 72 is a crossing of Middle Creek on new location. The normal water depth at the proposed site is 3.9 foot. The channel has a base width of 36.0 feet and a depth of 7.6 feet. Top of bank to top of bank measures approximately 44.0 feet. Recent drift was observed to be 7.9 feet above the stream bed. The drainage area for this crossing is 39,482 acres (61.7 square miles). A majority of the area is zoned as Residential (R-30). This crossing is located below headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be dual 1275' length bridges. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA detailed study Special Flood Hazard Zone AE. Middle Creek is listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 73 is a crossing of an unnamed tributary to Middle Creek on new location. The normal water depth at the proposed site is 1.2 foot. The channel has a base width of 8.6 feet and a depth of 2.4 feet. Top of bank to top of bank measures approximately 11.0 feet. Recent drift was observed to be 3.1 feet above the stream bed. The drainage area for this crossing is 142 acres (0.22 square miles). A majority of the area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@7'x5' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood

Hazard Zone AE but is in the backwater of Middle Creek. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 74 is a crossing of Little Creek on new location. The normal water depth at the proposed site is 2.6 feet. The channel has a base width of 11.0 feet and a depth of 4.6 feet. Top of bank to top of bank measures approximately 17.5 feet. Recent drift was observed to be 5.4 feet above the stream bed. The drainage area for this crossing is 3,013 acres (4.71 square miles). The entire area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@12'x10' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA limited detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 75 is a crossing of Ditch Branch on new location. The normal water depth at the proposed site is 2.0 feet. The channel has a base width of 9.0 feet and a depth of 3.9 feet. Top of bank to top of bank measures approximately 18.0 feet. Recent drift was observed to be 2.5 feet above the stream bed. The drainage area for this crossing is 258 acres (0.40 square miles). The entire area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@7'x6' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone and is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Site 76 is a crossing of Guffy Branch on new location. The normal water depth at the proposed site is 1.3 feet. The channel has a base width of 8.0 feet and a depth of 3.3 feet. Top of bank to top of bank measures approximately 14.0 feet. Recent drift was observed to be 3.8 feet above the stream bed. The drainage area for this crossing is 1,386 acres (2.17 square miles). The entire area is zoned as Residential. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@10'x9' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is in a FEMA limited detailed study Special Flood Hazard Zone AE. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site.

Sites 77-79 – Sites removed.

Site 80 is a crossing of an unnamed tributary to White Oak Creek along the existing alignment of I-40. Currently, there is an existing single 72" CMP at this crossing. The

normal water depth at the proposed site is 1.6 feet. The channel has a base width of 5.0 feet and a depth of 4.5 feet. Top of bank to top of bank measures approximately 11.0 feet. Recent drift was observed to be 3.5 feet above the stream bed. The drainage area for this crossing is 205 acres (0.32 square miles). A majority of the area is currently zoned as under Jurisdictional Planning. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@7'x7' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone and is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site and its junction with White Oak Creek.

Site 81 is a crossing of an unnamed tributary to White Oak Creek on new location for a proposed ramp to I-40 north. The normal water depth at the proposed site is 1.3 feet. The channel has a base width of 3.0 feet and a depth of 5.0 feet. Top of bank to top of bank measures approximately 6.0 feet. Recent drift was observed to be 2.5 feet above the stream bed. The drainage area for this crossing is 86 acres (0.13 square miles). A majority of the area is currently zoned as under Jurisdictional Planning. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 1@7'x7' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone and is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site and its junction with White Oak Creek.

Site 82 is a crossing of an unnamed tributary to White Oak Creek along the existing alignment of I-40. Currently, there is an existing single 72" CMP at this crossing. The normal water depth at the proposed site is 1.4 feet. The channel has a base width of 5.0 feet and a depth of 4.3 feet. Top of bank to top of bank measures approximately 13.0 feet. Recent drift was observed to be 3.3 feet above the stream bed. The drainage area for this crossing is 361 acres (0.56 square miles). A majority of the area is currently zoned as under Jurisdictional Planning. This crossing is located above headwater. Based on preliminary hydraulic analysis of this site, it is recommended that the proposed structure be a 2@9'x7' RCBC. Further detailed analysis will be required during final design in order to adequately address all the impacts associated with the floodplain. The creek is not in a FEMA Special Flood Hazard Zone and is listed in the non-regulated Zone X. The creek is not listed on the North Carolina Division of Water Quality (NCDWQ) 303(d) list for impaired streams. This stretch of creek is located in Class C and NSW per NCDWQ classifications for this site and its junction with White Oak Creek.

Wake County participates in the National Flood Insurance Regulatory Program. Results of this study were based upon the current Effective FIRM maps for Wake County. The

Hydraulics Unit will coordinate with the Federal Emergency Management Agency (FEMA) to determine if a Conditional Letter of Map Revision (CLOMR) and a subsequent final Letter of Map Revision (LOMR) are required for the project. If required, the Division will submit sealed as-built construction plans to the Hydraulics Unit upon project completion certifying the project was built as shown on construction plans.

Wetlands were observed sporadically through the corridor. NCDOT "Best Management Practices for the Protection of Surface Waters" will be utilized throughout the life of the project. Erosion and sedimentation will be controlled through the specification, installation, and maintenance of more stringent erosion and sedimentation control methods. Existing drainage patterns will be maintained to the extent practicable. Groundwater resources should not be affected by the project, as the roadway approaches are primarily on fill. Nutrient sensitive buffers are located throughout the entire project. There are no water supply watershed critical areas located downstream of this project, therefore Hazardous Spill Basins are not required for this project. It is anticipated that construction of the project will require a United States Army Corps of Engineers 404 individual permit and a 401 Water Quality Certification.

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# SUMMARY TABLE OF HYDRAULIC RECOMMENDATIONS

RECOMMENDED STRUCTURE	3@11'x11' RCBC	2@8'x8' RCBC	2@6'x9' RCBC	2@8'x9' RCBC	2@7'x7' RCBC	2@7'x5' RCBC	2@6'x5' RCBC	1@5'x5' RCBC	2@6'x5' RCBC	2@8'x7' RCBC	2@7'x5' RCBC	2@6'x5' RCBC	2@5'x5' RCBC	3@8'x5' RCBC	2@7'x5' RCBC	2@9'x6' RCBC
DETAILED STUDY	Yes (Zone AE)	No (Zone X)	Yes (Zone AE)	Yes (Zone AE)	No (Zone X)	No (Zone X)	No (Zone X)	No (Zone X)	No (Zone X)	No (Zone X)	No (Zone X)	No (Zone X)	No (Zone X)	No (Zone X)	No (Zone X)	No (Zone X)
FLOOD ZONE	səX	No	Yes	Yes	oN	No	No	oN	No	oN	No	oN	No	No	No	No
DA (SQ. MI.)	5.38 (3,446 Ac.)	1.10 (705 Ac.)	1.01 (647 Ac.)	1.69 (1,083 Ac.)	0.51 (325 Ac.)	0.25 (160 Ac.)	0.15 (99 Ac.)	0.15 (93 Ac.)	0.17 (112 Ac.)	0.76 (485 Ac.)	0.21 (135 Ac.)	0.19 (124 Ac.)	0.15 (97 Ac.)	0.51 (326 Ac.)	0.24 (152 Ac.)	0.67 (426 Ac.)
EXISTING STRUCTURE	New Location	New Location	New Location	New Location	New Location	New Location	New Location	New Location	New Location	New Location	New Location	New Location	New Location	New Location	New Location	New Location
STREAM	Middle Creek	Unnamed Tributary to Middle Creek	Rocky Branch	Camp Branch	Unnamed Tributary to Camp Branch	Unnamed Tributary to Middle Creek	Bells Lake	Unnamed Tributary to Middle Creek	Unnamed Tributary to Middle Creek	Mills Branch	Unnamed Tributary to Mills Branch	Unnamed Tributary to Mills Branch	Unnamed Tributary to Panther Branch	Panther Branch	Little Creek	Juniper Branch
SITE	1	2	3	4	5	9	7	8	6	10	11	12	13	14	15	16

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RECOMMENDED STRUCTURE	2@7'x5' RCBC	2@9'x7' RCBC	2@8'x6' RCBC	2@6'x5' RCBC	3@7'x5' RCBC	825' Dual Bridges	2@6'x5' RCBC	3@9'x5' RCBC		320' Dual Bridges	2@7'x6' RCBC	1@6'x7' RCBC	1@8'x6' RCBC	545' Dual Bridges Cor-R 590' Dual Bridges Cor-T 635' Dual Bridges Cor-MG	3@10'x8' RCBC	72" RCP	2@7'x6' RCBC
DETAILED STUDY	No (Zone X)	Yes (Zone AE)	No (Zone X)	No (Zone X)	No (Zone X)	Yes (Zone AE)	Yes (Zone AE)	Yes (Zone AE)		Yes (Zone AE)	No (Zone X)	No (Zone X)	No (Zone X)	Yes (Zone AE)	Yes (Zone AE)	Yes (Zone AE)	Yes (Zone AE)
FLOOD ZONE	No	Yes	No	No	No	Yes	Yes	Yes		Yes	No	No	No	Yes	Yes	Yes	Yes
DA (SQ. MI.)	0.24 (153 Ac.)	0.93 (594 Ac.)	0.44 (282 Ac.)	0.17 (110 Ac.)	0.52 (332 Ac.)	77.20 (49,411 Ac.)	0.19 (120 Ac.)	0.76 (487 Ac.)		6.35 (4,067 Ac.)	0.40 (253 Ac.)	0.16 (104 Ac.)	0.19 (121 Ac.)	1,086.00 (695041 Ac)	4.60 (2,946 Ac.)	0.13 (84 Ac.)	0.31 (199Ac.)
EXISTING STRUCTURE	New Location	New Location	New Location	New Location	New Location	New Location	New Location	New Location		New Location	New Location	New Location	New Location	New Location	New Location	New Location	New Location
STREAM	Unnamed Tributary to Guffy Branch	Guffy Branch	Buffalo Creek	Unnamed Tributary to Swift Creek	Unnamed Tributary to Swift Creek	Swift Creek	Unnamed Tributary to Swift Creek	Unnamed Tributary to Swift Creek	Removed	White Oak Creek	Unnamed Tributary to White Oak Creek	Unnamed Tributary to White Oak Creek	Unnamed Tributary to Neuse River	Neuse River	Unnamed Tributary to Neuse River	Unnamed Tributary to Neuse River	Unnamed Tributary to Neuse River
SITE	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

	STREAM	EXISTING STRUCTURE	DA (SQ. MI.)	FLOOD ZONE	DETAILED STUDY	RECOMMENDED STRUCTURE
name	Unnamed Tributary to Neuse River	New Location	0.16 (100Ac.)	No	No (Zone X)	5@5'x6' RCBC
	Swift Creek	New Location	38.8 (24,800 Ac.)	Yes	Yes (Zone AE)	Dual 1105' Bridges
	Yates Branch	New Location	13.09 (8,378 Ac.)	Yes	Yes (Zone AE)	Dual 600' Bridges
ınam	Unnamed Tributary to Yates Branch	New Location	0.17 (106 Ac.)	No	No (Zone X)	2@5'x6' RCBC
	Buck Branch	New Location	1.58 (1,011 Ac.)	Yes	Yes (Zone AE)	3@8'x8' RCBC
	Reedy Creek	New Location	0.95 (611 Ac.)	Yes	Yes (Zone AE)	2@9'x8' RCBC
Ree	Reedy Creek Tributary	New Location	0.75 (477 Ac.)	Yes	Yes (Zone AE)	2@8'x8' RCBC
	Bagwell Branch	New Location	1.30 (830 Ac.)	Yes	Yes (Zone AE)	2@10'x9' RCBC
	Mahlers Creek	New Location	1.74 (1,114 Ac.)	Yes	Yes (Zone AE)	Dual 315' Bridge
ıam	Unnamed Tributary to Mahlers Creek	New Location	0.15 (97 Ac.)	No	No (Zone X)	2@5'x6' RCBC
	White Oak Creek	New Location	1.80 (1,152 Ac.)	Yes	Yes (Zone AE)	3@11'x7' RCBC
nan	Unnamed Tributary to White Oak Creek	New Location	0.24 (151 Ac.)	No	No (Zone X)	2@7'x6' RCBC
	White Oak Creek	New Location	8.00 (5,123 Ac.)	Yes	Yes (Zone AE)	Dual 280' Bridges
	Little Creek	New Location	0.64 (407 Ac.)	No	No (Zone X)	3@8'x6' RCBC
В	Beddingfield Creek	New Location	0.98 (627 Ac.)	$ m N_{O}$	No (Zone X)	2@11'x6' RCBC
	Neuse River	New Location	1,089 (696,748 Ac.)	Yes	Yes (Zone AE)	Dual 675' Bridges
nan  -	Unnamed Tributary to Neuse River	New Location	4.32 (2,763 Ac.)	Yes	Yes (Zone AE)	3@12'x8' RCBC

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SITE	STREAM	EXISTING STRUCTURE	DA (SQ. MI.)	FLOOD ZONE	DETAILED STUDY	RECOMMENDED STRUCTURE
50	Beddingfield Creek	New Location	0.81 (521 Ac.)	No	No (Zone X)	2@10'x6' RCBC
51	Unnamed Tributary to Neuse River	New Location	0.35 (224 Ac.)	No	No (Zone X)	1@12'x6' RCBC
52	Unnamed Tributary to Neuse River	New Location	0.94 (600 Ac.)	Yes	Yes (Zone AE)	3@5'x8' RCBC
52B	Unnamed Tributary to Neuse River	New Location	0.89 (572 Ac.)	No	No (Zone X)	3@6'x7' RCBC
53	Guffy Branch	New Location	0.74 (471 Ac.)	Yes	Yes (Zone AE)	2@11'x6' RCBC
54	Swift Creek	New Location	76.0 (48,631 Ac.)	Yes	Yes (Zone AE)	Dual 710' Bridges
55	Unnamed Tributary to Swift Creek	New Location	0.16 (102 Ac.)	Yes	Yes (Zone AE)	1@7'x7' RCBC
99	Unnamed Tributary to Swift Creek	99., CMP	0.43 (272 Ac.)	oN	No (Zone X)	1@11'x7' RCBC
57	Unnamed Tributary to Swift Creek	72" RCP	0.49 (316 Ac.)	oN	No (Zone X)	2@7'x7' RCBC
58	Unnamed Tributary to Swift Creek	New Location	1.63 (1,045 Ac.)	No	No (Zone X)	2@10'x8' RCBC
59	Unnamed Tributary to Swift Creek	New Location	0.50 (321 Ac.)	No	No (Zone X)	2@8'x6' RCBC
61	Swift Creek	Dual 200' Bridges	80.2 (51,348 Ac.)	Yes	Yes (Zone AE)	Dual 260' Bridges
9	Removed					
62	Unnamed Tributary to Swift Creek	Dual 600' Bridges	3.83 (2,450 Ac.)	Yes	Yes (Zone AE)	595' Bridge
63	Unnamed Tributary to Swift Creek	New Location	2.60 (1,666Ac.)	No	No (Zone X)	4 - 425' Bridges
64	Middle Creek	New Location	24.90 (15,925 Ac.)	Yes	Yes (Zone AE)	Bridges $1@1030$ ' & $1@1,050$ '
65	Unnamed Tributary to Middle Creek	New Location	1.20 (770 Ac.)	Xes	No (Backwater)	Double 10'x7' RCBC
99	Unnamed Tributary to Middle Creek	New Location	0.16 (103 Ac.)	No	No (Zone X)	Single 8'x6' RCBC

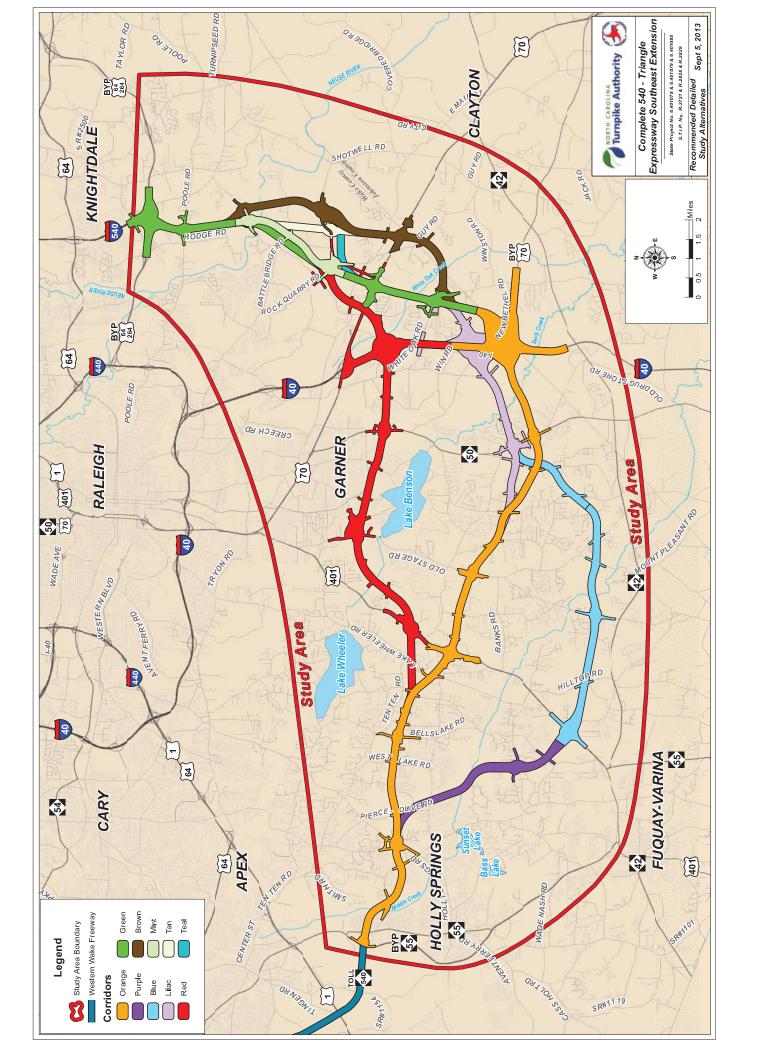
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	RECOMMENDED STRUCTURE	Single 11'x5' RCBC	Dual 505' Bridges	3@9'x8' RCBC	2@7'x5' RCBC	2@7'x5' RCBC	Dual 1275' Bridges	2@7'x5' RCBC	2@12'x10' RCBC	2@7'x6' RCBC	2@10'x9' RCBC				2@7'x7' RCBC	1@7'x7' RCBC	2@9'x7' RCBC
	RECO] STR	Single 1	Dual 5	3@9'	2@7	2@7	Dual 13	2@7	2@12	2@7'	2@10				2@7	1@7	2@9
(Zone X)	DETAILED STUDY	No (Zone X)	Yes (Zone AE)	Yes (Zone AE)	No (Zone X)	No (Zone X)	Yes (Zone AE)	No (Backwater)	Yes (Zone AE)	No (Zone X)	Yes (Zone AE)				No (Zone X)	No (Zone X)	No
52)	DET	(ZC	(Zo	(Zo	(Z)	)Z)	(Zol	(Bac	(Zo	)Z)	(Zol				(Z)	)Z)	ļ
	FLOOD ZONE	No	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes				No	No	Z
(103 Ac)	DA (SQ. MI.)	0.16 (100 Ac.)	6.43 (4,112 Ac.)	2.0 (1,278 Ac.)	0.22 (140 Ac.)	0.22 (141 Ac.)	61.7 (39,482 Ac.)	0.22 (142 Ac.)	4.71 (3,013 Ac.)	0.40 (258 Ac.)	2.17 (1,386 Ac.)				0.32 (205 Ac.)	0.13 (86 Ac.)	0.56
(10		(10	(4,1	(1,2	) (14	(14	) (39,4	) (14	(3,0	(25	(1,3)				(20	8)	
	ING	cation	cation	cation	cation	cation	cation	cation	cation	cation	cation				MP	cation	MP
	EXISTING STRUCTURE	New Location	New Location	New Location	New Location	New Location	New Location	New Location	New Location	New Location	New Location				72" CMP	New Location	72" CMP
		errible		errible	errible	errible		Aiddle							te Oak	te Oak	te Oak
lek Ye	3AM	tary to Tek	Creek	tary to T ek	tary to T ek	tary to Tek	Creek	itary to Nek	Creek	ranch }	3ranch	oved	oved	oved	tary Whi ek	tary Whi ek	tary Whi
Creek	STREAM	Unnamed Tributary to Terrible Creek	Terrible Creek	Unnamed Tributary to Terrible Creek	Unnamed Tributary to Terrible Creek	Unnamed Tributary to Terrible Creek	Middle Creek	Unnamed Tributary to Middle Creek	Little Creek	Ditch Branch	Guffy Branch	Removed	Removed	Removed	Unnamed Tributary White Oak Creek	Unnamed Tributary White Oak Creek	Unnamed Tributary White Oak
		Unnam		Unnam	Unnam	Unnam		Unnam							Unnam	Unnam	Unnam
	SITE	29	89	69	70	71	72	73	74	75	92	77	78	62	80	81	82

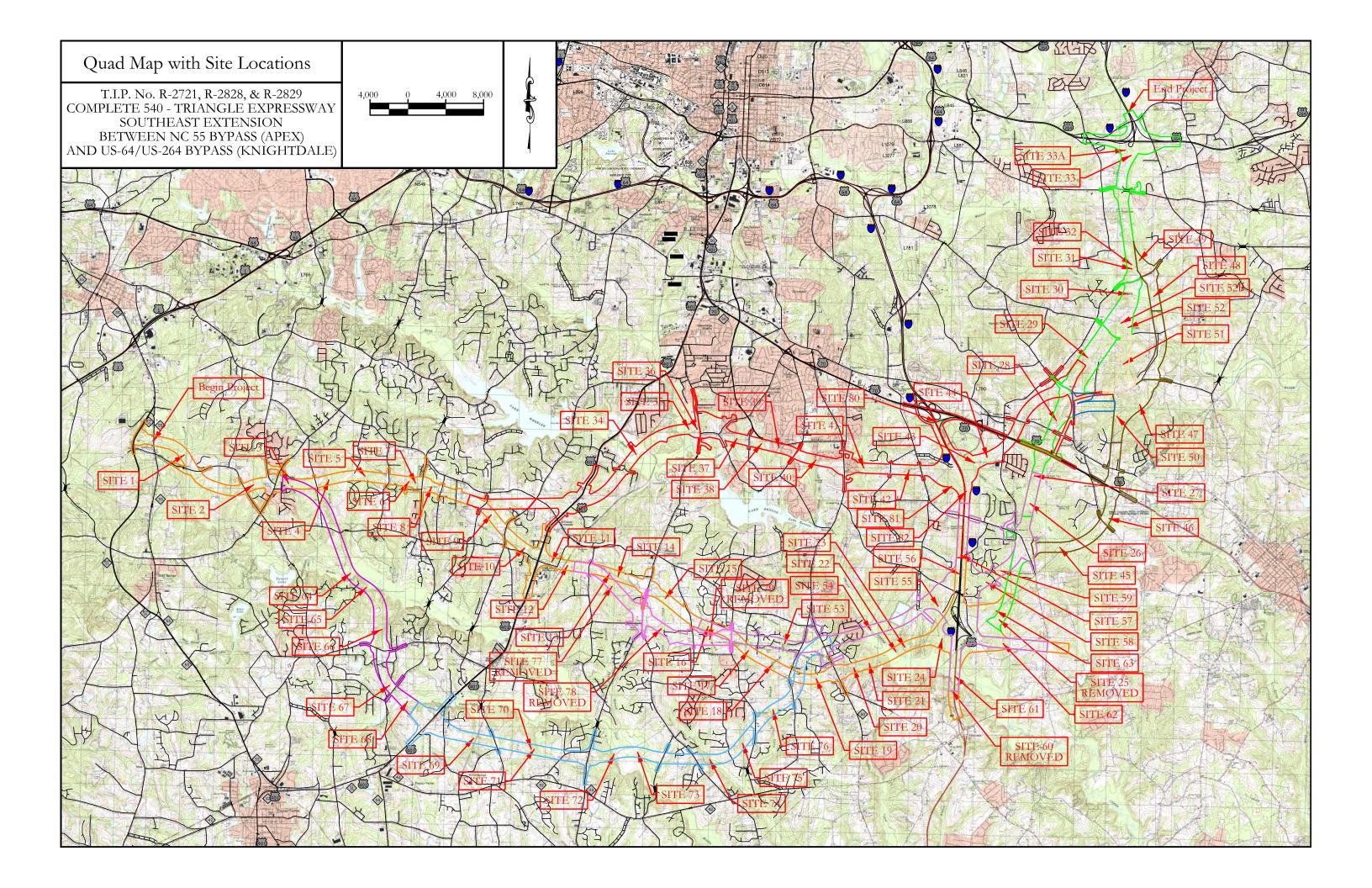
# II. Preliminary Design and Assessment Checklist

### CHECKLIST FOR PRELIMINARY HYDRAULIC INVESTIGATION

TIP No.:	R-2721 R-282		WAKE	Prepared By: _m/L
ITEM No. 1		OFFICE DATA: PROJECT INITIATION	- research existing files	
2		PRELIMINARY DESIG	N FORM- appendix D of design	guidelines
3	_/	LOCATION MAP- ident	tify project limits and nearby drain	nage structures
4		BMU DATABASE DAT	A- highlight important information	n (old project#, structures, etc.)
5	NA_	OLD BRIDGE/CULVER	RT SURVEY REPORTS	
6		USGS QUAD MAP -Label:quad map name	, begin/end project, streams, ma	jor drainage structures
7	_/_	- FIS data (discharges.	e, community name, stream, sca profiles, etc.) from COE or FEMA (date ordere	
8	_/	PRELIMINARY HYDRO - Determine drainage at or planimeter		
9	NA_		AULIC DESIGN our group for previous scour studi nt and detour structures	ies
10			nvironmental sensitivity map 5cfs average daily flow) or (>5cfs tion	adf) headwaters
11		structures in flood plai - Profile; Label: road dir normal and ordinary hi - Conduct site interview	ow, utilities, road name/#, stream n rection, high water marks, road a igh water marks	nd flood plain profiles
12		PHOTOS - Upstream structure far	ce, up and downstream waterwa	ys, both roadway

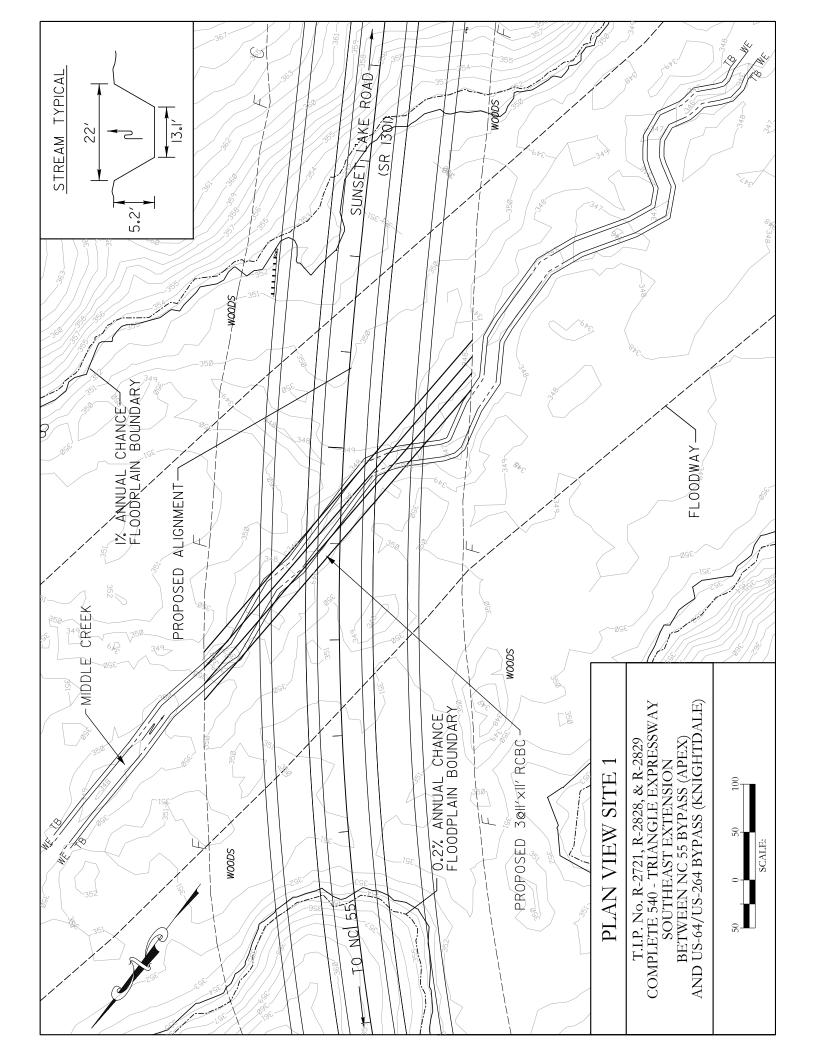
# III. Project Maps

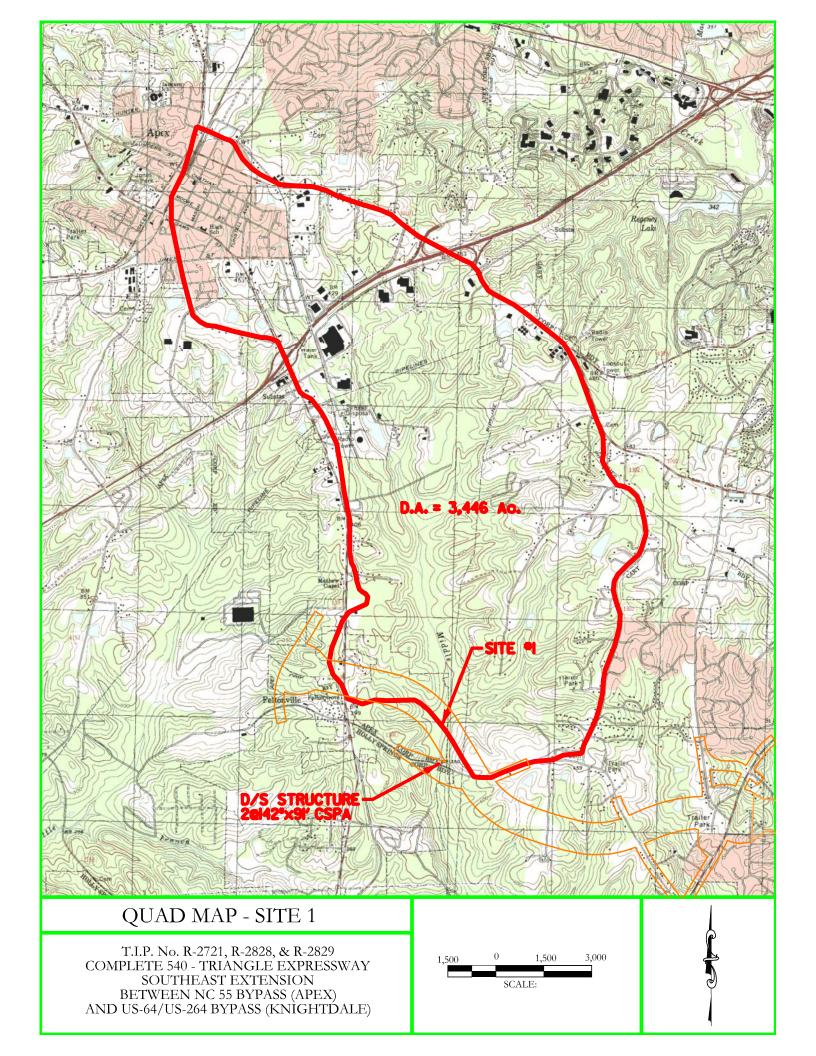




### IV. Site Information (Sites 1 thru 82)

### Site 1





STREAM NAME: Middle Creek sq. miles

5.38

PROJECT NAME: Triangle Expressway SE Ext Drainage Area =

ENGLISH

6/28/2010

Site #1

METHOD USED: Rep. 01-4207 REGION: BLUE RIDGE

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ort 01-4207	Sand Hills	(cfs)	111.01	180.54	235.55	314.85	383.84	455.11	539.22	663.86
TIONS Ran	Coastal Plain	(cfs)	200.78	375.52	529.16	762.18	972.27	1213.02	1488.51	1914.57
AL FOLIA	Blue Ridge	(cfs)	439.89	756.06	1017.48	1409.16	1752.44	2132.53	2560.05	3210.56
RIIR	FREQUENCY		2YR	5YR	10YR	25YR	SOYR	100YR	200YR	500YR
(O IO) SNOIT	Blue Ridge	(cfs)	460.61	765.73	1022.63	1405.98	1734.54	2121.40	2549.70	3223.71
SION FOLL	Coastal Plain	(cfs)	201.01	396.74	576.35	886.10	1163.64	1507.00	1927.23	2597.94
00	1									
SGS RURAL REGRESS	Sand Hills	(cfs)	101.96	168.94	223.70	305.02	375.31	454.94	260.60	677.64

# **USGS URBAN REGRESSION EQUATIONS**

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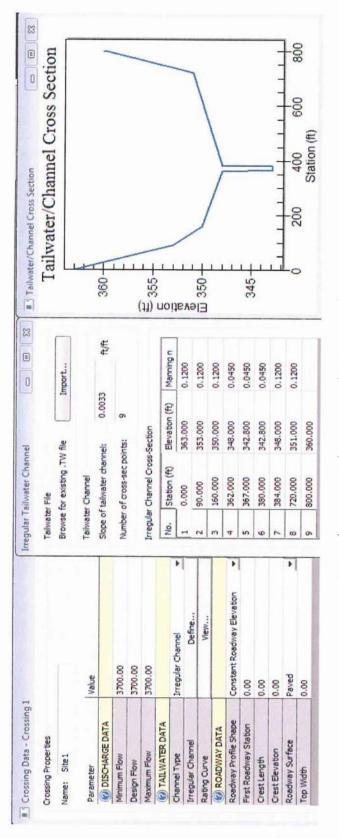
(These Equations are used only for comparison)

FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	
	(cfs)	(cfs)	(cfs)	2
5YR	588.53	1145.43	1913.01	
10YR	696.58	1471.23	2314.25	
25YR	857.52	2012.68	2911.86	
50YR	1008.79	2522.65	3485.65	
100YR	1200.34	3205.02	4242.37	
200YR	1950.42	4119.44	6479.91	(Based
500YR	1664.78	5011.10	5981.20	

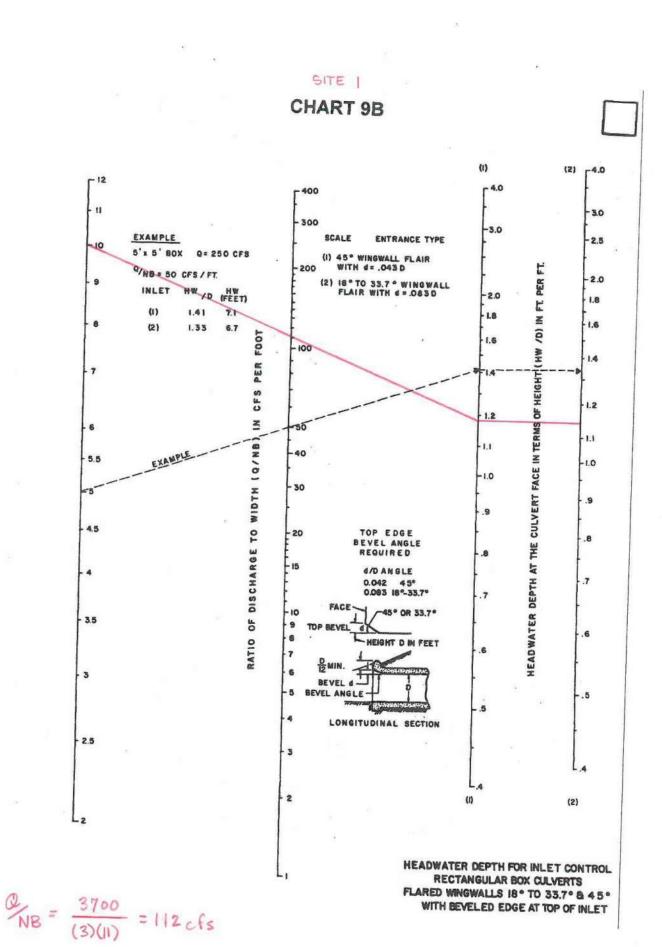
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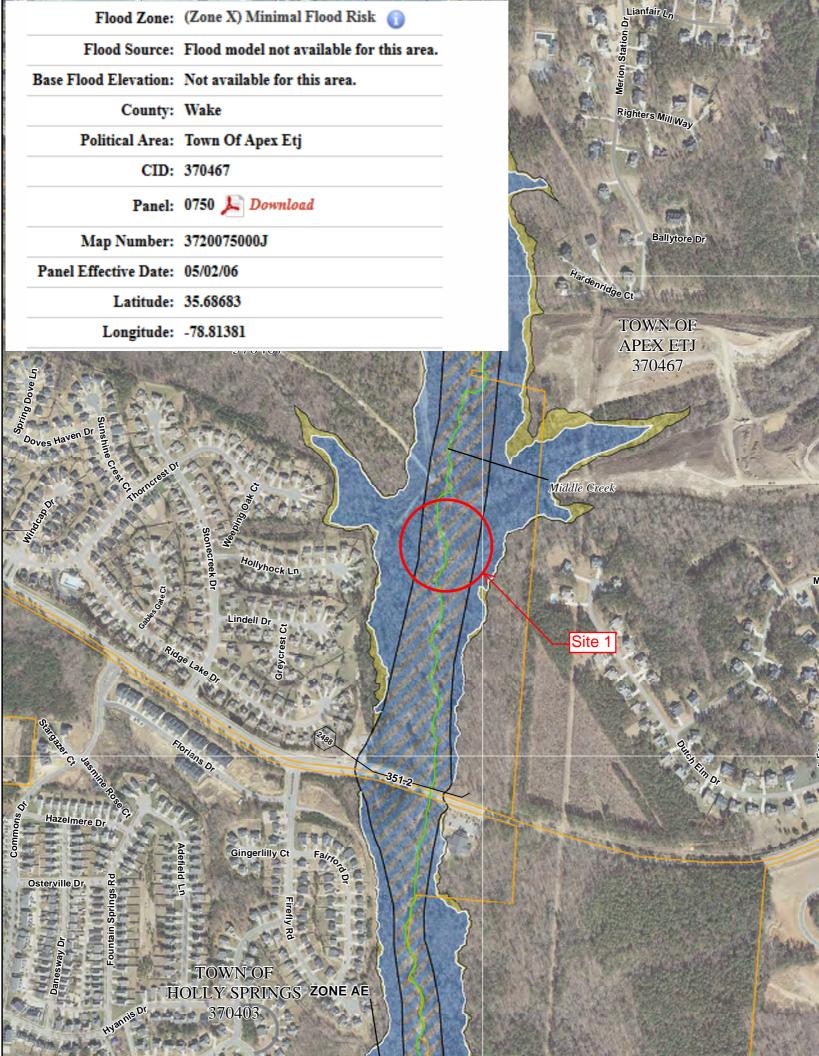
on 2.80xQ10)

		CONTRACTOR AND	CONTROL DESCRIPTION OF THE PERSON OF THE PER			
" Impervious =	45				FEMA	IA
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Discharge Used	FREQUENCY	Disharges
	(cfs)	(cfs)	(cfs)			
5YR	1421.24	1811.69	2189.66			
10YR	1677.51	2216.00	2608.72		10YR	2298
25YR	1989.00	2867.43	3351.53		SOYR	4375
50YR	2241.97	3233.01	3680.40	3700	100YR	5686
100YR	2447.39	3560.37	3963.47		500YR	9836
200YR	4697.04	6204.80	7304.40	(Based on 2.80xQ10)		
500YR	6139.70	8110.56	9547.90	(Based on 3.66xQ10)		



Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
3700.000	352,339	9.539	1.961	1.964
3700.000	352,339	9.539	1,961	1.964
3700.000	352,339	9.539	1,961	1.964
3700.000	352,339	9.539	1,961	1.964
3700.000	352,339	9.539	1.961	1.964
3700.000	352,339	9.539	1.961	1.964
3700.000	352,339	9.539	1,961	1.964
3700.000	352,339	9.539	1.961	1.964
3700.000	352,339	9.539	1,961	1.964
3700.000	352,339	9.539	1.961	1.964
3700.000	352,339	9.539	1.961	1.964

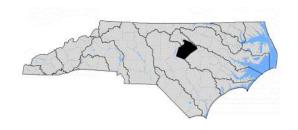




### PRELIMINARY FLOOD INSURANCE STUDY

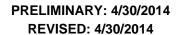
### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

State of North Carolina

Flood Insurance Study Number 37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 9, "Flooding Sources Studied by Detailed Methods: Redelineated", lists all flooding sources that were studied by detailed methods for the prestatewide FIS and redelineated for previous FISs. These flooding sources were not part of this revision and their effective analyses remain valid.

Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	Riverine	Sources	Affected Communties
	From	То	
Basin 10, Stream 2	The confluence with Little River (Basin 10, Stream 1)	Approximately 0.9 mile upstream of confluence with Little River (Basin 10, Stream 1)	Rdu Wake County
Basin 10, Stream 3	The confluence with Little River (Basin 10, Stream 1)	Moss Road	Rdu Wake County
Buffalo Branch (Basin 10, Stream 22)	The confluence with Little River (Basin 10, Stream 1)	Morphus Bridge Road	Rdu Town Of Wendell Wake County
Buffalo Creek (Basin 9, Stream 1)	The Wake/Johnston County boundary	Robertsons Pond Dam	Rdu Town Of Wendell Wake County
Kit Creek	The Chatham/Wake County Boundary	Approximately 475 feet upstream of Railroad	Rdu Town Of Cary Wake County
Little Creek (Basin 11, Stream 2)	The Wake/Johnston County boundary	Cemetery Road	Rdu Town Of Zebulon Wake County
Site 1	The confluence with Swift Creek	Approximately 0.7 mile upstream of confluence of Middle Creek Tributary	Rdu Town Of Apex Town Of Cary Town Of Fuquay-Varina Town Of Holly Springs Wake County
Panther Branch (Basin 22, Stream 2)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.5 mile upstream of Banks Road	Rdu Wake County
Panther Creek	The Chatham/Wake County Boundary	Approximately 1.0 mile upstream of Green Level to Durham Road	Town Of Cary
Poplar Creek (Basin 13, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 900 Feet upstream of Fayetteville Street	Rdu Town Of Knightdale Wake County
Swift Creek	The confluence with the Neuse River	The confluence of Yates Branch (Basin 20, Stream 13)	Rdu Town Of Garner Wake County
White Oak Creek	The confluence with Swift Creek	Approximately 0.4 mile upstream of Pergo Parkway	Rdu Town Of Clayton Town Of Garner Wake County

Table 10, "Flooding Sources Studied by Detailed Methods: Limited Detailed", lists all flooding sources within the county that were studied by limited detailed methods for either this FIS or previous FISs.

Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed

Source	Riverine	Sources	Affected Communties
	From	То	
Bachelor Branch (Basin 28, Stream 6)	The confluence with White Oak Creek	Approximately 530 feet upstream of Highway 55	Rdu Town Of Cary Wake County
Basin 11, Stream 7	The Wake/Johnston County boundary	Approximately 0.4 mile upstream of Wake/Johnston County boundary	Rdu Wake County
Basin 14, Stream 2	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.4 mile upstream of Lake Myra Road	Rdu Wake County
Basin 14, Stream 3	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.7 mile upstream of confluence with Marks Creek (Basin 14, Stream 1)	Rdu Town Of Knightdale Town Of Wendell Wake County
Basin 20, Stream 5	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 1.7 miles upstream of confluence with Swift Creek (Basin 20, Stream 1)	Rdu Wake County
Basin 28, Stream 7	The confluence with Basin 28, Stream 8	Approximately 0.4 mile upstream of confluence with Basin 28, Stream 8	Town Of Cary
Beddingfield Creek	Approximately 0.4 mile upstream of the confluence with Neuse River	Approximately 0.2 mile upstream of Shotwell Road	Rdu Town Of Clayton Wake County
Big Branch	The confluence with Harris Reservoir	Approximately 0.9 mile upstream of Highway 1	Rdu Town Of Apex Wake County
Black Creek	Approximately 260 feet upstream of State HWY 210	Approximately 1.0 mile upstream of dam along Black Creek (Basin 23, Stream 1)	Rdu Town Of Fuquay-Varina Wake County

Table 13 - Summ	ary of Dis	charges			
Flooding Source Location	Drainage Area	10% Annual	Dischar 2% Annual	ges (cfs) 1% Annual	0.2% Annual
Location	(square miles)	Chance	Chance	Chance	Chance
Just upstream of Chatham/Wake County boundary	3.80	*	*	2,450	*
Approximately 0.9 mile upstream of Chatham/Wake County boundary	3.30	1,220	1,990	2,320	3,240
Approximately 1,580 feet downstream of New Hill Olive Chapel Road	2.20	986	1,720	2,060	3,060
Approximately 0.4 mile upstream of New Hill Olive Chapel Road	1.40	888	1,380	1,630	2,380
Little Creek (Into Middle Creek)					
Approximately 530 feet downstream of Wake/Johnston County boundary	9.90	*	*	1,710	*
At confluence of Guffy Branch (Basin 21, Stream 4)	5.19	*	*	1,190	*
Approximately 1,580 feet upstream of confluence of Guffy Branch (Basin 21, Stream 4)	5.05	*	*	1,171	*
Approximately 0.9 mile downstream of confluence of Juniper Branch (Basin 21, Stream 2)	4.86	*	*	1,150	*
Approximately 0.5 mile downstream of confluence of Juniper Branch (Basin 21, Stream 2)	4.42	*	*	1,080	*
At confluence of Juniper Branch (Basin 21, Stream 2)	2.27	*	*	744	*
Approximately 0.8 mile downstream of Pagan Road	2.04	*	*	701	*
Approximately 530 feet upstream of Pagan Road	1.52	*	*	594	*
Approximately 0.7 mile upstream of Pagan Road	1.18	*	*	513	*
Little River					
At Wake/Johnston County boundary	69.24	*	*	11,700	*
Marks Creek					
Approximately 0.7 mile downstream of Knightdale Eagle Rock Road	7.90	*	*	3,300	*
Middle Creek					
Just upstream of Panther Branch (Basin 22, Stream 2)	56.70	*	*	9.900	*
Just upstream of Terrible Creek (Basin 22, Stream 19)	43.60	*	*	8,600	*
Moccasin Creek					
Approximately 0.4 mile upstream of Franklin/Nash County boundary	27.96	*	*	7,470	*
Approximately 0.9 mile upstream of Franklin/Nash County boundary	26.57	*	*	7,230	*
Morris Branch				•	
At Chatham/Wake County boundary	1.40	821	1,380	1,730	2,730
Approximately 0.4 mile upstream of Chatham/Wake County boundary	1.20	707	1,300	1,630	2,490
Just downstream of Green Level to Durham Road	0.80	765	1,080	1,230	1,840
Norris Branch				1	
Just upstream of confluence with Cary Branch	1.70	*	*	1,038	*
Panther Creek	1		1	1.,000	
At Chatham/Wake County boundary	3.60	800	1,600	2,150	4,100
At Yates Store Road	2.50	635	1,330	1,795	3,400
Just upstream of Yates Store Road	2.00	555	1,170	1,590	3,030
Approximately 0.8 mile upstream of Yates Store Road just downstream of tributary	1.40	445	955	1,305	2,525
Approximately 0.6 mile upstream of Yates Store Road just upstream of tributary	0.80	320	695	960	1,800
Poplar Creek (Basin 13, Stream 1)	15.50	1	1-50	1-50	1 .,555
At mouth	9.00	*	*	3,600	*
	10.00			10,000	
Reedy Branch (Basin 27, Stream 5)	4.10	1 520	2,550	3,020	4 430
At confluence with Beaver Creek	J4.10	1,520	12,000	3,020	4,430
Terrible Creek (Basin 22, Stream 19)	L		1.		*
At mouth	12.30	*	*	4,600	<u> </u> *

**Table 16 - Roughness Coefficients** 

	ougnness Coefficients	
Stream	Channel "n"	Overbank "n"
Beaver Creek	0.043 to 0.050	0.100 to 0.200
Beddingfield Creek	0.050	0.130
Big Branch	0.050	0.140
Black Creek	0.025 to 0.060	0.030 to 0.150
Buckhorn Creek	0.040 to 0.048	0.145
Buffalo Creek (Basin 9, Stream 1)	0.030 to 0.070	0.035 to 0.140
Buffalo Creek West	0.045 to 0.052	0.030 to 0.140
Cary Branch	0.040	0.140
Guffy Branch (Basin 21, Stream 4)	0.047	0.130
Jim Branch	0.045	0.145
Juniper Branch (Basin 21, Stream 2)	0.045	0.110 to 0.130
Kit Creek	0.030 to 0.070	0.070 to 0.110
Little Beaver Creek	0.045 to 0.055	0.100 to 0.220
Little Black Creek	0.030 to 0.070	0.070 to 0.130
Little Creek (Basin 11, Stream 2)	0.030 to 0.080	0.070 to 0.150
Little Creek (Into Middle Creek)	0.033 to 0.047	0.095 to 0.140
Little River	0.040 to 0.066	0.070 to 0.240
Marks Creek	0.025 to 0.070	0.070 to 0.130
Middle Creek	0.042 to 0.050	0.030 to 0.140
Mill Branch	0.050	0.030 to 0.150
Mill Creek (South)	0.035 to 0.060	0.040 to 0.160
Moccasin Creek	0.030 to 0.070	0.070 to 0.220
Morris Branch	0.030 to 0.050	0.100 to 0.200
Nancy Branch	0.045 to 0.050	0.120 to 0.150
Neuse River	0.035 to 0.060	0.055 to 0.250
Norris Branch	0.048	0.145
Panther Creek	0.030 to 0.070	0.070 to 0.130
Reedy Branch (Basin 27, Stream 5)	0.045 to 0.050	0.100 to 0.200
Snipes Creek	0.042 to 0.045	0.120 to 0.130
Swift Creek	0.040 to 0.072	0.035 to 0.240
Thomas Creek	0.050	0.145
Unnamed Tributary (#1) to Swift Creek	0.045 to 0.060	0.050 to 0.150
White Oak Creek	0.035 to 0.050	0.035 to 0.150

For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained using digital elevation data obtained with LIDAR technology developed as part of the North Carolina Statewide Floodplain Mapping Program. The hydraulic model is prepared using this digital elevation data, without surveying bathymetric or structural data. Where bridge or culvert data are readily available, such as from the North Carolina Department of Transportation, these data have been reflected in the hydraulic model. If these structural data are not readily available, field measurements of these structures were made to approximate their geometry in the hydraulic models. In addition, this method does not include field surveys that determine specifics on channel and floodplain characteristics. A limited detailed study is a "buildable" product that can be upgraded to a fully detailed study at a later date by verifying stream channel characteristics, bridge and culvert opening geometry, and by analyzing multiple recurrence intervals.

The results of the HEC-RAS computations are tabulated for all cross sections (Table 17, "Limited Detailed Flood Hazard Data"). Flood Profiles have not been developed for streams studied by limited detailed methods. Water-surface elevation rasters were developed for steams studied by limited detailed methods. In addition, floodways for streams studied by limited detailed methods are not delineated on the FIRM. However, the 1% annual chance water-surface elevations, flood discharges, and non-encroachment widths from the limited detailed studies for every modeled cross section are given in Table 17. The non-encroachment widths given at modeled cross sections can be used by communities to enforce floodplain management ordinances that meet the requirement defined in 44 CFR 60.3(c)(10).

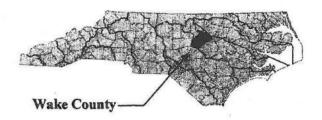
Between cross sections for streams studied by limited detailed methods, 1% annual chance water-surface elevations can be calculated by mathematical interpolation using the distance along the stream centerline. Non-encroachment widths and, therefore, the location of a non-encroachment area boundary between cross sections should be determined based on either 1) mathematical interpolation, or 2) the non-encroachment width at the upstream or downstream cross section, whichever is larger. If the width determined by this second method is wider than the Special Flood Hazard Area (SFHA) or the 1% annual chance floodplain delineated on the FIRM for this location along the stream, the non-encroachment area shall be considered to

### FLOOD INSURANCE STUDY

A Report of Flood Hazards in

### WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 2 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV002A

www.fema.gov and www.ncfloodmaps.com



recobling SOURCE	(CE		FLOODWAY	<b>&gt;</b>	W.	BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD 88)	E ELEVATION	
CROSS SECTION	DISTANCE <sup>1</sup>	WIDTH (FEET)	SECTION AREA (SQUARE	MEAN VELOCITY (FEET PER	REGULATORY	WITHOUT	WITH FLOODWAY	INCREASE
Middle Creek (Basin 22, Stream 1) (continued)			1000	SECOND				
2035	203,540	670	3,655	2.1	270.0	0.020	2070	90
2041	204,130	610	3,484	2.2	271.1	274 4	270.0	0.0
2050	205,000	740	3,910	1.9	274.1	274.1	274.1	0.5
2070	207,000	006	3,771	2.0	276.0	276.0	276.7	200
2094	209,350	840	4,073	1.8	280.1	280.1	2.020	2.5
2115	211,450	700	3,437	2.1	282.7	282.7	283.4	
2134	213,400	840	5,181	1.4	284.7	284.7	785.6	900
2145	214,530	830	4,806	1.5	285.6	285.6	286.5	000
2156	215,600	780	3,253	2.2	287.0	287.0	288.0	
2161	216,140	730	3,371	2.0	289.2	289.2	280.3	9 -
2181	218,070	750	4,617	1.4	291.1	291.1	291.5	
2198	219,800	800	4,686	1.4	292.1	292.1	292.7	
2204	220,375	260	2,480	2.6	292.7	292.7	293.3	9.0
1777	222,125	200	2,602	2.4	297.2	297.2	297.2	000
7477	224,160	200	3,457	1.8	299.5	299.5	300.2	0.7
2528	75,800	238	1,989	2.9	300.9	300.9	301.9	-
5/77	757,500	120	1,383	4.1	304.3	304.3	305.0	200
1/77	227,665	260	2,792	2.7	311.3	311.3	3117	200
2329	232,910	310	1,109	3.1	314.5	314.5	315.0	
2366	236,595	390	2,273	1.5	322.3	322.3	323.0	0.0
7488	248,810	200	1,387	2.5	351.2	351.2	25.50	
2613	261.270	190	1 080	3.2	270.2	1000	7.1.0	0.0

FLOODWAY DATA

MIDDLE CREEK (BASIN 22, STREAM 1)

WAKE COUNTY, NC AND INCORPORATED AREAS

FEDERAL EMERGENCY MANAGEMENT AGENCY

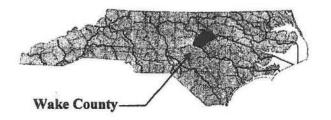
TABLE 13

### FLOOD INSURANCE STUDY

A Report of Flood Hazards in

### WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 5 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





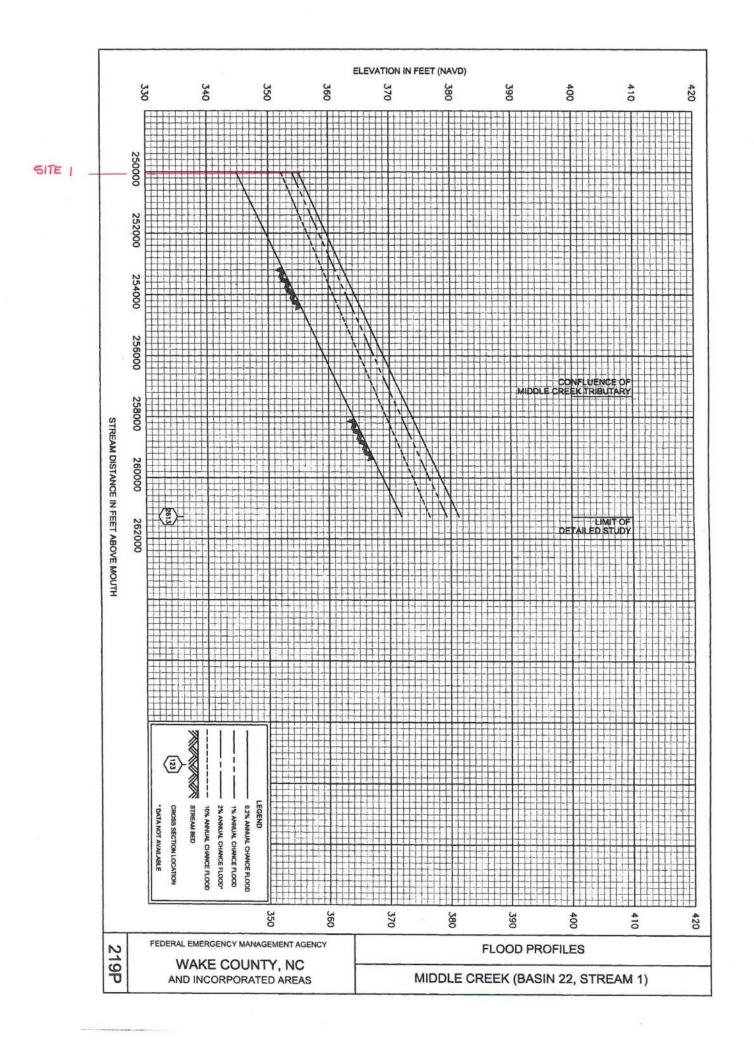
May 2, 2006

Federal Emergency Management Agency State of North Carolina

> Flood Insurance Study Number 37183CV005A

www.fema.gov and www.ncfloodmaps.com





.0315 NEUSE RIVER BASIN

			G] e.e.	SITE
Jame of Stream	Description	Class	Class	Index No.
and of boroun	200011901011			
nnamed Tributary to Swift reek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)
nnamed Tributary to Swift reek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)
rift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)
ack Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)
uck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)
eedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)
eedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)
wift Creek	From dam at Lake Benson to Neuse River	C;NSW	05/01/88	27-43-(8)
ahlers Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-9
eal Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-10
nite Oak Creek (Austin ond)	From source to Swift Creek	C; NSW	05/01/88	27-43-11
ittle Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-12
ooper Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-13
eedy Branch (Little Branch)	From source to Swift Creek	C; NSW	05/01/88	27-43-14
iddle Creek	From source to backwaters of Sunset Lake	C; NSW	05/01/88	27-43-15-(1)
iddle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	27-43-15-(2)
asal Creek [(Bass Lake, Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	27-43-15-3
iddle Creek	From dam at Sunset Lake to Swift Creek	C;NSW	05/01/88	27-43-15-(4)
ocky Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-4.5
mp Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-5
lls Lake	Entire lake and connecting stream to Middle Creek	C; NSW	05/01/88	27-43-15-6
ills Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-7
errible Creek (Johnsons ond)	From source to dam at Johnsons Pond	B;NSW	05/01/88	27-43-15-8-(1)
errible Creek	From dam at Johnsons Pond to Middle Creek	C;NSW	05/01/88	27-43-15-8-(2)
nthey Dyoneh	Process of the Market of the Council	C; NSW	05/01/00	27-43-15-9
anther Branch	From source to Middle Creek	CINOW	02/01/00	71-43-13-3

### 2012 North Carolina 303(d) List-Category 5

Neuse	Neuse River Basin	asin		10-digit	10-digit Watershed	0302020108			Crabtree Creek	reek
> AU Number	ımber	Name		Description			Length or Area	Units	Classification	Category
	Category	/ Rating	Use		Reason for Rating	Parameter			Year	
> 27-33-4-1	-4-1	Little Brier Creek	r Creek	From source 1	From source to Brier Creek		5.3	FW Miles	C;NSW	ro.
	Ŋ	Impaired	Fish Consumption	ption	Standard Violation	PCB			2008	
> 27-33-5	٠ <sup>5</sup>	Black Creek	¥:	From source to Crabt	to Crabtree Lake, Crabtree Cr.	Ġ.	3.6	FW Miles	C;NSW	ıs
. — <b>——</b>	Ŋ	Impaired	Aquatic Life		Fair Bioclassification	Ecological/biological Integrity Benthos	ntegrity Benthos	S	1998	
Neuse	Neuse River Basin	asin		10-dig	10-digit Watershed	0302020109			Middle Creek	reek
				12-di	12-digit Subwatershed	030202010902			Middle Middle Creel	Creel
> 27-43	27-43-15-8-(2)	Terrible Creek	reek	From dam at	From dam at Johnsons Pond to Middle Creek	Creek	7.8	FW Miles	C;NSW	5
	5	Impaired	Aquatic Life		Fair Bioclassification	Ecological/biological Integrity Benthos	ntegrity Benthos	S	2012	
				12-di	12-digit Subwatershed	030202010901			UpperMiddle Creek	Creek
> 27-43	27-43-15-(1)b1	Middle Creek	eek	From 0.8 miles south		of US 1 to ut on west of creek 3.0 miles downstream	n 3.0	FW Miles	C;NSW	R
- <del></del>	Ŋ	Impaired	Aquatic Life		Fair Bioclassification	Ecological/biological Integrity Benthos	ntegrity Benthos	S	2008	
> 27-43	27-43-15-(1)b2	Middle Creek	eek	From ut on west isde Sunset Lake	est isde of creek 3.0 miles	of creek 3.0 miles downstream to backwaters of	1.6	FW Miles	C;NSW	r.
-	r	Impaired	Aquatic Life		Standard Violation	Turbidity			2012	
	Ŋ	Impaired	Aquatic Life		Fair Bioclassification	Ecological/biological Integrity Benthos	ntegrity Benthos	S	2012	
> 27-43	27-43-15-(1)but3		UT to Middle Creek	source to Middle Creek	dle Creek		2.6	FW Miles		ıs
. — <b>—</b>	Ŋ	Impaired	Aquatic Life		Standard Violation	Turbidity			2012	
> 27-43	27-43-15-(4)a1	Middle Creek	eek	From dam at	Sunset Lake to small impor	From dam at Sunset Lake to small impoundment upstream of US 401	4.5	FW Miles	C;NSW	ıs
- <b></b>	2	Impaired	Aquatic Life		Standard Violation	Turbidity			2010	
Neuse	Neuse River Basin	asin		10-dig	10-digit Watershed	0302020110			Swift Creek	reek
				12-di	12-digit Subwatershed	030202011002			Lake Benson-Swift Creel	Creel

### PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

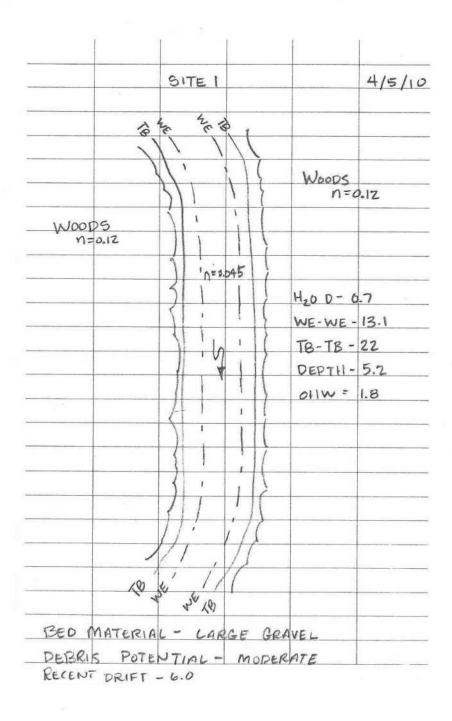
COUNTY Wake	PROJECT NUMBER R-2721 & R-2828
STREAM Middle Creek (Site 1)	
ASSESSMENT PREPARED	BY Mulkey, INC. DATE 6/11/2010 (MLH)
	HYDROLOGIC EVALUATION
NEAREST GAGING STATI	ON ON THIS STREAM (NONE <u>X</u> )
ARE FLOOD STUDIES AV	AILABLE ON THIS STREAM: Yes
FLOOD DATA: Q <sub>10</sub> 2,200 CFS EST. BKW Q <sub>50</sub> 3,700 CFS EST. BKW Q <sub>500</sub> 9,500 CFS EST. BKW	TR. $N/A$ FT. $Q_{25}$ $3,400$ CFS EST. BKWTR. $N/A$ FT. $N/A$ FT. $Q_{100}$ $4,000$ CFS EST. BKWTR. $N/A$ FT. $N/A$ FT.
DRAINAGE AREA <u>5.28 Sq.</u>	Mi. METHOD USED TO COMPUTE Q: USGS Urban Regression
<u>PF</u>	ROPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: LC	OW MODERATE X HIGH
COULD THIS BE SIG	GNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT:	YES NO <u>X</u>
EXPLANTION: A flo	oodway modification may be required at this site.
LIST BUILDINGS IN	FLOOD PLAIN: None LOCATION:
UPSTREAM LAND I	
ANY FLOOD ZONIN	NG? (FIA STUDIES, ETC.) YES X NO
TYPE OF STUDY: F	FEMA – Special Flood Hazard Zone AE
REGULATORY FLO	ODWAY WIDTH 500 ft. Section 2488 (AS NOTED IN FIS)
COMMENTS:	

### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 14,200 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 44,800 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? N/A
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS
NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Wehadkee TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service
ENVIRONMENTAL CONSIDERATIONS
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: Buried culverts 1 foot to allow for fish passage.
MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES \_\_\_ NO  $\underline{\mathbf{x}}$  PROTECTION NEEDED \_\_\_

ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
ALTERNATIVES
RECOMMENDED DESIGN <u>3@11'x11' RCBC</u>
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING 330 Sq. Ft.
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YESNO $\underline{X}$ DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC





NC DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS BRIDGE MANAGEMENT UNIT

**ATTENTION** 

### **BRIDGE INSPECTION REPORT**

COUNTY WAKE	BRIDGE NUMBER 910372 INSPECTION CYCLE 2 YRS
ROUTE SR1301	ACROSS MIDDLE CREEK M.P. 0
OCATION 0.6MI.E.JCT.NC55	
SUPERSTRUCTURE 2 LINES 142X91 CSP	PA;60'6 ALONG CENTERLINE PIPE
SUBSTRUCTURE	
SPANS	
	LATITUDE 35° 40' 80.0" 48,0"
ONGITUDE 78° 49' 50.0"	INVENTORY RATING HS-20
LONGITUDE 78° 49' 50.0" PRESENT CONDITION GOOD	INVENTORY RATING HS-20
PRESENT CONDITION GOOD  NSPECTION DATE 12/03/2008	INVENTORY RATING HS-20 OPERATING RATING H5-26
SPANS LONGITUDE 78° 49' 50.0"  PRESENT CONDITION GOOD INSPECTION DATE 12/03/2008  PRESENT POSTING Not Posted  COMPUTER UPDATE 5~8~	OPERATING HS-20 OPERATING RATING PROPOSED POSTING  U.P.
PRESENT CONDITION GOOD  NSPECTION DATE 12/03/2008  PRESENT POSTING Not Posted	OPERATING HS-20 OPERATING RATING HS-26 PROPOSED POSTING W. P.



SIGN NO		NUMBERE REQUIRE
No	WEIGHT LIMIT	
No	DELINEATORS	
No	NARROW BRIDGE	
No	ONE LANE BRIDGE	
No	LOW CLEARANCE	

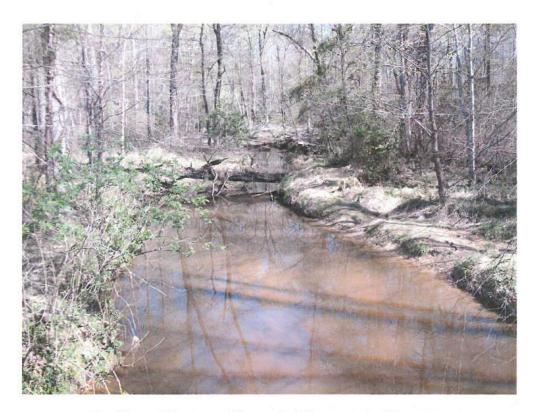
**LOOKING EAST** 



Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.



Looking at Upstream Channel of Downstream Structure.

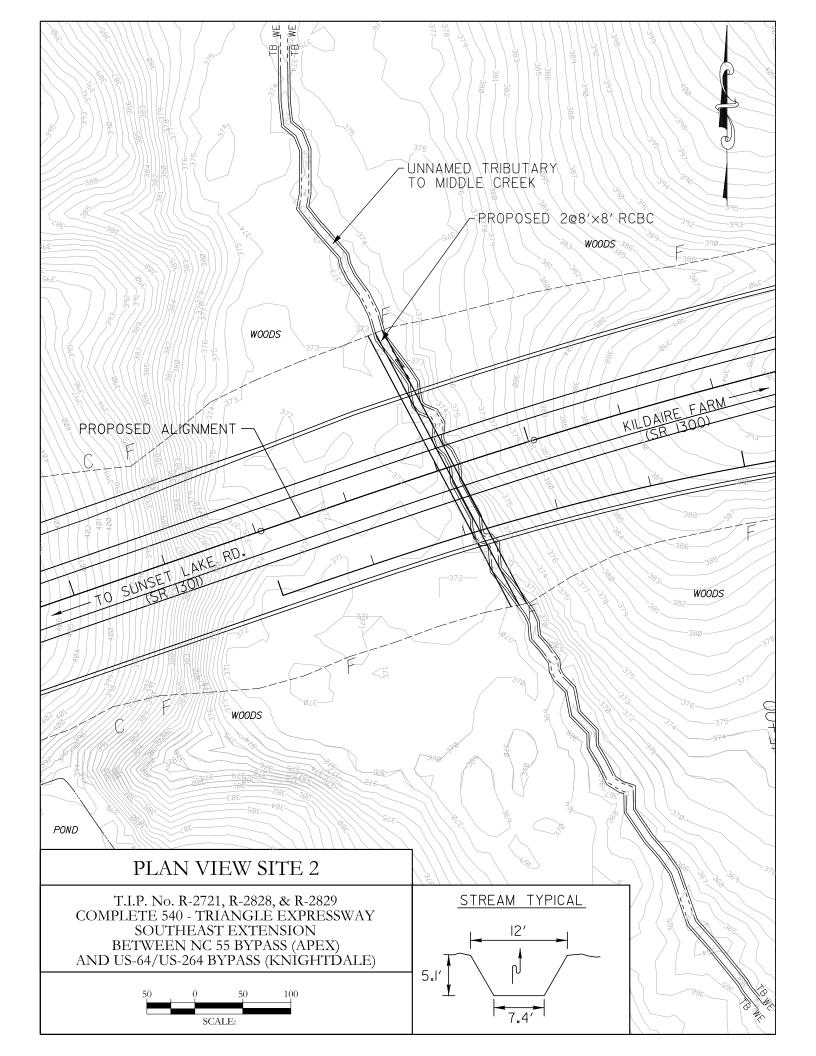


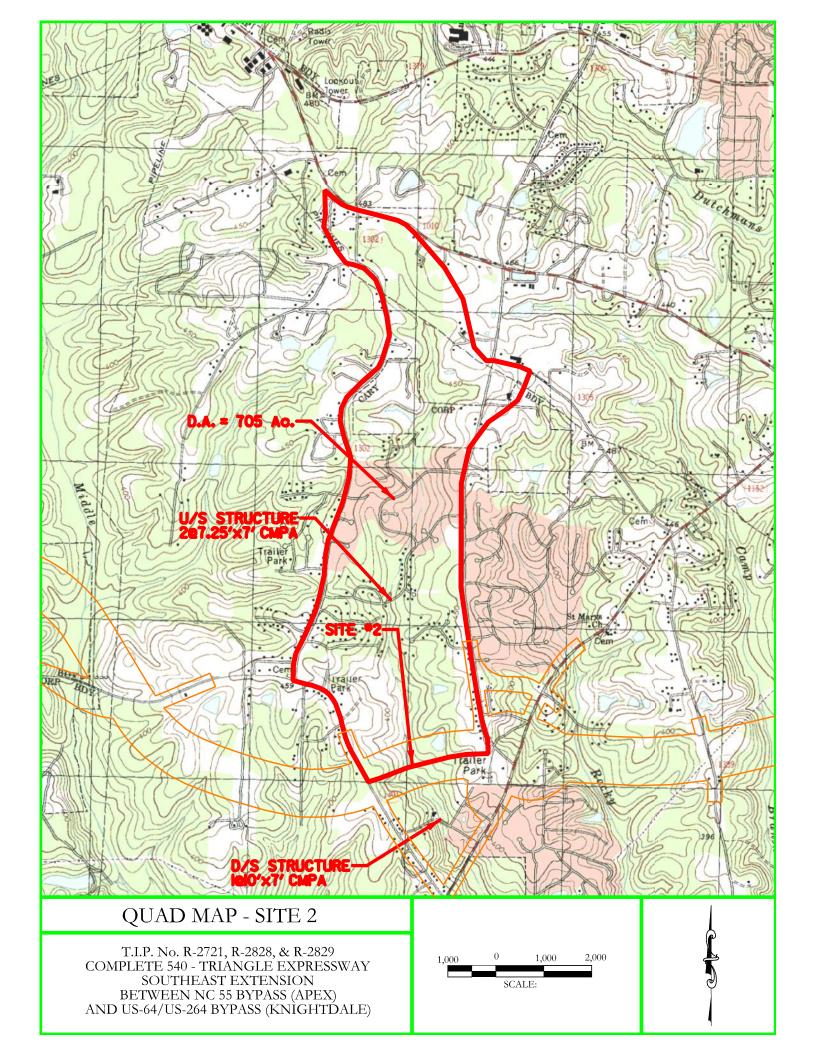
Looking at Upstream Face of Downstream Structure. (2 @ 10'x7'CSPA)



Looking at Downstream Face of Downstream Structure.

### Site 2





PROJECT NAME: Triangle Expressway SE Ext. 6/8/2010

STREAM NAME: Unnamed Trib to Middle Creek

REGION: BLUE RIDGE

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ENGLISH	Drainage Area =	Ξ	sq. miles		METHOD USED:	Rep. 01-4207		
USGS RL	JSGS RURAL REGRES	SSION EQU	ATIONS (OLD)	RUR	RURAL EQUA	TIONS Rep	Report 01-4207	
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills	
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)	
2YR	31.85	73.71	153.80	2YR	144.34	68.89	35.85	
SYR	52.36	157.50	264.35	5YR	258.13	137.05	59.33	
10YR	69.11	237.31	355.85	10YR	355.75	199.35	77.91	
25YR	92.60	380.83	497.08	25YR	506.18	297.34	104.80	
50YR	112.86	514.60	618.13	50YR	639.56	387.82	128.17	
100YR	135.50	684.68	764.44	100YR	790.73	493.94	152.69	
200YR	166.71	895.28	924.63	200YR	962.91	617.77	181.49	
500YR	197.09	1243.81	1199.13	500YR	1228.85	813.75	224.15	

## **USGS URBAN REGRESSION EQUATIONS**

BDF=

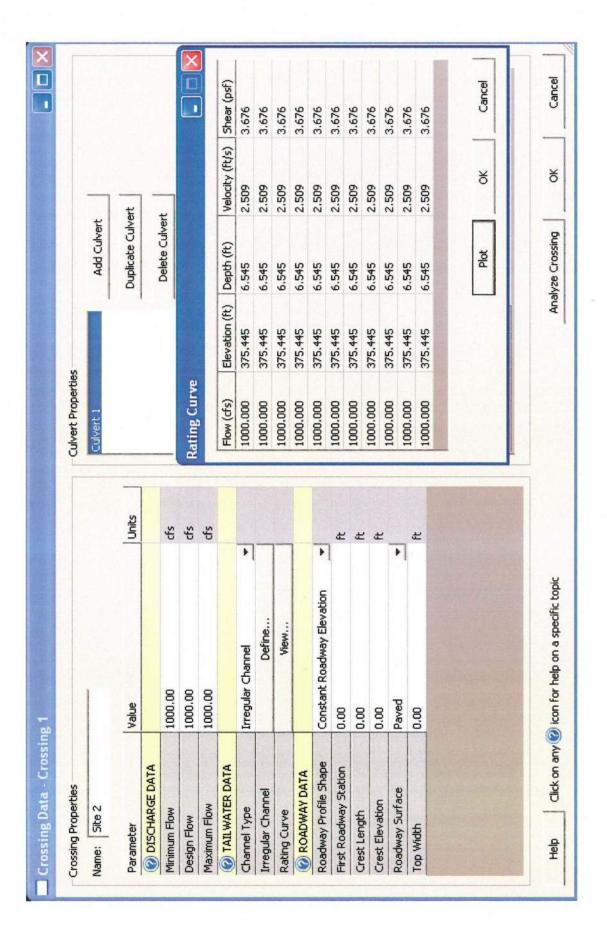
(These Equations are used only for comparison)

FREQUENCY	Sand Hills	Coastal Plain	_	
	(cfs)	(cfs)	(cfs)	
5YR	180.19	425.42		
10YR	213.62	566.16		
25YR	260.41	807.16		
50YR	300.39	1026.66		
100YR	350.41	1322.72		
200YR	598.15	1585.24		(Based on 2.80xQ10)
500YR	469.08	2124.87		

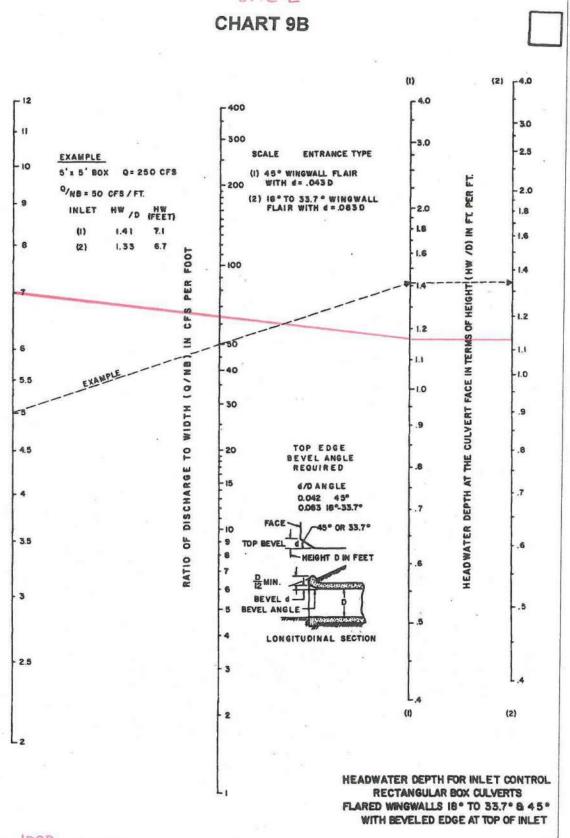
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S	and Hills	Coastal Plain	Blue Ridge	Discharge Used	FREQUENCY	Disha
	(cfs)	(cfs)	(cfs)			
	294.20	402.80	467.15			
	377.20	541.16	607.44		10YR	No.
	502.48	814.68	892.23		SOYR	1000
	591.59	967.08	1026.64	1000	100YR	7.30
	673.45	1117.68	1156.61		100YR	at one
	1056.17	1515.25	1700.83	(Based on 2.80xQ10)	500YR	
	1380.56	1980.65	2223.23	(Based on 3.66xQ10)		1

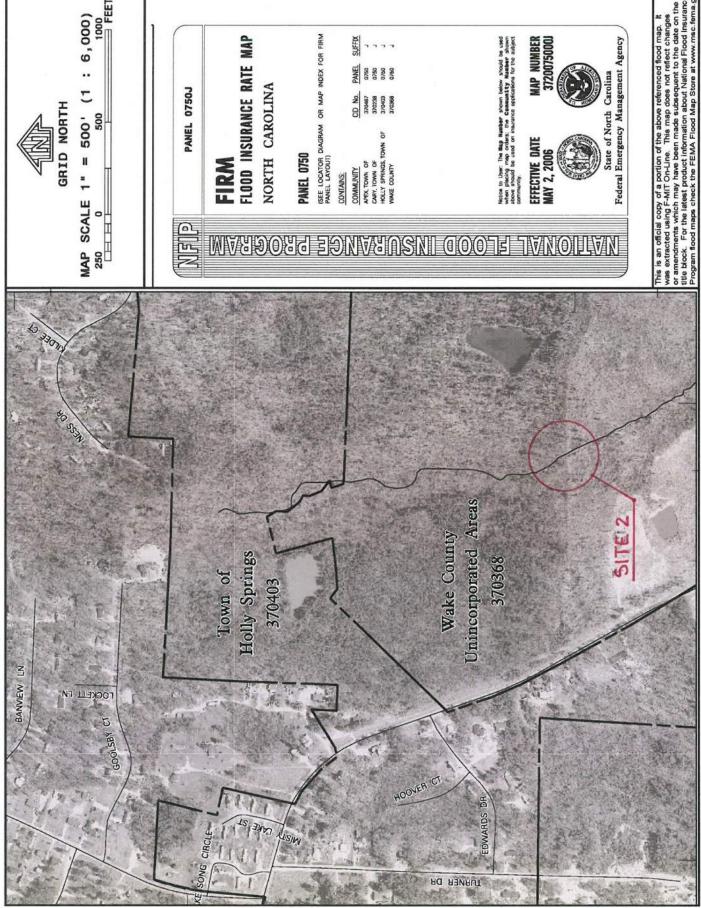
Disharges







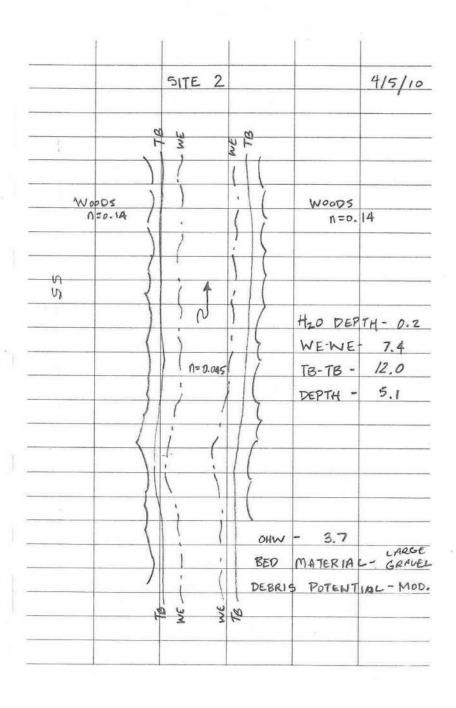
 $Q_{/NB} = \frac{1000}{(2)(8)} = 62.5$ 



.0315 NEUSE RIVER BASIN

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.0315 NEUSE RIVER BAS				SITE	- 2
Name of Stream	Description	Class	Class Date	Index No.	
Unnamed Tributary to Swift Creek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)	
Unnamed Tributary to Swift Creek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)	
Swift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)	
Buck Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)	
Buck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)	
Reedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)	
Reedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)	
Swift Creek	From dam at Lake Benson to Neuse River	C;NSW	05/01/88	27-43-(8)	
Mahlers Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-9	
Jeal Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-10	
White Oak Creek (Austin Pond)	From source to Swift Creek	C; NSW	05/01/88	27-43-11	
Little Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-12	
Cooper Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-13	
Reedy Branch (Little Branch)	From source to Swift Creek	C; NSW	05/01/88	27-43-14	
Middle Creek	From source to backwaters of Sunset Lake	C; NSW	05/01/88	27-43-15-(1)	
Middle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	27-43-15-(2)	
Basal Creek [(Bass Lake, (Mills Pond)]	From source to Sunset Lake, Middle Creek	B; NSW	05/01/88	27-43-15-3	
Middle Creek	From dam at Sunset Lake to Swift Creek	C; NSW	05/01/88	27-43-15-(4)	
Rocky Branch	From source to Middle Creek	C;NSW	05/01/88	27-43-15-4.5	
Camp Branch	From source to Middle Creek	C; NSW		27-43-15-5	
Bells Lake	Entire lake and connecting stream to Middle Creek	C;NSW		27-43-15-6	
Mills Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-7	
Terrible Creek (Johnsons Pond)	From source to dam at Johnsons Pond	B;NSW	05/01/88	27-43-15-8-(1)	
Terrible Creek	From dam at Johnsons Pond to Middle Creek	C;NSW	05/01/88	27-43-15-8-(2)	
Panther Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-9	
rancher branch					

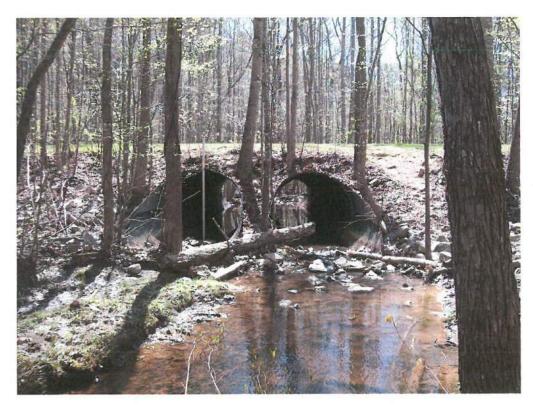




Looking Upstream from Proposed Crossing



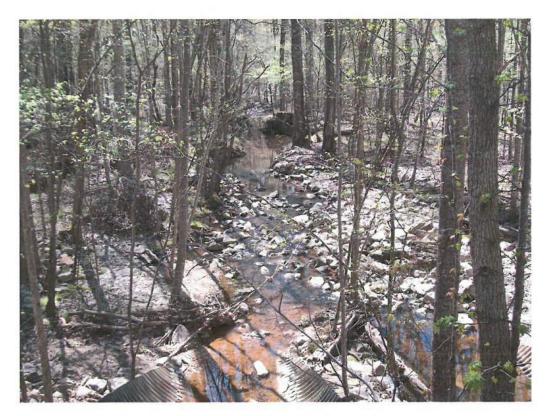
Looking Downstream from Proposed Crossing



Looking at Upstream Face of Upstream Structure (2 @ 87"x84" CSPA)



Looking at Downstream Face of Upstream Structure



Looking at Downstream Channel of Upstream Structure



Looking at Upstream Face of Downstream Structure (1 @ 120"x84" CSPA)

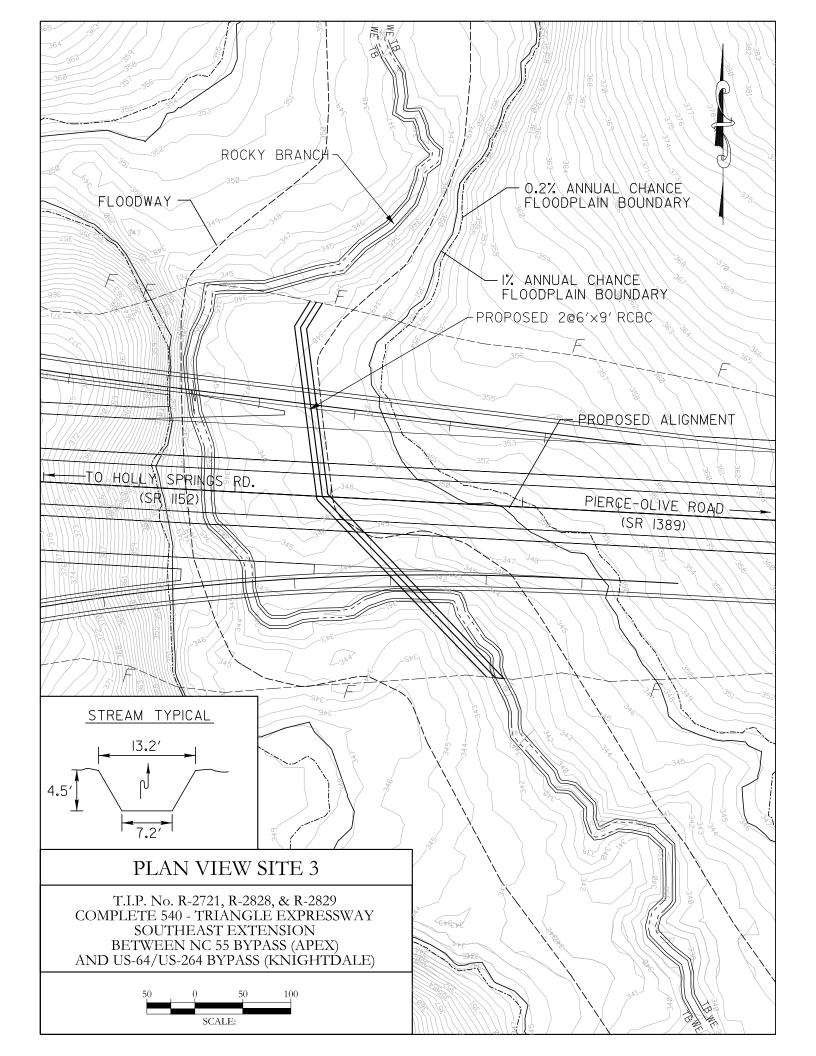


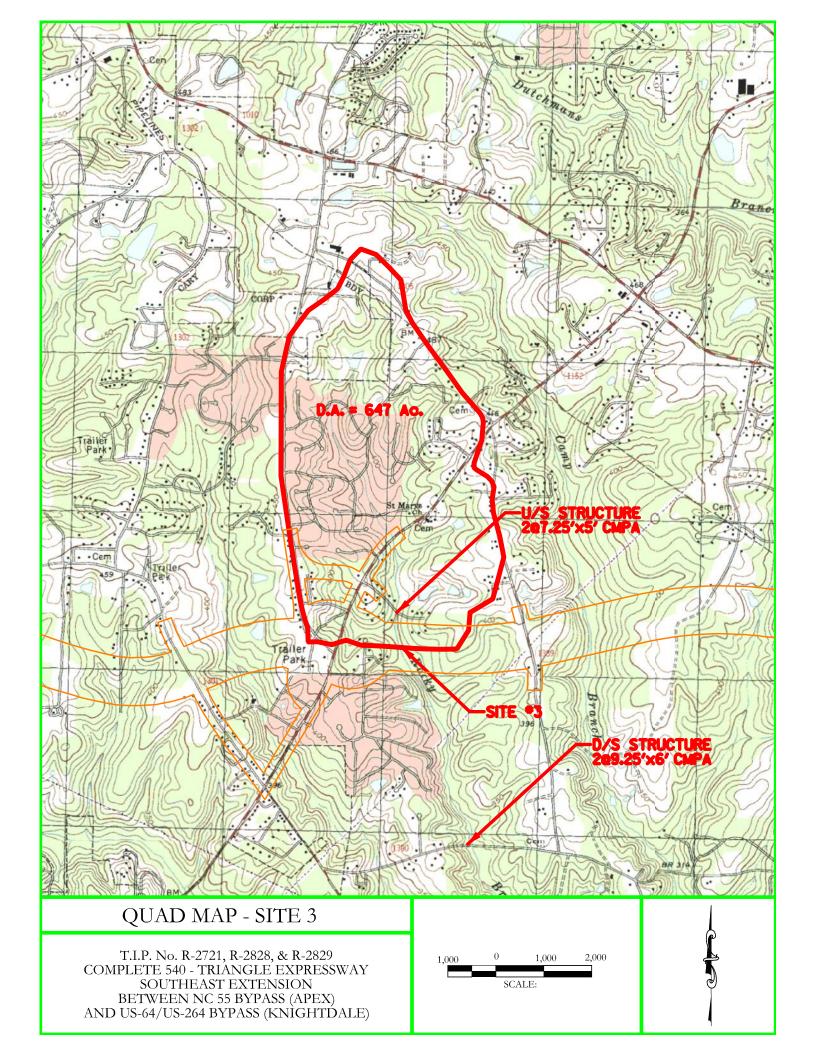
Looking at Downstream Face of Downstream Structure



Looking at Upstream Channel of Downstream Structure

# Site 3





6/28/2010

Coastal Plain         Blue Ridge         FREQUENCY         Blue Ridge         C(fs)         (cfs)         243.64         243.64         243.64         243.64         255.78         479.06         479.06         479.06         479.06         479.05         257.8         479.06         479.05         2605.82         2605.82         2605.82         2605.82         2605.82         1167.00         1167.00	PROJECT NAM ENGLISH	PROJECT NAME: Triangle Expressway SE Ext. IGLISH Drainage Area = 1.(	sway SE Ext.	STREAM NAME: Rocky Branch sq. miles		REGION: METHOD USED:	REGION: BLUE RIDGE HOD USED: Rep. 01-4207	Site #3
(cfs) 144.99 249.66 336.22 470.05 584.77 723.61 875.55 1007F	ומטטו	RAI REGREG	TION FOIL	ATIONS (OI D)	dild	AI FOILY	TIONS Don	7007 104 000
(cfs)         (cfs)         (cfs)         (cfs)         (cfs)           29.92         69.84         144.99         2YR         135.95         65.13           49.16         149.87         249.66         67.8         243.64         129.82           64.88         226.25         336.22         10YR         336.21         189.15           86.85         363.92         470.05         25YR         479.06         282.66           105.79         492.51         584.77         50YR         605.82         369.12           126.96         656.24         723.61         100YR         749.65         470.64           156.18         859.12         875.55         200YR         913.58         589.24           184.42         1195.51         1137.03         500YR         1167.00         777.16	REQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
29.92     69.84     144.99     2YR     135.95     65.13       49.16     149.87     249.66     6YR     243.64     129.82       64.88     226.25     336.22     10YR     336.21     189.15       86.85     36.392     470.05     25YR     479.06     282.66       105.79     492.51     584.77     50YR     605.82     369.12       126.96     656.24     723.61     100YR     749.65     470.64       156.18     859.12     875.55     200YR     913.58     589.24       184.42     1195.51     1137.03     500YR     1167.00     777.16		(cfs)	(cfs)	(cfs)			(cfs)	(cfs)
49.16       149.87       249.66       6VR       243.64       129.82         64.88       226.25       336.22       10YR       336.21       189.15         86.85       36.392       470.05       25YR       479.06       282.66         105.79       492.51       584.77       605.82       369.12         126.96       656.24       723.61       100YR       749.65       470.64         156.18       859.12       875.55       200YR       913.58       589.24         184.42       1195.51       1137.03       500YR       1167.00       777.16	2YR	29.92	69.84	144.99	2YR	135.95	65.13	33.74
64.88         226.25         336.22         10YR         336.21         189.15           86.85         363.92         470.05         25YR         479.06         282.66           105.79         492.51         584.77         50YR         605.82         369.12           126.96         656.24         723.61         100YR         749.65         470.64           156.18         859.12         875.55         200YR         913.58         589.24           184.42         1195.51         1137.03         500YR         1167.00         777.16	5YR	49.16	149.87	249.66	5YR	243.64	129.82	55.89
86.85     363.92     470.05     25YR     479.06     282.66       105.79     492.51     584.77     50YR     605.82     369.12       126.96     656.24     723.61     100YR     749.65     470.64       156.18     859.12     875.55     200YR     913.58     589.24       184.42     1195.51     1137.03     500YR     1167.00     777.16	10YR	64.88	226.25	336.22	10YR	336.21	189.15	73.41
105.79     492.51     584.77     50YR     605.82     369.12       126.96     656.24     723.61     100YR     749.65     470.64       156.18     859.12     875.55     200YR     913.58     589.24       184.42     1195.51     1137.03     500YR     1167.00     777.16	25YR	86.85	363.92	470.05	25YR	479.06	282.66	98.78
126.96 656.24 723.61 100YR 749.65 470.64 156.18 859.12 875.55 200YR 913.58 589.24 184.42 1195.51 1137.03 500YR 1167.00 777.16	50YR	105.79	492.51	584.77	SOYR	605.82	369.12	120.83
156.18 859.12 875.55 200YR 913.58 589.24 184.42 1195.51 1137.03 500YR 1167.00 777.16	100YR	126.96	656.24	723.61	100YR	749.65	470.64	143.98
184.42 1195.51 1137.03 500YR 1167.00 777.16	200YR	156.18	859.12	875.55	200YR	913.58	589.24	171.16
	500YR	184.42	1195.51	1137.03	500YR	1167.00	777.16	211.43

# **USGS URBAN REGRESSION EQUATIONS**

BDF= 11 (These Equations are used only for comparison)

								(Based on 2.80xQ10)	
	ш						1366.49		
of companison)	Coastal Plain	(cfs)	403.35	537.82	768.46	978.21	1261.24	1505.88	2029.06
a aic asca olliy	Sand Hills	(cfs)	169.08	200.47	244.24	281.44	327.96	561.31	438.20
ווכפס בלחמווסוו	FREQUENCY Sand Hills Coastal Plain		5YR	10YR	25YR	50YR	100YR	200YR	500YR

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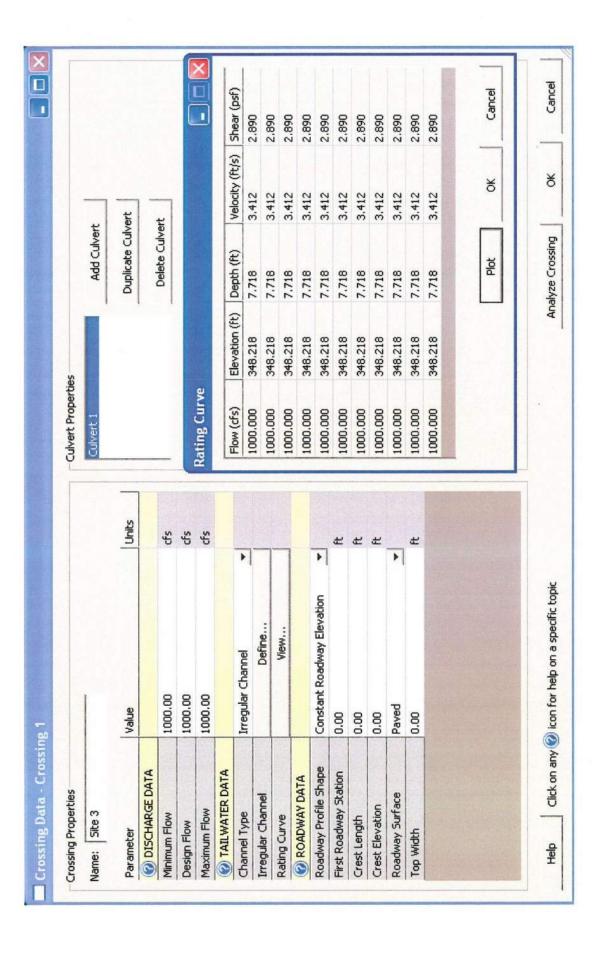
	Blue Ridge Discharge Used	(cfs)	440.77	574.41		975.22 1000	78	1608.34 (Based on 2.80xQ10)
	Coastal Plair	(cfs)	380.89	513.05	775.99	922.10	1066.69	1436.53
20	Sand Hills	(cfs)	277.14	356.02	475.60	560.29	638.19	98.966
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR

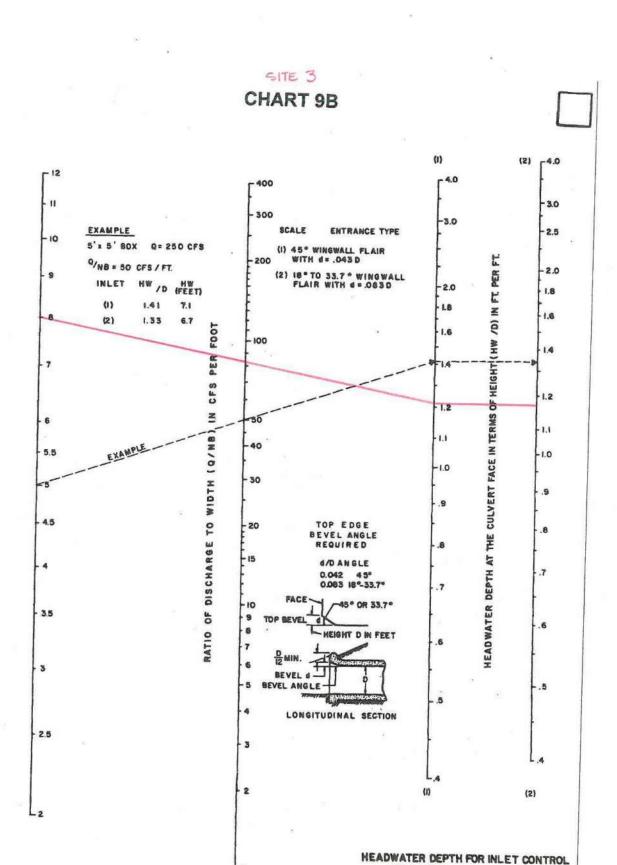
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FREQUENCY

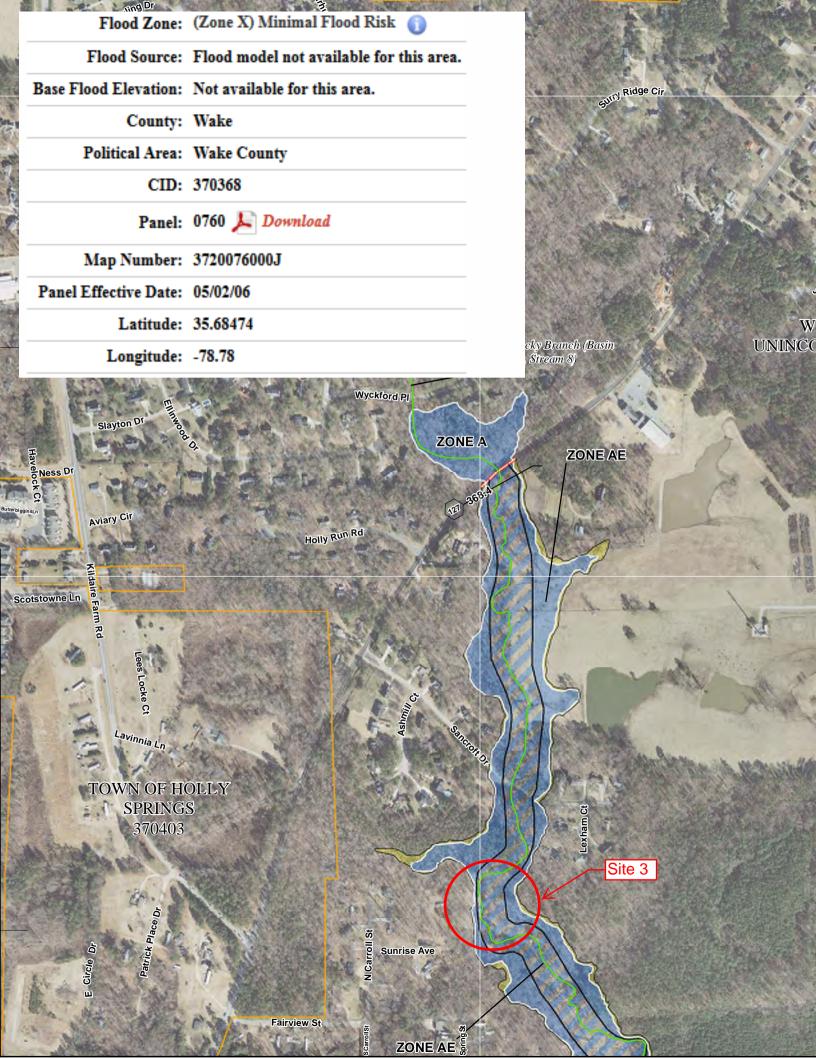
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 $Q = \frac{1000}{2(6)} = 83.3$ 

RECTANGULAR BOX CULVERTS
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## FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000





Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

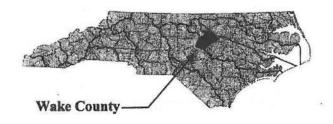
Table 9 - Fig	poding Sources Studied	by Detailed Methods: R	edelineated
Source		Sources	Affected Communties
Middle Creek	From The confluence with Swift Creek	To Approximately 0.7 mile upstream of confluence of Middle Creek Tributary	Rdu Town Of Apex Town Of Cary Town Of Fuquay-Varina Town Of Holly Springs Wake County
Millbrook Tributary to Marsh Creek (Basin 18, Stream 19)	The confluence with Marsh Creek (Basin 18, Stream 17)	East Millbrook Road	City Of Raleigh
Mills Branch (Basin 22, Stream 5)	The confluence with Middle Creek (Basin 22, Stream 1)	Railroad	Rdu Town Of Fuquay-Varina Wake County
Mine Creek (Basin 18, Stream 31)	The confluence with Crabtree Creek (Basin 18, Stream 9)	The confluences of East Fork Mine Creek (Basin 18, Stream 34) and West Fork Mine Creek (Basin 12, Stream 33)	City Of Raleigh
Morrisville Tributary (Basin 18, Stream 26)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Approximately 0.3 mile upstream of Railroad	Town Of Morrisville
Mud Branch (Basin 4, Stream 15)	The confluence with Horse Creek (Basin 4, Stream 1)	Approximately 3.0 miles upstream of confluence with Horse Creek (Basin 4, Stream 1)	Rdu Wake County
Neil Branch (Basin 24, Stream 8)	The confluence with Neil Creek (Basin 24, Stream 7)	East Spring Avenue	Town Of Fuquay-Varina
Neil Creek (Basin 24, Stream 7)	The confluence with Angier Creek (Basin 24, Stream 4)	Holland Road	Town Of Fuquay-Varina
Neuse River	Entire shoreline in Wake County	Entire shoreline within Granville County	Rdu Wake County
Neuse River	Wayne/Lenoir County boundary	Falls of the Neuse Road	City Of Raleigh Rdu Town Of Clayton Town Of Knightdale Town Of Wake Forest Wake County
New Light Creek	The confluence with Neuse River (Basin 15, Stream 1)	The confluence of Basin 3, Stream 8	Rdu Wake County
Panther Branch (Basin 22, Stream 2)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.5 mile upstream of Banks Road	Rdu Wake County
Panther Creek	The Chatham/Wake County Boundary	Approximately 1.0 mile upstream of Green Level to Durham Road	Town Of Cary
Perry Creek East Branch (Basin 15, Stream 27)	The confluence with Perry Creek (Basin 15, stream 26)	Approximately 0.3 mile upstream of Bivens Drive	City Of Raleigh
Pigeon House Branch (Basin 18, Stream 27)	The confluence with Crabtree Creek (Basin 18, Stream 9)	West Peace Street	City Of Raleigh
Poplar Branch (Basin 13, Stream 2)	The confluence with Poplar Creek (Basin 13, Stream 1)	Farm Road	Town Of Knightdale
Poplar Creek (Basin 13, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 900 Feet upstream of Fayetteville Street	Rdu Town Of Knightdale Wake County
Powell Creek (Basin 8, Stream 7)	The confluence with Hodges Creek (Basin 8, Stream 1)	Approximately 1.3 miles upstream of Peebles Road	City Of Raleigh Rdu Town Of Rolesville Wake County
Reedy Creek (Basin 20, Stream 11)	The confluence with Swift Creek (Basin 20, Stream 1)	Seventh Avenue	Rdu Town Of Garner Wake County
Reedy Creek (Basin 6, Stream 8)	The confluence with Sanford Creek (Basin 6, Stream 7)	Rogers Road	Town Of Rolesville Town Of Wake Forest
Reedy Creek Tributary (Basin 20, Stream 9)	The confluence with Reedy Creek (Basin 20, Stream 11)	Claymore Drive	Town Of Garner
Site 3 reek (Basin 18, Stream 3)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Trinity Road	City Of Raleigh
Rocky Branch (Basin 22, Stream 8)	The confluence with Middle Creek (Basin 22, Stream 1)	Holly Springs Road	Rdu Town Of Holly Springs Wake County
Rocky Branch (Basin 30, Stream 5)	Approximately 60 feet downstream of Western Boulevard (upstream crossing)	Approximately 900 feet upstream of Pullen Road	City Of Raleigh
Rocky Branch (Basin 30, Stream 5)	The confluence with Walnut Creek (Basin 30, Stream 1)	Approximately 215 feet upstream of Fayetteville Road	City Of Raleigh
Rocky Ford Branch (Basin 24, Stream 5)	The confluence with Kenneth Creek (Basin 24, Stream 2)	Approximately 0.9 mile upstream of confluence with Kenneth Creek (Basin 24, Stream 2)	Rdu Town Of Fuquay-Varina Wake County
Sanford Creek (Basin 6, Stream 7)	The confluence with Smith Creek (Basin 6, Stream 1)	Approximately 300 feet upstream of the confluence of Basin 6, Stream 9	Rdu Town Of Rolesville Town Of Wake Forest Wake County
Smith Creek	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 0.9 mile upstream of Oak Grove Church Road	Rdu Town Of Wake Forest Wake County
Southeast Prong Beaverdam Creek (Basin 18, Stream 30)	The confluence with Beaverdam Creek (Basin 18, Stream 28)	Wade Avenue	City Of Raleigh

	0				oodway D		. 0 ( 5		
Floodwa Cross Section	y Source Distance (Feet	Width (Feet)	Floodway Section Area	Mean Velocity	Regulatory	Wa 1% Annual	ter Surface Elev Without	With Floodway	Increase
Closs Section	Above Mouth)	widii (i eet)	(Square Feet)	(Feet Per Second)	rregulatory	Chance Future Water-Surface Elevation	Floodway	Williamodway	morease
239	23,922	315	2,056	2.3	261.7	261.7	261.7	262.2	0.5
249	24,871	245	1,448	3.2	264.3	264.3	264.3	265.2	0.9
253	25,325	225	1,366	3.3	265.0	265.0	265.0	266.0	1.0
262	26,150	210	1,421	3.2	269.6	269.6	269.6	269.9	0.3
268	26,759	250	1,503	3.0	270.9	270.9	270.9	271.9	0.9
272	27,156	240	1,194	3.8	272.1	272.1	272.1	273.1	1.0
278	27,750	240	1,670	2.7	275.8	275.8	275.8	275.9	0.2
285	28,487	275	1,846	2.5	277.0	277.0	277.0	277.7	0.7
292	29,182	330	1,783	2.6	278.0	278.0	278.0	279.0	1.0
299	29,939	270	1,442	3.2	279.6	279.6	279.6	280.6	1.0
310	31,033	175	1,663	2.7	289.5	289.5	289.5	290.2	0.7
317	31,671	245	2,192	2.0	290.0	290.0	290.0	290.8	0.8
323	32,262	250	1,694	2.5	290.3	290.3	290.3	291.3	1.0
328	32,835	110	637	6.6	290.9	290.9	290.9	291.9	1.0
333	33,305	160	1,021	4.1	294.5	294.5	294.5	295.1	0.5
337	33,724	220	1,425	2.9	296.2	296.2	296.2	296.9	0.7
341	34,088	225	1,317	3.2	297.1	297.1	297.1	297.9	0.8
345	34,540	235	1,394	2.6	298.4	298.4	298.4	299.4	1.0
350	35,007	142	856	4.2	299.6	299.6	299.6	300.6	1.0
	ek (Basin 18, S		1030	7.2	239.0	233.0	233.0	1300.0	11.0
012	1,180	50	340	9.3	252.9 <sup>1</sup>	*	240.2	241.2	1.0
033	3,255	80	500	6.4	252.9 <sup>1</sup>	*	252.7	253.7	1.0
088	8,775	130	385	5.6	282.0	*	282.0	282.0	0.0
190	18,980	100	564	3.7	334.9	*	334.9	335.7	0.8
201	20,070	120	617	3.4	340.4	*	340.4	340.9	0.5
218	21,770	150	840	2.1	348.3	*	348.3	349.3	1.0
240	23,955	50	263	5.3	363.8	*	363.8	364.5	0.7
Richland Cree	· · · · · · · · · · · · · · · · · · ·	100	1200	0.0	000.0	I	000.0	1001.0	10.1
006	561	33	182	7.6	229.5	229.9	229.5	230.4	0.9
009	929	45	201	6.9	232.7	233.0	232.7	233.6	0.9
015	1,450	75	215	6.4	239.5	239.7	239.5	239.6	0.1
020	1,966	20	141	9.8	244.4	244.8	244.4	245.4	1.0
	2,455	40	209	6.6	251.2	251.7	251.2	251.4	0.2
029	2,872	40	215	5.5	254.1	254.5	254.1	255.1	1.0
033	3,341	22	104	11.5	258.8	259.1	258.8	259.4	0.5
038	3,804	30	143	8.3	265.0	265.4	265.0	266.0	1.0
043	4,285	30	163	7.1	269.5	269.8	269.5	270.2	0.6
048	4,819	43	129	9.0	277.0	277.4	277.0	277.0	0.0
	5,240	20	99	11.7	282.3	282.6	282.3	282.3	0.0
052	5,689	20	120	5.6			287.0		0.0
057					287.0	287.6		287.3	
060	6,038	18	64	10.5	289.3	289.5	289.3	289.3	0.0
064 Rocky Branch	6,430 n (Basin 22, St	66 ream 8)	791	0.8	310.8	310.9	310.8	311.8	1.0
016	1 610	145	364	4 1	301.9	*	301.9	302.9	1.0
* * * *		7.1	1	· · ·		<del>.</del>		1	

A Report of Flood Hazards in

# WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 1 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV001A



Table 7—Summary of Discharges

				Dis	charges (d	fs)	
Flooding Source	Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	1% Future Annual Chance	0.2% Annual Chance
	Just downstream of NRCS Dam No.	5.2	100	110	165	*	710
Richland	Just upstream of NRCS Dam No.	5.2	1,220	2,220	2,750	*	5,000
Creek (Basin 18, Stream 3) (continued)	Just upstream of Medfield Tributary (Basin 18, Stream 39)	2.9	1,080	1,800	2,150	*	3,650
	At Interstate 40	1.8	850	1,450	1,730	*	2,900
	Approximately 1,000 feet upstream of Trinity Road	0.9	640	1,100	1,300	*	2,070
	At confluence with Richland Creek (Basin 5, Stream 1)	0.7	728	1,140	1,380	1,580	2,010
	Approximately 0.5 mile upstream of confluence with Richland Creek (Basin 5, Stream 1)	0.5	605	1,010	1,190	1,370	1,680
Richland Creek Tributary	Approximately 0.8 mile upstream of confluence with Richland Creek (Basin 5, Stream 1)	0.4	600	990	1,160	1,310	1,630
	Approximately 1.1 miles upstream of confluence with Richland Creek (Basin 5, Stream 1)	0.2	361	579	672	741	928
Rocky Branch	At mouth	1.8	530	1,100	1,500	*	2,900
(Basin 22, Stream 8)	At Holly Springs Road	0.6	250	570	800	*	1,650

Site 3

### Section 5.0 - Engineering Methods

SITE 3 -

Table 10-Roughness Coefficients

Stream	Channel "n"	Overbank "n"
Rocky Branch (Basin 22, Stream 8)	0.030 - 0.070	0.070 - 0.110
Rocky Branch (Basin 30, Stream 5) (upstream)	0.030 - 0.070	0.070 - 0.110
Rocky Ford Branch (Basin 24, Stream 5)	0.030 - 0.070	0.070 - 0.110
Sanford Creek (Basin 6, Stream 7)	0.030 - 0.070	0.070 - 0.110
Smith Creek (Basin 6, Stream 1)	0.030 - 0.070	0.070 - 0.110
Snipes Creek	0.042 - 0.045	0.120 - 0.130
Southeast Prong Beaverdam Creek (Basin 18, Stream 30)	0.030 - 0.070	0.070 - 0.110
Southwest Prong Beaverdam Creek (Basin 18, Stream 29)	0.030 - 0.060	0.050 - 0.090
Spring Branch (Basin 6, Stream 6)	0.030 - 0.070	0.070 - 0.110
Stirrup Iron Creek (Basin 18, Stream 12)	0.030 - 0.070	0.070 - 0.110
Straight Branch (Basin 20, Stream 23)	0.030 - 0.070	0.070 - 0.110
Swift Creek (Basin 20, Stream 1)	0.040 - 0.072	0.070 - 0.240
Swift Creek Tributary No. 7 (Basin 20, Stream 24)	0.030 - 0.070	0.070 - 0.110
Swift Creek Tributary No. 7A (Basin 20, Stream 25)	0.030 - 0.070	0.070 - 0.110
Sycamore Creek (Basin 18, Stream 6)	0.030 - 0.070	0.070 - 0.130
Terrible Creek (Basin 22, Stream 19)	0.030 - 0.070	0.070 - 0.110
Thomas Creek	0.050	0.145
Toms Creek (Basin 7, Stream 1)	0.030 - 0.070	0.070 - 0.110
Tributary to Big Branch Tributary No. 1 (Basin 30,	0.020 0.070	0.070 0.440
Stream 8)	0.030 - 0.070	0.070 - 0.110
Turkey Creek (Basin 18, Stream 5)	0.030 - 0.070	0.070 - 0.150
Turkey Creek (Basin 18, Stream 23)	0.030 - 0.070	0.070 - 0.110
Turkey Creek Tributary	0.046	0.100-0.150
Upper Barton Creek (Basin 16, Stream 1)	0.030 - 0.070	0.070 - 0.110
Unnamed Tributary to Swift Creek	0.040 - 0.043	0.105 - 0.133
Utley Creek	0.050	0.147
Walnut Creek (Basin 30, Stream 1)	0.038 - 0.050	0.100 - 0.200
West Fork Mine Creek (Basin 18, Stream 33)	0.030 - 0.070	0.070 - 0.110
Wheelers Creek (Basin 10, Stream 25)	0.030 - 0.070	0.070 - 0.110
White Oak Creek (Basin 19, Stream 1)	0.030 - 0.070	0.070 - 0.110
White Oak Creek (Basin 26, Stream 1)	0.050	0.150
White Oak Creek (Basin 28, Stream 1)	0.045 - 0.050	0.100 - 0.150
Wildcat Branch (Basin 30, Stream 4)	0.030 - 0.070	0.070 - 0.110
Yates Branch (Basin 20, Stream 13)	0.030 - 0.070	0.070 - 0.110

Does not include ineffective flow areas where n = 1.0 or 10.0

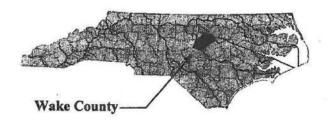
For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained

Flood Insurance Study Report: Wake County, North Carolina and Incorporated Areas May 2, 2006

A Report of Flood Hazards in

# WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 6 OF 7**

<b>Community Name</b>	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse



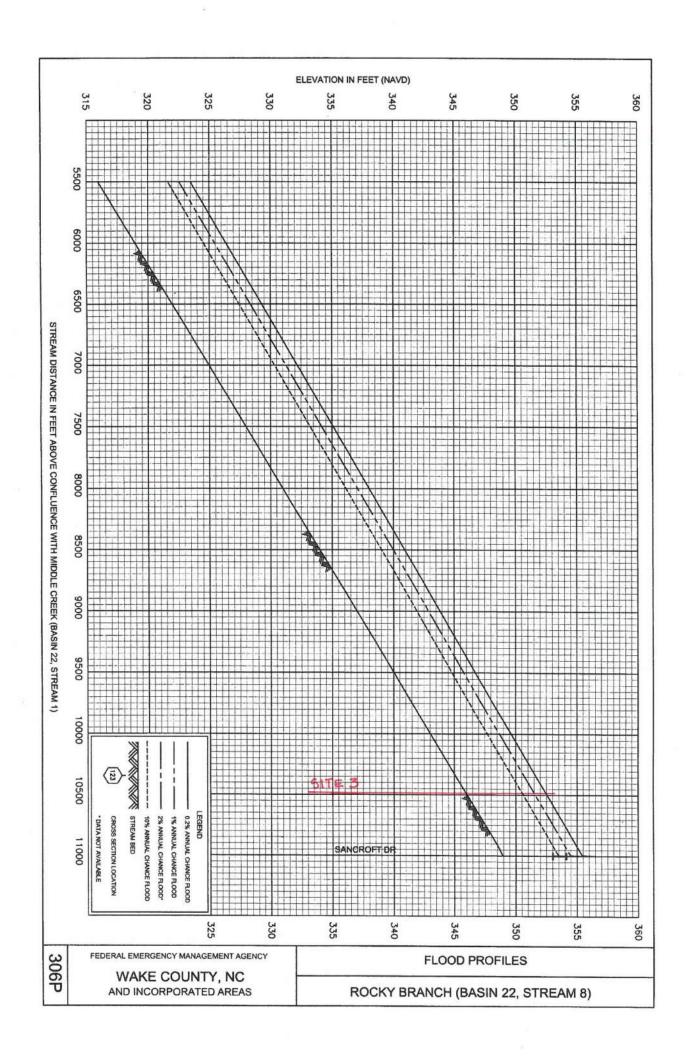


May 2, 2006

Federal Emergency Management Agency State of North Carolina

> Flood Insurance Study Number 37183CV006A

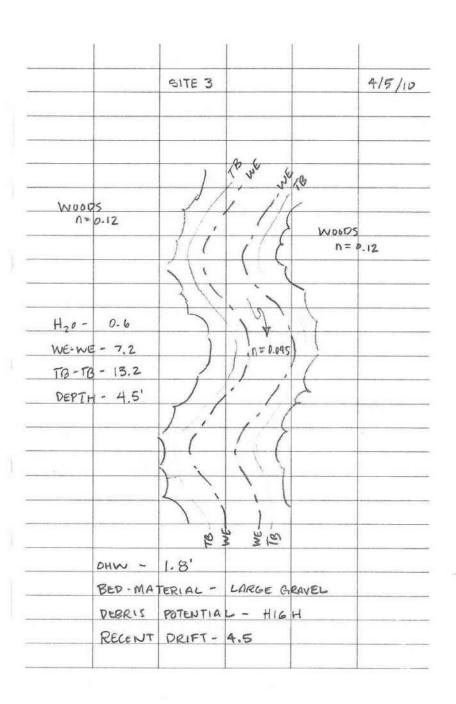




.0315 NEUSE RIVER BASIN

SITE 3

.0315 NEUSE RIVER BAS				SITE
			Class	
Name of Stream	Description	Class	Date	Index No.
Unnamed Tributary to Swift Creek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)
Unnamed Tributary to Swift Creek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)
Swift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)
Buck Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)
Buck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)
Reedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)
Reedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)
Swift Creek	From dam at Lake Benson to Neuse River	C; NSW	05/01/88	27-43-(8)
Mahlers Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-9
Neal Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-10
White Oak Creek (Austin Pond)	From source to Swift Creek	C; NSW	05/01/88	27-43-11
Little Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-12
Cooper Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-13
Reedy Branch (Little Branch)	From source to Swift Creek	C; NSW	05/01/88	27-43-14
Middle Creek	From source to backwaters of Sunset Lake	C; NSW	05/01/88	27-43-15-(1)
Middle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	27-43-15-(2)
Basal Creek [(Bass Lake, (Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	27-43-15-3
Middle Creek	From dam at Sunset Lake to Swift Creek	C; NSW	05/01/88	27-43-15-(4)
Rocky Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-4.5
Camp Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-5
Bells Lake	Entire lake and connecting stream to Middle Creek	C;NSW	05/01/88	27-43-15-6
Mills Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-7
Terrible Creek (Johnsons Pond)	From source to dam at Johnsons Pond	B;NSW	05/01/88	27-43-15-8-(1)
Terrible Creek	From dam at Johnsons Pond to Middle Creek	C;NSW	05/01/88	27-43-15-8-(2)
Panther Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-9
Little Creek	From source to Middle Creek	C; NSW		27-43-15-10





Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing



Debris Potential High



Looking at Downstream Channel of Upstream Structure



Looking at Upstream Face of Upstream Structure (2 @ 87" x 60" CMPA)



Looking at Downstream Face of Upstream Structure

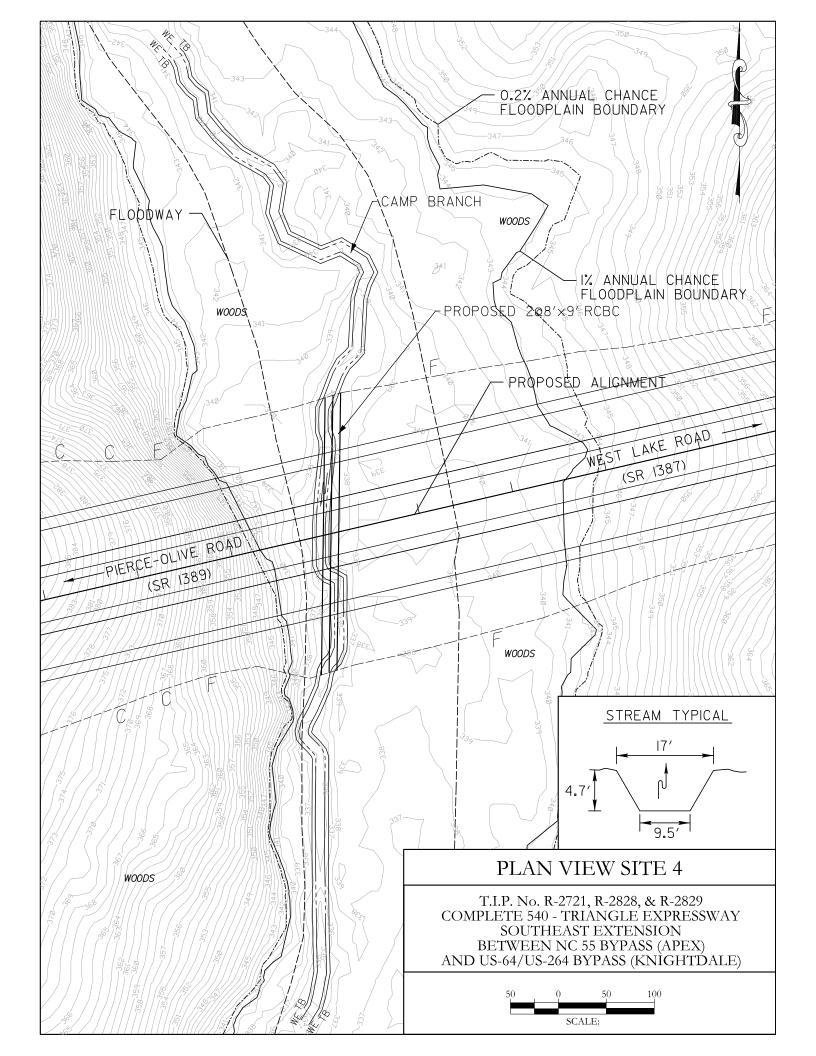


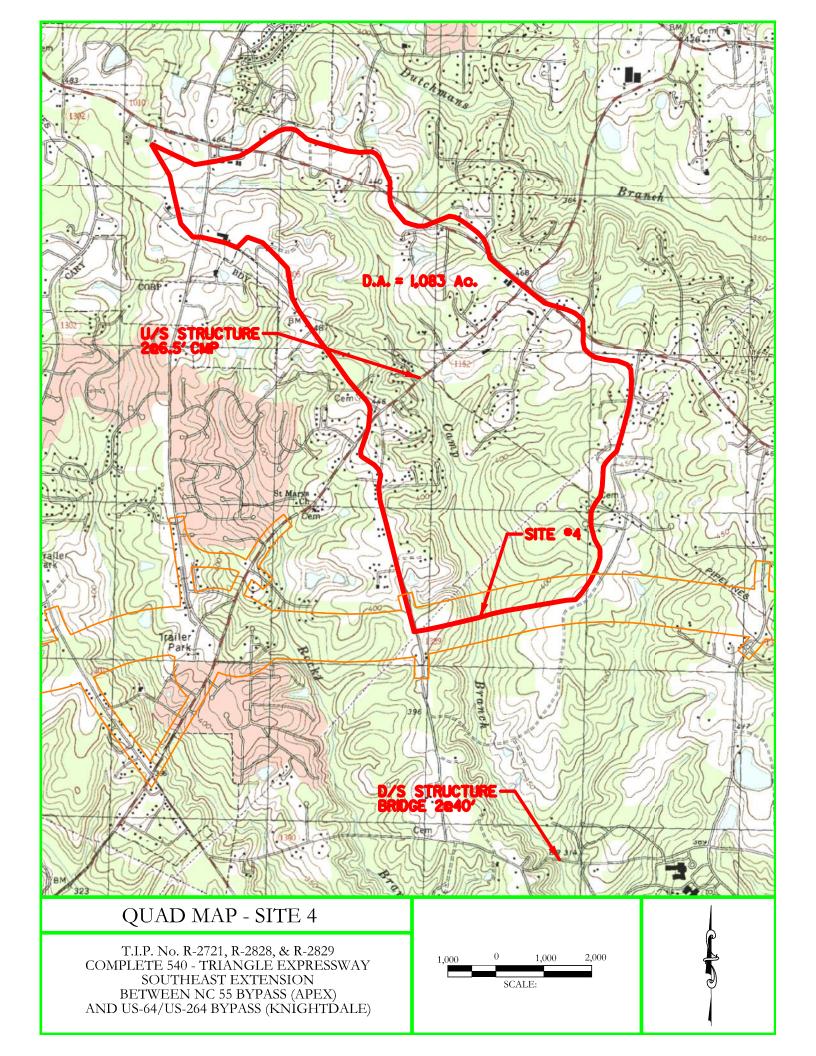
Looking at Upstream Face of Downstream Structure (2 @ 111" x 72" CMPA)



Looking at Downstream Face of Downstream Structure

# Site 4





STREAM NAME: Camp Branch sq. miles 1.69 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = 6/28/2010 ENGLISH

REGION: BLUE RIDGE

METHOD USED: Rep. 01-4207

ort 01-4207	Sand Hills	(cts)	48.67	80.18	105.09	141.12	172.45	205.17	243.66	300.67
TIONS Rep	Coastal Plain	(cfs)	92.10	180.01	259.60	383.57	497.29	629.84	783.69	1025.68
AL EQUA	Blue Ridge	(cfs)	195.12	345.22	472.72	667.72	840.05	1034.15	1254.48	1593.42
RUR	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR
 ATIONS (OLD)	Blue Ridge	(cfs)	206.93	352.48	473.47	658.54	817.15	1007.53	1216.57	1566.94
SSION EQUA	Coastal Plain	(cfs)	69.96	202.22	301.70	478.57	641.70	847.56	1101.63	1518.05
JSGS RURAL REGRE	Sand Hills	(cfs)	43.63	71.88	94.96	127.84	156.21	188.04	231.44	275.26
USGS RUF	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR

# **USGS URBAN REGRESSION EQUATIONS**

BDF=

(These Equations are used only for comparison)

FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	
	(cfs)	(cfs)	(cfs)	
5YR	248.20	556.14	857.85	
10YR	294.11	733.05	1046.53	
25YR	359.48	1033.49	1334.19	
50YR	416.88	1309.32	1592.48	
100YR	488.91	1680.53	1936.50	
200YR	823.52	2052.54	2930.28	(Based on 2.80xQ10)
500YR	62.099	2679.96	2750.53	

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FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Discharge Used	
	(cfs)	(cfs)	(cfs)		
SYR	397.37	533.63	625.83		
10YR	504.47	707.76	804.74		
25YR	662.55	1040.62	1159.91		
50YR	777.72	1228.93	1329.50	1300	
100YR	882.67	1413.61	1492.03		
200YR	1412.50	1981.73	2253.27	(Based on 2.80xQ10)	
SOOYR	1846.34	2590.40	2945.35	(Based on 3.66xQ10)	

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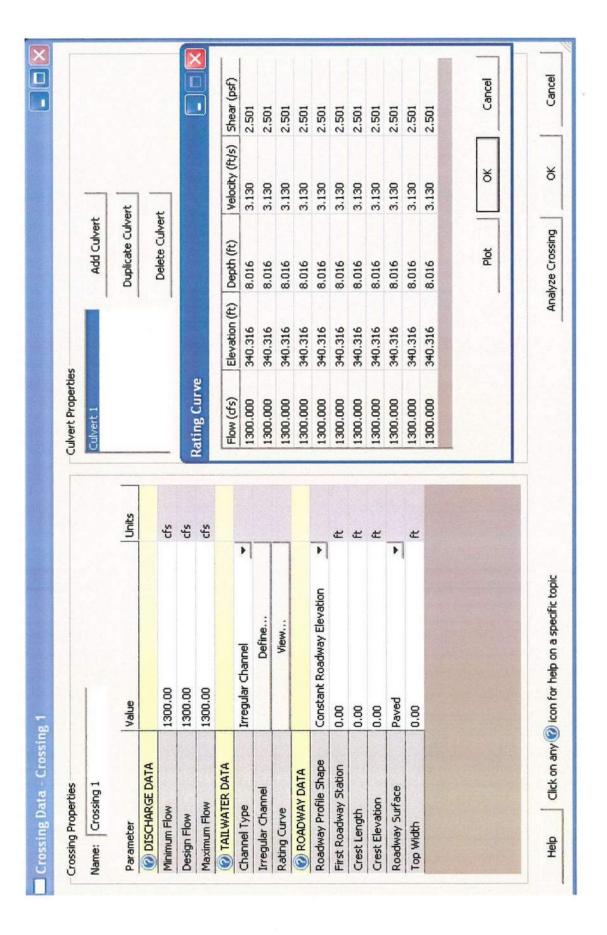
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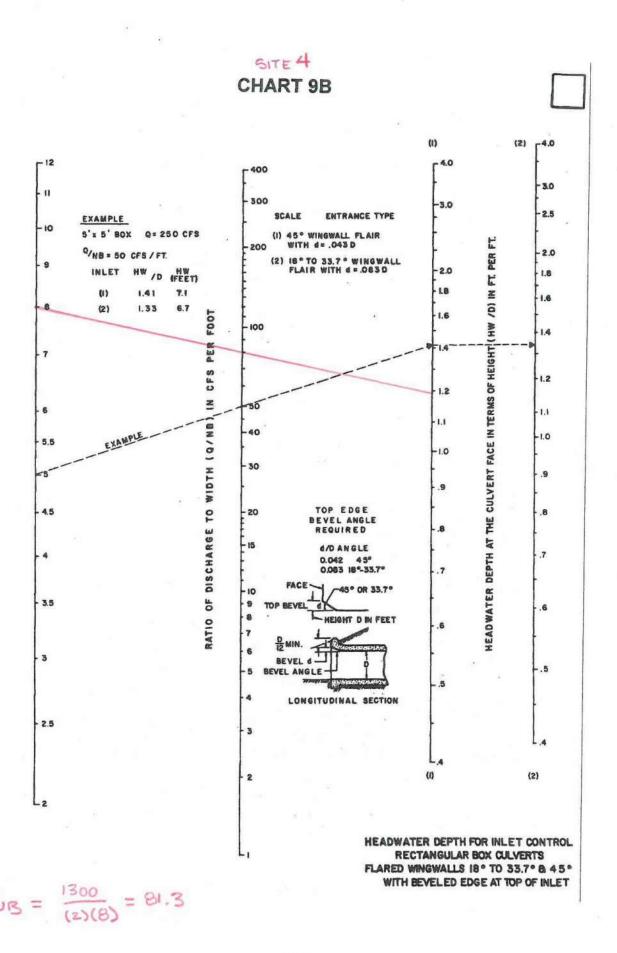
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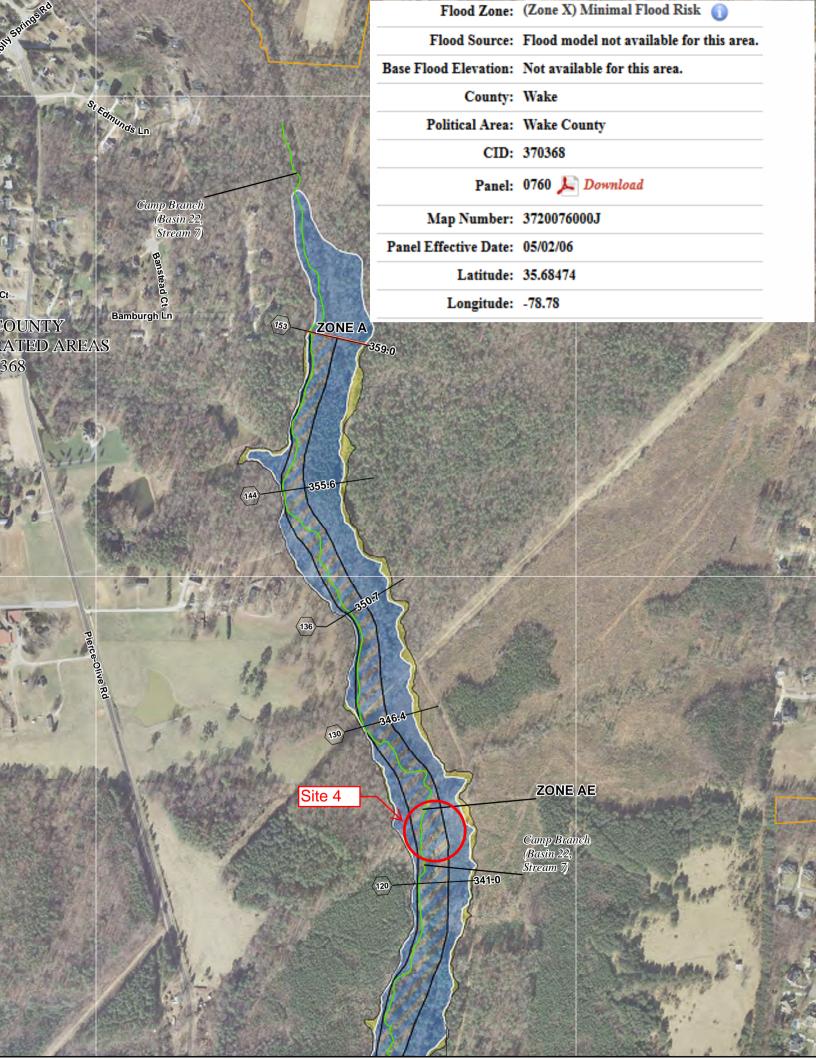
500 1050 1430 2780

100YR 500YR

10YR 50YR



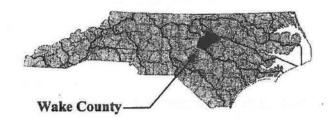




A Report of Flood Hazards in

# WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 1 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV001A



### Table 5—Flooding Sources Studied by Detailed Methods: Redelineated

	Riverine	Sources	Affected
Source	Source From To		Communities
Beaverdam Lake	Entire shoreline	in Wake County	Wake County (Unincorporated Areas
Beaver Creek Tributary (Basin 27, Stream 3)	The confluence with Beaver Creek (Basin 27, Stream 2)	Approximately 0.3 mile downstream of Holland Road	Wake County (Unincorporated Areas)
Big Branch (Basin 10, Stream 8)	The confluence with Little River (Basin 10, Stream 1)	Highway 96/Zebulon Road	Wake County (Unincorporated Areas)
Big Branch (Basin 30, Stream 2)	Rock Quarry Road	Auburn Church Road	Town of Garner, City of Raleigh, Wake County (Unincorporated Areas)
Big Branch Tributary No. 1 (Basin 30, Stream 6)	Approximately 0.5 mile upstream of Interstate 40	The confluence of Adams Branch (Basin 30, Stream 9)	Town of Garner Wake County (Unincorporated Areas)
Adams Branch (Basin 30, Stream 9)	The confluence with Big Branch Tributary No. 1 (Basin 30, Stream 6)	Corwin Road	Town of Garner Wake County (Unincorporated Areas)
Black Creek Tributary A (Basin 18, Stream 11)	The confluence with Crabtree Creek (Basin 18, Stream 9)	North Harrison Avenue	Town of Cary
Bradley Creek (Basin 24, Stream 3)	The confluence with Kenneth Creek (Basin 24, Stream 2)	South Main Street (U.S. Route 401)	Wake County (Unincorporated Areas)
Buck Branch (Basin 20, Stream 12)	The confluence with Reedy Branch (Basin 20, Stream 11)	Approximately 0.7 mile upstream of Vandora Springs Road	Town of Garner
Buckhorn Branch (Basin 3, Stream 9)	The confluence with Newlight Creek (Basin 3, Stream 1)	Approximately 1.4 miles upstream of the confluence with Newlight Creek (Basin 3, Stream 1)	Wake County (Unincorporated Areas)
Buffalo Branch (Basin 10, Stream 22)	The confluence with Little River (Basin 10, Stream 1)	Morphus Bridge Road	Wake County (Unincorporated Areas)
Buffalo Creek (Basin 9, Stream 1)	The Wake/Johnston County boundary	Robertsons Pond Dam	Town of Wendell, Wake County (Unincorporated Areas)
Camp Branch (Basin 22, Stream 7)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 2.0 miles upstream of Optimist Farm Road	Town of Cary, Wake County (Unincorporated Areas)
Cedar Creek (Basin 15, Stream 34)	The confluence with Falls Lake	Approximately 0.4 mile upstream of Coachmans Way	Wake County (Unincorporated Areas)
Coles Branch (Basin 18, Stream 24)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Approximately 0.5 mile downstream of Maynard Road	Town of Cary, Town of Morrisville

SITE 4 ---

## Section 5.0 - Engineering Methods

Table 7—Summary of Discharges

	Name and the second sec								
				Discharges (cfs)					
	Flooding Source	Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	1% Future Annual Chance	0.2% Annual Chance	
		At mouth	3.7	810	1,660	2,230	*	4,155	
ITE 4 _	Camp Branch (Basin 22,	Just upstream of tributary at Optimist Farm Road	2.3	590	1,235	1,675	*	3,185	
	Stream 7)	Approximately 0.6 mile downstream of Holly Springs Road	1.4	445	955	1,305	*	2,525	
		Approximately 0.8 mile downstream of Rex Road	4.5	*	*	1,904	3,390	*	
	App 1 down 2 dow	Approximately 1,060 feet downstream of Rex Road	4.2	*	*	1,822	3,240	*	
		Just upstream of confluence with Cary Branch Tributary	2.1	*	*	1,188	2,010	*	
		Approximately 1,580 feet upstream of confluence with Cary Branch Tributary	1.7	*	*	1,028	1,700	*	
		Approximately 0.7 mile upstream of confluence with Cary Branch Tributary	1.6	*	*	1,009	1,680	*	
		Approximately 1.1 miles upstream of confluence with Cary Branch Tributary	1.6	*	*	979	1,630	*	
		Approximately 1.4 miles upstream of confluence with Cary Branch Tributary	1.5	**	*	944	1,580	*	

Flood Insurance Study Report: Wake County, North Carolina and Incorporated Areas May 2, 2006

**Table 10—Roughness Coefficients** 

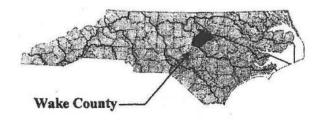
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Stream	Channel "n"	Overbank "n"
Basin 22, Stream 6	0.030 - 0.070	0.070 - 0.110
Basin 22, Stream 9	0.030 - 0.070	0.070 - 0.110
Basin 22, Stream 20	0.030 - 0.070	0.070 - 0.110
Basin 23, Stream 2	0.050	0.140
Basin 23, Stream 2 Tributary	0.050	0.150
Basin 23, Stream 3	0.048	0.140
Basin 23, Stream 4	0.050	0.150
Basin 23, Stream 5	0.050	0.150
Basin 27, Stream 4	0.030 - 0.070	0.070 - 0.110
Basin 28, Stream 7	0.050 - 0.055	0.150 - 0.155
Basin 28, Stream 8	0.047 - 0.050	0.100 - 0.200
Basin 30, Stream 3	0.030 - 0.070	0.070 - 0.110
Beaver Creek (Basin 27, Stream 2)	0.043 - 0.050	0.100 - 0.200
Beaverdam Creek (Basin 11, Stream 3)	0.030 - 0.070	0.070 - 0.130
Beaverdam Creek (Basin 12, Stream 1)	0.024 - 0.070	0.070 - 0.130
Beaverdam Creek (Basin 15, Stream 21)	0.018 - 0.070	0.070 - 0.130
Beaverdam Creek (Basin 18, Stream 28)	0.040 - 0.055	0.090 - 0.200
Beaver Creek Tributary (Basin 27, Stream 3)	0.030 - 0.070	0.070 - 0.110
Big Branch	0.050	0.140
Big Branch (Basin 10, Stream 8)	0.030 - 0.070	0.070 - 0.130
Big Branch (Basin 18, Stream 21)	0.035 - 0.055	0.090 - 0.200
Big Branch (Basin 26, Stream 5)	0.050	0.140
Big Branch (Basin 30, Stream 2)	0.030 - 0.070	0.070 - 0.110
Big Branch Tributary No. 1 (Basin 30, Stream 6)	0.030 - 0.070	0.070 - 0.120
Adams Branch (Basin 30, Stream 9)	0.030 - 0.070	0.070 - 0.110
Black Creek (Basin 23, Stream 1)	0.045	0.150
Black Creek Tributary A (Basin 18, Stream 11)	0.030 - 0.070	0.070 - 0.110
Bradley Creek (Basin 24, Stream 3)	0.030 - 0.070	0.070 - 0.110
Bridges Branch	0.050	0.130
Brier Creek (Basin 18, Stream 14)	0.024 - 0.040	0.100 - 0.200
Buck Branch (Basin 20, Stream 12)	0.030 - 0.070	0.070 - 0.011
Buckhorn Branch (Basin 3, Stream 9)	0.030 - 0.070	0.070 - 0.011
Buckhorn Creek	0.040 - 0.048	0.145
Buffalo Branch (Basin 10, Stream 22)	0.030 - 0.070	0.070 - 0.110
Buffalo Creek (Basin 9, Stream 1)	0.030 - 0.070	0.070 - 0.130
Camp Branch (Basin 22, Stream 7)	0.030 - 0.070	0.070 - 0.110
Cary Branch	0.040	0.140
Cedar Creek (Basin 15, Stream 34)	0.030 - 0.070	0.070 - 0.110
Cedar Fork (Basin 10, Stream 15)	0.042	0.130
Clark Branch (Basin 28, Stream 3) Coles Branch (Basin 18, Stream 24)	0.050 0.030 - 0.070	0.150 0.070 - 0.200

# FLOOD INSURANCE STUDY

A Report of Flood Hazards in

# WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 2 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
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Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
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Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV002A

www.fema.gov and www.ncfloodmaps.com



CROSS SECTION DISTANCE <sup>1</sup> WIDTH AREA VELOCITY  Camp Branch (Basin 22, Stream 7)  (Basin		(FEET NAVO 89)	7
Camp Branch (Basin 22, Stream 7)  (Basin 22, Stream 7)  1,885  019  025  2,490  210  829  030  3,045  245  749  75  366  6,260  115  6,860  115  6,860  115  6,860  115  6,860  115  6,860  115  6,860  115  6,860  115  115  140  157  108  11,980  11,00  11	SECTION MEAN AREA VELOCITY (SQUARE (FEET PER FEET)	WITHOUT WITH FLOODWAY	INCREASE
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5,550 75 356 056 6,260 135 593 069 6,860 115 446 079 7,880 140 514 092 9,200 160 572 096 9,820 140 593 102 10,150 160 581 11,980 160 489 13,620 100 332 144 14,380 120 408 15,290 140 526	829		0.8
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102 10,150 160 581 10,800 108 160 523 10,800 160 523 11,980 160 489 130 13,000 140 424 13,620 100 332 144 14,380 120 408 15,290 140 526	593 2.6		9.0
Te 4 108 10,800 160 523 11,980 160 489 13,000 140 424 136 13,620 100 332 144 14,380 120 408 15,290 140 526	581 2.6		0.7
130 11,980 160 489 130 13,000 140 424 136 13,620 100 332 144 14,380 120 408 15,290 140 526	523 2.9		800
13,000 140 424 13,620 100 332 14,380 120 408 15,290 140 526	489 2.9		
13,620 100 332 14,380 120 408 15,290 140 526	424 3.4		
14,380 120 408 15,290 140 526	332 43		0.0
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**FLOODWAY DATA** 

CAMP BRANCH (BASIN 22, STREAM 7)

TABLE 13

WAKE COUNTY, NC AND INCORPORATED AREAS

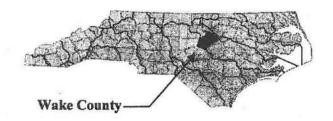
FEDERAL EMERGENCY MANAGEMENT AGENCY

# FLOOD INSURANCE STUDY

A Report of Flood Hazards in

# WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



## **VOLUME 4 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





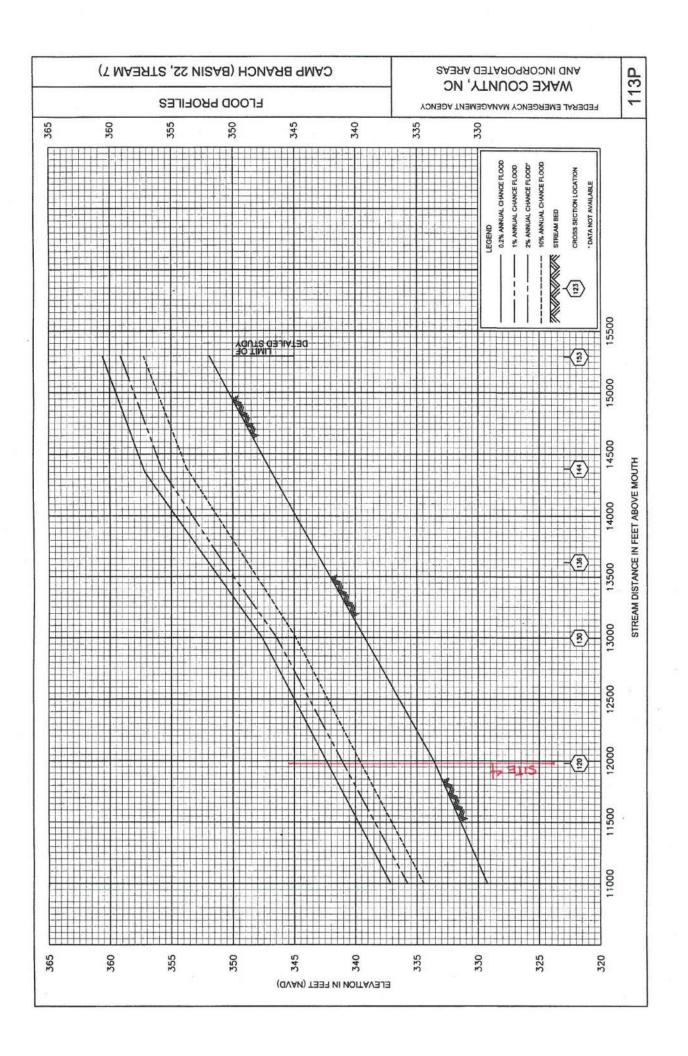
May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV004A

www.fema.gov and www.ncfloodmaps.com





			Claca	
Name of Stream	Description	Class	Class Date	Index No.
nnamed Tributary to Swift reek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)
Innamed Tributary to Swift Creek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)
Swift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)
Buck Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)
Buck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)
Reedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)
Reedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)
Swift Creek	From dam at Lake Benson to Neuse River	C;NSW	05/01/88	27-43-(8)
Mahlers Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-9
Meal Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-10
White Oak Creek (Austin Cond)	From source to Swift Creek	C; NSW	05/01/88	27-43-11
Little Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-12
Cooper Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-13
eedy Branch (Little Branch)	From source to Swift Creek	C; NSW	05/01/88	27-43-14
iddle Creek	From source to backwaters of Sunset Lake	C; NSW	05/01/88	27-43-15-(1)
Middle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	27-43-15-(2)
Basal Creek [(Bass Lake, (Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	27-43-15-3
Middle Creek	From dam at Sunset Lake to Swift Creek	C;NSW	05/01/88	27-43-15-(4)
Rocky Branch	From source to Middle Creek	C;NSW	05/01/88	27-43-15-4.5
amp Branch	From source to Middle Creek	C; NSW	05/01/88	
ells Lake	Entire lake and connecting	C; NSW	05/01/88	
	stream to Middle Creek			
Mills Branch	From source to Middle Creek	C; NSW		27-43-15-7
Perrible Creek (Johnsons Pond)	From source to dam at Johnsons Pond	B; NSW	05/01/88	27-43-15-8-(1)
Terrible Creek	From dam at Johnsons Pond to Middle Creek	C;NSW	05/01/88	27-43-15-8-(2)
Panther Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-9
Little Creek	From source to Middle Creek	C;NSW		27-43-15-10

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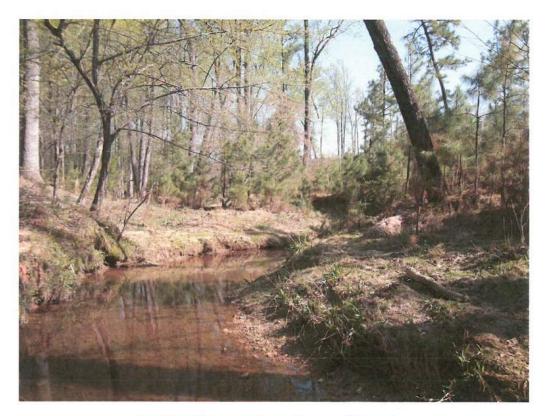
NC DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS BRIDGE MANAGEMENT UNIT

ATTENTION

# **BRIDGE INSPECTION REPORT**

INSPECTION TYPE:	Routine Inspection	1			
COUNTY WAKE	BRIDGE NUMBER	910386 INSPEC	TION CYCLE	2 YRS	
ROUTE SR1390	ACROSS PRONG	MIDDLE CREEK		M.P. <u>0</u>	
LOCATION 0.4MI.E.JCT SR1389					
SUPERSTRUCTURE PPC CORED SLAB (E	MD 29-24-90)				
SUBSTRUCTURE EBTS&IBT:PPC CAPS	STEEL H-PILES @ \	/AR. CTS.			
SPANS 2 @ 40'					
LONGITUDE 78° 46' 10.2"		LATITUDE 35° 39'	43.2"		
PRESENT CONDITION GOOD		INVENTORY RATING	H	5-35	
INSPECTION DATE 02/02/2009		OPERATING RATING		5-59	
PRESENT POSTING Not Posted		PROPOSED POSTING		No P.	
COMPUTER UPDATE 6-10	1-9	ANALYSIS DATE	3-	-16-9	
POSTING LETTER DATE		SUFFICIENCY RATIN	G		
OTHER SIGNS PRESENT	12				
		5	SIGN NOTICE SSUED FOR		NUMBERED REQUIRED
			No v	EIGHT LIMIT	
			No D	ELINEATORS	
		1	No NA	RROW BRIDGE	-
			No ONE	LANE BRIDGE	
A STATE OF THE STA	19		No LOV	V CLEARANCE	

**LOOKING EAST** 



Looking Upstream from Proposed Crossing



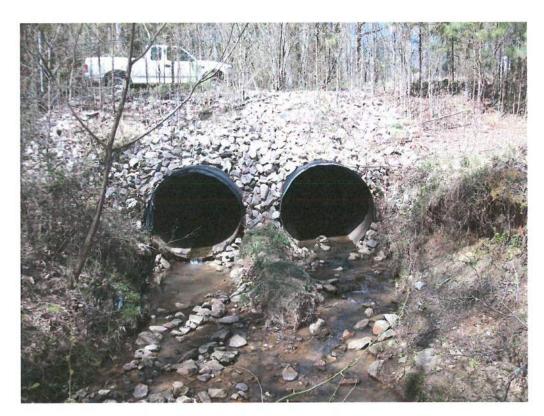
Looking Downstream from Proposed Crossing



Looking at Downstream Channel of Upstream Structure



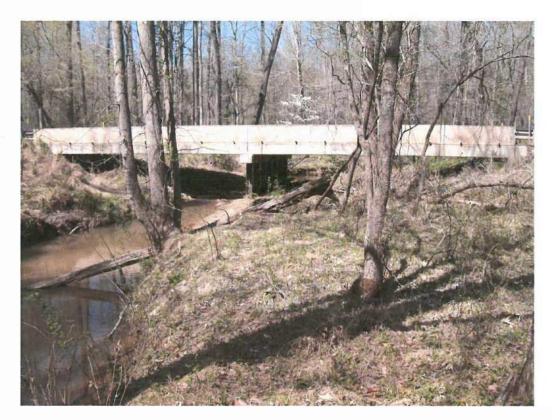
Looking at Upstream Face of Upstream Structure (2 @ 6.5' CMP)



Looking at Downstream Face of Upstream Structure

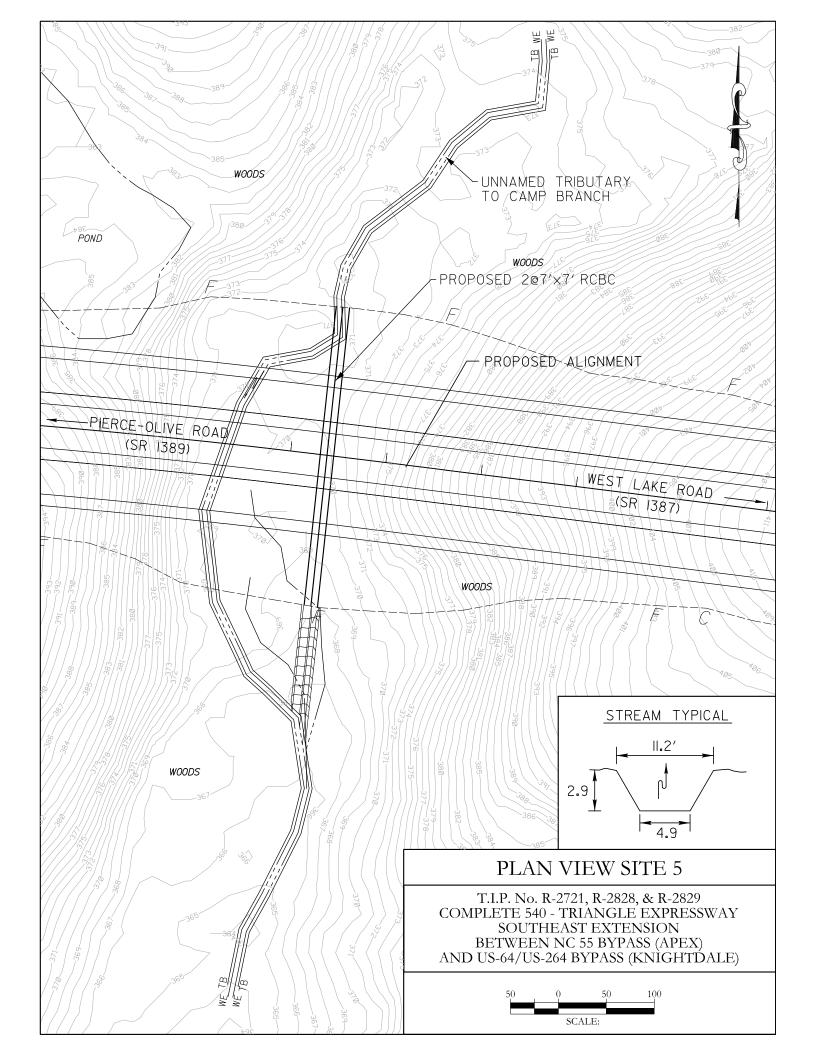


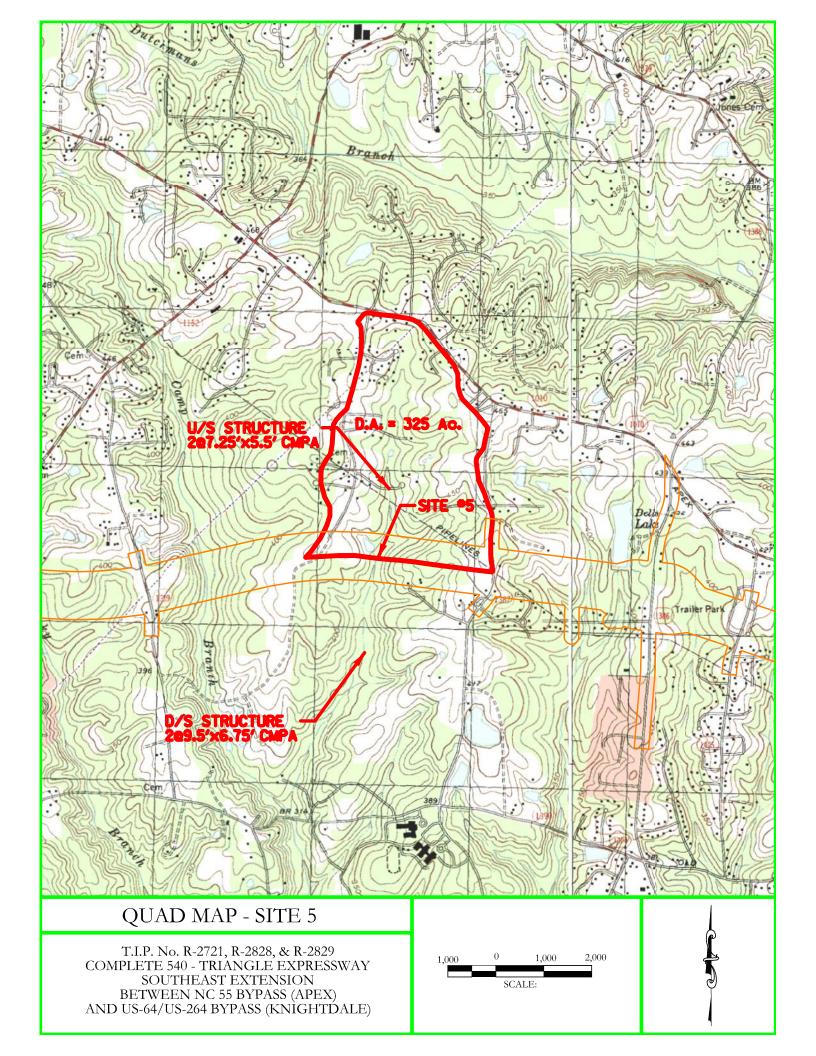
Looking at Upstream Face of Downstream Structure (Bridge #386)



Looking at Downstream Face of Downstream Structure

# Site 5





6/8/2010	10				
ROJECT N	AME: Triangle Expressway SE	Ext.	STREAM NAME: Unnamed Trib to Camp Branch		REGION: BLUE RIDGE
IGLISH	Drainage Area =	0.51	sq. miles	USED: Re	Rep. 01-4207

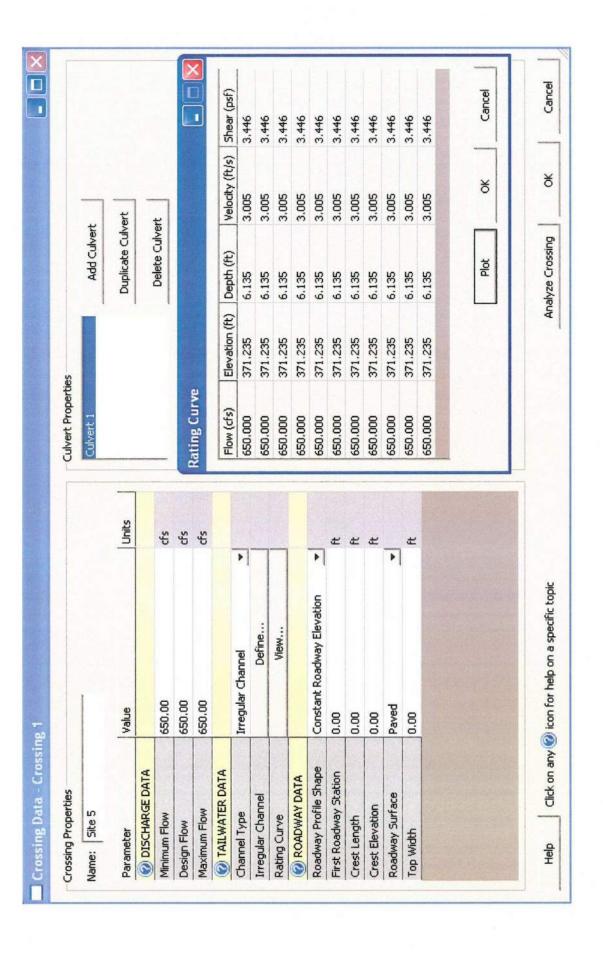
<b>USGS RUR</b>	ISGS RURAL REGRE	ESSION EQU	ATIONS (OLD)	RUF	RAL EQUA	TIONS Rep	RURAL EQUATIONS Report 01-4207	
FREQUENCY	Sand Hills	Coastal Plain	-01	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills	
	(cfs)	(cfs)			(cfs)	(cfs)	(cfs)	
2YR	18.13	45.35	90.43	2YR	84.15	41.12	20.74	
5YR	29.69	100.69	157.95	5YR	153.41	84.12	34.62	
10YR	39.13	154.42	213.44	10YR	213.87	124.25	45.59	
25YR	51.99	253.01	300.45	25YR	308.31	188.49	61.52	
SOYR	63.07	346.65	375.06	SOYR	392.56	248.51	75.36	
100YR	75.38	467.28	466.33	100YR	489.09	319.69	89.98	
200YR	92.66	617.62	565.79	200YR	599.72	403.54	107.11	
500YR	108.38	870.68	742.84	500YR	771.86	537.72	132.49	

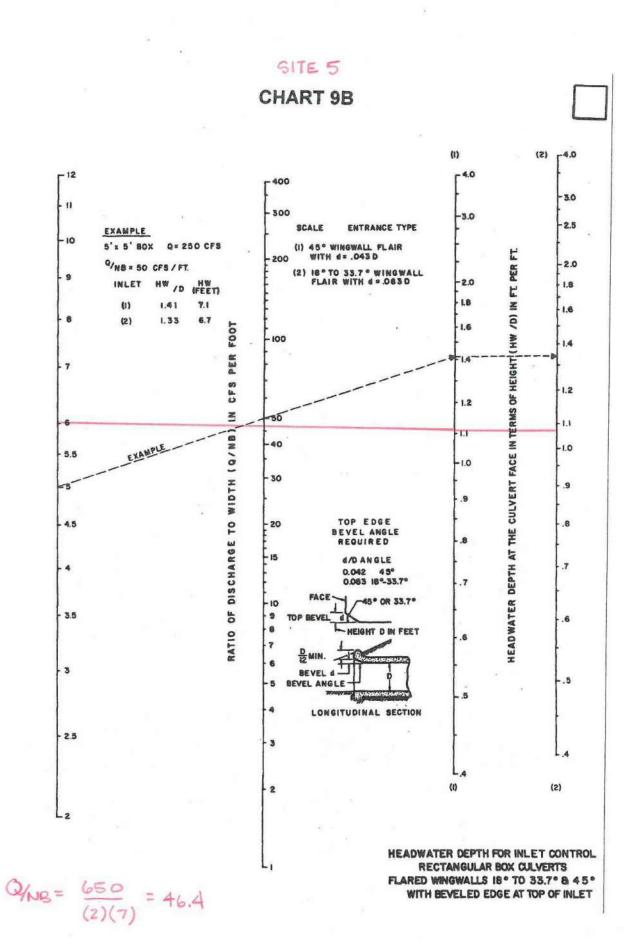
# **USGS URBAN REGRESSION EQUATIONS**

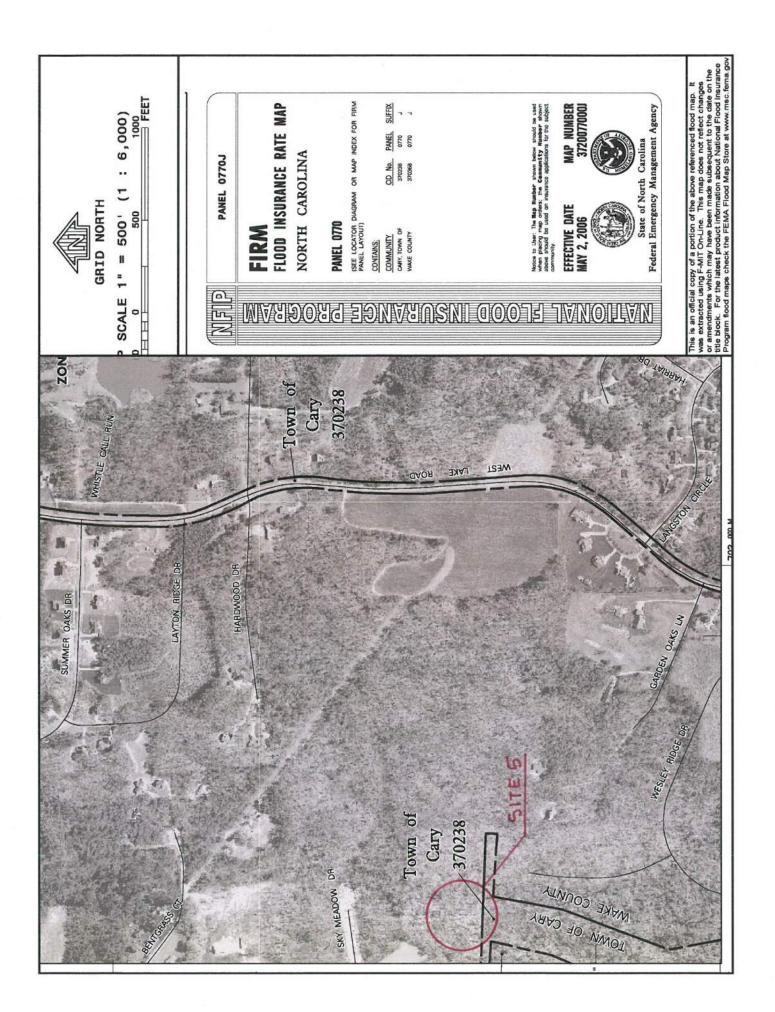
BDF=

(These Equation	ns are used only	for comparison)		
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	
	(cfs) (cfs)	(cfs)	(cfs)	
5YR	101.58	263.34	374.14	
10YR	120.53	356.54	460.42	
25YR	146.22	518.58	595.01	
SOYR	167.08	664.31	708.08	
100YR	193.04	861.69	860.26	
200YR	337.48	998.30	1289.17	(Based on 2.80xQ10)
500YR	254.02	1402.52	1231.28	

1101101	2000	つつこうこうびょう	חואויות	ואומתם לכסים מכן סווכבו ממן -מם		
% Impervious =	20				FEMA	A
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Discharge Used	FREQUENCY	Disharges
	(cfs)	(cfs)	(cfs)			
5YR	171.78	243.46	276.77			
10YR	224.17	334.73	367.15		10YR	
25YR	306.29	525.67	557.84		50YR	
SOYR	362.56	629.78	646.33	650	100YR	
100YR	414.95	734.03	733.21		100YR	
200YR	627.68	937.23	1028.03	(Based on 2.80xQ10)	500YR	
500YR	820.46	1225.09	1343.79	(Based on 3.66xQ10)		







.0315 NEUSE RIVER BASIN

SITE 5

			Class	SITE !
Jame of Stream	Description	Class	Date	Index No.
and of beleam	Description		Date	THACK NO.
nnamed Tributary to Swift reek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)
nnamed Tributary to Swift reek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)
wift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)
uck Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)
uck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)
eedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)
eedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)
wift Creek	From dam at Lake Benson to Neuse River	C;NSW	05/01/88	27-43-(8)
ahlers Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-9
eal Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-10
hite Oak Creek (Austin ond)	From source to Swift Creek	C; NSW	05/01/88	27-43-11
ittle Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-12
ooper Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-13
eedy Branch (Little Branch)	From source to Swift Creek	C; NSW	05/01/88	27-43-14
iddle Creek	From source to backwaters of Sunset Lake	C; NSW	05/01/88	27-43-15-(1)
iddle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	27-43-15-(2)
asal Creek [(Bass Lake, Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	27-43-15-3
iddle Creek	From dam at Sunset Lake to Swift Creek	C;NSW	05/01/88	27-43-15-(4)
ocky Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-4.5
amp Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-5
ells Lake	Entire lake and connecting stream to Middle Creek	C;NSW	05/01/88	27-43-15-6
ills Branch	From source to Middle Creek	C;NSW	05/01/88	27-43-15-7
errible Creek (Johnsons ond)	From source to dam at Johnsons Pond	B;NSW	05/01/88	27-43-15-8-(1)
errible Creek	From dam at Johnsons Pond to Middle Creek	C;NSW	05/01/88	27-43-15-8-(2)
anther Branch	From source to Middle Creek	C;NSW	05/01/88	27-43-15-9
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Looking Upstream from Proposed Crossing



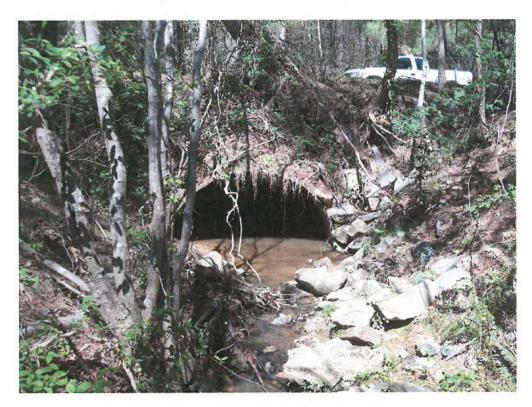
Looking Downstream from Proposed Crossing



Looking at Downstream Channel of Upstream Structure



Looking at Upstream Face of Upstream Structure (1 @ 7.25' x 5.5' CMPA)



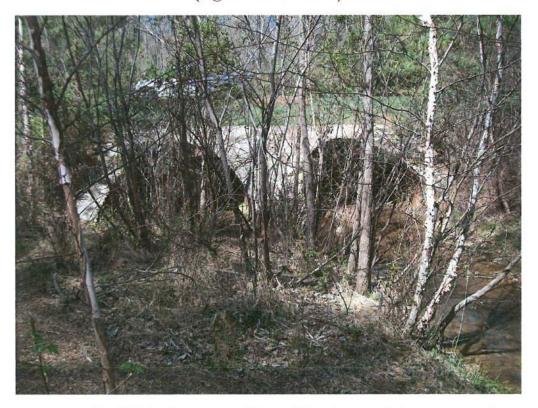
Looking at Downstream Face of Upstream Structure



Looking at Upstream Channel of Downstream Structure

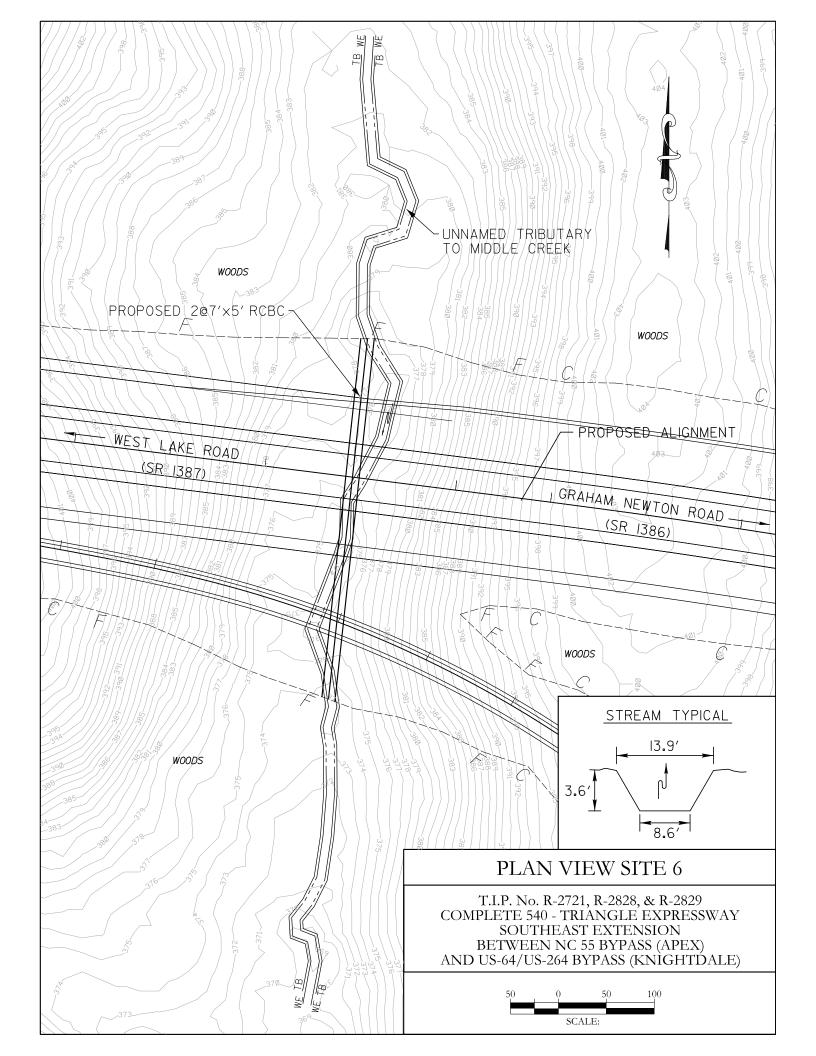


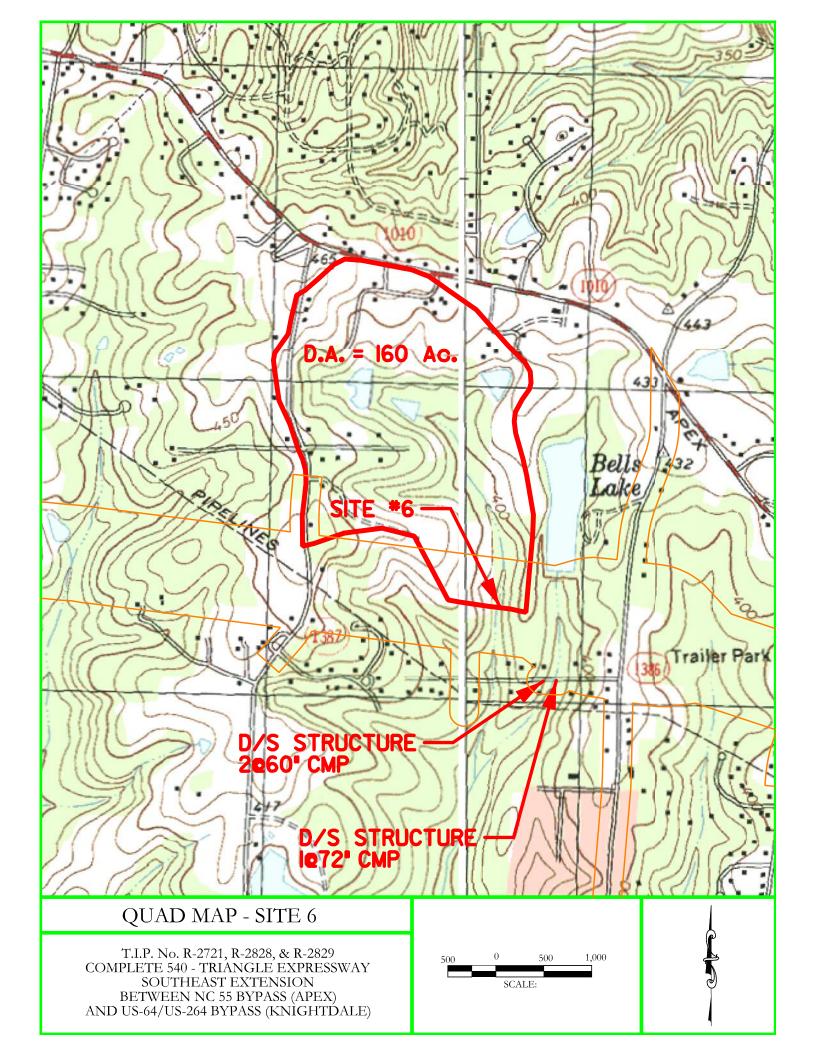
Looking at Upstream Face of Downstream Structure (2 @ 9.5' x 6.75' CMPA)



Looking at Downstream Face of Downstream Structure

# Site 6





	REGION: BLUE RIDGE	METHOD USED: Rep. 01-4207
	STREAM NAME: Unnamed Trib to Middle Creek	sq. miles
7/14/2010	PROJECT NAME: Triangle Expressway SE Ext.	ENGLISH Drainage Area = 0.25

Sand Hills	(cfs)	12.48	21.00	27.74	37.54	46.04	55.10	65.68	81.36	
Coastal Plain	(cfs)	25.45	53.49	80.15	123.51	164.46	213.54	271.87	366.16	
Blue Ridge	(cfs)	51.01	94.67	133.41	194.66	249.63	313.23	386.56	501.43	
FREQUENCY		2YR	5YR	10YR	25YR	SOYR	TOOYR	200YR	500YR	
Blue Ridge	(cfs)	55.25	97.97	132.85	188.35	235.96	294.85	358.76	476.43	
Coastal Plain	(cts)	28.90	66.49	103.66	173.15	240.29	327.86	437.69	625.45	
IIIS	÷	22	54	60.	.43	92.	.75	.75	.24	
Sand F	(cts)	10.7	17.	23	30	36	43	53	62	
	Blue Ridge Coastal	Blue Ridge Coastal (cfs) (cfs) (cfs) (cfs)	Company   Comp	Company	Blue Ridge         FREQUENCY         Blue Ridge         Coastal           (cfs)         (cfs)         (cfs)         (cfs)           55.25         2yR         51.01         25.4           97.97         5yR         94.67         53.4           132.85         10yR         133.41         80.1	Blue Ridge         FREQUENCY         Blue Ridge         Coastal           (cfs)         (cfs)         (cfs)         (cfs)           55.25         2yR         51.01         25.4           97.97         5yR         94.67         53.4           132.85         10YR         133.41         80.1           188.35         25YR         194.66         123.3	Blue Ridge         FREQUENCY         Blue Ridge         Coastal           (cfs)         (cfs)         (cfs)         (cfs)         (cfs)           55.25         27R         51.01         25.4         25.4           97.97         57R         94.67         53.4           132.85         107R         133.41         80.1           188.35         25YR         194.66         123.5           235.96         50YR         249.63         164.4	Blue Ridge         FREQUENCY         Blue Ridge         Coastal           (cfs)         (cfs)         (cfs)         (cfs)         (cfs)           55.25         57.8         51.01         25.4           97.97         57R         94.67         53.4           132.85         257R         133.41         80.1           188.35         257R         194.66         123.3           235.96         507R         249.63         164.4           294.85         1007R         313.23         213.3	Blue Ridge         FREQUENCY         Blue Ridge         Coastal           (cfs)         (cfs)	Blue Ridge         FREQUENCY         Blue Ridge           (cfs)         (cfs)         (cfs)           55.25         2yR         51.01           97.97         5yR         94.67           132.85         10yR         133.41           188.35         25yR         194.66           235.96         50yR         249.63           294.85         100yR         313.23           358.76         200yR         386.56           476.43         500YR         501.43

# **USGS URBAN REGRESSION EQUATIONS**

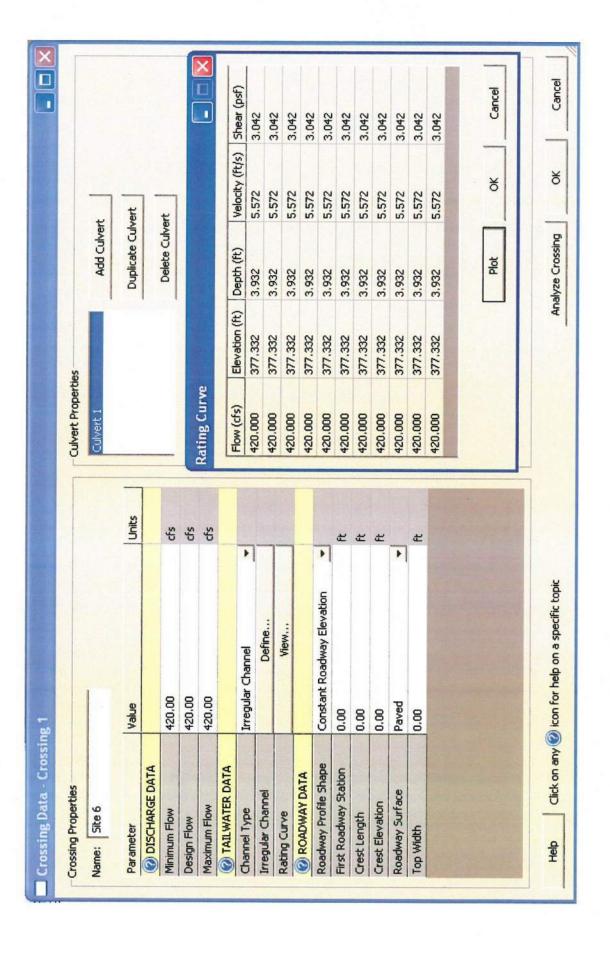
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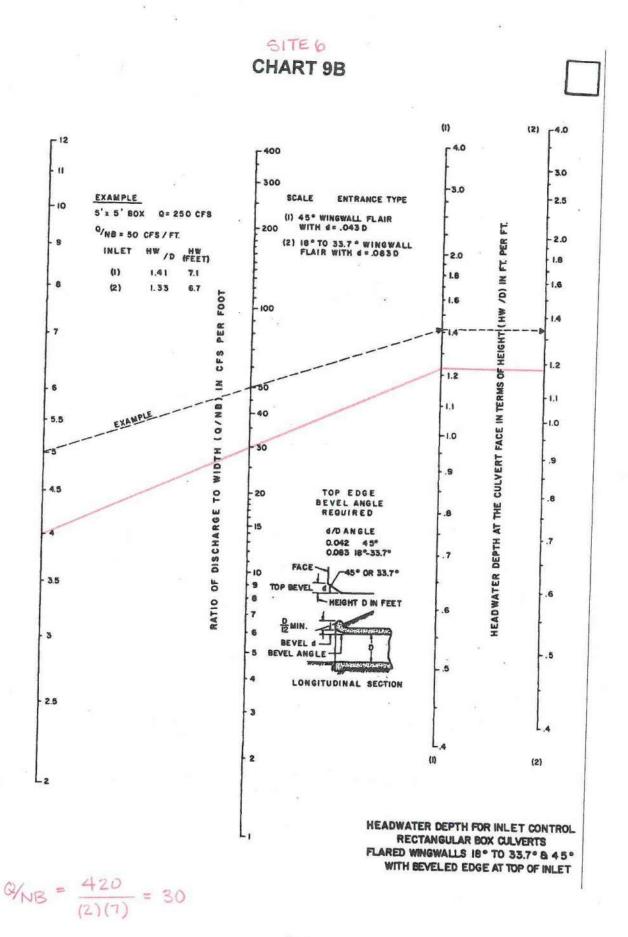
( These Equations are used only for comparison)

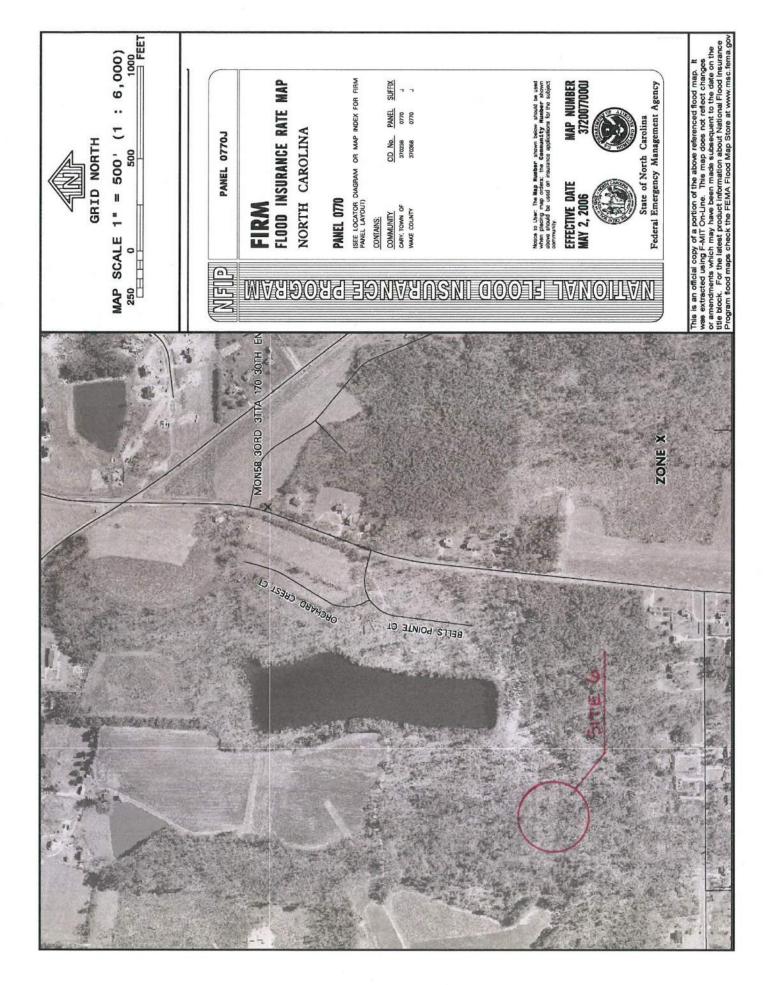
FREQUENCY Sand Hills Coastal Plain

Blue Ridge	(cfs)	228.34	282.45	367.99	437.13	530.80	790.87 (Based on 2.80xQ10)	
Coastal Plain	(cfs)	168.78	232.18	344.03	443.62	579.05	650.11	954 02
Sand Hills								
FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

100,000	Coastal Plain (cfs) (152.62 214.37 350.12 423.07 496.99 600.24	Impervious) USGS Fact Sheet 007-00	FEMA	Blue Ridge Discharge Used	170.32	230.17	360.85	420.78 420	480.42	(Based on 2.80xQ10)	
20 Sand Hills (cfs) 104.29 138.34 193.52 230.22 264.81 387.36		NC REGRES	% Impervious =	FREQUENCY	SYR	10YR	25YR	SOYR	100YR	200YR	







			Class	A CONTRACTOR OF THE STATE OF TH
Jame of Stream	Description	Class	Date	Index No.
nnamed Tributary to Swift reek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)
nnamed Tributary to Swift reek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)
rift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)
uck Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)
uck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)
eedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)
eedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)
wift Creek	From dam at Lake Benson to Neuse River	C;NSW	05/01/88	27-43-(8)
ahlers Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-9
eal Branch	From source to Swift Creek	C;NSW	Control of the Control	27-43-10
ite Oak Creek (Austin	From source to Swift Creek	C;NSW	05/01/88	27-43-11
ttle Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-12
oper Branch	From source to Swift Creek	C; NSW	The second second	27-43-13
edy Branch (Little Branch)	From source to Swift Creek	C; NSW	05/01/88	27-43-14
ddle Creek	From source to backwaters of Sunset Lake	C;NSW	05/01/88	27-43-15-(1)
iddle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	27-43-15-(2)
asal Creek [(Bass Lake, Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	27-43-15-3
iddle Creek	From dam at Sunset Lake to Swift Creek	C;NSW	05/01/88	27-43-15-(4)
ocky Branch	From source to Middle Creek	C;NSW	05/01/88	27-43-15-4.5
mp Branch	From source to Middle Creek	C;NSW		27-43-15-5
lls Lake	Entire lake and connecting stream to Middle Creek	C;NSW	05/01/88	27-43-15-6
lls Branch	From source to Middle Creek	C;NSW	05/01/88	27-43-15-7
errible Creek (Johnsons and)	From source to dam at Johnsons Pond	B;NSW	05/01/88	27-43-15-8-(1
errible Creek	From dam at Johnsons Pond to Middle Creek	C;NSW	05/01/88	27-43-15-8-(2
			Section Above Charles	00 10 15 0
anther Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-9

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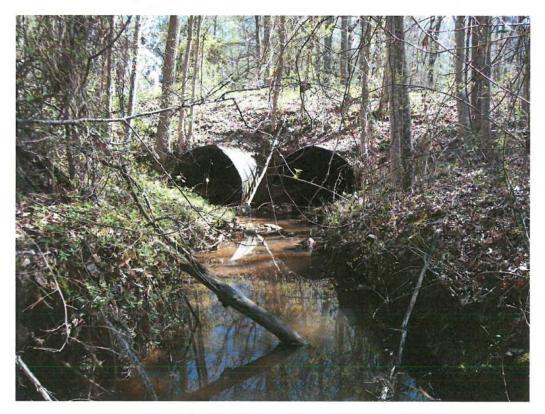
Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing. Site #6 has two Downstream Structures approximately 60 feet apart due to the stream braiding.



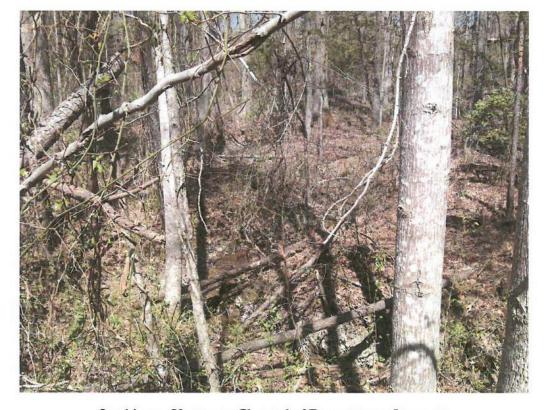
Looking at Upstream Channel of Downstream Structure #1



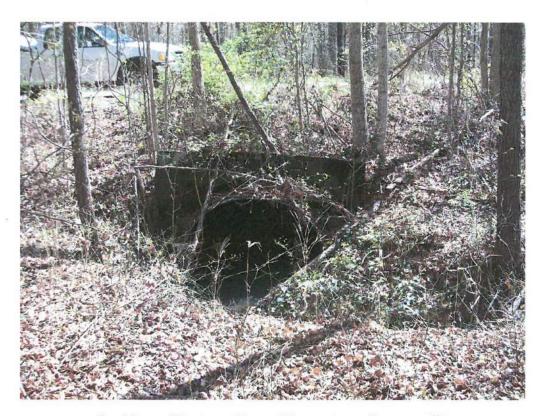
Looking at Upstream Face of Downstream Structure #1 (2 @ 60" CMP)



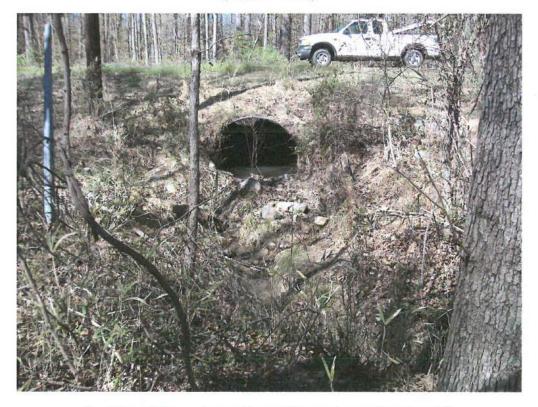
Looking at Downstream Face of Downstream Structure #1



Looking at Upstream Channel of Downstream Structure

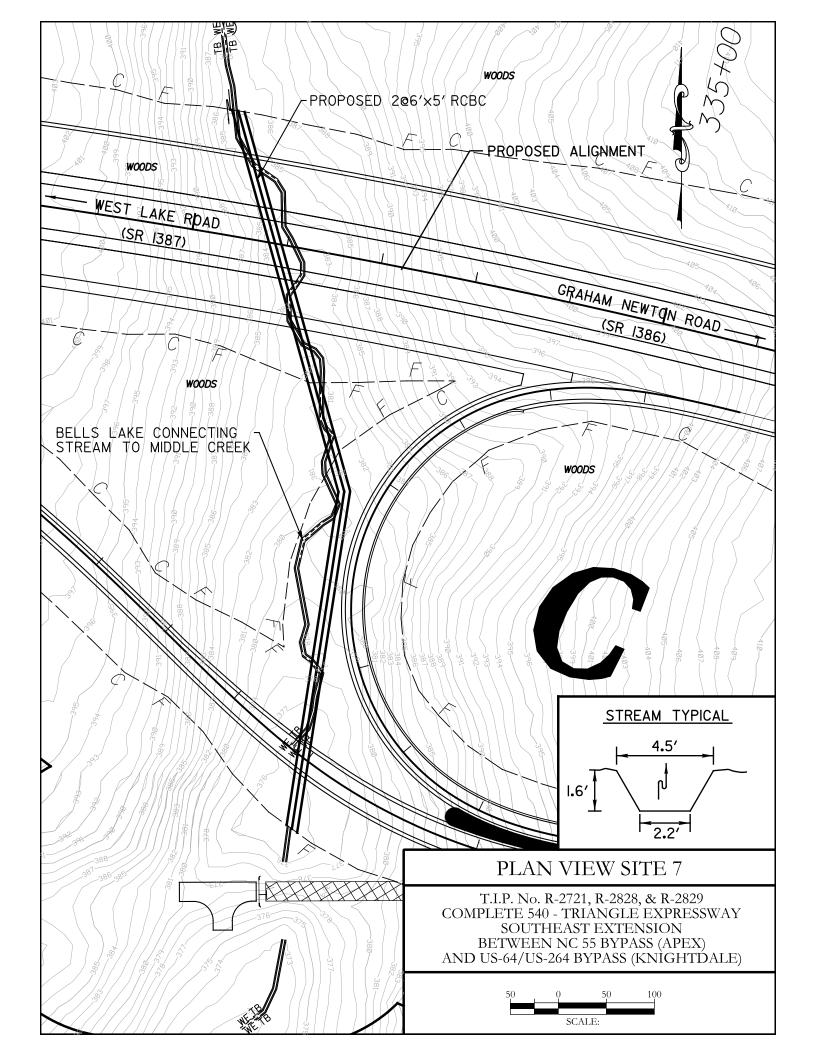


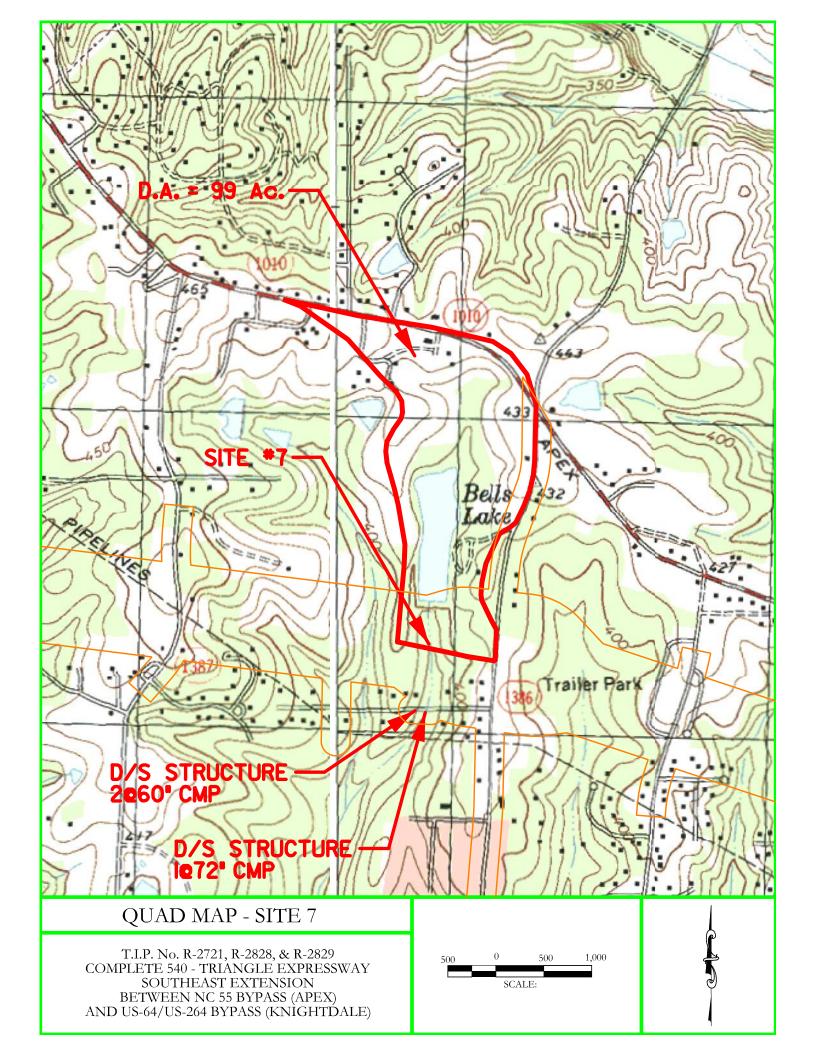
Looking at Upstream Face of Downstream Structure #2 (1 @ 72" CMP)



Looking at Downstream Face of Downstream Structure #2

### Site 7





	REGION: BLUE RIDGE	IETHOD USED: Rep. 01-4207
	STREAM NAME: Unnamed Trib to Middle Creek	sq. miles METH
01	JAME: Triangle Expressway SE Ext.	Drainage Area = 0.15
6/8/201	PROJECT N	ENGLISH

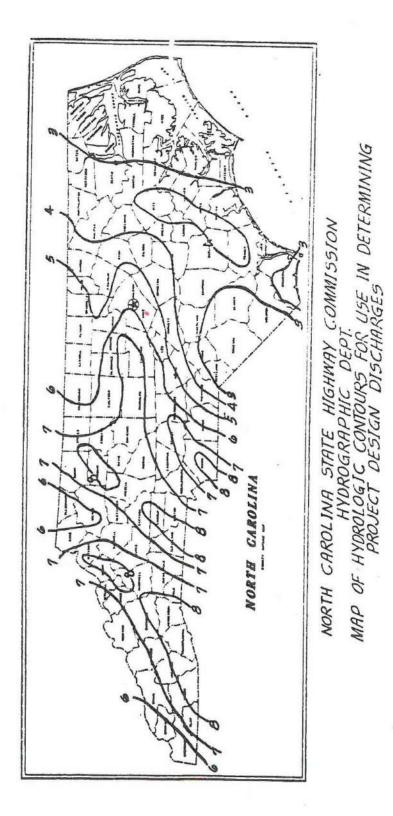
SGS RURAL REGRESSION EQUATIONS (OLD)	ATIONS (OLD)		RUF	SAL EQUA	TIONS	Report 01-4207
S Coastal Plain Bl	Blue Ridge FREQU	FREQU	ENCY	Blue Ridge	Coastal Plain	Sand Hills
(cfs)	(cfs)			(cfs)	(cfs)	(cfs)
20.92 38.82		2,	/R	35.64	18.05	8.68
49.39 69.57		40	YR	66.99	38.67	14.68
15.82 77.91 94.59			IOYR	95.13	58.54	19.43
131.94 134.79		14	5YR	140.02	91.23	26.35
184.80 169.29		4,	SOYR	180.47	122.36	32.35
254.35 212.30		-	100YR	227.62	159.92	38.77
341.99 258.85		2	00YR	282.20	204.86	46.26
493.46 346.56		LD .	000YR	368.12	278.03	57.37

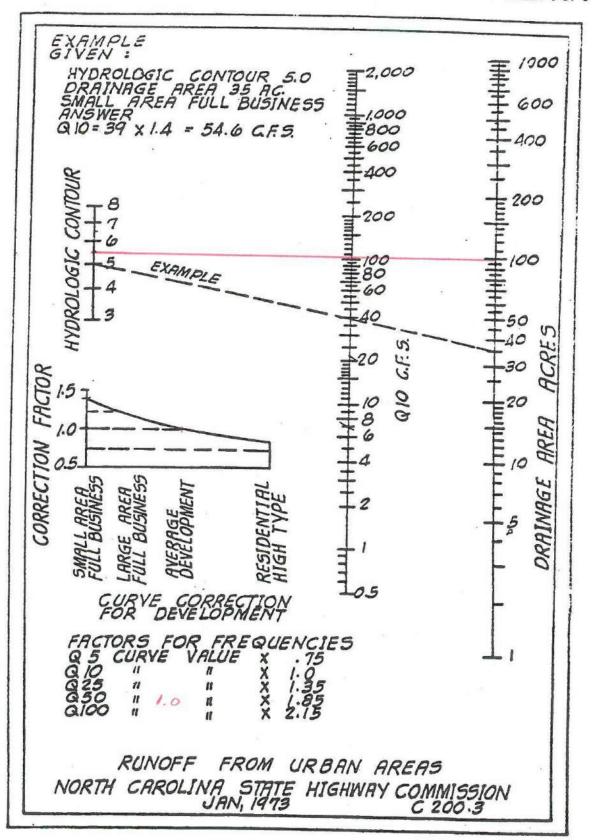
## **USGS URBAN REGRESSION EQUATIONS**

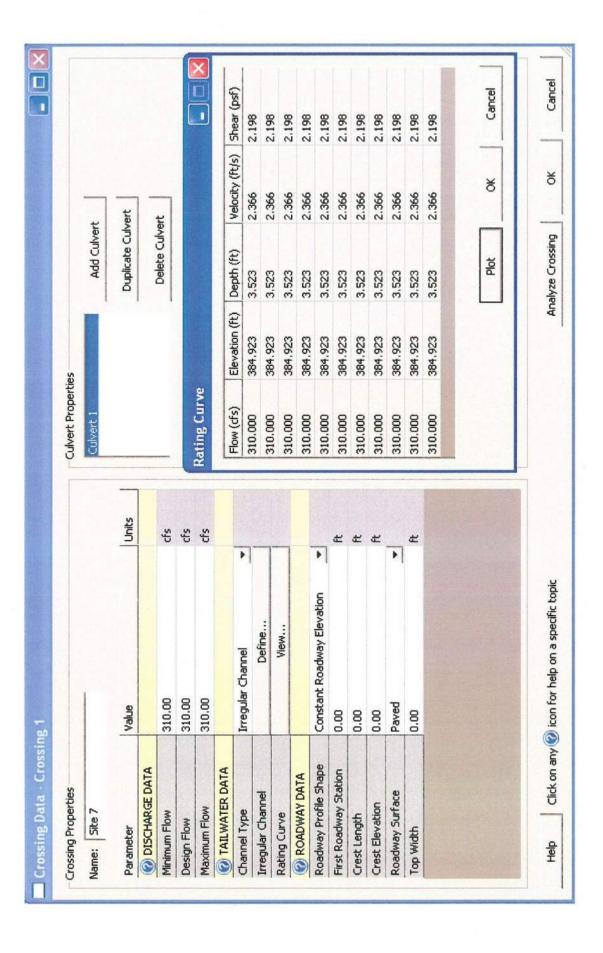
BDF=

(These Equations	ns are used only	for comparison)		
FREQUENCY	Sand Hills	Sand Hills Coastal Plain	Blue Ridge	
	(cfs)	(cfs)	(cfs)	
5YR	40.79	122.72	160.30	
10YR	48.46	170.75	199.02	
25YR	58.34	256.39	260.80	
50YR	65.66	332.18	309.41	
100YR	74.71	435.54	375.56	
200YR	135.68	478.10	557.26	(Based on 2.80xQ10)
500YR	95.67	723.86	541.76	

% Impervious = 20         Sand Hills         Coastal Plain (cfs)         Licks)         Cfs)         Cfs)         Cfs)         Cfs)         Cfs)         Cfs)         Cfs)         Cfs)         FEQUENCY         Disharges           5YR         72.93         109.22         120.28         120.28         100.28         100.7R         100/R         100/R	NC REGRES	SSION EQ	ION EQUATIONS (%	Impervio	ious) USGS Fact Sheet 007-00		
Sand Hills         Coastal Plain         Blue Ridge         Discharge Used         FREQUENCY           (cfs)         (cfs)         (cfs)         (cfs)         (cfs)         (cfs)           72.93         109.22         120.28         164.71         107R           97.90         155.78         164.71         507R           139.27         261.68         264.10         507R           166.27         318.14         309.39         310         1007R           191.94         375.84         354.86         1007R         5007R           274.11         436.19         461.20         (Based on 2.80xQ10)         5007R           358.30         570.16         602.85         (Based on 3.66xQ10)         5007R	Impervious =	20				FEN	IA
(cfs) (cfs) (cfs) 72.93 (cfs) 72.93 109.22 120.28 97.90 155.78 164.71 139.27 261.68 264.10 166.27 318.14 309.39 354.86 274.11 436.19 602.85 (Based on 2.80xQ10) 358.30 570.16 602.85 (Based on 3.66xQ10)	REQUENCY	Sand Hills	Coastal Plain	Blue Ridge		FREQUENCY	Disharges
72.93 109.22 120.28 97.90 155.78 164.71 139.27 261.68 264.10 166.27 318.14 309.39 310 191.94 375.84 354.86 274.11 436.19 461.20 (Based on 2.80xQ10) 358.30 570.16 602.85 (Based on 3.66xQ10)		(cfs)	(cfs)	(cfs)			
97.90 155.78 164.71 139.27 261.68 264.10 166.27 318.14 309.39 310 191.94 375.84 354.86 274.11 436.19 461.20 (Based on 2.80xQ10) 358.30 570.16 602.85 (Based on 3.66xQ10)	5YR	72.93	109.22	120.28			
139.27 261.68 264.10 166.27 318.14 309.39 310 191.94 375.84 354.86 274.11 436.19 461.20 (Based on 2.80xQ10) 358.30 570.16 602.85 (Based on 3.66xQ10)	10YR	97.90	155.78	164.71		10YR	
166.27 318.14 309.39 310 191.94 375.84 354.86 274.11 436.19 461.20 (Based on 2.80xQ10) 358.30 570.16 602.85 (Based on 3.66xQ10)	25YR	139.27	261.68	264.10		50YR	
191.94 375.84 354.86 274.11 436.19 461.20 (Based on 2.80xQ10) 358.30 570.16 602.85 (Based on 3.66xQ10)	50YR	166.27	318.14	309.39	310	100YR	
274.11 436.19 461.20 (Based on 2.80xQ10) 358.30 570.16 602.85 (Based on 3.66xQ10)	100YR	191.94	375.84	354.86		100YR	
358.30 570.16 602.85 (	200YR	274.11	436.19	461.20	(Based on 2.80xQ10)	500YR	
	500YR	358.30	570.16	602.85	(Based on 3.66xQ10)		

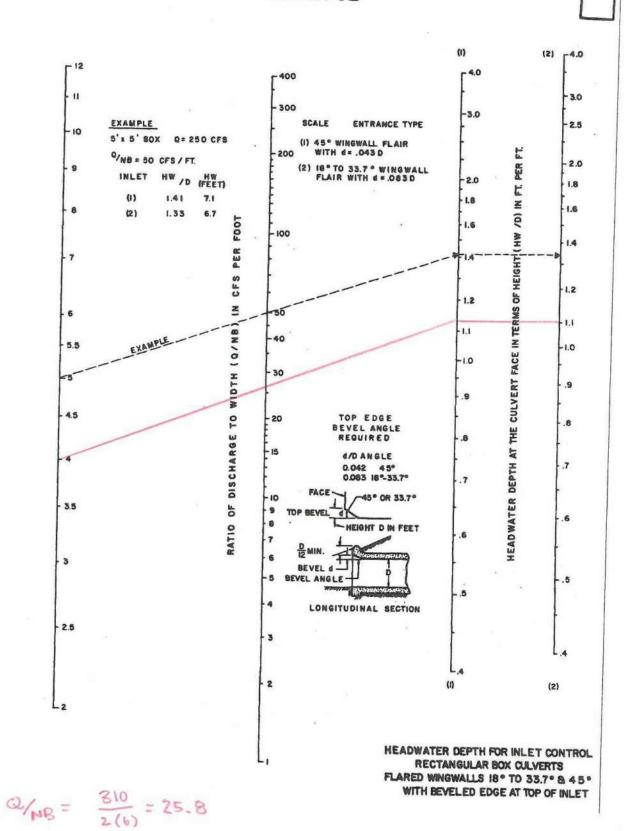


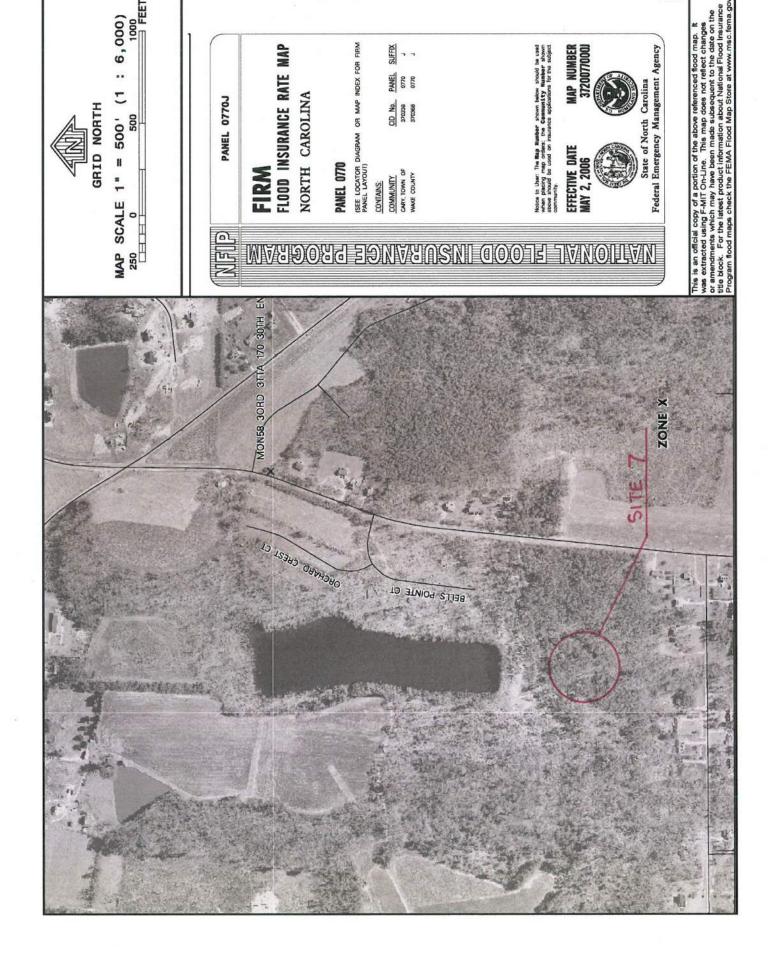




SITE 7







.0315 NEUSE RIVER BASIN

51	T	E	7
-			

			Class	The second secon
Name of Stream	Description	Class	Date	Index No.
nnamed Tributary to Swift reek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)
nnamed Tributary to Swift reek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)
wift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)
uck Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)
uck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)
eedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)
eedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)
wift Creek	From dam at Lake Benson to Neuse River	C; NSW	05/01/88	27-43-(8)
Jahlers Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-9
eal Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-10
nite Oak Creek (Austin	From source to Swift Creek	C;NSW	05/01/88	27-43-11
ittle Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-12
ooper Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-13
eedy Branch (Little Branch)	From source to Swift Creek	C; NSW	05/01/88	27-43-14
iddle Creek	From source to backwaters of Sunset Lake	C; NSW	05/01/88	27-43-15-(1)
Middle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	27-43-15-(2)
Basal Creek [(Bass Lake, (Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	27-43-15-3
Middle Creek	From dam at Sunset Lake to Swift Creek	C;NSW	05/01/88	27-43-15-(4)
Rocky Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-4.5
Camp Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-5
dells Lake	Entire lake and connecting stream to Middle Creek	C;NSW	05/01/88	27-43-15-6
Mills Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-7
Terrible Creek (Johnsons Pond)	From source to dam at Johnsons Pond	B;NSW	05/01/88	27-43-15-8-(1)
Terrible Creek	From dam at Johnsons Pond to Middle Creek	C;NSW	05/01/88	27-43-15-8-(2)
Panther Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-9
Little Creek	From source to Middle Creek	C; NSW	05/01/88	27-43-15-10

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Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing



Looking at Upstream Channel of Downstream Structure



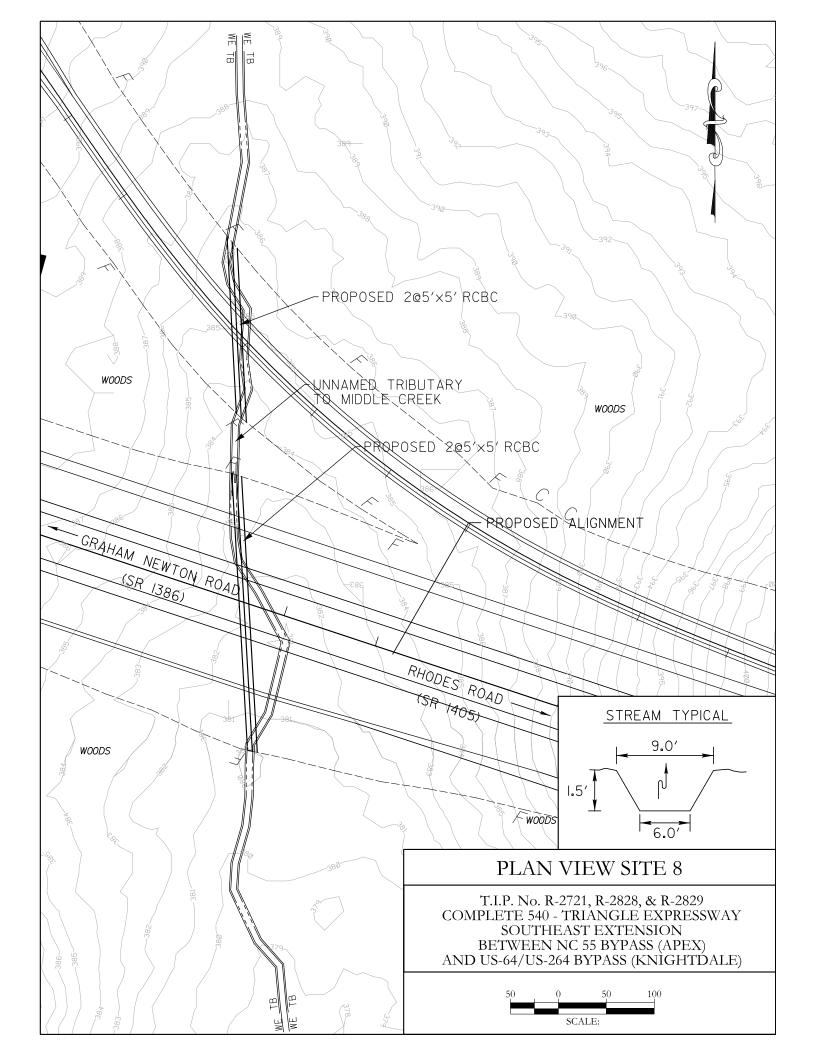
Looking at Upstream Face of Downstream Structure (1 @ 72" CMP)

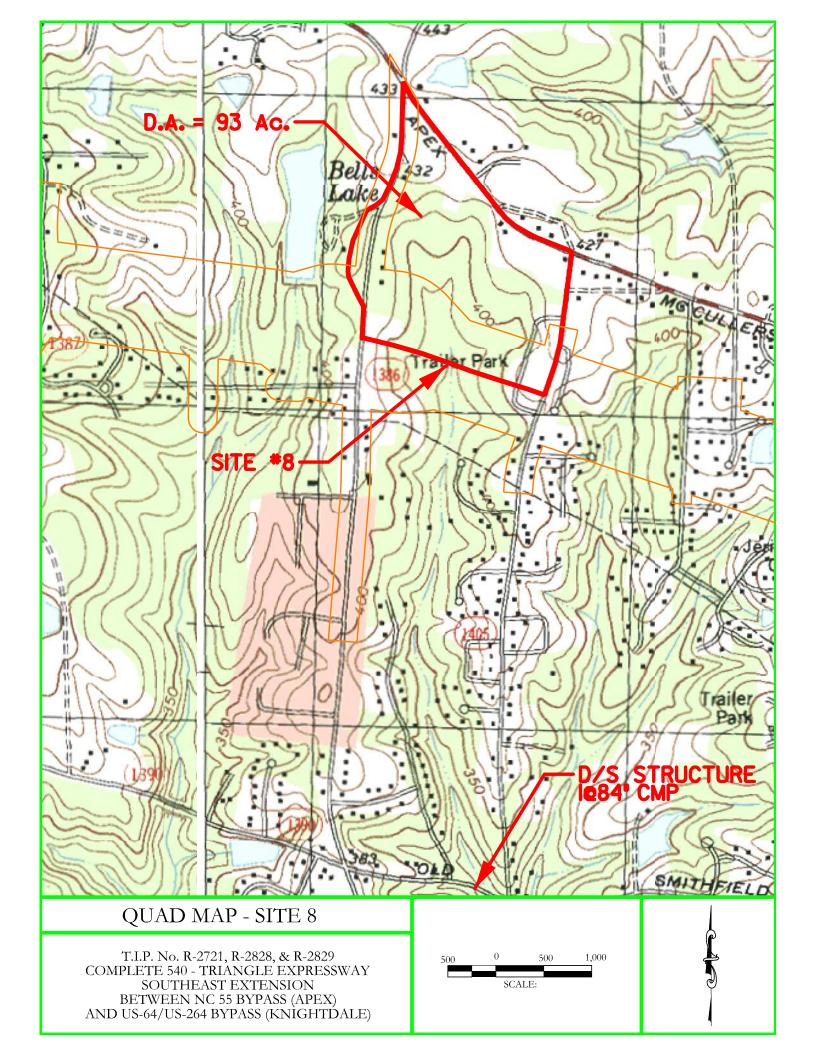
Page 2 of 3



Looking at Downstream Face of Downstream Structure.

### Site 8





PROJECT NAME: Triangle Expressway SE Ext. 6/8/2010

Drainage Area =

0.15

STREAM NAME: Unnamed Trib to Middle Creek sq. miles

REGION: BLUE RIDGE

11-4207	
Rep. 0	
USED:	
QO	

ENGLISH	Drainage Area =	0.15	sd. miles		METHOD USED:	Rep. 01-4207		
USGS R	JSGS RURAL REGRES	SSION EQU	ATIONS (OLD)	RUR	RURAL EQUA	TIONS Report	ort 01-4207	
FREQUENCY	Y Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills	
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)	
2YR	7.39	20.92	38.82	2YR	35.64	18.05	8.68	
5YR	12.03	49.39	69.57	5YR	66.99	38.67	14.68	
10YR	15.82	77.91	94.59	10YR	95.13	58.54	19.43	
25YR	20.74	131.94	134.79	25YR	140.02	91.23	26.35	
50YR	24.97	184.80	169.29	50YR	180.47	122.36	32.35	
100YR	29.63	254.35	212.30	100YR	227.62	159.92	38.77	
200YR	36.38	341.99	258.85	200YR	282.20	204.86	46.26	
500YR	41.83	493.46	346.56	500YR	368.12	278.03	57.37	

## **USGS URBAN REGRESSION EQUATIONS**

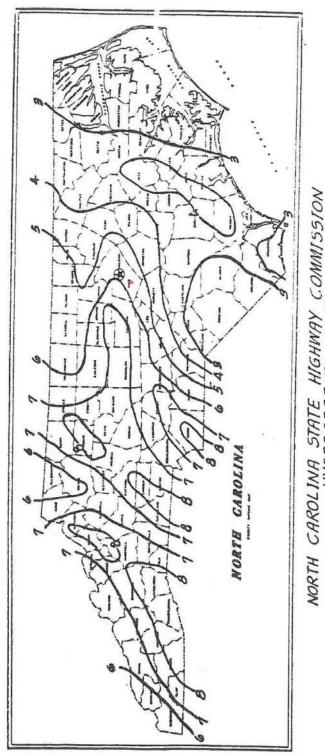
BDF=

(These Equations are used only for comparison)

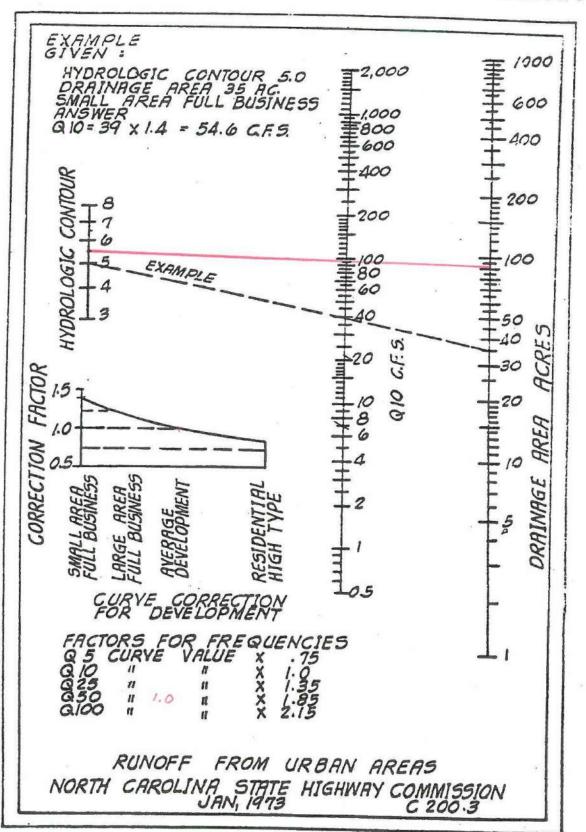
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	
	(cfs)	(cfs)	(cfs)	
5YR	40.79	122.72	160.30	
10YR	48.46	170.75	199.02	
25YR	58.34	256.39	260.80	
50YR	65.66	332.18	309.41	
100YR	74.71	435.54	375.56	
200YR	135.68	478.10	557.26	(Based on 2.80xQ10)
500YR	95.67	723.86	541.76	

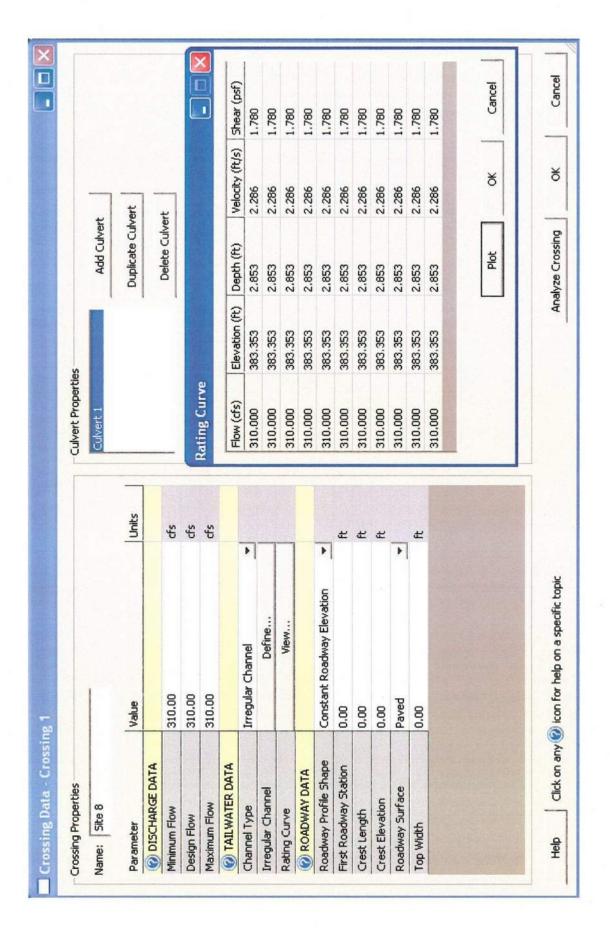
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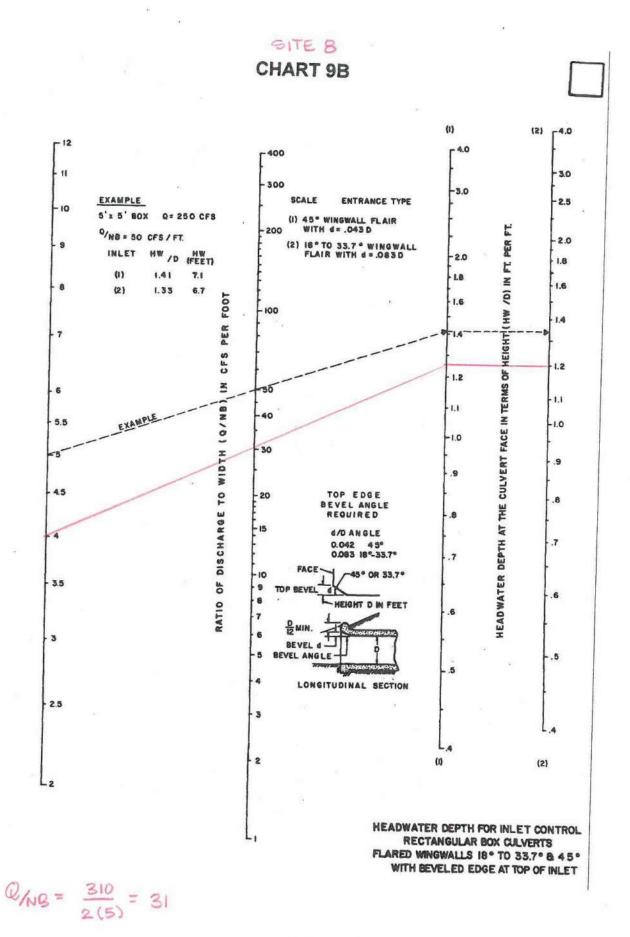
% Impervious =	20				H	MA
<b>≿</b>	Sand Hills (cfs)	Coastal Plain (cfs)	Blue Ridge (cfs)	Discharge Used	FREQUENCY	Disharges
	72.93	109.22	120.28			
~	97.90	155.78	164.71		10YR	
~	139.27	261.68	264.10		50YR	
2	166.27	318.14	309.39	310	100YR	
α	191.94	375.84	354.86		100YR	
200YR	274.11	436.19	461.20	(Based on 2.80xQ10)	500YR	
02	358.30	570.16	602.85	(Based on 3.66xQ10)		

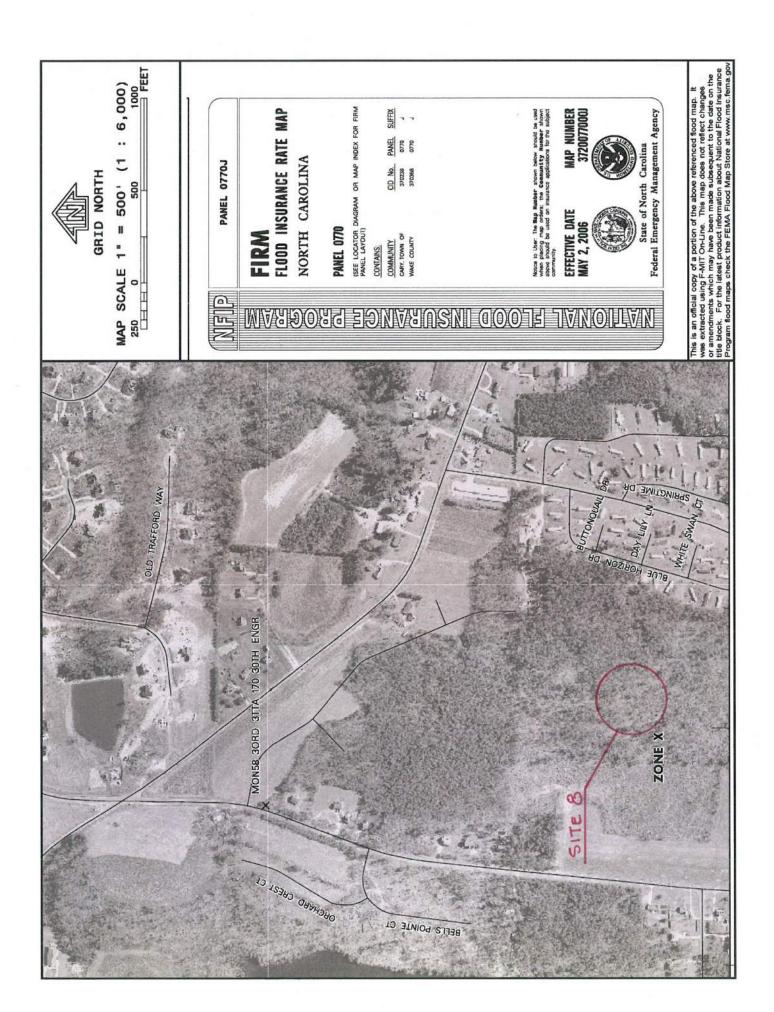


NORTH CAROLINA STATE HIGHWAY COMMISSION HYDROGRAPHIC DEPT. MAP OF HYDROLOGIC CONTOURS FOR USE IN DETERMINING PROJECT DESIGN DISCHARGES







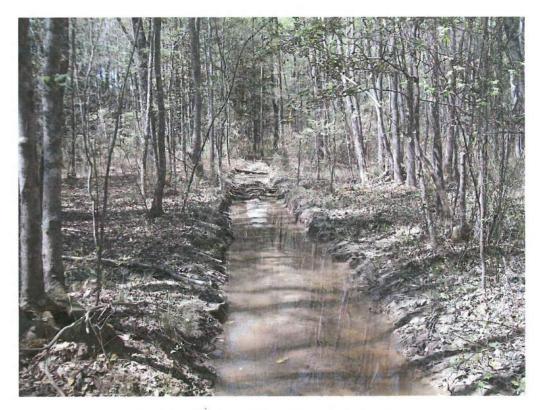


.0315 NEUSE RIVER BASIN

SITE 8

			Class	
ame of Stream	Description	Class	Date	Index No.
named Tributary to Swift eek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)
named Tributary to Swift eek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)
ift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)
ack Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)
nck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)
eedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)
eedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)
wift Creek	From dam at Lake Benson to Neuse River	C; NSW	05/01/88	27-43-(8)
ahlers Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-9
eal Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-10
ite Oak Creek (Austin nd)	From source to Swift Creek	C; NSW	05/01/88	27-43-11
ittle Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-12
poper Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-13
edy Branch (Little Branch)	From source to Swift Creek	C; NSW	05/01/88	27-43-14
ddle Creek	From source to backwaters of Sunset Lake	C; NSW	05/01/88	27-43-15-(1)
iddle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	27-43-15-(2)
asal Creek [(Bass Lake, Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	27-43-15-3
iddle Creek	From dam at Sunset Lake to Swift Creek	C;NSW	05/01/88	27-43-15-(4)
ocky Branch	From source to Middle Creek	C;NSW	05/01/88	27-43-15-4.5
amp Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-5
ells Lake	Entire lake and connecting stream to Middle Creek	C; NSW	05/01/88	27-43-15-6
ills Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-7
errible Creek (Johnsons ond)	From source to dam at Johnsons Pond	B;NSW	05/01/88	27-43-15-8-(1)
errible Creek	From dam at Johnsons Pond to Middle Creek	C; NSW	05/01/88	27-43-15-8-(2)
anther Branch	From source to Middle Creek	C;NSW	05/01/88	27-43-15-9
ittle Creek	From source to Middle Creek	C; NSW		27-43-15-10

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Looking Upstream from Proposed Crossing



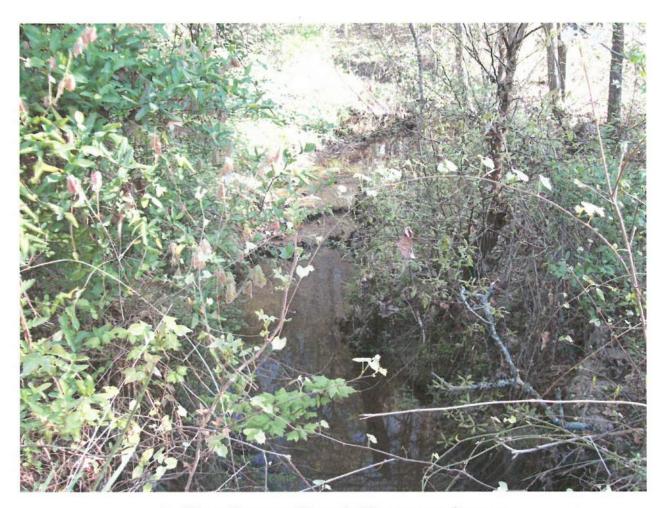
Looking Downstream from Proposed Crossing



Looking at Upstream Face of Downstream Structure (1@84" CMP)

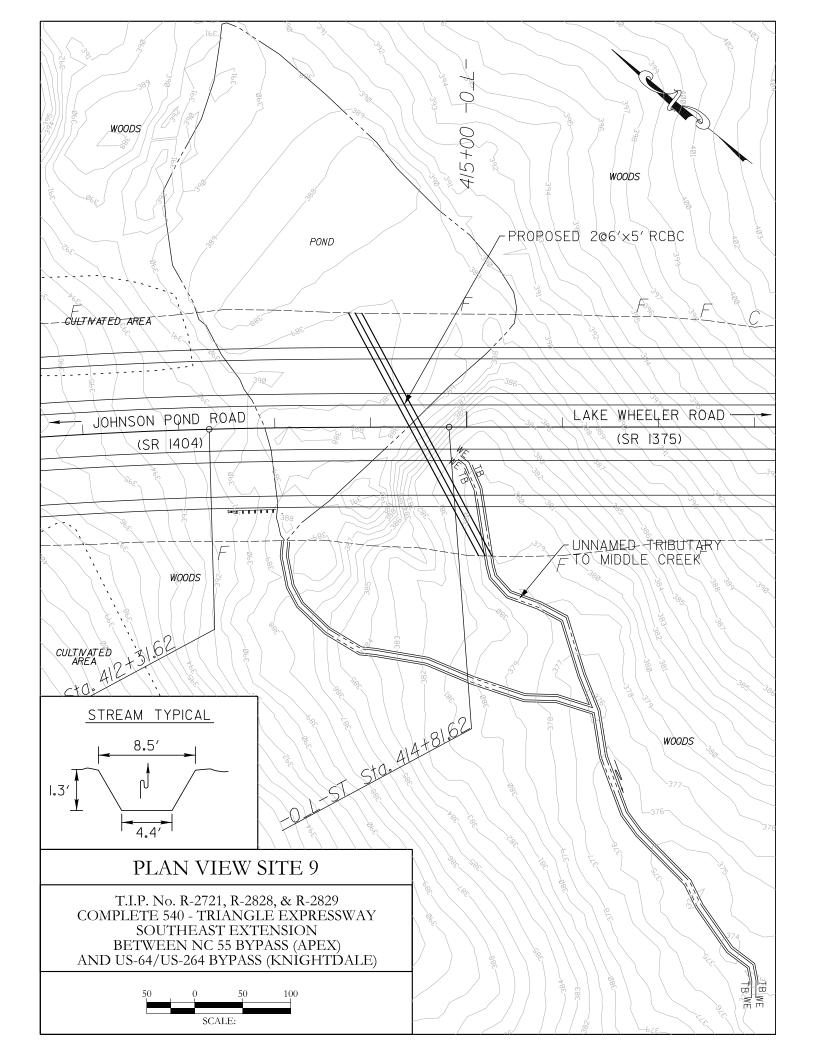


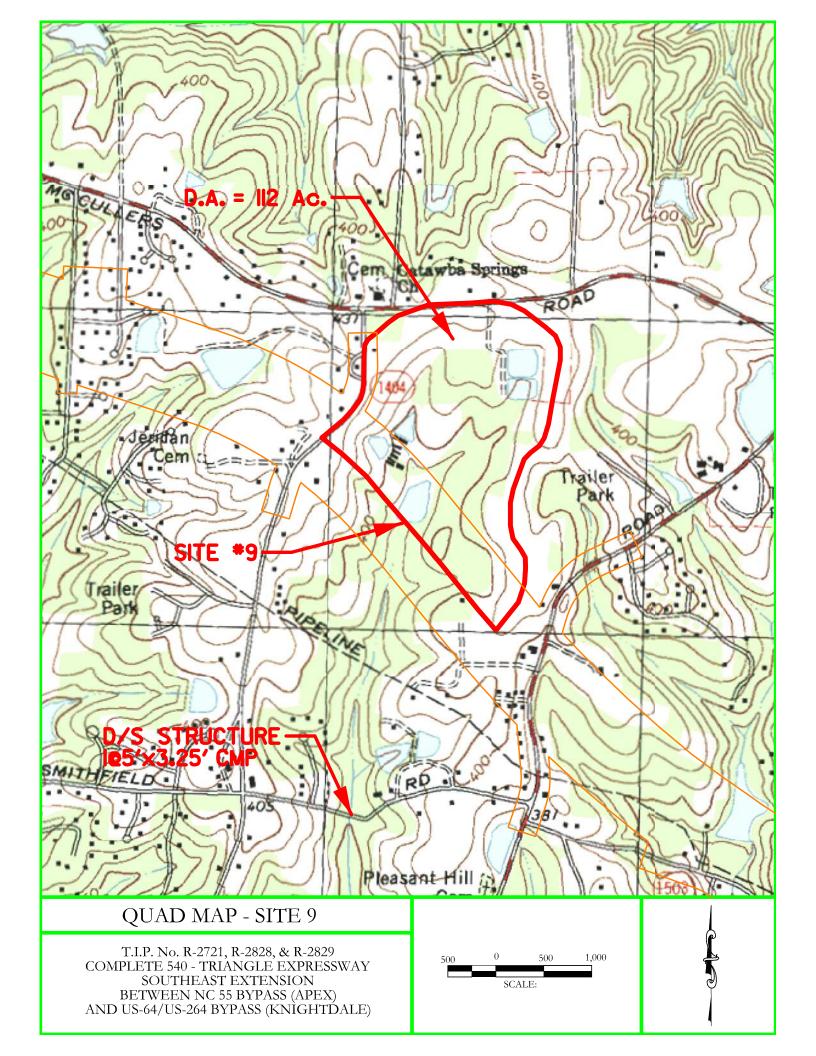
Looking at Downstream Face of Downstream Structure



Looking at Upstream Channel of Downstream Structure

### Site 9





	REGION: BLUE RIDGE	Rep. 01-4207
	EAM NAME: Unnamed Trib to Middle Creek	miles METHOD USED:
6/8/2010	ROJECT NAME: Triangle Expressway SE Ext. S	Drainage Area = 0.17 sq.
/9	PROJE	ENGLISH

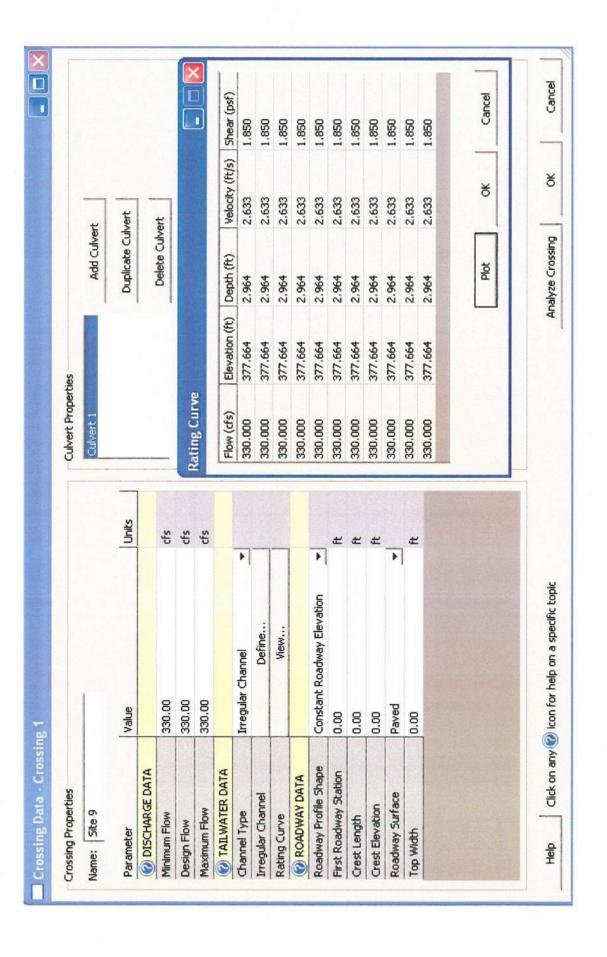
<b>USGS RUR</b>	SGS RURAL REGRE	SSION EQU	ATIONS (OLD)	RUR	RURAL EQUAT	SNOL	Report 01-4207	
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal	Sand Hills	
	(cts)	(cts)	(cfs)		(cfs)	(cfs)	(cfs)	
2YR	8.10	22.65	42.33	2YR	38.91	19.63	9.49	
5YR	13.20	53.13	75.66	5YR	72.92	41.87	16.03	
10YR	17.35	83.56	102.80	10YR	103.35	63.22	21.20	
25YR	22.78	141.03	146.31	25YR	151.79	98.26	28.73	
50YR	27.46	197.08	183.64	50YR	195.40	131.55	35.27	
100YR	32.60	270.67	230.10	100YR	246.14	171.66	42.26	
200YR	40.03	363.31	280.40	200YR	304.82	219.57	50.41	
500YR	46.10	522.97	374.67	500YR	397.08	297.43	62.50	

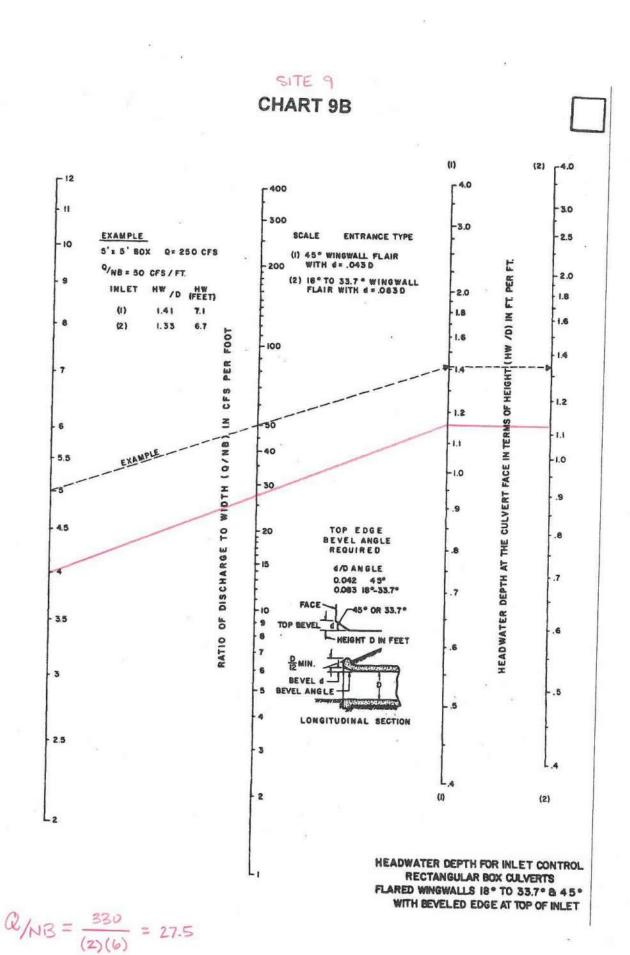
# **USGS URBAN REGRESSION EQUATIONS**

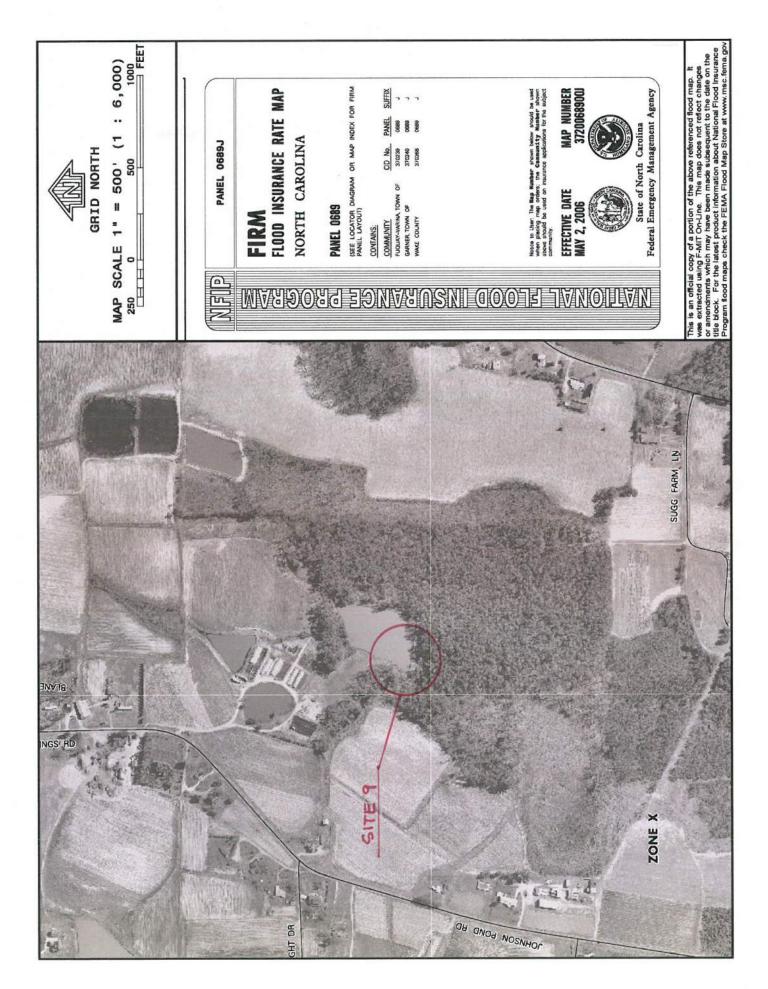
BDF= 11 (These Equations are used only for comparison)

								(Based on 2.80xQ10)	
	8					336.75			
of companison)	Coastal Plain	(cts)	132.68	184.10	275.54	356.58	467.02	515.49	774.52
is alle used offilly	Sand Hills	(cfs)	44.78	53.19	64.09	72.24	82.33	148.93	105.72
( Illese Edgallol	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR 105.72 774.52

	10:00:00				The same of the sa	
% Impervious =	20				FEMA	MA
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Discharge Used	FREQUENCY	Disharges
	(cfs)	(cfs)	(cfs)			
5YR	79.61	118.55	130.98			
10YR	106.55	168.46	178.79		10YR	
25YR	150.96	281.03	285.09		SOYR	60.0
50YR	180.07	341.16	333.60	330	100YR	
100YR	207.69	402.47	382.21		100YR	
200YR	298.35	471.68	500.60	(Based on 2.80xQ10)	500YR	1000
500YR	389.98	616.55	654.36	(Based on 3.66xQ10)		i



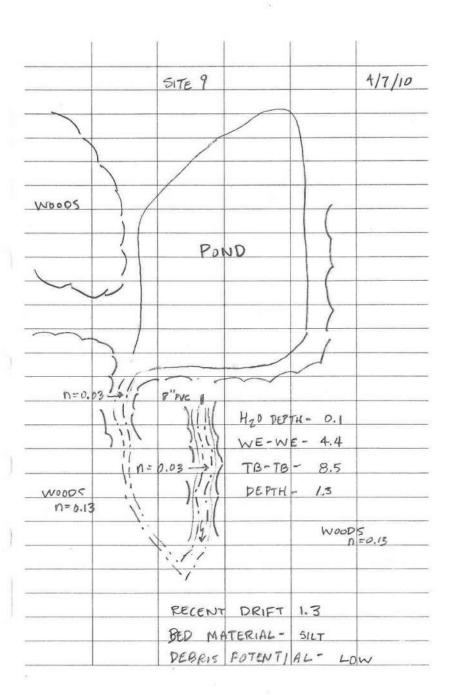




.0315 NEUSE RIVER BASIN

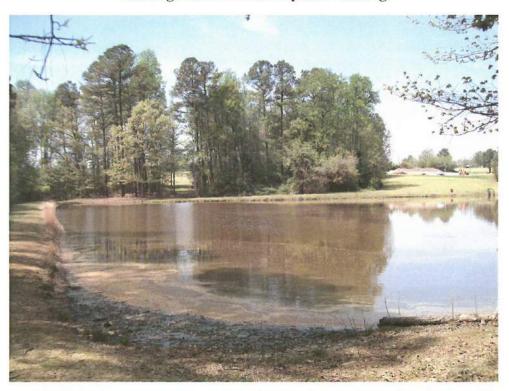
SITE 9

.0315 NEOSE RIVER BAS					SITE
			Class		
Name of Stream	Description	Class	Date	Index No.	4
nnamed Tributary to Swift reek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)	
nnamed Tributary to Swift reek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)	
wift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)	
uck Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)	
uck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)	
eedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)	
eedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)	
wift Creek	From dam at Lake Benson to Neuse River	C;NSW	05/01/88	27-43-(8)	
ahlers Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-9	
eal Branch	From source to Swift Creek	C;NSW	05/01/88	27-43-10	
hite Oak Creek (Austin ond)	From source to Swift Creek	C; NSW	05/01/88	27-43-11	
ittle Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-12	
ooper Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-13	
eedy Branch (Little Branch)	From source to Swift Creek	C; NSW	05/01/88	27-43-14	
iddle Creek	From source to backwaters of Sunset Lake	C; NSW	05/01/88	27-43-15-(1)	
diddle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	27-43-15-(2)	
Basal Creek [(Bass Lake, Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	27-43-15-3	
Middle Creek	From dam at Sunset Lake to Swift Creek	C;NSW	05/01/88	27-43-15-(4)	
Rocky Branch	From source to Middle Creek	C;NSW	05/01/88	27-43-15-4.5	
Camp Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-5	
ells Lake	Entire lake and connecting stream to Middle Creek	C;NSW	05/01/88	27-43-15-6	
Iills Branch	From source to Middle Creek	C;NSW	05/01/88	27-43-15-7	
errible Creek (Johnsons ond)	From source to dam at Johnsons Pond	B;NSW	05/01/88	27-43-15-8-(1)	
errible Creek	From dam at Johnsons Pond to Middle Creek	C;NSW	05/01/88	27-43-15-8-(2)	
Panther Branch	From source to Middle Creek	C;NSW	05/01/88	27-43-15-9	
Little Creek	From source to Middle Creek	C;NSW	05 /01 /00	27-43-15-10	





Looking Line Ahead of Proposed Crossing



Looking Line Back of Proposed Crossing



Looking North at Pond



Looking Downstream at Riser Outlet Channel



Looking Southwest Pond Corner Overflow



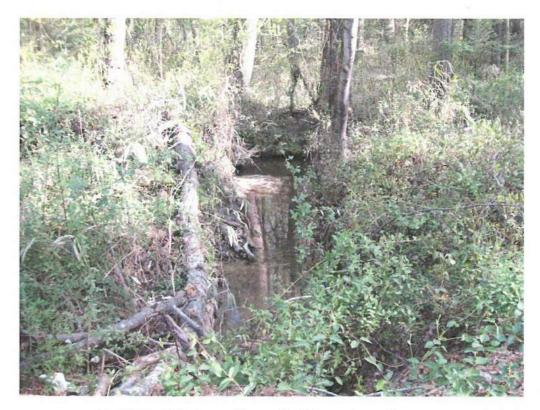
Looking Downstream at Pond Overflow Channel



Looking at Upstream Face of Downstream Structure. (1 @ 60" x 38" CMP)

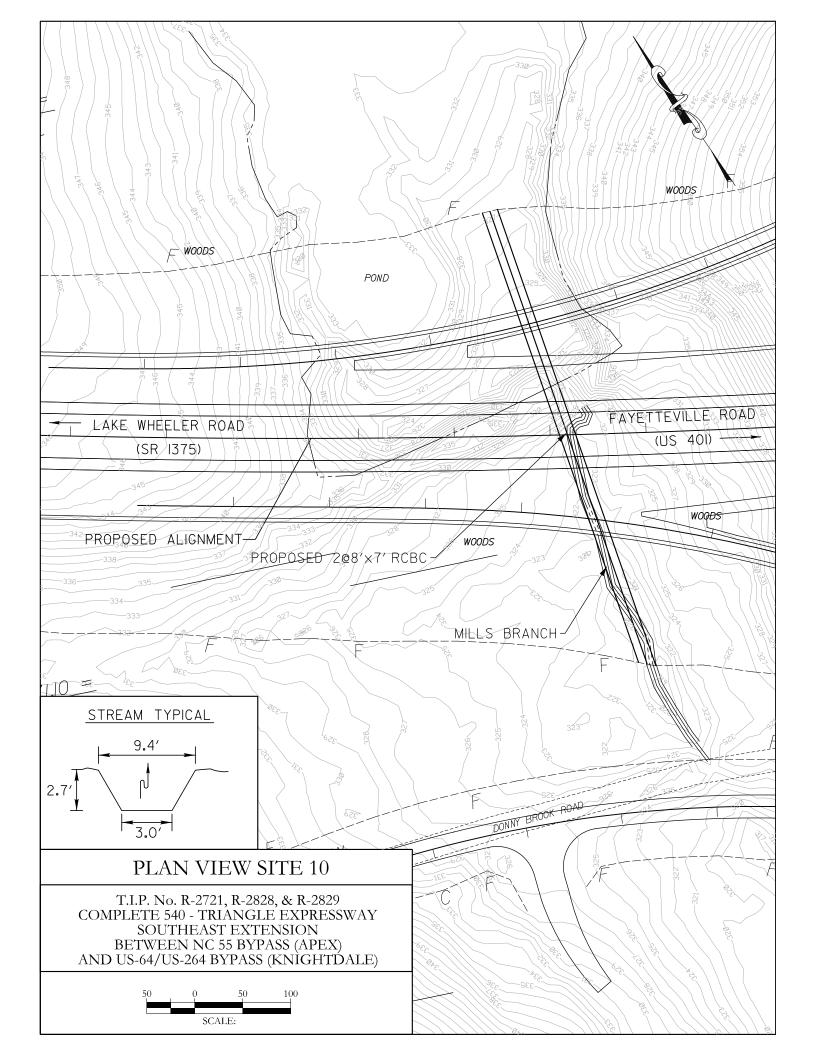


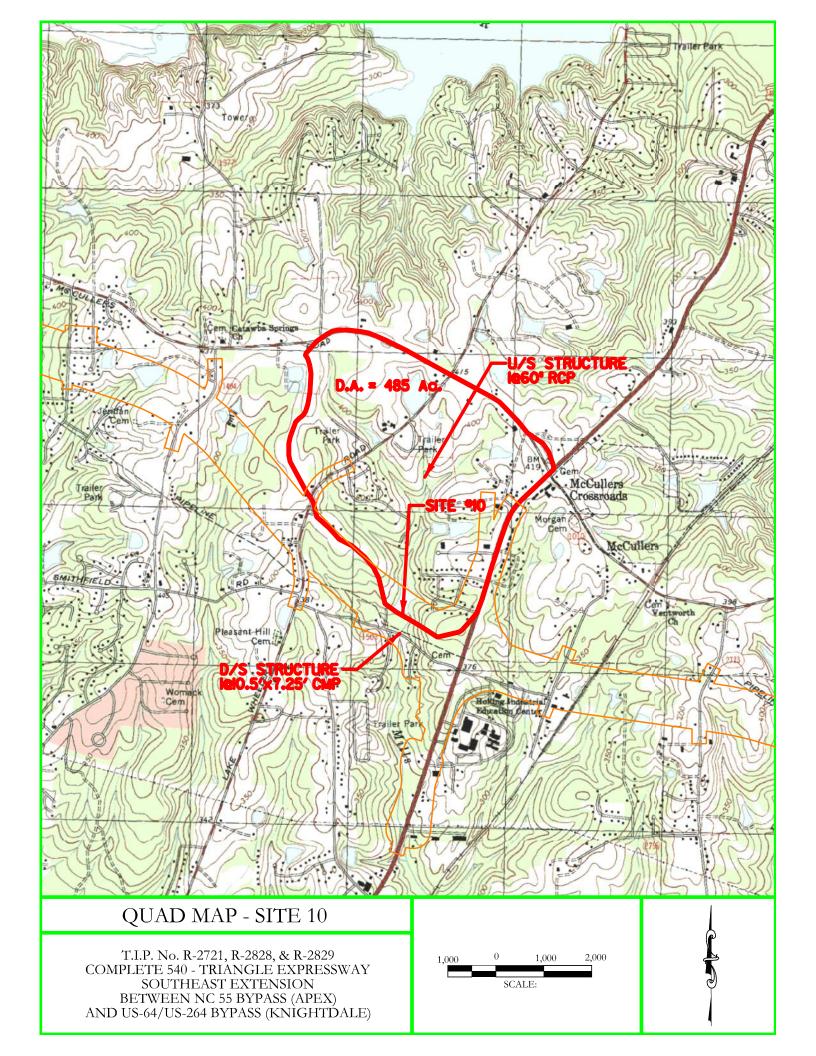
Looking at Downstream Face of Downstream Structure



Looking at Upstream Channel of Downstream Structure

# Site 10





# North Carolina

METHOD USED: Rep. 01-4207 REGION: BLUE RIDGE STREAM NAME: Mills Branch sd. miles 0.76 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = 7/7/2010 ENGLISH

<b>USGS RURAL</b>	RAL REGRE	SSION EQU.	ATIONS (OLD)		RUR	AL EQUA	TIONS Rep	oort 01-4207
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	臣	REQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cfs)	(cfs)	(cfs)			(cfs)	(cfs)	(cfs)
2YR	24.29	58.35	119.13		2YR	111.34	53.79	27.55
5YR	39.85	127.00	206.35		5YR	200.97	108.37	45.79
10YR	52.56	193.00	278.28		10YR	278.51	158.80	60.21
25YR	70.15	312.82	390.17		25YR	398.78	238.80	81.11
SOYR	85.30	425.53	486.08		50YR	505.72	313.08	99.27
100YR	102.20	569.74	602.69		100YR	627.57	400.67	118.40
200YR	125.68	748.86	730.06		200YR	766.77	503.35	140.83
500YR	147.82	1047.72	952.41		500YR	982.54	666.71	174.06

# **USGS URBAN REGRESSION EQUATIONS**

BDF=

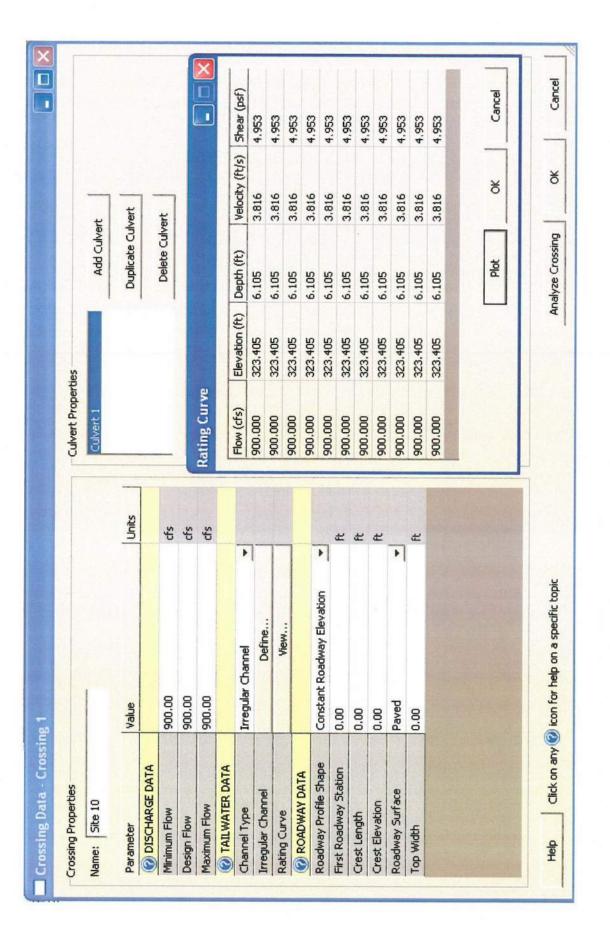
(These Equations are used only for comparison)

								(Based on 2.80xQ10)	
	Blue Ridge	(cts)	493.21	605.18	778.56	927.43	1127.09	1694.51	1609.08
of companison)	Coastal Plain					832.69			
is alle used offilly	Sand Hills	(cts)	136.77	162.21	197.28	226.53	263.04	454.19	349.23
( Illese Equations are used of illy for companson)	FREQUENCY	is.	SYR	10YR	25YR	SOYR	100YR	200YR	500YR

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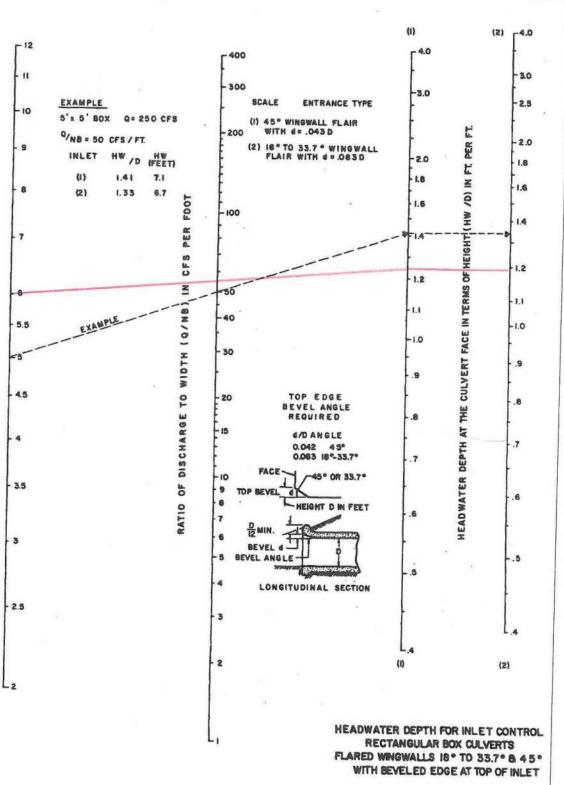
FEN	FREQUENCY			10YR	50YR	100YR	100YR	500YR	
	Discharge Used					006		Based on 2.80xQ10)	Based on 3.66xQ10)
	Blue Ridge	(cfs)	412.60	534.85	784.54	69.768	1006.14	1497.58	1957.55
	Coastal Plain	(cts)	359.20	481.81	727.30	859.48	988.95	1349.06	1763.42
25	Sand Hills	(cfs)	258.03	329.44	436.47	510.64	577.88	922.42	1205.74
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

MA

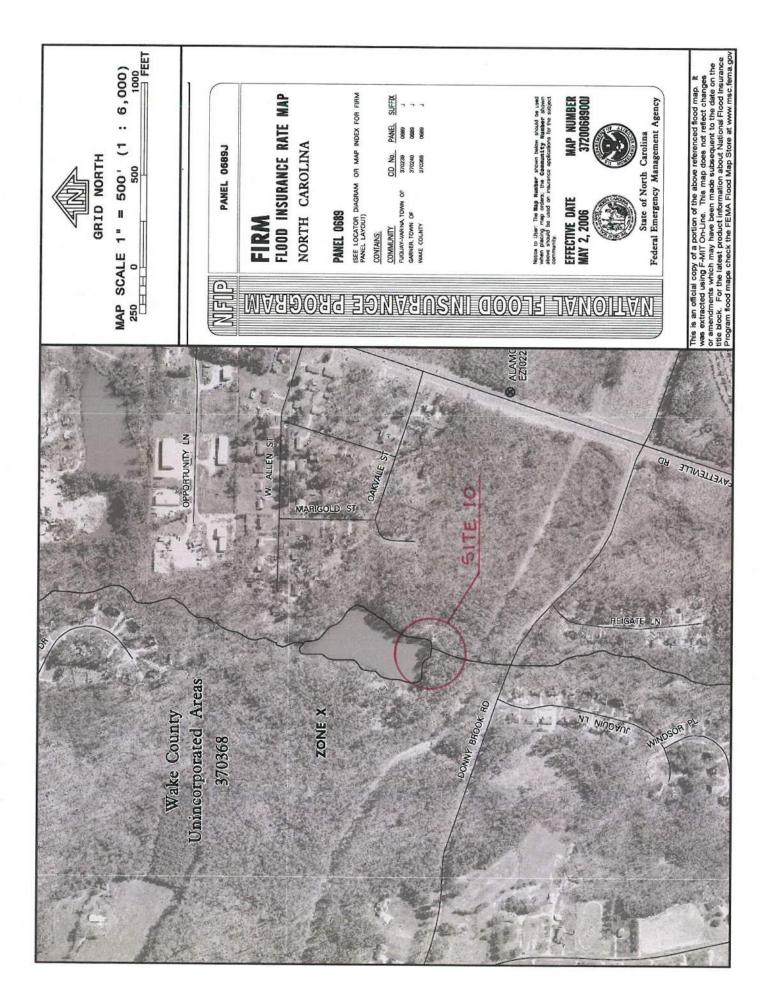




### **CHART 9B**



$$9/NB = \frac{900}{(2)(8)} = 56.25$$



.0315 NEUSE RIVER BASIN

	Total Control	

			01	211	EID
Name of Stream	Description	Class	Class	Tadan Na	
Name of Stream	Description	Class	Date	Index No.	
Unnamed Tributary to Swift Creek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)	
Unnamed Tributary to Swift Creek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)	
Swift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)	
Buck Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)	
Buck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)	
Reedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)	
Reedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)	
Swift Creek	From dam at Lake Benson to Neuse River	C;NSW	05/01/88	27-43-(8)	
Mahlers Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-9	
Meal Branch	From source to Swift Creek	C; NSW		27-43-10	
White Oak Creek (Austin Pond)	From source to Swift Creek	C; NSW	05/01/88	27-43-11	
Little Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-12	
Cooper Branch	From source to Swift Creek	C; NSW		27-43-13	
eedy Branch (Little Branch)	From source to Swift Creek	C; NSW		27-43-14	
iddle Creek	From source to backwaters of Sunset Lake	C;NSW		27-43-15-(1)	
Middle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	27-43-15-(2)	
dasal Creek [(Bass Lake, Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	27-43-15-3	
Middle Creek	From dam at Sunset Lake to Swift Creek	C;NSW	05/01/88	27-43-15-(4)	
ocky Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-4.5	
Camp Branch	From source to Middle Creek	C; NSW		27-43-15-5	
Bells Lake	Entire lake and connecting stream to Middle Creek	C; NSW	The second secon	27-43-15-6	
Mills Branch	From source to Middle Creek	C;NSW	05/01/88	27-43-15-7	
Cerrible Creek (Johnsons Pond)	From source to dam at Johnsons Pond	B;NSW	05/01/88	27-43-15-8-(1)	
Cerrible Creek	From dam at Johnsons Pond to Middle Creek	C;NSW	05/01/88	27-43-15-8-(2)	
Panther Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-9	
Little Creek	From source to Middle Creek	C;NSW		27-43-15-10	

		SITE 10			4/7/10
	\	PON	0	)	
		)/		- OVERFL	
	24" cmp		3	TB-TE	E - 10.0 - 17.8 4-5.5
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Looking Line Ahead of Proposed Crossing



Looking Line Back of Proposed Crossing



Looking North at Pond



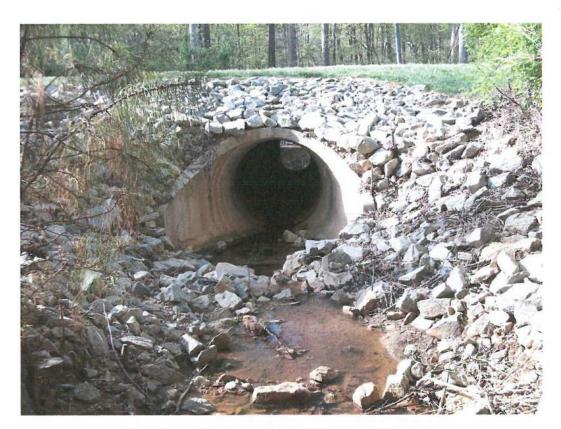
Looking Downstream at 24" CMP Riser Outlet
Page 2 of 6



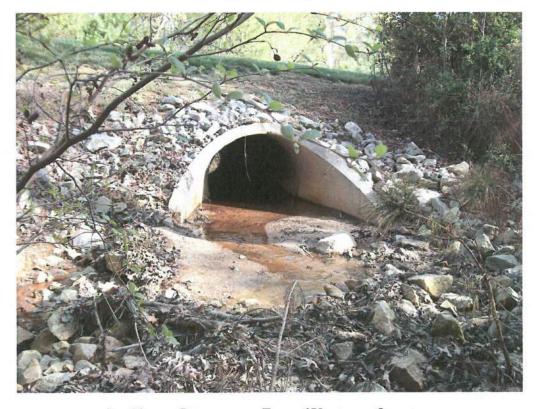
Looking Downstream at Riser Outlet Channel



Looking Upstream at Pond Overflow Channel



Looking at Upstream Face of Upstream Structure (1 @ 60" RCP)



Looking at Downstream Face of Upstream Structure



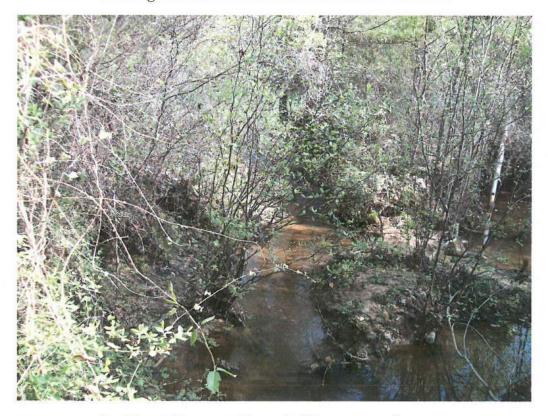
Looking at Downstream Channel of Upstream Structure



Looking at Upstream Face of Downstream Structure (1 @  $10.5^{\circ}$  x  $7.25^{\circ}$  CMPA)

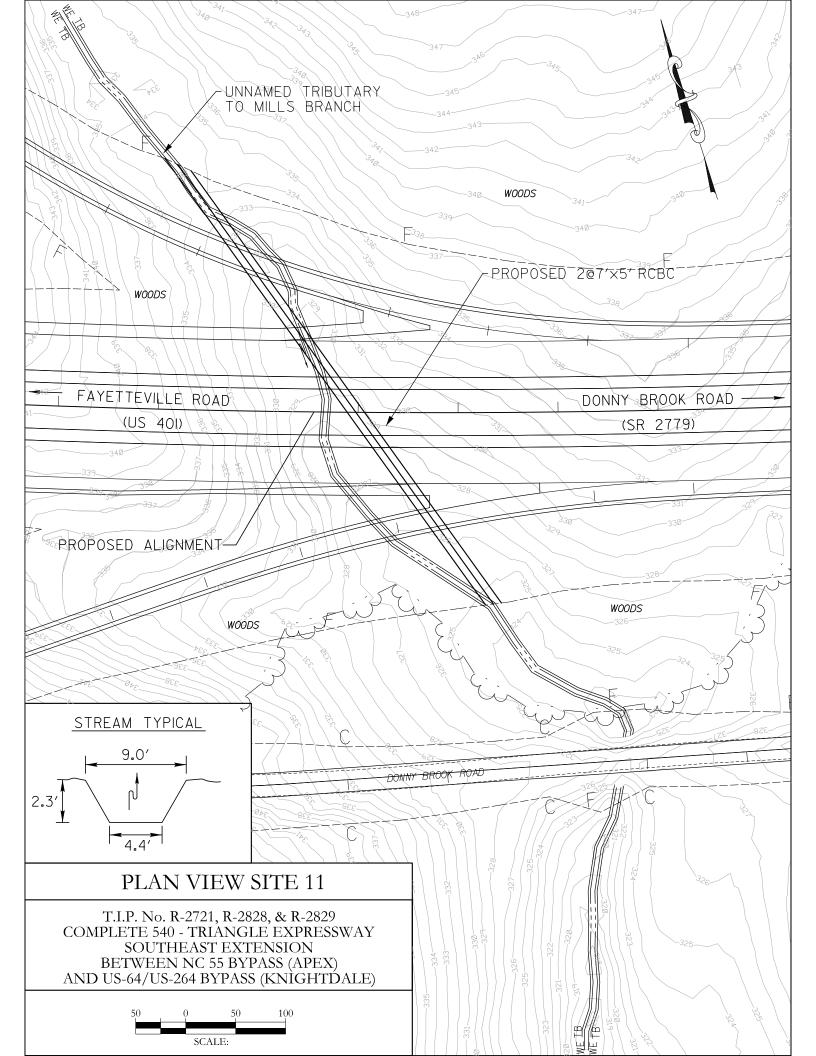


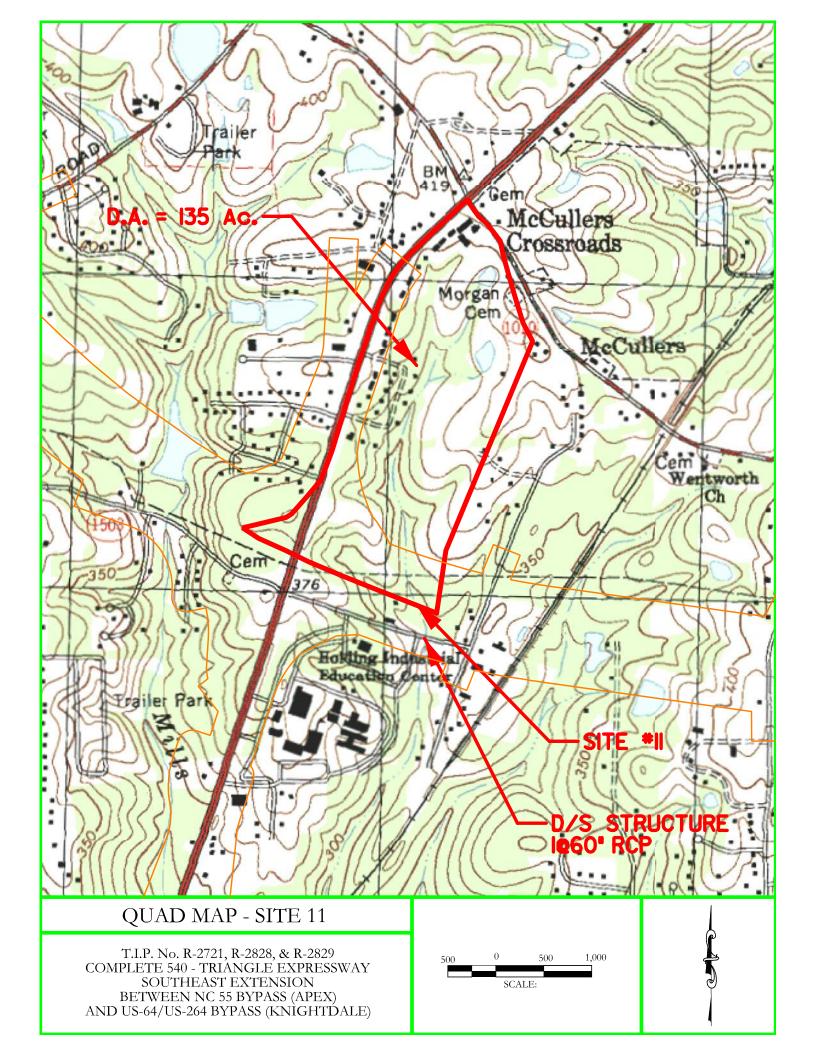
Looking at Downstream Face of Downstream Structure



Looking at Upstream Channel of Downstream Structure

## Site 11





Site #11

7/7/2010

PROJECT NA ENGLISH

STREAM NAME: Unnamed Trib to Mills Branch REGION: BLUE RIDGE	sq. miles METHOD USED: Rep. 01-4207	FIONS (OLD) RURAL EQUATIONS Report 01-4207	Slue Ridge Coastal Plain Sand Hills
sway SE Ext.	0.21	SION EQUA	Sand Hills Coastal Plain Blue Ridge
I NAME: Iriangle Expressway St Ext.	Drainage Area =	RURAL REGRESSION EQUATIONS (OLD)	CY Sand Hills

	コントンコン	つざいとううつ	ALIONS (OLD)	KOK	AL EQUA	ALIONS Rep	1074-IU 1100
REQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)
2YR	9.46	25.88	48.98	2YR	45.14	22.63	11.03
5YR	15.42	80.09	87.16	5YR	84.13	47.88	18.59
10YR	20.29	94.04	118.31	10YR	118.87	72.00	24.56
25YR	26.70	157.81	168.02	25YR	173.96	111.37	33.26
50YR	32.22	219.69	210.68	50YR	223.46	148.67	40.82
100YR	38.30	300.65	263.58	100YR	280.89	193.47	48.87
200YR	47.04	402.34	320.94	200YR	347.19	246.84	58.28
500YR	54.34	576.84	427.39	500YR	451.23	333.32	72.21

# **USGS URBAN REGRESSION EQUATIONS**

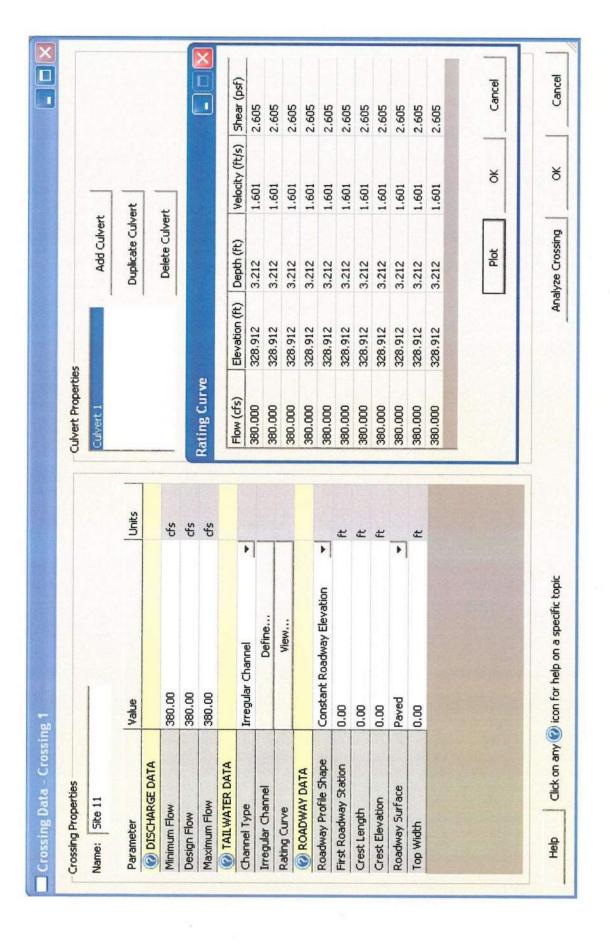
BDF=

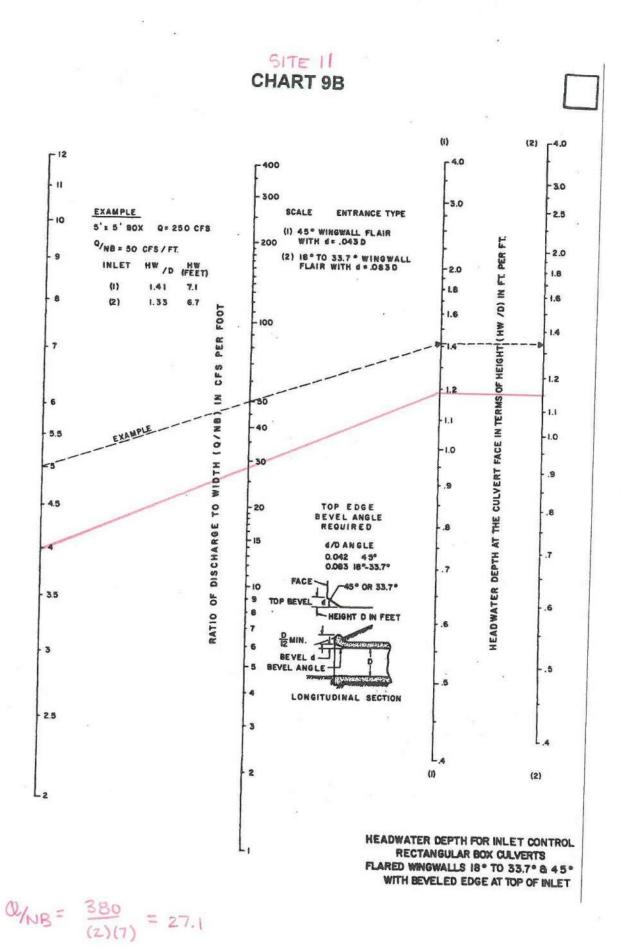
(These Equations are used only for comparison)

SYR         (cfs)         (cfs)         (cfs)           5YR         52.42         151.38         202.37           10YR         62.25         209.06         250.64           25YR         75.11         311.18         327.19           50YR         84.88         401.91         388.50           100YR         96.99         525.41         471.68           200YR         174.31         585.37         701.80         (Based on 2.80xQ10)           500YR         125.14         868.23         678.95	REDIENCY	Sand Hille	Coactal Diain	Blue Didge	
52.42 151.38 202.37 62.25 209.06 250.64 75.11 311.18 327.19 84.88 401.91 388.50 96.99 525.41 471.68 174.31 585.37 701.80 (125.14 868.23 678.95	2000	(cfs)	(cfs)	(cfs)	
62.25       209.06       250.64         75.11       311.18       327.19         84.88       401.91       388.50         96.99       525.41       471.68         174.31       585.37       701.80       (         125.14       868.23       678.95	SYR	52.42	151.38	202.37	
75.11     311.18     327.19       84.88     401.91     388.50       96.99     525.41     471.68       174.31     585.37     701.80     (       125.14     868.23     678.95	10YR	62.25	209.06	250.64	
84.88 401.91 388.50 96.99 525.41 471.68 174.31 585.37 701.80 ( 125.14 868.23 678.95	25YR	75.11	311.18	327.19	
96.99 525.41 471.68 174.31 585.37 701.80 ( 125.14 868.23 678.95	50YR	84.88	401.91	388.50	
174.31 585.37 701.80 ( 125.14 868.23 678.95	100YR	66.96	525.41	471.68	
125.14 868.23 678.95	200YR	174.31	585.37	701.80	(Based on 2.80xQ10)
	500YR	125.14	868.23	678.95	

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" Impervious =	20				E	-EMA
REQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Discharge Used	FREQUENCY	Disharges
SYR	(cis) 92.30	(crs) 136.15	(crs) 151.25			
10YR	122.94	192.24	205.33		10YR	
25YR	172.97	317.00	324.38		SOYR	200
SOYR	206.02	383.85	378.86	380	100YR	
100YR	237.26	451.78	433.23		100YR	100
200YR	344.23	538.27	574.91	(Based on 2.80xQ10)	500YR	
500YR	449.96	703.60	751.49	(Based on 3.66xQ10)		







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MAP NUMBER 3720068900J

State of North Carolina Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which we been made subsequent to the date on the title block. For the laterat product information about National Flood insurant

			Class		
Name of Stream	Description	Class	Date	Index No.	
Unnamed Tributary to Swift reek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)	
Innamed Tributary to Swift Treek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)	
wift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)	
Buck Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)	
Buck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)	
Reedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)	
Reedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)	
wift Creek	From dam at Lake Benson to Neuse River	C;NSW	05/01/88	27-43-(8)	
Mahlers Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-9	
Neal Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-10	
hite Oak Creek (Austin ond)	From source to Swift Creek	C; NSW	05/01/88	27-43-11	
Little Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-12	
Cooper Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-13	
eedy Branch (Little Branch)	From source to Swift Creek	C; NSW	05/01/88	27-43-14	
iddle Creek	From source to backwaters of Sunset Lake	C;NSW	05/01/88	27-43-15-(1)	
Middle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	27-43-15-(2)	
Basal Creek [(Bass Lake, Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	27-43-15-3	
Middle Creek	From dam at Sunset Lake to Swift Creek	C;NSW	05/01/88	27-43-15-(4)	
tocky Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-4.5	
amp Branch	From source to Middle Creek	C; NSW	and the state of t	27-43-15-5	
ells Lake	Entire lake and connecting stream to Middle Creek	C;NSW	05/01/88	27-43-15-6	
ills Branch	From source to Middle Creek	C;NSW	05/01/88	27-43-15-7	
Cerrible Creek (Johnsons Pond)	From source to dam at Johnsons Pond	B;NSW	05/01/88	27-43-15-8-(1)	
Terrible Creek	From dam at Johnsons Pond to Middle Creek	C;NSW	05/01/88	27-43-15-8-(2)	
Panther Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-9	
Little Creek	From source to Middle Creek	C; NSW		27-43-15-10	

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Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing



Looking at Upstream Face of Downstream Structure (1 @ 60" RCP)

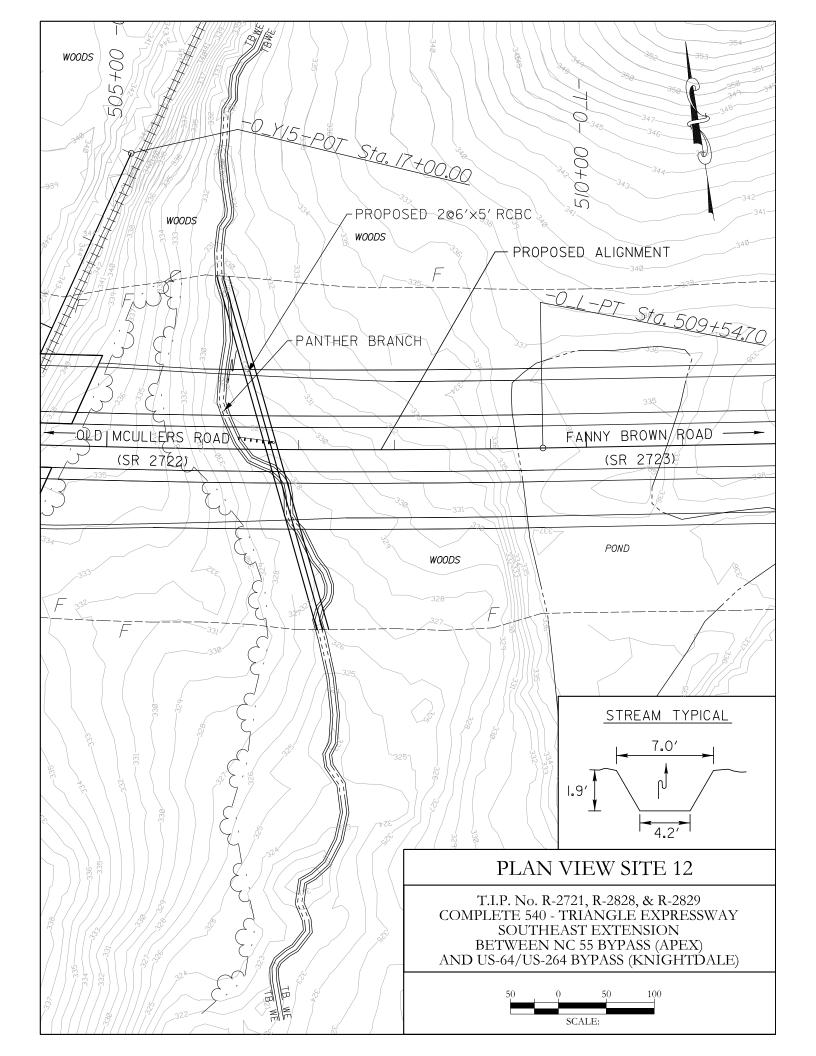


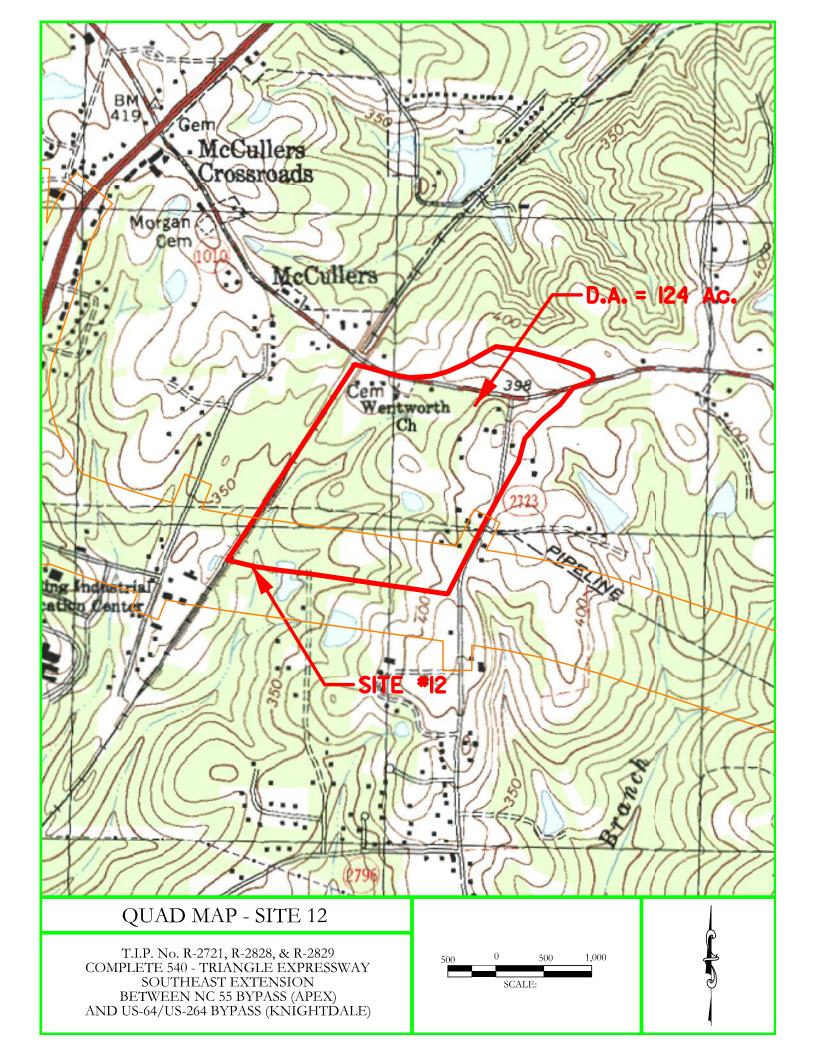
Looking at Downstream Face of Downstream Structure



Looking at Upstream Channel of Downstream Structure

## Site 12





### **North Carolina**

6/16/2014

5	JGE	
	<b>REGION: BLUE RIDGE</b>	Rep. 01-4207
	STREAM NAME: Panther Branch	METHOD USED:
		sd. miles
	way SE Ext.	0.19
-	NAME: Triangle Express	Drainage Area =
)	PROJECT	ENGLISH

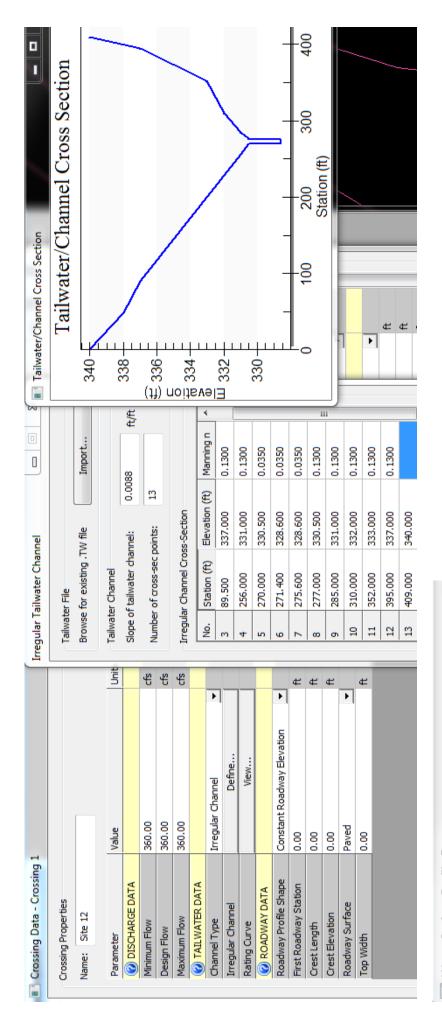
<b>NS Report 01-4207</b>	Sand Hills	(cfs)	10.27	17.33	22.91	31.03	38.09	45.62	54.41	67.44
TIONS Rep	Coastal Plain	(cfs)	21.16	44.94	67.70	104.96	140.30	182.82	233.52	315.81
RURAL EQUATIONS F	Blue Ridge		42.07	78.62	111.25	163.08	209.70	263.86	326.44	424.72
RUF	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR
ATIONS (OLD)	Blue Ridge	(cfs)	45.71	81.51	110.69	157.36	197.41	247.15	301.05	401.55
<b>JSGS RURAL REGRESSION EQU</b>	Coastal Plain	(cfs)	24.30	56.68	88.92	149.63	208.68	286.06	383.36	250.67
<b>AL REGRE</b>	Sand Hills	(cfs)	8.79	14.33	18.84	24.77	29.87	35.49	43.58	50.27
<b>USGS RUR</b>	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR

# USGS URBAN REGRESSION EQUATIONS BDF= 11 (These Equations are used only for comparison)

								(Based on 2.80xQ10)	
	ш,	(cfs)						655.27	634.86
ioi compansoni)	Coastal Plain	(cfs) (cfs)	142.22	196.85	293.76	379.76	496.90	551.17	822.51
IIIS AIR USEU UIIIS	Sand Hills	(cfs)	48.65	57.78	29.69	78.64	89.75	161.79	115.53
( These Eduations	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

IC REGRESSION EQUATIONS (% Impervious) USGS Fact Sheet 007-00	
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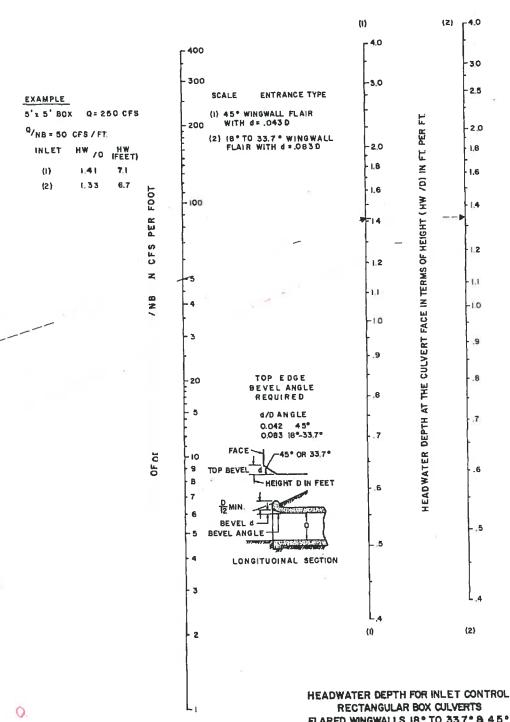
-EMA	Disharges								I
田	FREQUENCY			10YR	50YR	100YR	100YR	500YR	
								<u></u>	(
	lue Ridge Discharge Used					360		(Based on 2.80xQ10	(Based on 3.66xQ10)
	Blue Ridge	(cts)	141.29	192.30	305.14	356.71	408.26	538.43	703.81
	Coastal Plain	(cts)	127.51	180.58	299.42	363.00	427.71	505.63	660.94
20	Sand Hills	(cts)	90.98	114.89	162.17	193.30	222.76	321.68	420.48
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR



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Flow (cfs)	cfs)	Elevation (ft) Depth (ft)	Depth (ft)	Velocity (ft/s) Shear (psf)	Shear (psf)
360.000	00	332.757	4.157	2.295	2,283
360.000	00	332.757	4.157	2,295	2,283
360.000	00	332.757	4.157	2,295	2,283
360.000	00	332.757	4.157	2.295	2,283
360,000	00	332.757	4.157	2,295	2,283
360.000	00	332.757	4.157	2,295	2,283
360.000	00	332.757	4.157	2,295	2,283
360.000	00	332.757	4.157	2.295	2,283
360.000	00	332.757	4.157	2.295	2,283
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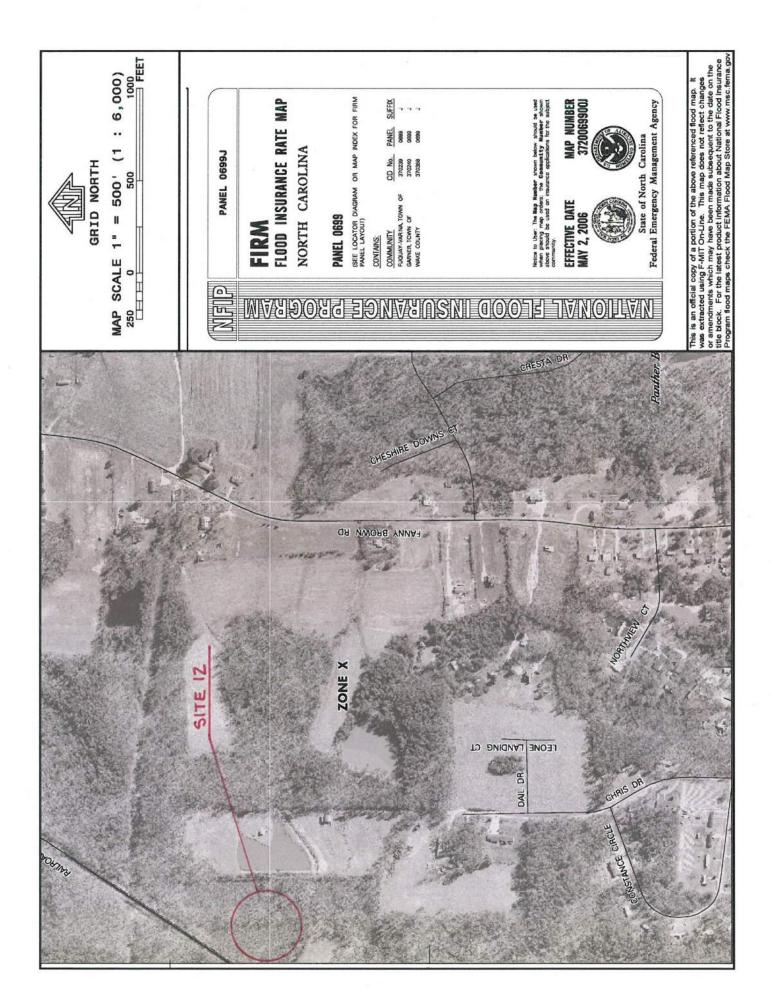




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WITH BEVELED EDGE AT TOP OF INLET



.0315 NEUSE RIVER BASIN

SITE 12

.0315 NEUSE RIVER BAS	JIN .			SITE 12
Name of Stream	Description	Class	Class Date	Index No.
Unnamed Tributary to Swift Creek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)
Unnamed Tributary to Swift Creek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)
Swift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)
Buck Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)
Buck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)
Reedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)
Reedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)
Swift Creek	From dam at Lake Benson to Neuse River	C;NSW	05/01/88	27-43-(8)
Mahlers Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-9
Neal Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-10
White Oak Creek (Austin Pond)	From source to Swift Creek	C; NSW	05/01/88	27-43-11
Little Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-12
Cooper Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-13
Reedy Branch (Little Branch)	From source to Swift Creek	C; NSW	05/01/88	27-43-14
Middle Creek	From source to backwaters of Sunset Lake	C;NSW	05/01/88	27-43-15-(1)
Middle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	27-43-15-(2)
Basal Creek [(Bass Lake, (Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	27-43-15-3
Middle Creek	From dam at Sunset Lake to Swift Creek	C;NSW	05/01/88	27-43-15-(4)
Rocky Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-4.5
Camp Branch	From source to Middle Creek	C; NSW		27-43-15-5
Bells Lake	Entire lake and connecting stream to Middle Creek	C;NSW	05/01/88	27-43-15-6
Mills Branch	From source to Middle Creek	C;NSW	05/01/88	27-43-15-7
Terrible Creek (Johnsons Pond)	From source to dam at Johnsons Pond	B;NSW	05/01/88	27-43-15-8-(1)
Terrible Creek	From dam at Johnsons Pond to Middle Creek	C; NSW	05/01/88	27-43-15-8-(2)
Panther Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-9
Little Creek	From source to Middle Creek	C; NSW	05/01/88	27-43-15-10

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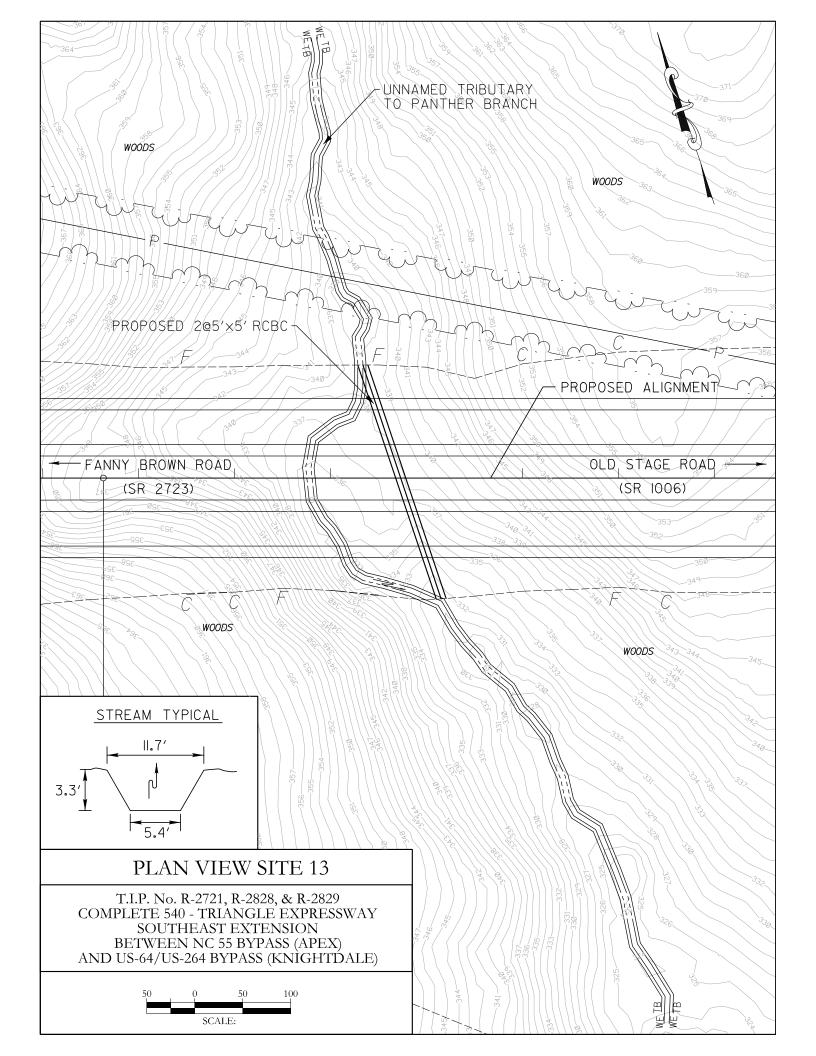


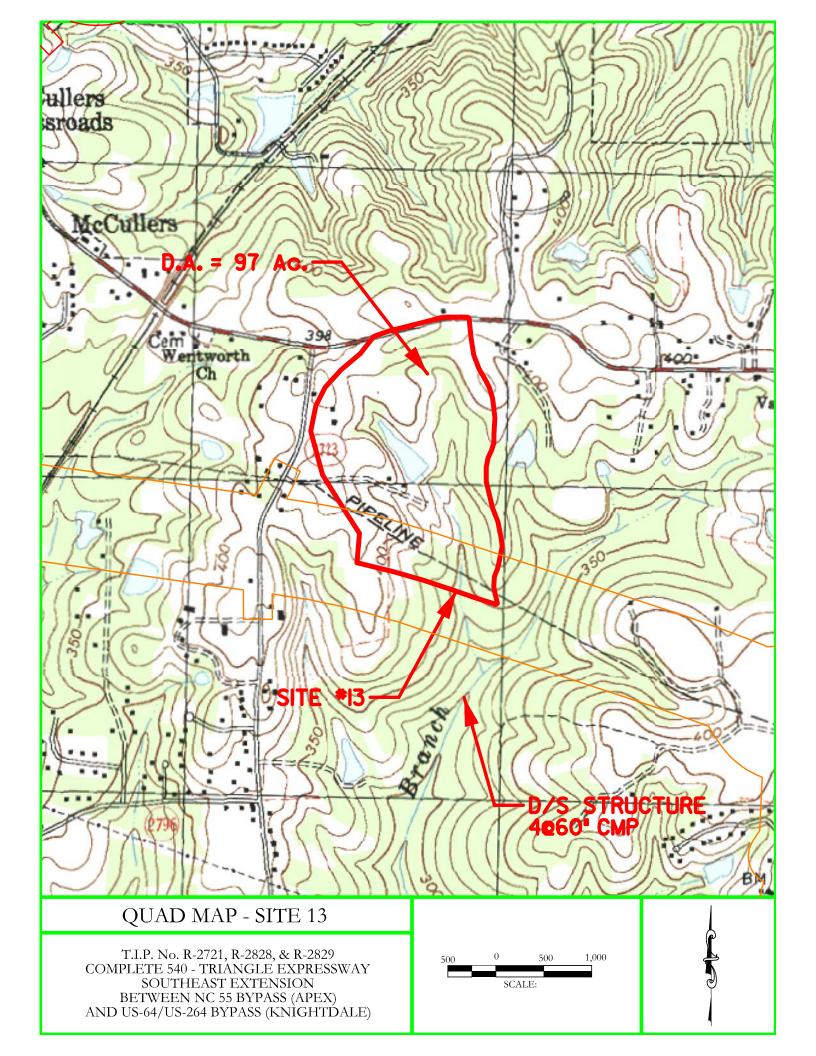
Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing

### Site 13





	STREA
7/7/2010	PROJECT NAME: Triangle Expressway SE Ext.

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DECLON: BILLE DIDGE

PROJECT NAME ENGLISH D	PROJECT NAME: Triangle Expressway SE Ext. GLISH Drainage Area = 0.1	ssway SE Ext. 0.15	STREAM NAME: Unnamed Irib. To Panther Branch sq. miles	med Trib. To Panth	er Branch METHOD USED:	Rep.	REGION: BLUE RIDGE 01-4207	
USGS RUR	AL REGRE	SSION EQU	JSGS RURAL REGRESSION EQUATIONS (OLD)	RUF	SAL EQUA	RURAL EQUATIONS Report 01-420	ort 01-4207	
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills	
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)	
2YR	7.39	20.92	38.82	2YR	35.64	18.05	8.68	
5YR	12.03	49.39	69.57	SYR	66.99	38.67	14.68	
10YR	15.82	77.91	94.59	10YR	95.13	58.54	19.43	
25YR	20.74	131.94	134.79	25YR	140.02	91.23	26.35	
50YR	24.97	184.80	169.29	SOYR	180.47	122.36	32.35	
100YR	29.63	254.35	212.30	100YR	227.62	159.92	38.77	
200YR	36.38	341.99	258.85	200YR	282.20	204.86	46.26	
500YR	41.83	493.46	346.56	500YR	368.12	278.03	57.37	

## **USGS URBAN REGRESSION EQUATIONS**

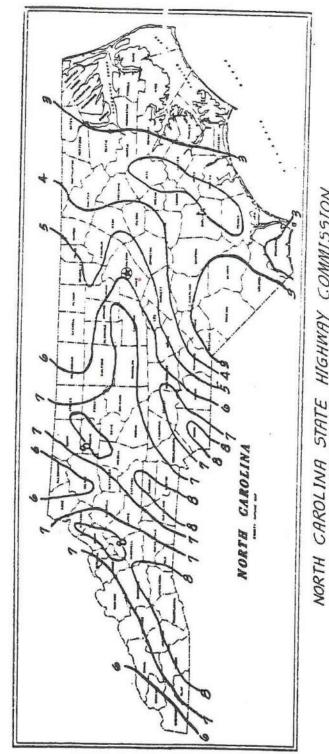
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(These Equations are used only for comparison)

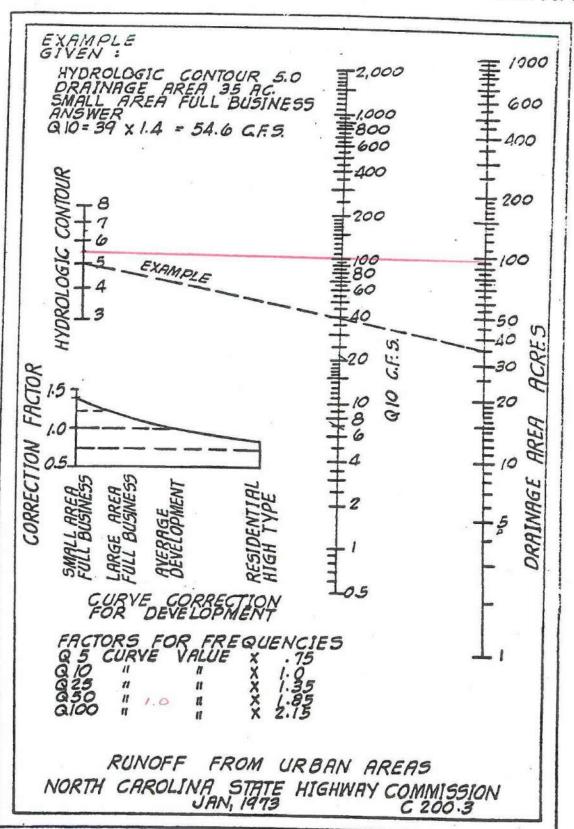
REQUENCY	Sand Hills	Coastal Plain	Blue Ridge	
	(cfs)	(cfs)	(cfs)	
5YR	40.79	122.72	160.30	
10YR	48.46	170.75	199.02	
25YR	58.34	256.39	260.80	
50YR	65.66	332.18	309.41	
100YR	74.71	435.54	375.56	
200YR	135.68	478.10	557.26	(Based on 2.80xQ10)
500YR	95.67	723.86	541.76	

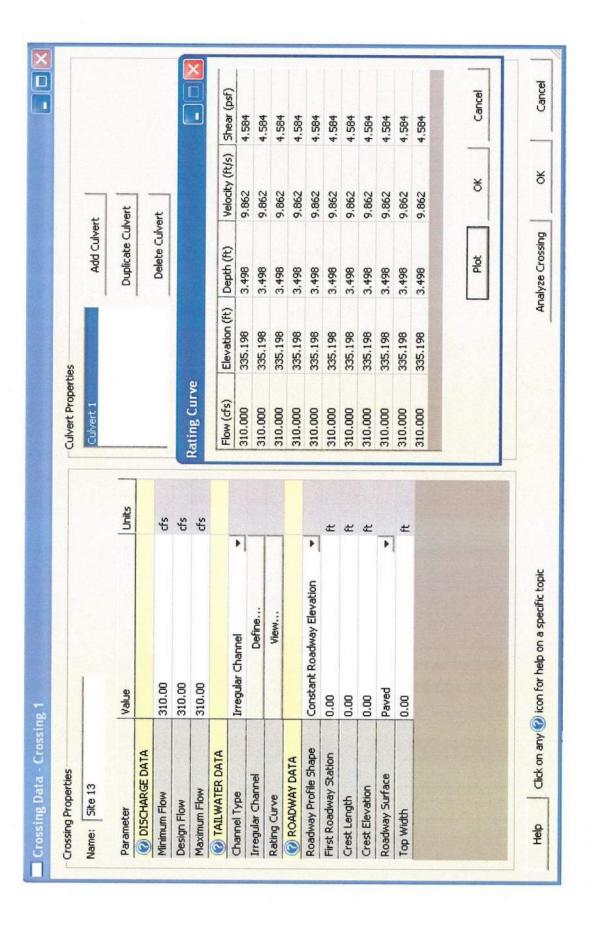
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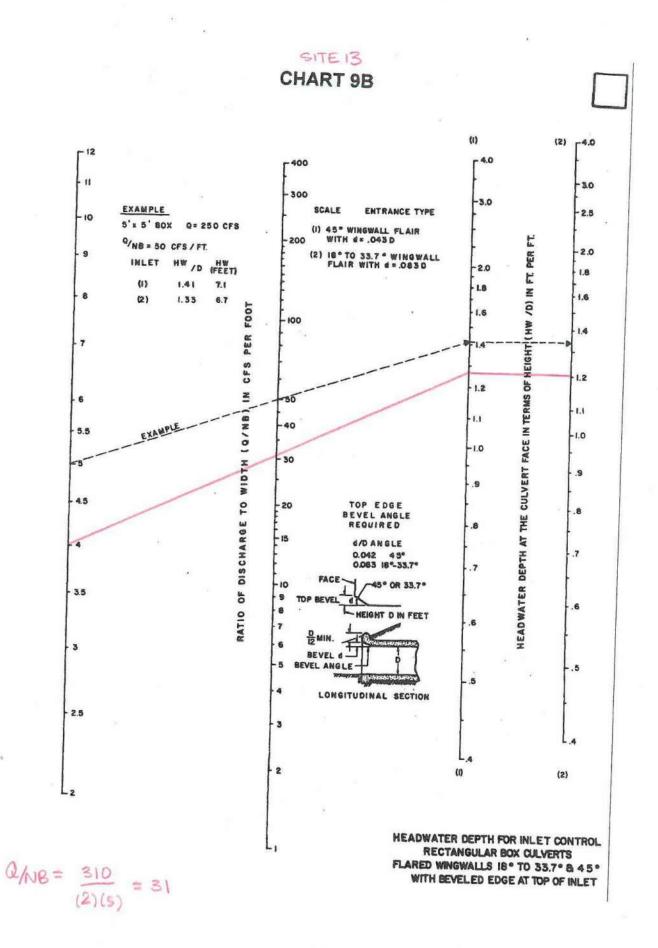
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FREQUENCY	07	Coastal Plain	Blue Ridge	Discharge Used	FREQUENCY	Disharges
		(cfs)	(cfs)			
5YR	72.93	109.22	120.28			
10YR	97.90	155.78	164.71		10YR	
25YR	139.27	261.68	264.10		SOYR	
50YR	166.27	318.14	309.39	310	100YR	
100YR	191.94	375.84	354.86		100YR	
200YR	274.11	436.19	461.20	(Based on 2.80xQ10)	500YR	
500YR	358.30	570.16	602.85	(Based on 3.66xQ10)		

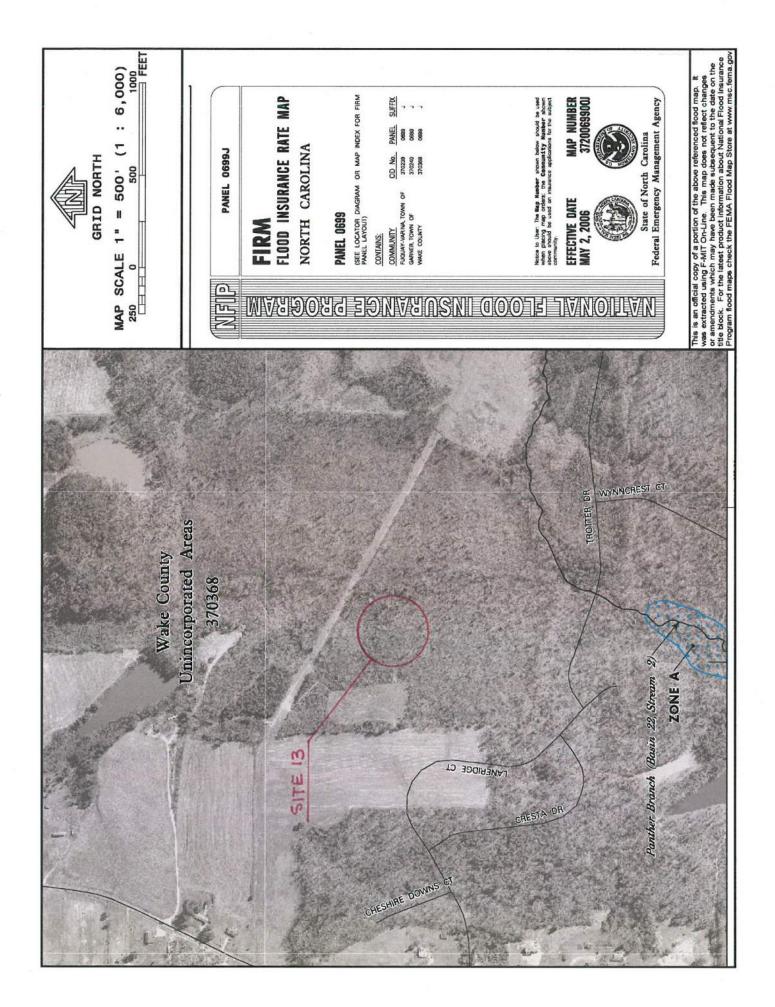


MORTH CHKOLINA STATE HIGHWAY COMMISSION HYDROGRAPHIC DEPT. MAP OF HYDROLOGIC CONTOURS FOR USE IN DETERMINING PROJECT DESIGN DISCHARGES









			Class		
Name of Stream	Description	Class	Date	Index No.	
Unnamed Tributary to Swift Creek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)	
Unnamed Tributary to Swift Creek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)	
Swift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)	
Buck Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)	
Buck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)	
Reedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)	
Reedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)	
Swift Creek	From dam at Lake Benson to Neuse River	C; NSW	05/01/88	27-43-(8)	
Mahlers Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-9	
Weal Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-10	
White Oak Creek (Austin Pond)	From source to Swift Creek	C;NSW	05/01/88	27-43-11	
Little Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-12	
Cooper Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-13	
Reedy Branch (Little Branch)	From source to Swift Creek	C;NSW	05/01/88	27-43-14	
Middle Creek	From source to backwaters of Sunset Lake	C;NSW	05/01/88	27-43-15-(1)	j
Middle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	27-43-15-(2)	
Basal Creek [(Bass Lake, (Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	27-43-15-3	
Middle Creek	From dam at Sunset Lake to Swift Creek	C;NSW	05/01/88	27-43-15-(4)	
Rocky Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-4.5	
Camp Branch	From source to Middle Creek	C; NSW	05/01/88		
Bells Lake	Entire lake and connecting	C; NSW	05/01/88	27-43-15-6	
	stream to Middle Creek				
Mills Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-7	
Terrible Creek (Johnsons Pond)	From source to dam at Johnsons Pond	B;NSW	05/01/88	27-43-15-8-(1)	
Terrible Creek	From dam at Johnsons Pond to Middle Creek	C; NSW	05/01/88	27-43-15-8-(2)	
Panther Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-9	
Little Creek	From source to Middle Creek	C; NSW	05/01/88	27-43-15-10	

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RECENT DRIF	t - 2,4'	
BED MATERI	AL - LARGE 6	RAVEL SMALL LOBB



Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.



Looking at Upstream Face of Downstream Structure (4 @ 60" CMP)

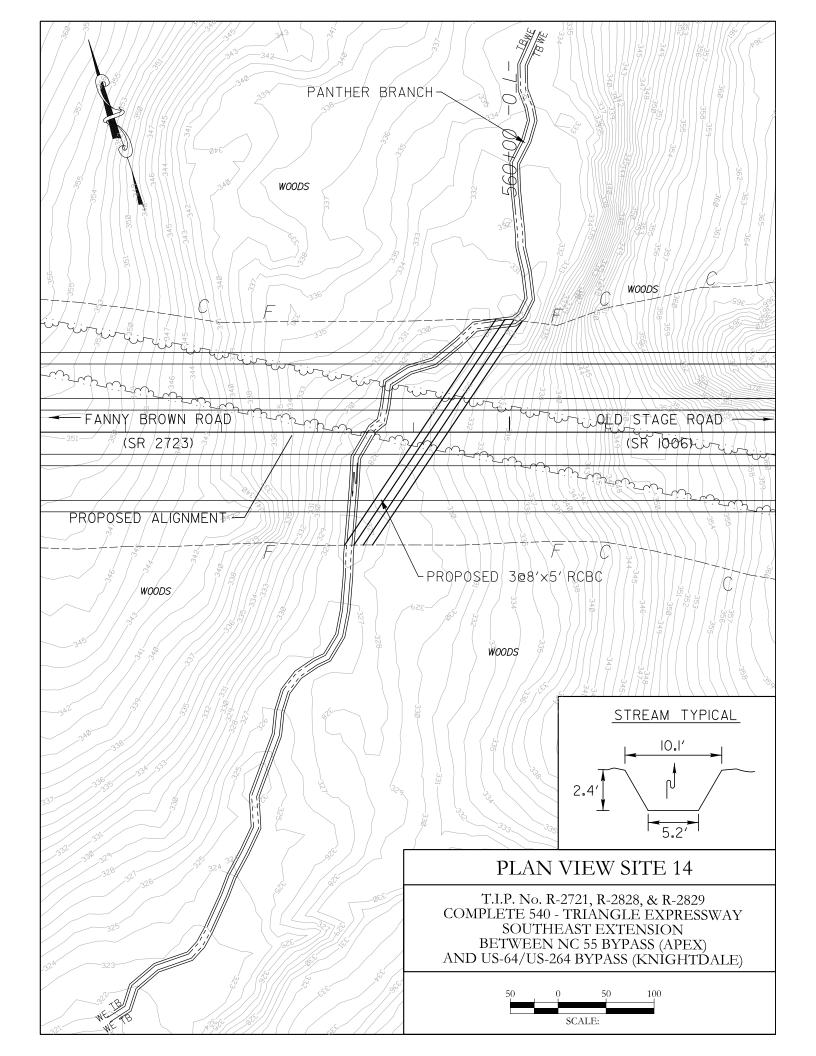


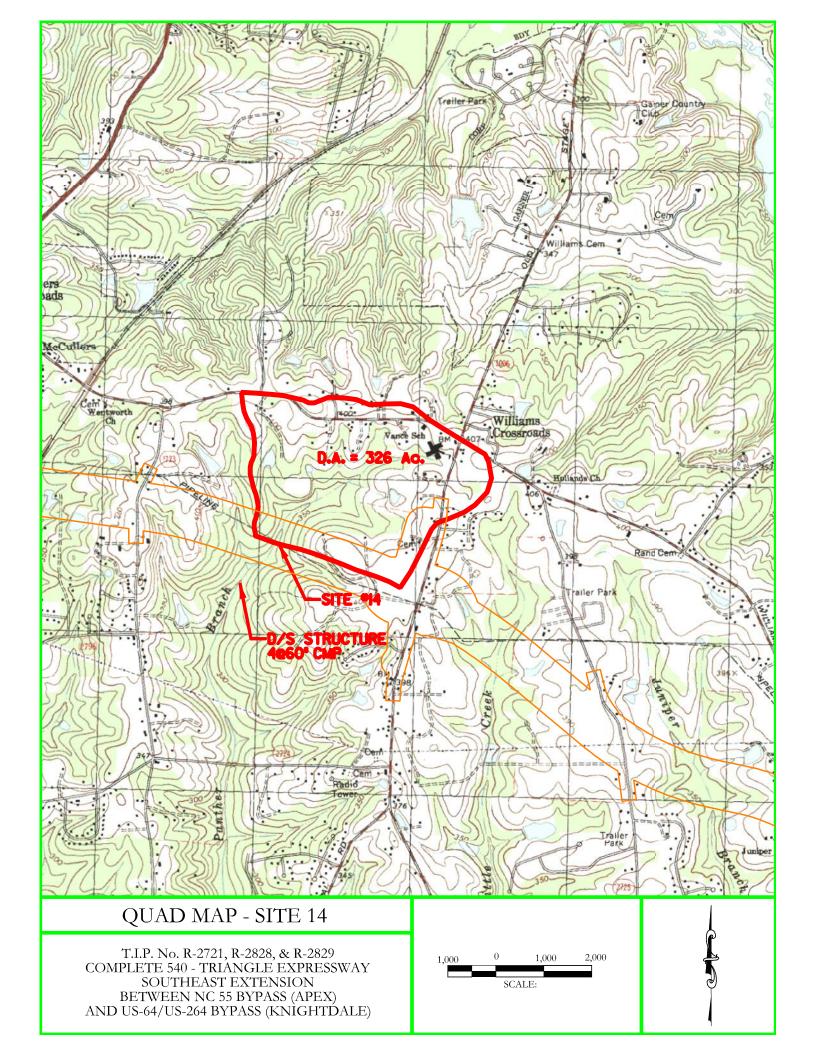
Looking at Downstream Face of Downstream Structure



Looking at Upstream Channel of Downstream Structure

### Site 14





	REGION: BLUE RIDGE	D USED: Rep 01-4207
	STREAM NAME: Panther Branch	METHO
		sa. miles
	V SE Ext.	0.51
010	NAME: Triangle Expressway	Drainage Area =
7/14/20	PROJECT	ENGLISH

<b>JSGS RUR</b>	ISGS RURAL REGRE	SSION EQU	ATIONS (OLD)	RUR	RAL EQUA	TIONS Rep	oort 01-4207
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)
2YR	18.13	45.35	90.43	2YR	84.15	41.12	20.74
5YR	29.69	100.69	157.95	5YR	153.41	84.12	34.62
10YR	39.13	154.42	213.44	10YR	213.87	124.25	45.59
25YR	51.99	253.01	300.45	25YR	308.31	188.49	61.52
SOYR	63.07	346.65	375.06	50YR	392.56	248.51	75.36
100YR	75.38	467.28	466.33	100YR	489.09	319.69	89.98
200YR	92.66	617.62	565.79	200YR	599.72	403.54	107.11
500YR	108.38	870.68	742.84	500YR	771.86	537.72	132.49

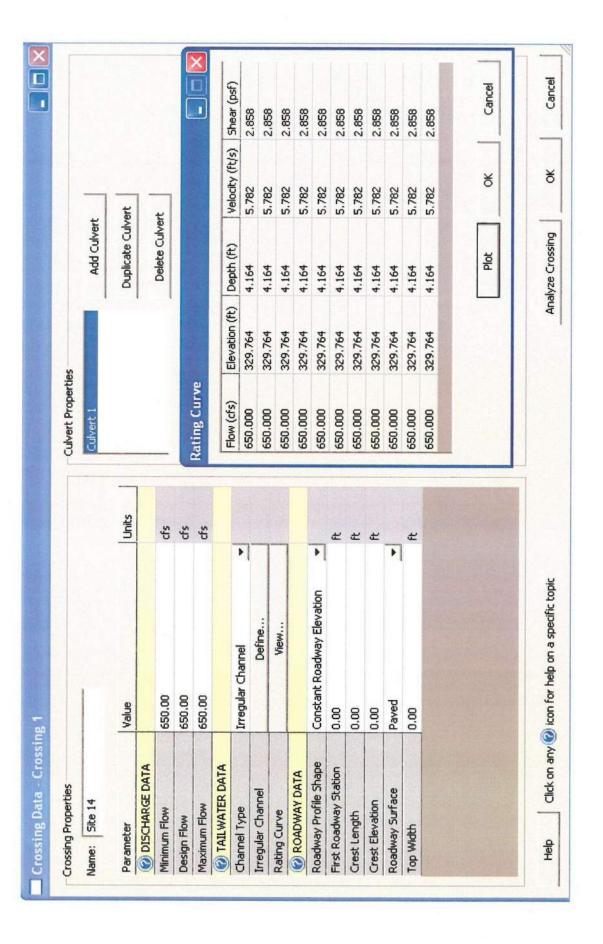
## **USGS URBAN REGRESSION EQUATIONS**

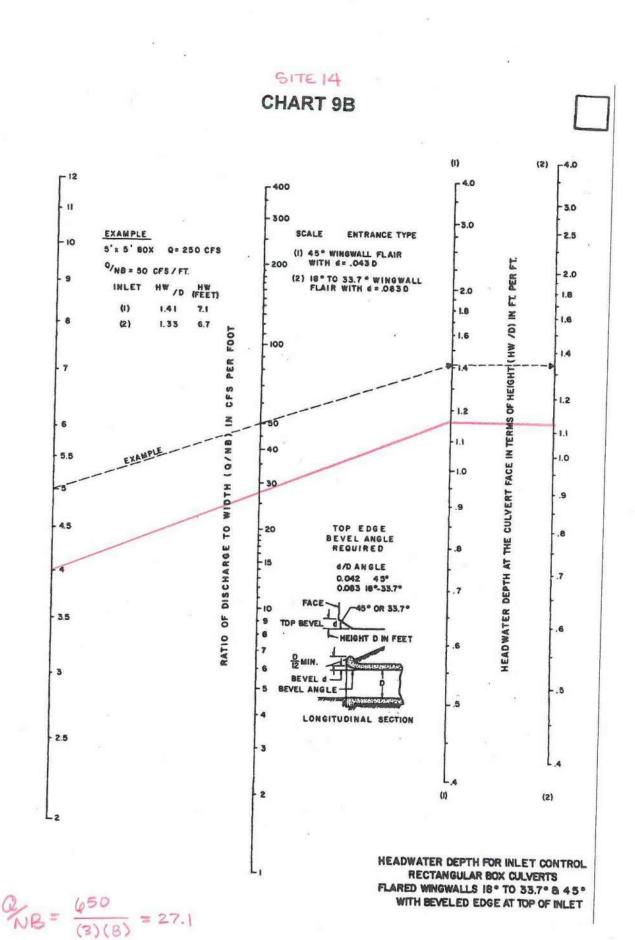
(These Equations are used only for comparison)

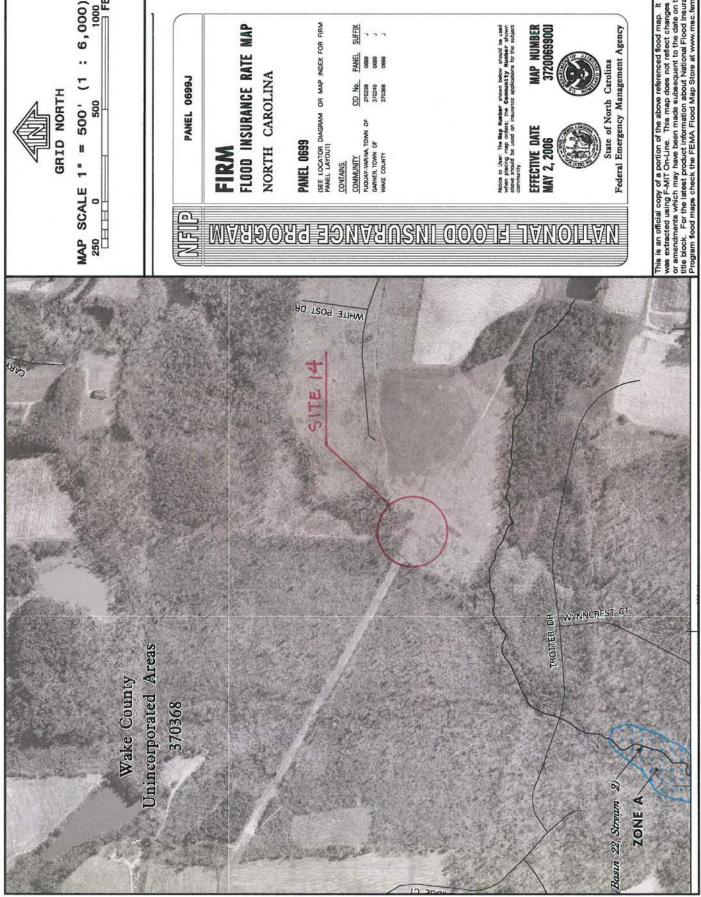
No.	1	in combando		
FREGUENCY	Sand Hills	Coastal Plain		
	(cts)	(cfs)		
5YR	101.58	263.34		
10YR	120.53	356.54		
25YR	146.22	518.58		
50YR	167.08	50YR 167.08 664.31	708.08	
100YR	193.04	861.69		
200YR	337.48	998.30		(Based on 2.80xQ10)
500YR	254.02	1402.52	1231.28	

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% Impervious =	20				FEN	IA
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Discharge Used	FREQUENCY	Disharges
5YR	171.78	243.46	276.77			
10YR	224.17	334.73	367.15		10YR	400
25YR	306.29	525.67	557.84		SOYR	875
50YR	362.56	629.78	646.33	650	100YR	1195
100YR	414.95	734.03	733.21		500YR	2320
200YR	627.68	937.23	1028.03	(Based on 2.80xQ10)		
500YR	820.46	1225.09	1343.79	(Based on 3.66xQ10)		







MAP NUMBER 3720069900J

.0315 NEUSE RIVER BASIN

SITE 14

.0315 NEUSE RIVER BAS	) IIV			SITE	14
			Class		
Name of Stream	Description	Class	Date	Index No.	
Unnamed Tributary to Swift Creek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)	
Unnamed Tributary to Swift Treek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)	
wift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)	
Buck Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)	15
Buck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)	
Reedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)	
Reedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)	
Swift Creek	From dam at Lake Benson to Neuse River	C;NSW	05/01/88	27-43-(8)	
Mahlers Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-9	
Weal Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-10	
White Oak Creek (Austin Pond)	From source to Swift Creek	C; NSW	05/01/88	27-43-11	
Little Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-12	
Cooper Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-13	
Reedy Branch (Little Branch)	From source to Swift Creek	C; NSW	05/01/88	27-43-14	
Middle Creek	From source to backwaters of Sunset Lake	C; NSW	05/01/88	27-43-15-(1)	
Middle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	27-43-15-(2)	
Basal Creek [(Bass Lake, (Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	27-43-15-3	
Middle Creek	From dam at Sunset Lake to Swift Creek	C; NSW	05/01/88	27-43-15-(4)	
Rocky Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-4.5	
Camp Branch	From source to Middle Creek	C; NSW		27-43-15-5	
Bells Lake	Entire lake and connecting stream to Middle Creek	C;NSW		27-43-15-6	
Mills Branch	From source to Middle Creek	C;NSW	05/01/88	27-43-15-7	
Terrible Creek (Johnsons Pond)	From source to dam at Johnsons Pond	B;NSW	05/01/88	27-43-15-8-(1)	
Terrible Creek	From dam at Johnsons Pond to Middle Creek	C;NSW	05/01/88	27-43-15-8-(2)	
Panther Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-9	
Little Creek	From source to Middle Creek	C; NSW	05/01/88		

### PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake	PROJECT NUMBER R-272	1 & R-2828
STREAM Panther Branch	ROUTE New Location	
(Site 14) ASSESSMENT PREPARED	BY Mulkey, INC. DATE (MLH)	6/11/2010
	HYDROLOGIC EVALUA	TION
NEAREST GAGING STATI	ON ON THIS STREAM	(NONE <u>X</u> )
ARE FLOOD STUDIES AV	AILABLE ON THIS STREAM	M: Yes
FLOOD DATA: Q <sub>10</sub> 370 CFS EST. BKWT Q <sub>50</sub> 650 CFS EST. BKWT Q <sub>500</sub> 1,300 CFS EST. BKWT	TR. <u>N/A</u> FT. Q <sub>25</sub> <u>550</u> CFS TR. <u>N/A</u> FT. Q <sub>100</sub> <u>750</u> CFS VTR. <u>N/A</u> FT.	EST. BKWTR. <u>N/A</u> FT. EST. BKWTR. <u>N/A</u> FT.
DRAINAGE AREA <u>0.51 Sq.</u>	Mi. METHOD USED TO CO	MPUTE Q: USGS Urban Regression
<u>P1</u>	ROPERTY RELATED EVAL	UATIONS
DAMAGE POTENTIAL: LO	OW MODERATE	<u>X</u> HIGH
COULD THIS BE SI	GNIFICANTLY INCREASEI	D BY PROPOSED
ENCROACHMENT:	YES	NO <u>X</u>
	aximum one foot rise in the na any existing insurable structur	atural base flood is allowed, but this res.
LIST BUILDINGS IN	N FLOOD PLAIN: None	LOCATION:
UPSTREAM LAND	USE Residential	
ANTICIPATE ANY	CHANGE? <u>No</u>	
ANY FLOOD ZONII	NG? (FIA STUDIES, ETC.)	YES <u>X</u> NO
TYPE OF STUDY: 1	FEMA – FEMA – non-regulate	ed Zone X
REGULATORY FLO	OODWAY WIDTH N/A	
COMMENTS:		

### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 26,400 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 69,900 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? N/A
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS  NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Wehadkee TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service

### **ENVIRONMENTAL CONSIDERATIONS**

LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: <u>Culvert is buried 1 foot to allow for fish passage.</u>

### MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED
ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
ALTERNATIVES
RECOMMENDED DESIGN <u>3@8'x5' RCBC</u>
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING <u>96 Sq. Ft.</u>
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YESNO $\underline{X}$ DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR A maximum one foot rise in the natural base flood.
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:

		SITE 14		4/7/10
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Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing



Looking at Upstream Face of Downstream Structure. (4 @ 60" CMP)



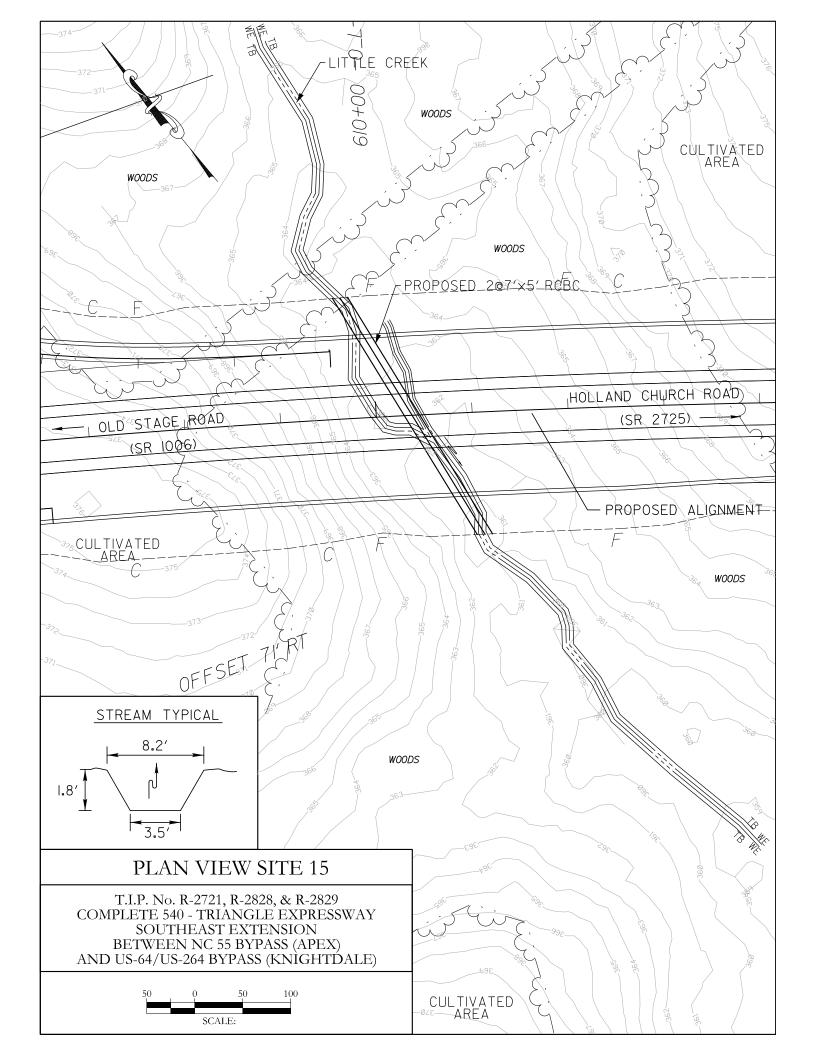
Looking at Downstream Face of Downstream Structure.

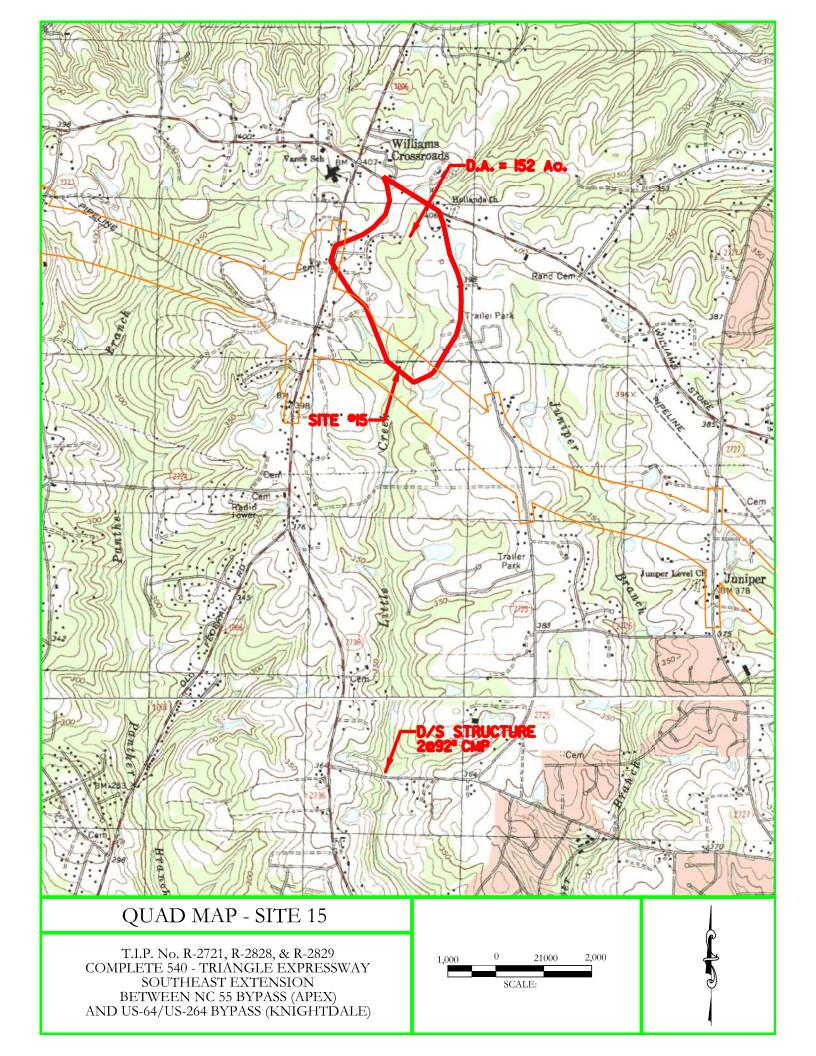
Page 2 of 3



Looking at Upstream Channel of Downstream Structure

### Site 15





	REGION: BLUE RIDGE	Rep. 01-4207
	STREAM NAME: Little Creek	METHOD USED:
		sd. miles
	ay SE Ext.	0.24
110	NAME: Triangle Expresswa	Drainage Area =
1/8/20	PROJECT	ENGLISH

FREQUENCY         Blue Ridge         Coastal P           (cfs)         (cfs)         (cfs)           2YR         49.57         24.76           5YR         92.09         52.12           10YR         129.85         78.16           25YR         189.60         120.55           50YR         243.24         160.62           200YR         305.34         208.66           200YR         376.96         265.79           500YR         489.20         358.19	<b>USGS RUR</b>	AL REGRE	<b>ISGS RURAL REGRESSION EQU</b>	ATIONS (OLD)	RUF	RURAL EQUAT	IONS	Report 01-4207
(cfs)         (cfs)         (cfs)         (cfs)         (cfs)           10.43         28.16         53.71         24.76         24.76           17.02         64.93         95.32         5VR         49.57         24.76           22.40         101.33         129.30         52.12         78.16           29.52         169.43         183.38         25VR         189.60         120.55           35.65         235.30         229.78         50VR         243.24         160.62           42.41         321.28         287.21         100VR         305.34         208.66           52.10         429.15         349.52         200VR         489.20         358.19	REQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	oastal P	Sand Hills
10.43     28.16     53.71     27R     49.57     24.76       17.02     64.93     95.32     57R     92.09     52.12       22.40     101.33     129.30     107R     129.85     78.16       29.52     169.43     183.38     25YR     189.60     120.55       35.65     235.30     229.78     50YR     243.24     160.62       42.41     321.28     287.21     100YR     305.34     208.66       52.10     429.15     349.52     200YR     489.20     358.19		(cts)	(cfs)	(cfs)		(cfs)	(cts)	(cts)
17.02     64.93     95.32     57R     92.09     52.12       22.40     101.33     129.30     10YR     129.85     78.16       29.52     169.43     183.38     25YR     189.60     120.55       35.65     235.30     229.78     50YR     243.24     160.62       42.41     321.28     287.21     100YR     305.34     208.66       52.10     429.15     349.52     200YR     489.20     358.19	2YR	10.43	28.16	53.71	2YR	49.57	24.76	12.13
22.40     101.33     129.30     10YR     129.85     78.16       29.52     169.43     183.38     25YR     189.60     120.55       35.65     235.30     229.78     50YR     243.24     160.62       42.41     321.28     287.21     100YR     305.34     208.66       52.10     429.15     349.52     200YR     376.96     265.79       60.29     613.71     464.46     500YR     489.20     358.19	5YR	17.02	64.93	95.32	5YR	92.09	52.12	20.41
29.52       169.43       183.38       25YR       189.60       120.55         35.65       235.30       229.78       50YR       243.24       160.62         42.41       321.28       287.21       100YR       305.34       208.66         52.10       429.15       349.52       200YR       376.96       265.79         60.29       613.71       464.46       500YR       489.20       358.19	10YR	22.40	101.33	129.30	10YR	129.85	78.16	26.96
35.65       235.30       229.78       50YR       243.24       160.62         42.41       321.28       287.21       100YR       305.34       208.66         52.10       429.15       349.52       200YR       376.96       265.79         60.29       613.71       464.46       500YR       489.20       358.19	25YR	29.52	169.43	183.38	25YR	189.60	120.55	36.49
42.41     321.28     287.21     100YR     305.34     208.66       52.10     429.15     349.52     200YR     376.96     265.79       60.29     613.71     464.46     500YR     489.20     358.19	50YR	35.65	235.30	229.78	50YR	243.24	160.62	44.76
52.10 429.15 349.52 200YR 376.96 265.79 60.29 613.71 464.46 500YR 489.20 358.19	100YR	42.41	321.28	287.21	100YR	305.34	208.66	53.57
60.29 613.71 464.46 500YR 489.20 358.19	200YR	52.10	429.15	349.52	200YR	376.96	265.79	63.87
	500YR	60.29	613.71	464.46	500YR	489.20	358.19	79.12

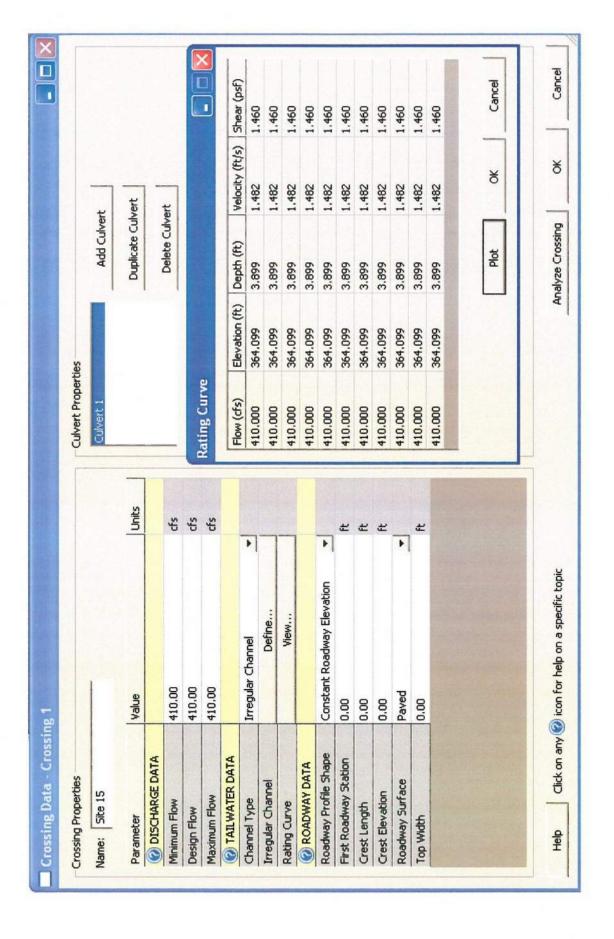
# USGS URBAN REGRESSION EQUATIONS BDF= 11

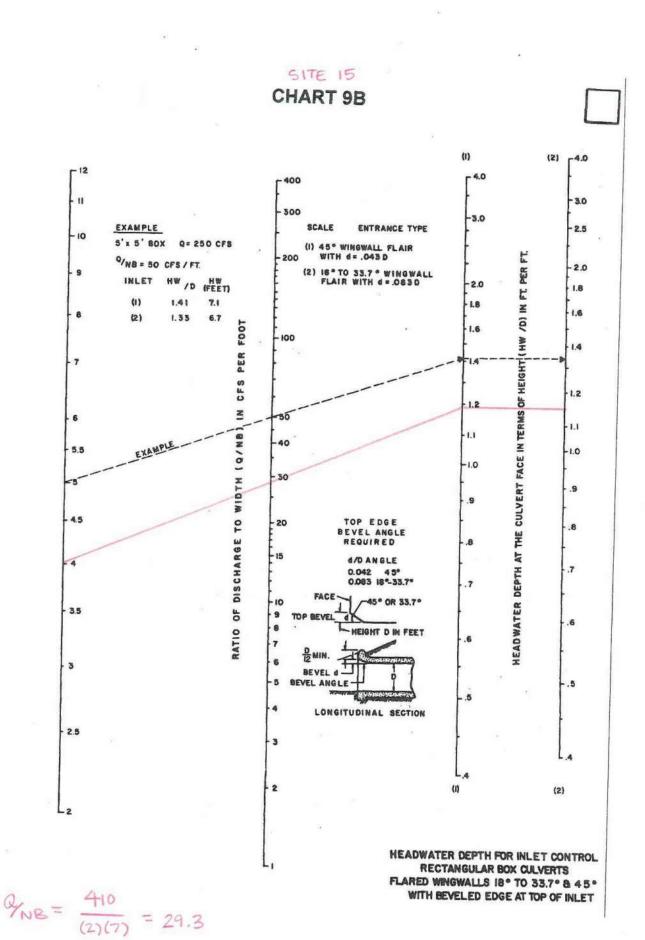
(These Equations are used only for comparison)

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FREQUENCY	Sand Hills	Coastal Plain	-	
	(cfs)	(cfs)		
5YR	57.91	164.54		
10YR	68.76	226.55		
25YR	83.03	336.04		
50YR	93.99	433.49		
100YR	107.58	566.02		
200YR	192.53	200YR 192.53 634.34	769.05	(Based on 2.80xQ10)
500YR	139.21	933.20		

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% Impervious =	20				T	FEMA
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Discharge Used	FREQUENCY	Disharges
5YR	(cis) 101.35	(CIS) 148.60	(cis) 165.65			
10YR	134.57	208.97	224.09		10YR	
25YR	188.50	342.07	351.96		50YR	
50YR	224.31	413.55	410.57	410	100YR	
100YR	258.08	486.02	468.93		100YR	
200YR	376.80	585.12	627.46	(Based on 2.80xQ10)	500YR	
500YR	492.53	764.84	820.18	(Based on 3.66xQ10)		







(000'9: SUFFIX FLOOD INSURANCE RATE MAP (SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT) 1" = 500' (1 NORTH CAROLINA PANEL 0698J CID No. GRID NORTH 500 PANEL 0698 COMMUNITY WAKE COUNTY CONTAINS:

MAP NUMBER 3720069800J EFFECTIVE DATE MAY 2, 2006

State of North Carolina

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood insuran

.0315 NEUSE RIVER BASIN

SITE 15

.0315 NEUSE RIVER BAS	7.2.1			SITE IS
			Class	
Name of Stream	Description	Class	Date	Index No.
Unnamed Tributary to Swift Creek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)
Unnamed Tributary to Swift Creek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)
Swift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)
Buck Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)
Buck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)
Reedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)
Reedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)
Swift Creek	From dam at Lake Benson to Neuse River	C; NSW	05/01/88	27-43-(8)
Mahlers Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-9
Neal Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-10
White Oak Creek (Austin Pond)	From source to Swift Creek	C; NSW	05/01/88	27-43-11
Little Creek	From source to Swift Creek	C;NSW	05/01/88	27-43-12
Cooper Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-13
Reedy Branch (Little Branch)	From source to Swift Creek	C; NSW	05/01/88	27-43-14
Middle Creek	From source to backwaters of Sunset Lake	C; NSW	05/01/88	27-43-15-(1)
Middle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	27-43-15-(2)
Basal Creek [(Bass Lake, (Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	27-43-15-3
Middle Creek	From dam at Sunset Lake to Swift Creek	C; NSW	05/01/88	27-43-15-(4)
Rocky Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-4.5
Camp Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-5
Bells Lake	Entire lake and connecting stream to Middle Creek	C; NSW	05/01/88	27-43-15-6
Mills Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-7
Terrible Creek (Johnsons Pond)	From source to dam at Johnsons Pond	B;NSW	05/01/88	27-43-15-8-(1)
Terrible Creek	From dam at Johnsons Pond to Middle Creek	C;NSW	05/01/88	27-43-15-8-(2)
Panther Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-9
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Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing



Looking at Upstream Face of Downstream Structure (2 @ 92" CMP)

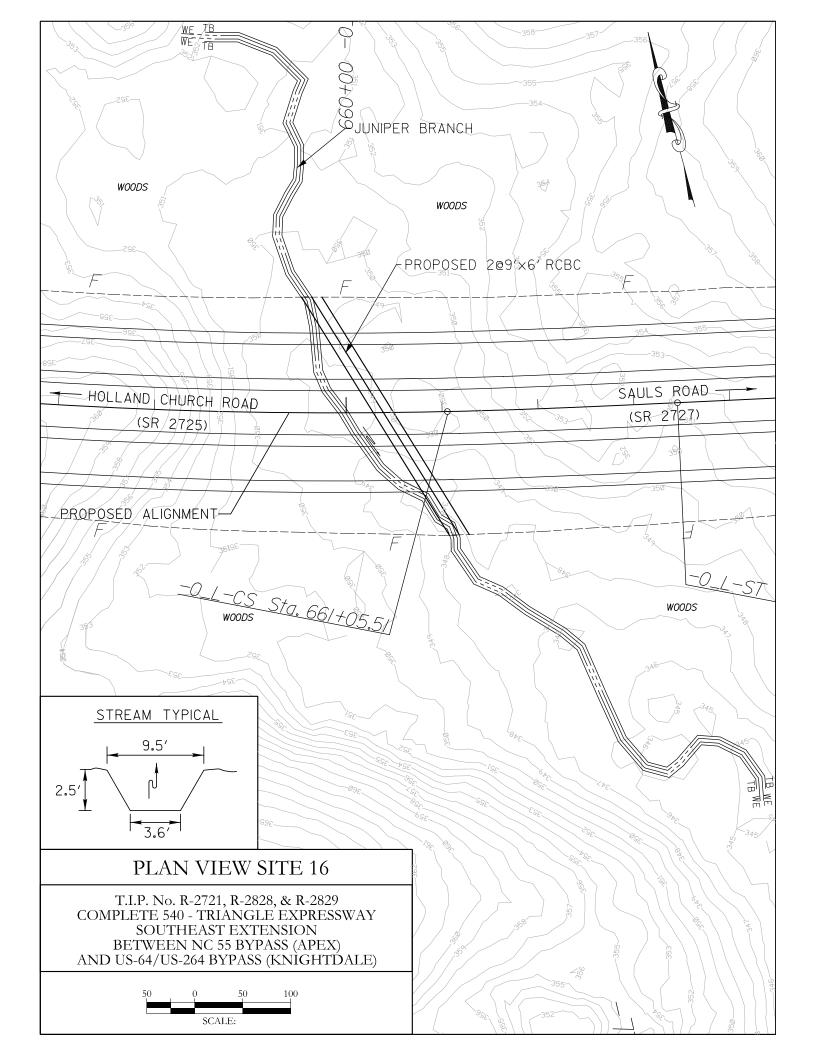


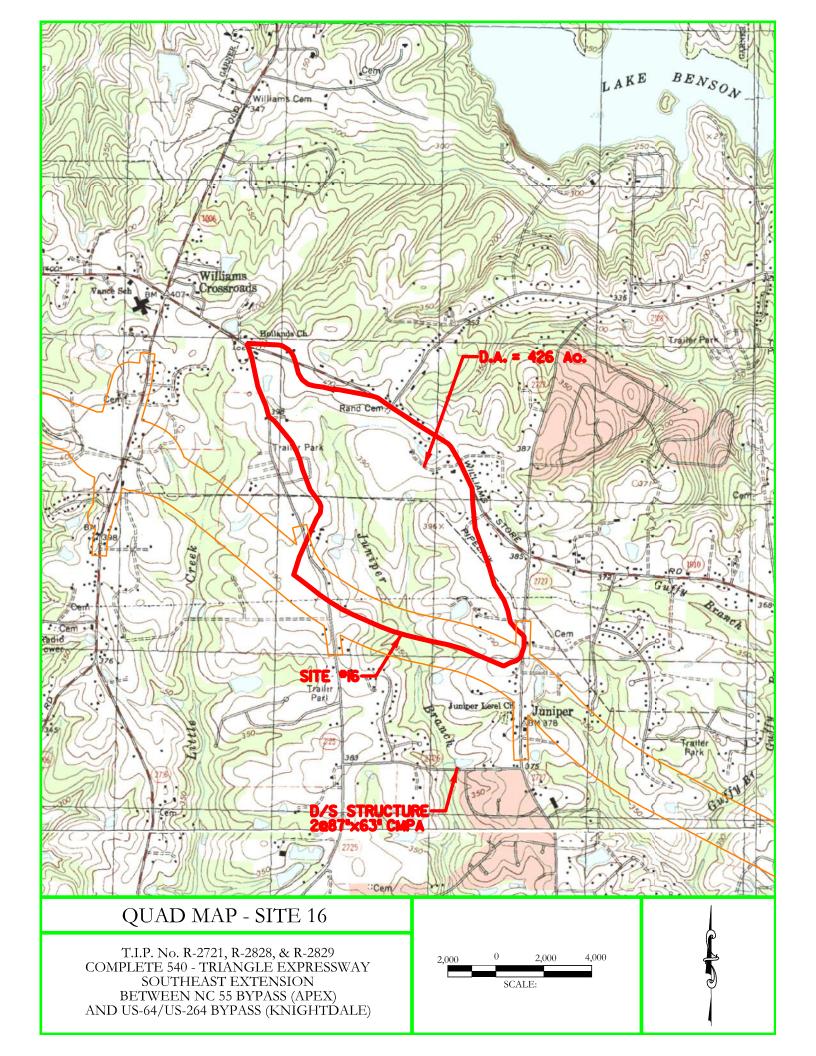
Looking at Downstream Face of Downstream Structure



Looking at Upstream Channel of Downstream Structure

### Site 16





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PROJECT NAME: Triangle Expressway SE Ext.

ENGLISH Drainage Area = 0.67

sd. miles

STREAM NAME: Juniper Branch

REGION: BLUE RIDGE

<b>SGS RURAI</b>	AL REGRE	SSION EQU	ATIONS (OLD)	RUR	SAL EQUA	ATIONS Rep	oort 01-4207
REQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)
2YR	22.14	53.88	109.19	2YR	101.92	49.41	25.19
5YR	36.31	118.02	189.64	5YR	184.53	100.03	41.92
10YR	47.88	179.87	255.91	10YR	256.22	146.96	55.14
25YR	63.81	292.54	359.25	25YR	367.64	221.60	74.33
50YR	77.54	398.84	447.84	50YR	466.82	291.05	66.06
100YR	92.83	535.15	555.77	100YR	580.03	373.08	108.56
200YR	114.14	704.63	673.57	200YR	709.49	469.40	129.16
500YR	134.01	988.20	880.49	500YR	910.40	622.92	159.68

## **USGS URBAN REGRESSION EQUATIONS**

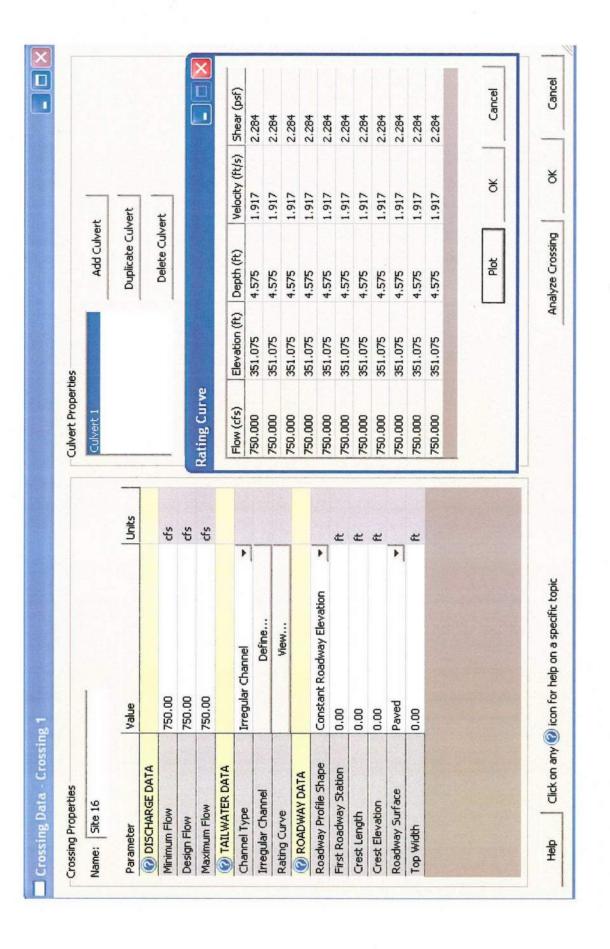
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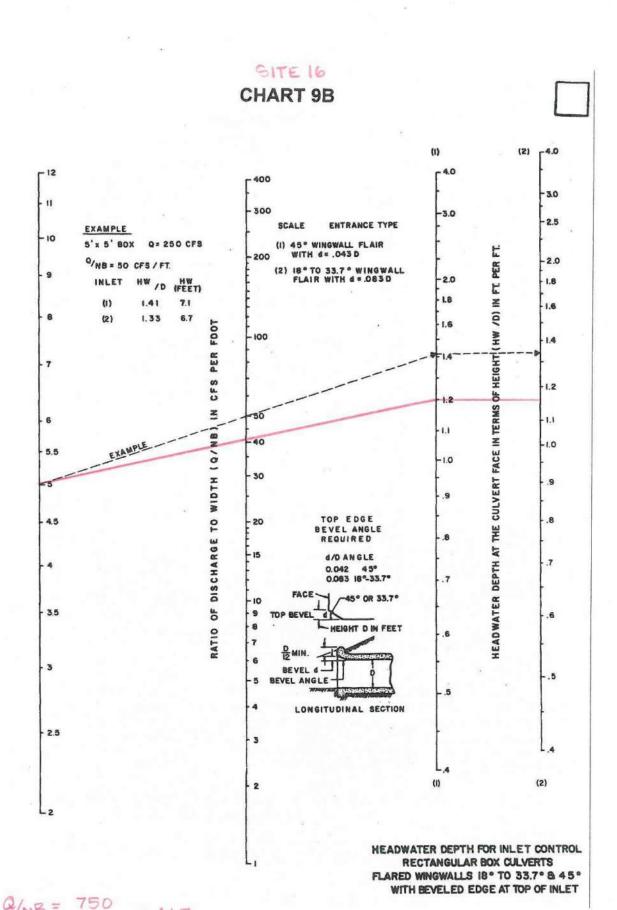
(These Equations are used only for comparison)

5YR         124.50         312.22         451.98           10YR         147.68         420.14         555.10           25YR         179.47         606.77         715.15           50YR         205.76         775.33         851.63           100YR         238.54         1003.27         1034.87           200YR         413.51         1176.40         1554.27         (Based on 2.80xQ10)           500YR         315.82         1625.39         1478.62	ζ	Sand Hills (cfs)	Coastal Plain (cfs)	
555.10 715.15 851.63 1034.87 1554.27		124.50	312.22	
715.15 851.63 1034.87 1554.27 1478.62	100,240	147.68	420.14	
851.63 1034.87 1554.27 1478.62	- Annaira	179.47	606.77	
1034.87 1554.27 1478.62	_	205.76	775.33	
1554.27		238.54	1003.27	
		413.51	1176.40	(Based on 2.80xQ10)
		315.82	1625.39	

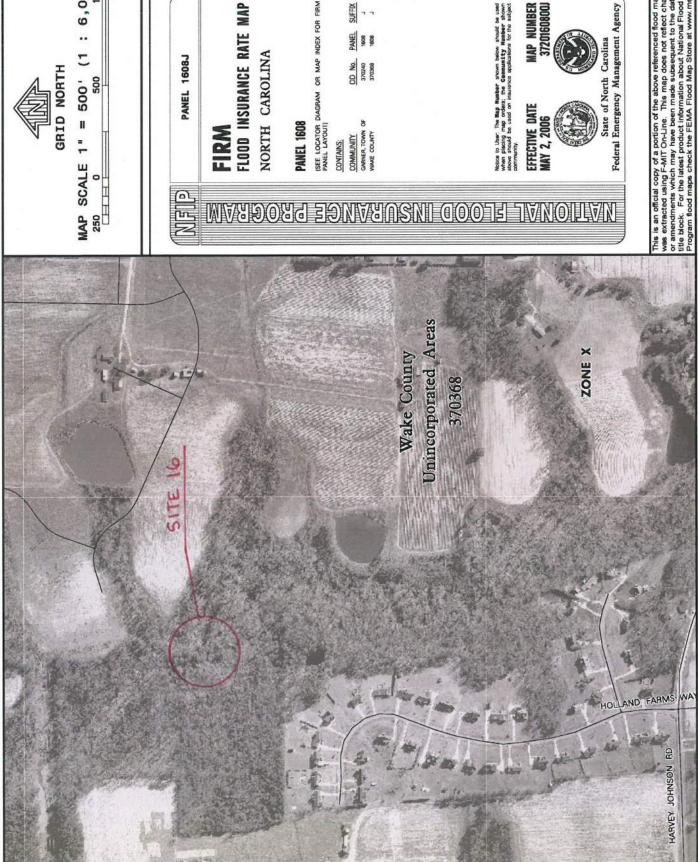
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FEMA	FREQUENCY Disharges			10YR	50YR	100YR	100YR	500YR	
	Discharge Used					750		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	Blue Ridge	(cts)	333.29	439.00	659.05	761.72	861.99	1229.21	1606.76
	Coastal Plain	(cts)	291.11	396.97	614.13	733.36	852.19	1111.51	1452.90
20	Sand Hills	(cts)	207.93	269.65	365.13	431.39	492.78	755.03	986.93
% Impervious =	FREQUENCY		5YR	10YR	25YR	SOYR	100YR	200YR	500YR





 $Q/NB = \frac{750}{(2)(9)} = 41.7$ 



GRID NORTH

MAP SCALE 1" = 500' (1 : 6,000)

PANEL 1608J

FLOOD INSURANCE RATE MAP

MAP NUMBER 3720160800J



State of North Carolina Federal Emergency Management Agency

.0315 N

NEUSE RIVER BASIN

SITE 16

			Class	
Name of Stream	Description	Class	Date	Index No.
Juniper Creek	From source to Little Creek	C;NSW	05/01/88	27-43-15-10-1
Guffy Branch	From source to Little Creek	C; NSW	05/01/88	27-43-15-10-2
Ditch Branch	From source to Guffy Branch	C; NSW	05/01/88	27-43-15-10-2-1
Buffalo Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-11
Mill Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-12
Beaverdam Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-13
Cow Branch	From source to Middle Creek	C; NSW	05/01/88	
Shop Branch	From source to Middle Creek	C; NSW	05/01/88	
Steep Hill Branch	From source to Middle Creek	C; NSW	05/01/88	
Arters Branch	From source to Neuse River	C; NSW	05/01/88	
Black Creek (Partins Pond, Panther Lake)	From source to dam at Panther Lake	B; NSW	50-515 USS 1955 1-5100 1	27-45-(1)
Black Creek	From dam at Panther Lake to mouth of Sassarixa Creek	C; NSW	05/01/88	27-45-(2)
Little Black Creek	From source to Black Creek	C; NSW	05/01/88	27-45-3
Hooks Branch	From source to Black Creek	C; NSW	05/01/88	27-45-4
McCullens Branch (McCullers Branch)	From source to Black Creek	C; NSW	05/01/88	27-45-5
Camp Branch	From source to Black Creek	C; NSW	05/01/88	27-45-6
Dicks Branch	From source to Black Creek	C; NSW	05/01/88	27-45-7
Hardee Mill Branch	From source to Black Creek	C:NSW	05/01/88	27-45-8
Pole Branch	From source to Black Creek	C; NSW	05/01/88	27-45-9
Reedy Creek	From source to Black Creek	C; NSW	05/01/88	
Gum Swamp	From source to Black Creek	C; NSW	And some section of the contraction in	27-45-11
Black Creek (Holts Lake)	From mouth of Sassarixa Creek to dam at Holts Lake	B;NSW	05/01/88	
Sassarixa Creek (Sassarixa Swamp)	From source to Black Creek	C; NSW	05/01/88	27-45-13
Black Creek	From dam at Holts Lake to Neuse River	C; NSW	05/01/88	27-45-(14)
Polecat Branch	From source to Neuse River	C; NSW	05/01/88	27-46
Mill Branch	From source to Polecat Branch	C; NSW	05/01/88	
Mirr Dranah	From course to Neugo Pivor	C.NEW	05/01/88	27-47
Miry Branch	From source to Neuse River	C; NSW		
Polecat Branch	From source to Neuse River	C; NSW	05/01/88 05/01/88	
Gar Gut NEUSE RIVER	From source to Neuse River From a point 1.7 miles upstream of Bawdy Creek to a point 0.8 mile upstream of Little River	C;NSW WS-IV;NSW		27-(49.5)
Bawdy Creek	From source to a point 0.9 mile below Johnston County SR 1007	C; NSW	05/01/88	27-50-(0.5)
Bawdy Swamp	From source to Bawdy Creek	C; NSW	05/01/88	27-50-1
Quicosin Swamp	From source to Bawdy Creek	C;NSW		27-50-2
Bawdy Creek	From a point 0.9 mile below Johnston County SR 1007 to Neuse River	WS-IV;NSW		27-50-(3)
Raccoon Swamp	From source to Neuse River	WS-IV;NSW	08/03/92	27-51

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Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing



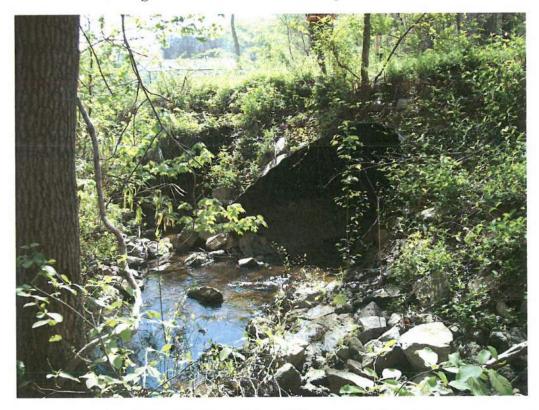
Looking at Upstream Face of Upstream Structure (3 @ 42" RCP)



Looking at Downstream Face of Upstream Structure



Looking at Downstream Channel of Upstream Structure



Looking at Upstream Face of Downstream Structure (2 @ 87" x 63" CMPA)

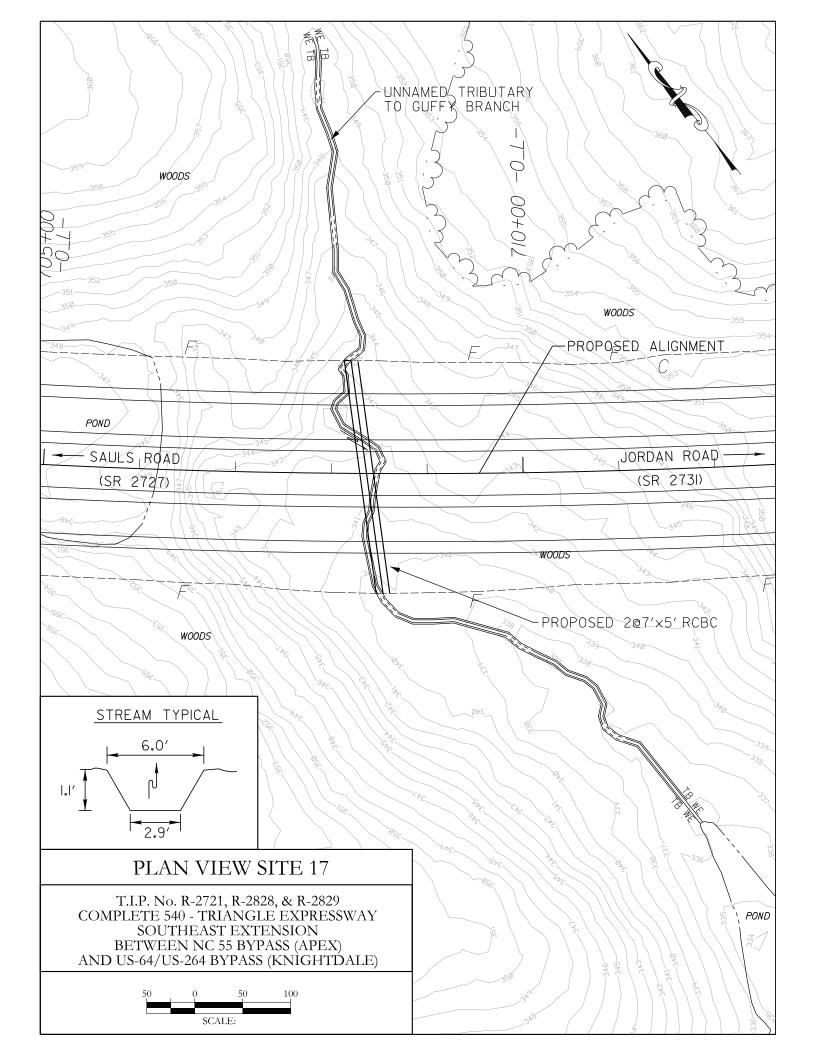


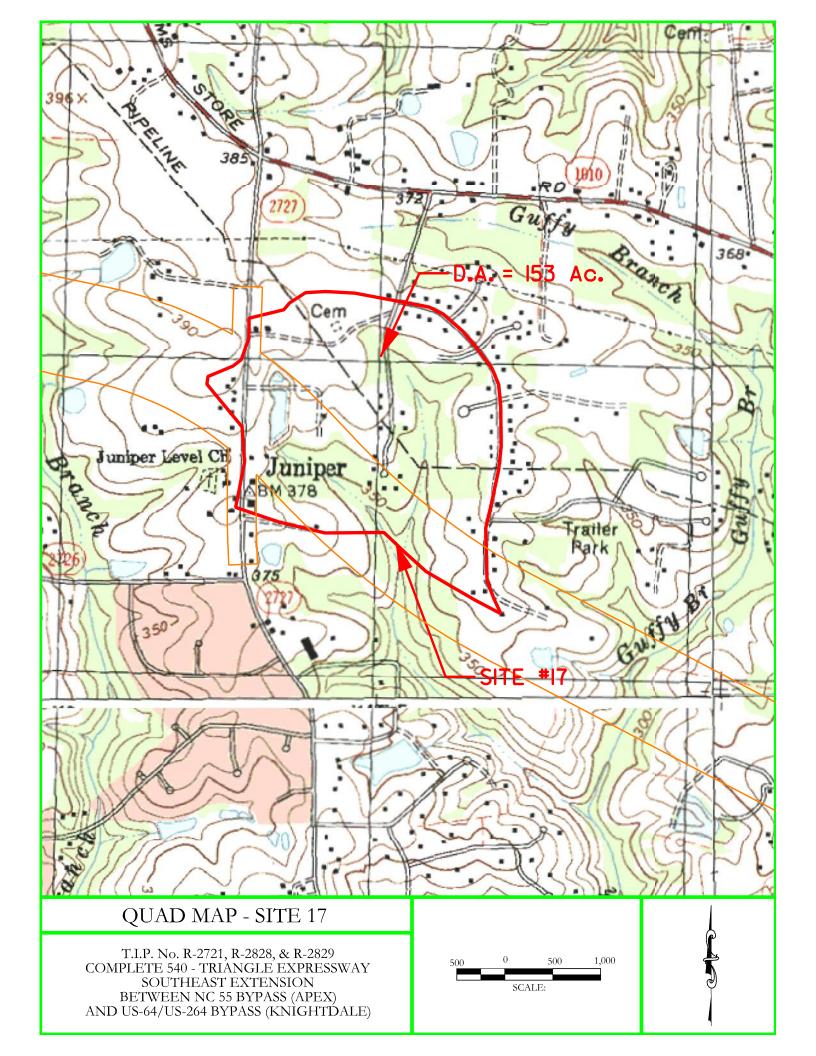
Looking at Downstream Face of Downstream Structure



Looking at Upstream Channel of Downstream Structure

### Site 17





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PROJEC ENGLISH

PROJECT NAMI	PROJECT NAME: Triangle Expressway SE Ext.  IGLISH Drainage Area = 0.2	ssway SE Ext. 0.24	Sq. miles METHOD INDICATES METHOD IN SQ. MILES	amed Trib to Guffy	Branch METHOD USED:	Rep. 01-4207	REGION: BLUE RIDGE 01-4207	
USGS RUF	AL REGRE	SSION EQU	ISGS RURAL REGRESSION EQUATIONS (OLD)	RUR	RURAL EQUAT	SNOL	Report 01-4207	
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills	
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)	
2YR	10.43	28.16	53.71	2YR	49.57	24.76	12.13	
5YR	17.02	64.93	95.32	5YR	92.09	52.12	20.41	
10YR	22.40	101.33	129.30	10YR	129.85	78.16	26.96	
25YR	29.52	169.43	183.38	25YR	189.60	120.55	36.49	
50YR	35.65	235.30	229.78	50YR	243.24	160.62	44.76	
100YR	42.41	321.28	287.21	100YR	305.34	208.66	53.57	
200YR	52.10	429.15	349.52	200YR	376.96	265.79	63.87	
500YR	60.29	613.71	464.46	500YR	489.20	358.19	79.12	

## **USGS URBAN REGRESSION EQUATIONS**

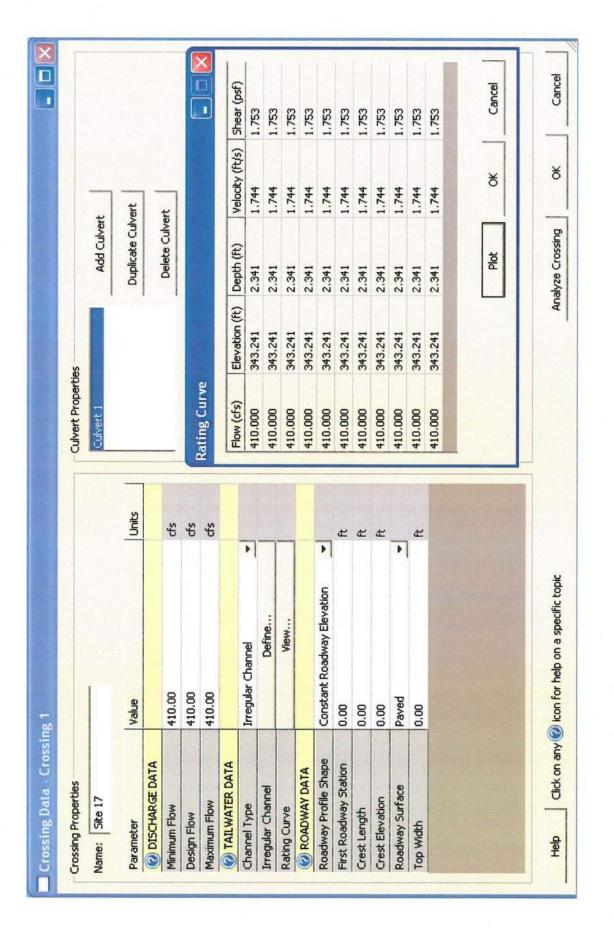
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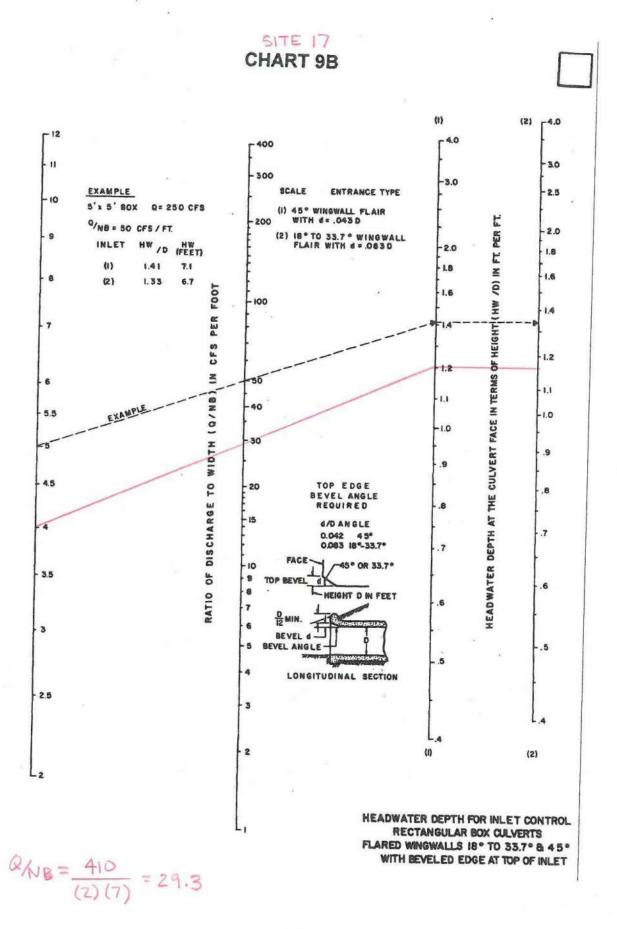
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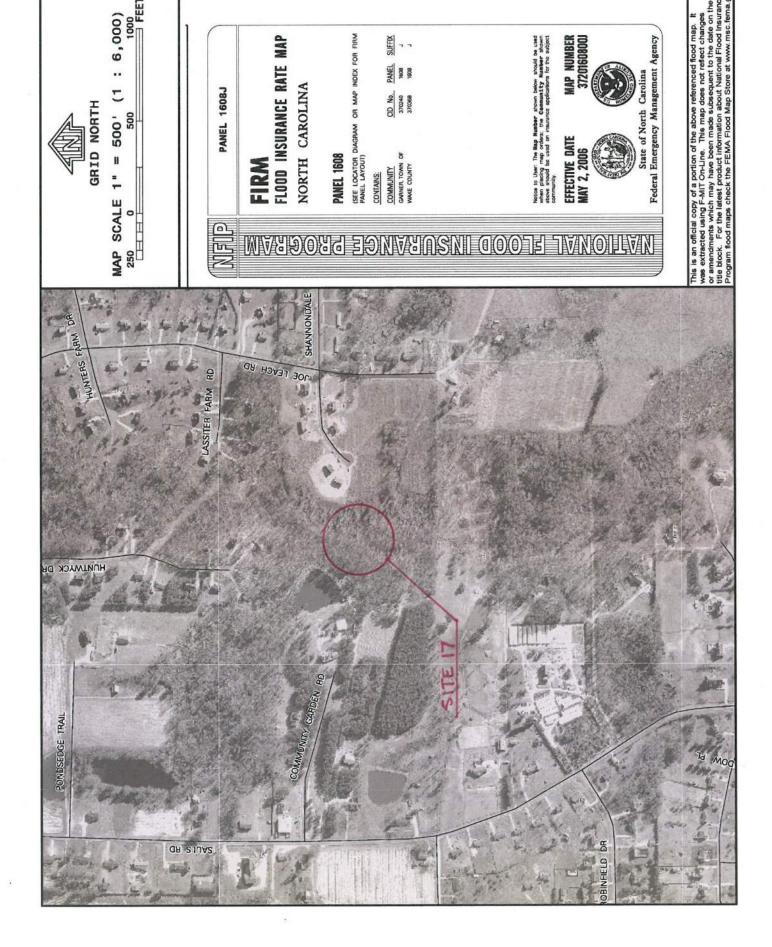
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FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Discharge Used	FREQUENCY	Disharges
	(cfs)	(cfs)	(cfs)			
5YR	101.35	148.60	165.65			
10YR	134.57	208.97	224.09		10YR	1000
25YR	188.50	342.07	351.96		SOYR	
50YR	224.31	413.55	410.57	410	100YR	Residence
100YR	258.08	486.02	468.93		100YR	
200YR	376.80	585.12	627.46	(Based on 2.80xQ10)	500YR	
500YR	492.53	764.84	820.18	(Based on 3.66xQ10)		







			Class		
Name of Stream	Description	Class	Date	Index No.	
Juniper Creek	From source to Little Creek	C;NSW	05/01/88	27-43-15-10-1	
Guffy Branch	From source to Little Creek	C; NSW	05/01/88	27-43-15-10-2	
Ditch Branch	From source to Guffy Branch	C;NSW	05/01/88	27-43-15-10-2-1	
Buffalo Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-11	
Mill Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-12	
Beaverdam Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-13	
Cow Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-14	
Shop Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-15	
Steep Hill Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-16	
Arters Branch	From source to Neuse River	C; NSW	05/01/88	27-44	
Black Creek (Partins Pond, Panther Lake)	From source to dam at Panther Lake	B; NSW	05/01/88	27-45-(1)	
Black Creek	From dam at Panther Lake to mouth of Sassarixa Creek	C;NSW	05/01/88	27-45-(2)	
Little Black Creek	From source to Black Creek	C; NSW	05/01/88	27-45-3	
Hooks Branch	From source to Black Creek	C;NSW	05/01/88	27-45-4	
McCullens Branch (McCullers Branch)	From source to Black Creek	C; NSW	05/01/88	27-45-5	
Camp Branch	From source to Black Creek	C; NSW	05/01/88	27-45-6	
Dicks Branch	From source to Black Creek	C; NSW		27-45-7	
Hardee Mill Branch	From source to Black Creek	C; NSW		27-45-8	
Pole Branch	From source to Black Creek	C; NSW		27-45-9	
Reedy Creek	From source to Black Creek	C; NSW		27-45-10	
Gum Swamp	From source to Black Creek	C; NSW		27-45-11	
Black Creek (Holts Lake)	From mouth of Sassarixa	B;NSW		27-45-(12)	
Black Creek (Hores Bake)	Creek to dam at Holts Lake	2/		Verse appropriate	
Sassarixa Creek (Sassarixa Swamp)	From source to Black Creek	C; NSW	05/01/88	27-45-13	
Black Creek	From dam at Holts Lake to Neuse River	C; NSW	05/01/88	27-45-(14)	
Polecat Branch	From source to Neuse River	C; NSW	05/01/88	27-46	
Mill Branch	From source to Polecat Branch	C; NSW	05/01/88	27-46-1	
Miry Branch	From source to Neuse River	C; NSW	05/01/88	27-47	
Polecat Branch	From source to Neuse River	C; NSW	05/01/88		
Gar Gut	From source to Neuse River	C; NSW	05/01/88		
NEUSE RIVER	From a point 1.7 miles upstream of Bawdy Creek to a point 0.8 mile upstream of Little River	WS-IV;NSW	08/03/92	27-(49.5)	
Bawdy Creek	From source to a point 0.9 mile below Johnston County SR 1007	C;NSW	05/01/88	27-50-(0.5)	
Bawdy Swamp	From source to Bawdy Creek	C; NSW	05/01/88	27-50-1	
Quicosin Swamp	From source to Bawdy Creek	C; NSW		27-50-2	
Bawdy Creek	From a point 0.9 mile below Johnston County SR 1007 to Neuse River	WS-IV;NSW		27-50-(3)	
		1000 (000) 0000	20 (20 (20	00.51	

08/03/92 27-51

From source to Neuse River

Raccoon Swamp

WS-IV;NSW

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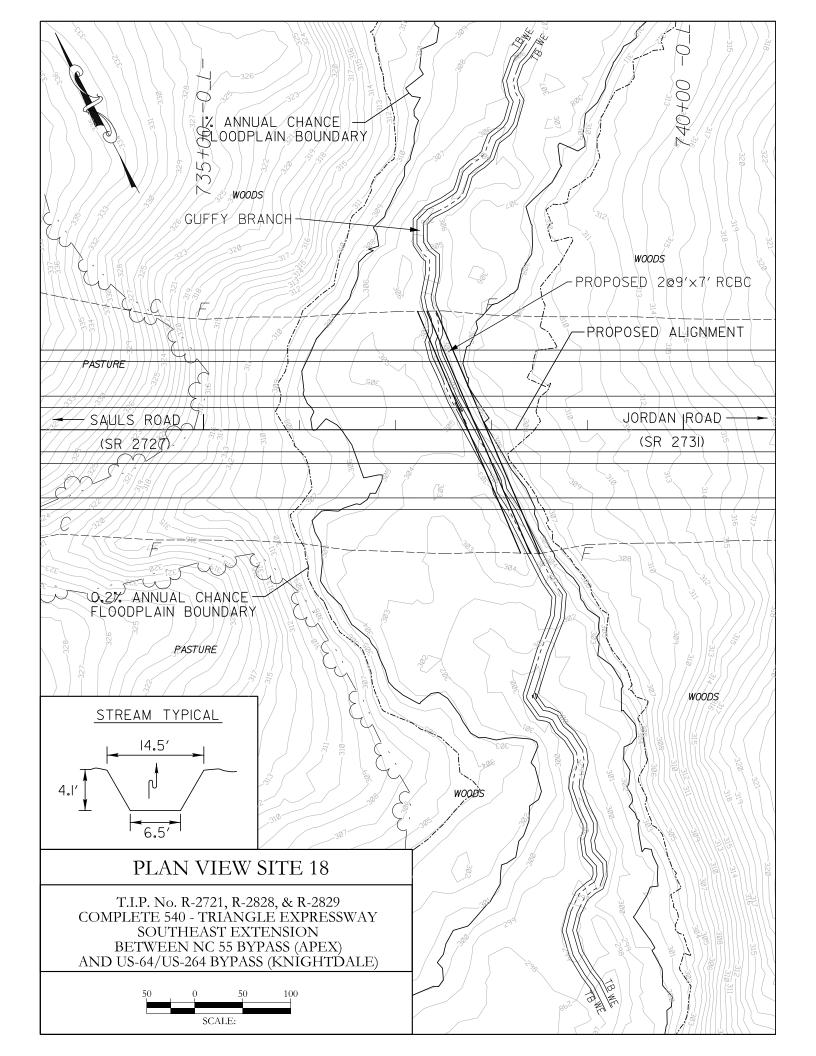
Looking Upstream from Proposed Crossing

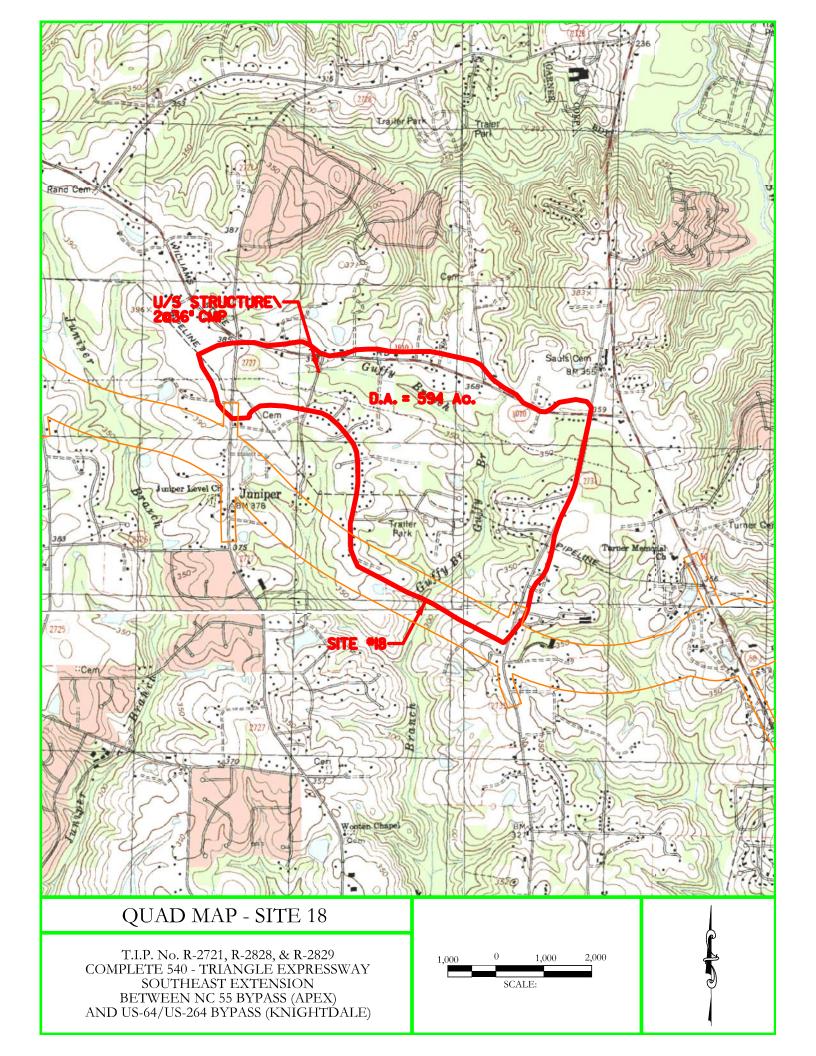


Looking Downstream from Proposed Crossing

Page 1 of 1

## Site 18





	REGION: BLUE RIDGE	Rep. 01-4207
	STREAM NAME: Guffy Branch	METHOD USED:
		sd. miles
	y SE Ext.	0.93
10	NAME: Triangle Expresswa	Drainage Area =
6/8/201	PROJECT NA	ENGLISH

FREQUENCY         Sand Hills         Coastal Plain         Blue Ridge         FREQUENCY         Blue Ridge         Coastal Plain         Sand Hills           (cfs)         (cfs)         (cfs)         (cfs)         (cfs)         (cfs)         (cfs)         (cfs)           2yR         28.16         66.29         136.96         2yR         230.40         123.19         52.75           10yR         61.03         216.06         318.26         445.32         25yR         454.23         269.16         93.29           25yR         81.63         472.06         554.23         686.22         50yR         574.89         351.90         114.13           100yR         119.21         629.87         686.22         100yR         711.96         449.17         161.74           200yR         172.95         1150.60         1080.05         500YR         1110.17         743.35         199.83	<b>USGS RUR</b>	AL REGRE	SSION EQU	ATIONS (OLD)	RUF	SAL EQUA	ATIONS Rep	oort 01-4207
(cfs)     (cfs)       136.96     2YR     128.29       236.23     5YR     128.29       236.23     10YR     318.33       445.32     25YR     454.23       554.23     50YR     574.89       686.22     100YR     711.96       830.58     200YR     868.30       1080.05     500YR     1110.17	FREQUENCY	Sand Hills	Coastal Plain	00	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
136.96       2YR       128.29         236.23       5YR       230.40         318.26       10YR       318.33         445.32       25YR       454.23         554.23       50YR       574.89         686.22       100YR       711.96         830.58       200YR       868.30         1080.05       500YR       1110.17		(cfs)	(cfs)			(cfs)	(cfs)	(cfs)
236.23       5YR       230.40         318.26       10YR       318.33         445.32       25YR       454.23         554.23       50YR       574.89         686.22       100YR       711.96         830.58       200YR       868.30         1080.05       500YR       1110.17	2YR	28.16	66.29		2YR	128.29	61.62	31.81
318.26       10YR       318.33         445.32       25YR       454.23         554.23       50YR       574.89         686.22       100YR       711.96         830.58       200YR       868.30         1080.05       500YR       1110.17	SYR	46.26	142.84		5YR	230.40	123.19	52.75
445.32       25YR       454.23         554.23       50YR       574.89         686.22       100YR       711.96         830.58       200YR       868.30         1080.05       500YR       1110.17	10YR	61.03	216.06		10YR	318.33	179.79	69.30
554.23       50YR       574.89         686.22       100YR       711.96         830.58       200YR       868.30         1080.05       500YR       1110.17	25YR	81.63	348.29		25YR	454.23	269.16	93.29
686.22 100YR 711.96 830.58 200YR 868.30 1080.05 500YR 1110.17	SOYR	99.39	472.06		50YR	574.89	351.90	114.13
830.58 868.30 1080.05 500YR 868.30	100YR	119.21	629.87		100YR	711.96	449.17	136.04
1080.05 1110.17	200YR	146.64	825.55		200YR	868.30	562.91	161.74
	500YR	172.95	1150.60		500YR	1110.17	743.35	199.83

# **USGS URBAN REGRESSION EQUATIONS**

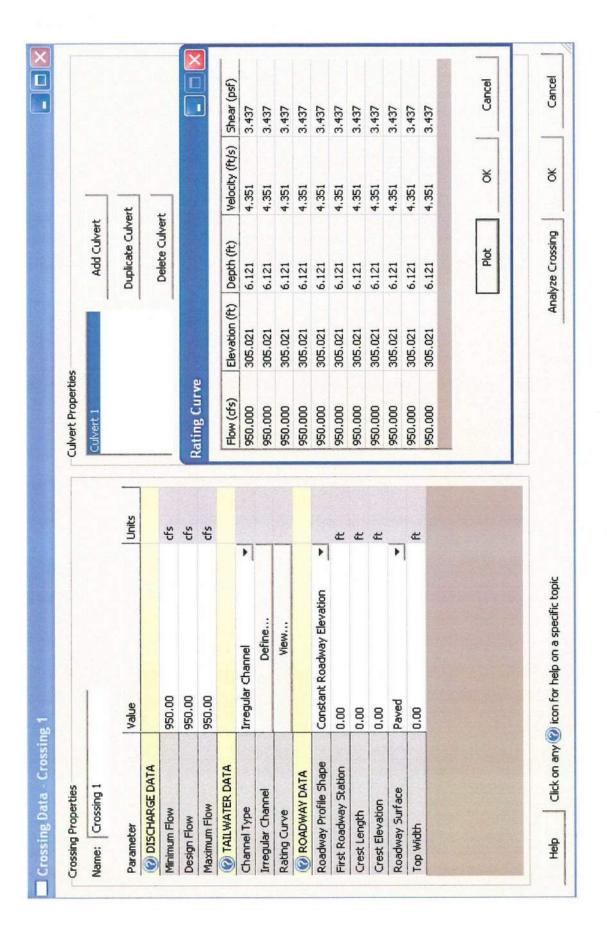
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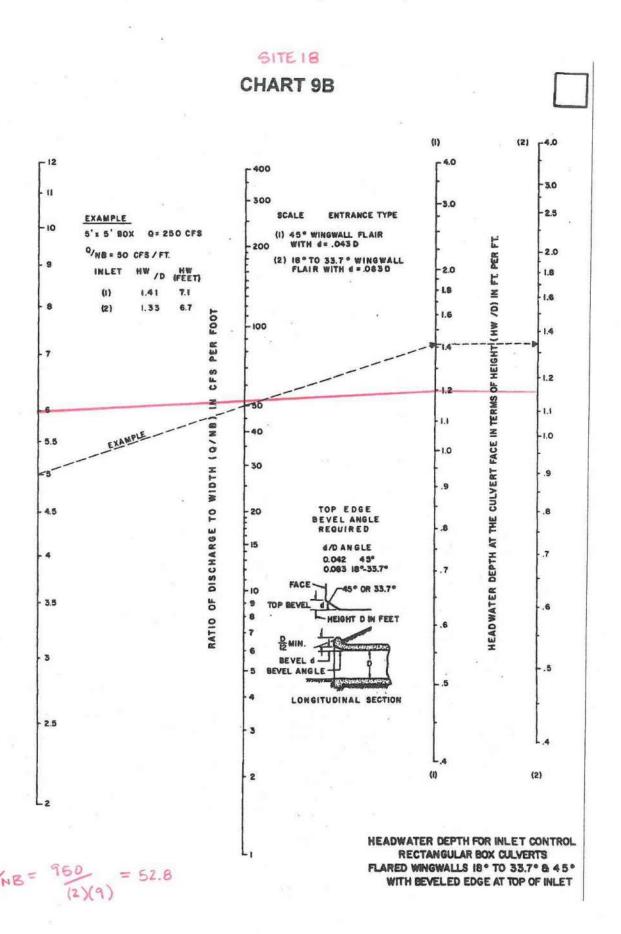
(These Equations are used only for comparison)

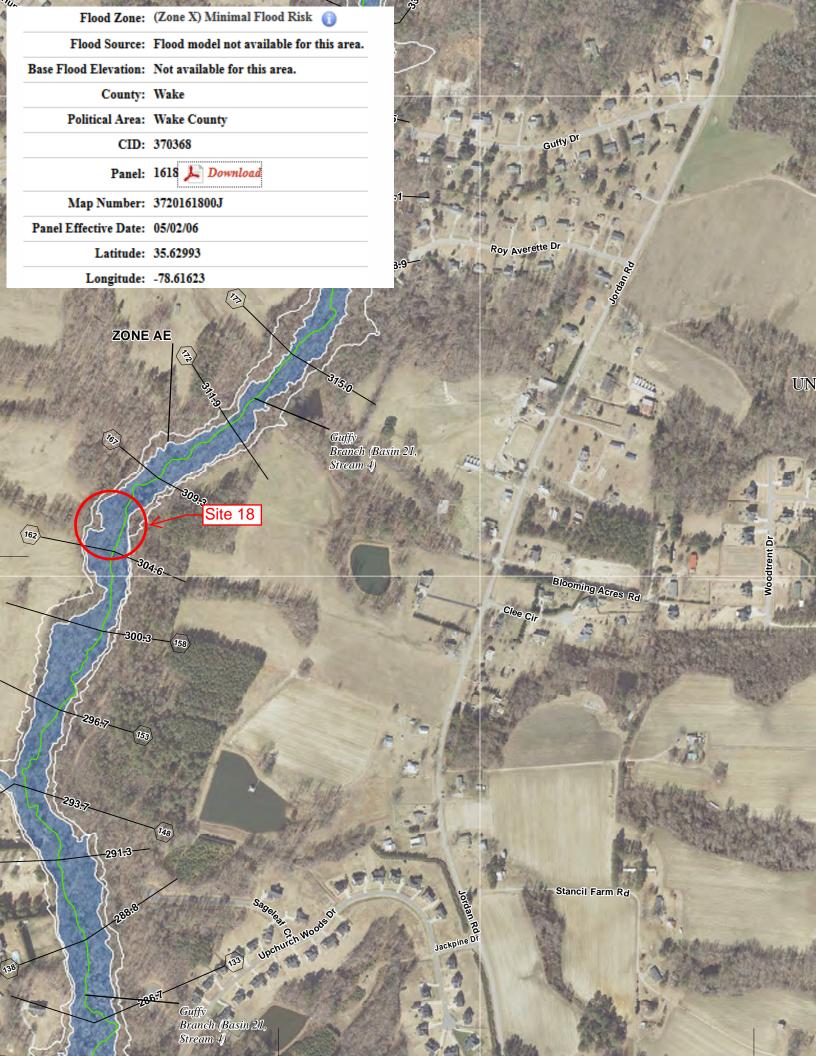
REQUENCY	Sand Hills	Coastal Plain	Blue Ridge	
	(cfs)	(cfs)	(cfs)	
5YR	158.99	383.11	567.22	
10YR	188.52	511.77	694.98	
25YR	229.57	732.82	892.03	
50YR	264.26	933.55	1063.13	
100YR	307.62	1204.53	1292.21	
200YR	527.86	1432.95	1945.93	(Based on 2.80xQ10)
500YR	410.27	1940.55	1842.44	

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FEMA	FREQUENCY Disharges			10YR	50YR	100YR	100YR	500YR	
	Discharge Used					950		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	Blue Ridge	(cfs)	416.68	544.19	805.24	927.95	1047.01	1523.72	1991.72
	Coastal Plain	(cfs)	360.85	487.26	740.34	880.60	1019.61	1364.32	1783.36
20	Sand Hills	(cfs)	261.58	336.68	450.98	531.59	605.86	942.70	1232.24
% Impervious =	FREQUENCY		5YR	10YR	25YR	SOYR	100YR	200YR	500YR



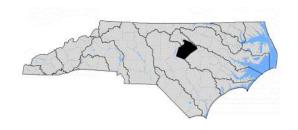




# PRELIMINARY FLOOD INSURANCE STUDY

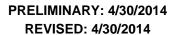
### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

State of North Carolina

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed

Source	Riverin	Riverine Sources		
	From	То		
Buckhorn Creek	The confluence with Harris Reservoir	Approximately 0.5 mile upstream of Honeycutt Road	Rdu Town Of Holly Springs Wake County	
Buffalo Creek (Basin 9, Stream 1)	State Highway 42	The Johnston/Wake County boundary	Rdu Wake County	
Cary Branch	The confluence with Harris Reservoir	Approximately 2.5 miles upstream of Rex Road	Rdu Town Of Holly Springs Wake County	
Guffy Branch (Basin 21, Stream 4)	The confluence with Little Creek (Basin 21, Stream 1)	Approximately 4.3 miles upstream of confluence with Little Creek (Basin 21, Stream 1)	Rdu Wake County	
Harris Reservoir	Entire shoreline within Chatham County	Entire shoreline within Chatham County	Rdu Wake County	
Jim Branch	The confluence with Harris Reservoir	Approximately 0.5 mile upstream of confluence with Harris Reservoir	Rdu Wake County	
Juniper Branch (Basin 21, Stream 2)	The confluence with Little Creek (Basin 21, Stream 1)	Approximately 0.8 mile upstream of Pagen Road	Rdu Wake County	
Little Black Creek	The confluence with Black Creek	Approximately 0.6 mile upstream of Walter Myatt Road	Rdu Wake County	
Little Creek (Into Middle Creek)	The confluence with Middle Creek	Approximately 2.3 miles upstream of the confluence of Juniper Branch	Rdu Wake County	
Marks Creek	The confluence with the Neuse River	Approximately 0.8 mile downstream of Knightdale Eagle Rock Road	Rdu Town Of Clayton Town Of Wendell Wake County	
Nancy Branch	Approximately 0.4 mile upstream of confluence with Panther Creek	Approximately 0.1 miles upstream of Del Webb Avenue	Town Of Cary	
Norris Branch	The confluence with Cary Branch	Approximately 500 feet upstream of Avent Ferry Road	Rdu Town Of Holly Springs Wake County	
Snipes Creek	The confluence with the Little River	Approximately 0.6 mile upstream of State Highway 96	Rdu Town Of Zebulon Wake County	
Thomas Creek	The confluence with Harris Reservoir	Approximately 100 feet downstream of Highway 1	Rdu Wake County	

Table 11, "Stream Name Changes" is not applicable in Wake County.

Site18

This FIS also incorporates the determinations of letters issued by FEMA resulting in map changes (Letters of Map Revision [LOMRs]), as shown in Table 12, "Letters of Map Revision".

**Table 12 - Letters of Map Revision** 

Case Number	Date Issued	Flooding Source/Description	Communities
06-04-C341P	12/3/2007	Marks Creek / 06-04-C341P	Rdu
06-04-C341P	12/3/2007	Marks Creek / 06-04-C341P	Town Of Wendell
07-04-2076P	4/13/2007	Panther Creek / 07-04-2076P	Town Of Cary

### 5.0 Engineering Methods

For the flooding sources in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded at least once on the average during any 10-, 25-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2% annual chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedance) during the term of a 30-year mortgage is approximately 26 percent (about 3 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

**Table 13 - Summary of Discharges** 

Flooding Source	Drainage Area	10% Annual	2% Annual	rges (cfs)	0.20/ 4
Location	(square miles)	Chance	2% Annual Chance	1% Annual Chance	0.2% A Char
Approximately 0.8 mile upstream of Highway 1	0.10	*	*	198	*
Black Creek					
Approximately 0.6 mile downstream of Wake/Johnston County boundary	14.50	*	*	2,130	*
Buckhorn Creek					
Approximately 250 feet upstream of Cass Holt Road	11.40	*	*	3,395	*
Approximately 1,580 feet downstream of Sweet Springs Road	10.20	*	*	3,176	*
Just downstream of Sweet Springs Road	8.70	*	*	2,887	*
Approximately 0.6 mile upstream of Sweet Springs Road	8.50	*	*	2,842	*
Approximately 1.6 miles upstream of Sweet Springs Road	7.90	*	*	2,704	*
Approximately 1.2 miles downstream of Buckhorn Duncan Road	5.90	*	*	2,268	*
Approximately 0.8 mile downstream of Buckhorn Duncan Road	5.60	*	*	2,180	*
Approximately 0.4 mile downstream of Buckhorn Duncan Road	5.30	*	*	2,105	*
Approximately 180 feet downstream of Buckhorn Duncan Road	3.10	*	*	1,508	*
Approximately 1,060 feet upstream of Buckhorn Duncan Road	2.80	*	*	1,429	*
Approximately 0.4 mile upstream of Buckhorn Duncan Road	2.70	*	*	1,396	*
Buffalo Branch (Basin 10, Stream 22)					
At Morphus Bridge Road	0.40	*	*	600	*
Buffalo Creek (Basin 9, Stream 1)					
At County boundary	18.40	*	*	5,300	*
Buffalo Creek West					
At Johnston-Wake County Boundary	1.81	251	442	542	778
Cary Branch	·				
Approximately 0.8 mile downstream of Rex Road	4.50	*	*	1,904	*
Approximately 1,060 feet downstream of Rex Road	4.20	*	*	1,822	*
Just upstream of confluence with Cary Branch Tributary	2.10	*	*	1,188	*
Approximately 1,580 feet upstream of confluence with Cary Branch Tributary	1.70	*	*	1,028	*
Guffy Branch (Basin 21, Stream 4)	·				•
At confluence with Little Creek (Basin 21, Stream 1)	4.02	*	*	1,029	*
t downstream side of Coule Dead	3.32	*	*	923	*
Approximately 0.7 mile upstream of Sauls Road	2.89	*	*	853	*
Approximately 1.3 miles upstream of Sauls Road	2.38	*	*	764	*
Approximately 2.1 miles upstream of Sauls Road	1.84	*	*	660	*
Jim Branch					
Approximately 0.4 mile upstream of confluence with Buckhorn Creek	1.80	*	*	1,082	*
Approximately 0.8 mile upstream of confluence with Buckhorn Creek	1.60	*	*	1,011	*
Approximately 1.2 miles upstream of confluence with Buckhorn Creek	1.20	*	*	816	*
Juniper Branch (Basin 21, Stream 2)					
At confluence with Little Creek (Basin 21, Stream 1)	2.03	*	*	700	*
Approximately 530 feet downstream of Pagan Road	1.59	*	*	607	*
Approximately 1,580 feet upstream of Pagan Road	1.36	*	*	557	*
Approximately 530 feet downstream of Lakefield Drive	1.08	*	*	489	*
Kit Creek					

**Table 16 - Roughness Coefficients** 

Stream	Channel "n"	Overbank "n"
Beaver Creek	0.043 to 0.050	0.100 to 0.200
Beddingfield Creek	0.050	0.130
Big Branch	0.050	0.140
Black Creek	0.025 to 0.060	0.030 to 0.150
Buckhorn Creek	0.040 to 0.048	0.145
ffalo Creek (Basin 9, Stream 1)	0.030 to 0.070	0.035 to 0.140
8 falo\Creek West	0.045 to 0.052	0.030 to 0.140
Cary Branch	0.040	0.140
Guffy Branch (Basin 21, Stream 4)	0.047	0.130
Jim Branch	0.045	0.145
Juniper Branch (Basin 21, Stream 2)	0.045	0.110 to 0.130
Kit Creek	0.030 to 0.070	0.070 to 0.110
Little Beaver Creek	0.045 to 0.055	0.100 to 0.220
Little Black Creek	0.030 to 0.070	0.070 to 0.130
Little Creek (Basin 11, Stream 2)	0.030 to 0.080	0.070 to 0.150
Little Creek (Into Middle Creek)	0.033 to 0.047	0.095 to 0.140
Little River	0.040 to 0.066	0.070 to 0.240
Marks Creek	0.025 to 0.070	0.070 to 0.130
Middle Creek	0.042 to 0.050	0.030 to 0.140
Mill Branch	0.050	0.030 to 0.150
Mill Creek (South)	0.035 to 0.060	0.040 to 0.160
Moccasin Creek	0.030 to 0.070	0.070 to 0.220
Morris Branch	0.030 to 0.050	0.100 to 0.200
Nancy Branch	0.045 to 0.050	0.120 to 0.150
Neuse River	0.035 to 0.060	0.055 to 0.250
Norris Branch	0.048	0.145
Panther Creek	0.030 to 0.070	0.070 to 0.130
Reedy Branch (Basin 27, Stream 5)	0.045 to 0.050	0.100 to 0.200
Snipes Creek	0.042 to 0.045	0.120 to 0.130
Swift Creek	0.040 to 0.072	0.035 to 0.240
Thomas Creek	0.050	0.145
Unnamed Tributary (#1) to Swift Creek	0.045 to 0.060	0.050 to 0.150
White Oak Creek	0.035 to 0.050	0.035 to 0.150

For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained using digital elevation data obtained with LIDAR technology developed as part of the North Carolina Statewide Floodplain Mapping Program. The hydraulic model is prepared using this digital elevation data, without surveying bathymetric or structural data. Where bridge or culvert data are readily available, such as from the North Carolina Department of Transportation, these data have been reflected in the hydraulic model. If these structural data are not readily available, field measurements of these structures were made to approximate their geometry in the hydraulic models. In addition, this method does not include field surveys that determine specifics on channel and floodplain characteristics. A limited detailed study is a "buildable" product that can be upgraded to a fully detailed study at a later date by verifying stream channel characteristics, bridge and culvert opening geometry, and by analyzing multiple recurrence intervals.

The results of the HEC-RAS computations are tabulated for all cross sections (Table 17, "Limited Detailed Flood Hazard Data"). Flood Profiles have not been developed for streams studied by limited detailed methods. Water-surface elevation rasters were developed for steams studied by limited detailed methods. In addition, floodways for streams studied by limited detailed methods are not delineated on the FIRM. However, the 1% annual chance water-surface elevations, flood discharges, and non-encroachment widths from the limited detailed studies for every modeled cross section are given in Table 17. The non-encroachment widths given at modeled cross sections can be used by communities to enforce floodplain management ordinances that meet the requirement defined in 44 CFR 60.3(c)(10).

Between cross sections for streams studied by limited detailed methods, 1% annual chance water-surface elevations can be calculated by mathematical interpolation using the distance along the stream centerline. Non-encroachment widths and, therefore, the location of a non-encroachment area boundary between cross sections should be determined based on either 1) mathematical interpolation, or 2) the non-encroachment width at the upstream or downstream cross section, whichever is larger. If the width determined by this second method is wider than the Special Flood Hazard Area (SFHA) or the 1% annual chance floodplain delineated on the FIRM for this location along the stream, the non-encroachment area shall be considered to

**Table 17 - Limited Detailed Flood Hazard Data** 

	Table 17 - l	<u>-imited Detailed Flo</u>	od Hazard Data	
Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water- Surface Elevation (feet NAVD 88)	Non-Encroachment Width (fe Left/Right from Stream Centerline
046	4,623	1,822	238.7	80 / 197
050	4,961	1,822	239.0	150 / 94
052	5,250	1,188	239.4	33 / 100
057	5,677	1,188	240.2	14 / 53
060	5,969	1,188	241.9	14 / 57
063	6,327	1,188	243.3	14 / 24
069	6,851	1,028	246.3	92 / 14
073	7,303	1,028	248.2	65 / 13
078	7,812	1,028	251.1	13 / 14
Guffy Branch (Basin 21,			201.1	107 14
005	500	1,029	231.31	121 / 97
010	1,028	1,029	233.3	16 / 109
015	1,500	1,029	235.6	23 / 32
021	2,140	923	238.4	-9,999 / -9,999
022	2,175	923	238.4	-9,999 / -9,999
027	2,749	923	241.8	22 / 44
033	3,290	923	246.1	53 / 33
039	3,855	923	247.6	37 / 158
044	4,374	923	249.1	5 / 175
049	4,860	923	250.9	31 / 53
053	5,340	923	252.5	94 / 16
058	5,775	923	253.9	12 / 22
063	6,275	853	256.4	28 / 8
068	6,775	853	258.5	60 / 15
073	7,275	853	260.2	41 / 74
078	7,775	853	262.2	4 / 159
083	8,275	853	264.0	40 / 103
088	8,775	853	266.4	38 / 80
092	9,228	853	268.9	77 / 34
098	9,793	764	271.0	70 / 110
103	10,342	764	272.6	3 / 116
108	10,801	764	275.4	45 / 99
113	11,314	764	278.1	35 / 76
118	11,821	764	280.5	111 / 6
		764		66 / 34
123	12,321	764	282.3	81 / 7
128	12,801	660	284.2	93 / 11
3 3 148	14,269 14,769	517	291.3 293.7	40 / 31
		517		2 / 108
153	15,269	287	296.7	
221	22,065	287	350.5	6/4
226 Jim Branch	22,633		354.7	25 / 45
002	227	1,082	232.21	13 / 147
006	568	1,082	232.21	13 / 80
		1,082	232.21	44 / 20
009	871	1,082	232.21	
012	1,221	1 '	Z3Z.Z '	21 / 45

## **FLOOD INSURANCE STUDY**

### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





**Table 17 - Limited Detailed Flood Hazard Data** 

Table 17 - Limited Detailed Flood Hazard Data								
Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water- Surface Elevation (feet NAVD 88)	Non-Encroachment Width (feet) Left/Right from Stream Centerline				
065	6,522	710	321.2	8 / 10				
072	7,225	710	336.0	10 / 12				
075	7,518	710	336.7	18 / 55				
Fowlers Mill Creek (Basin	10, Stream 12)			T				
006	648	3,101	266.3 <sup>1</sup>	158 / 90				
011	1,086	3,101	266.31	191 / 90				
015	1,472	3,101	266.3 <sup>1</sup>	100 / 125				
020	2,033	3,101	266.3	50 / 150				
026	2,584	3,101	267.2	200 / 90				
030	3,023	3,101	267.9	170 / 80				
039	3,949	3,101	272.6	37 / 200				
044	4,390	3,101	274.2	209 / 202				
050	5,048	3,101	275.9	209 / 202				
055	5,530	3,101	277.5	209 / 202				
071	7,092	2,556	286.0	431 / 273				
081	8,130	1,590	286.1	276 / 428				
088	8,753	1,590	289.9	35 / 30				
093	9,275	1,590	298.5	48 / 126				
098	9,787	1,373	301.9	116 / 50				
103	10,335	1,373	308.5	30 / 50				
107	10,653	1,373	312.6	26 / 35				
Guffy Branch (Basin 21, S	tream 4)							
005	500	1,029	231.3 <sup>1</sup>	121 / 97				
010	1,028	1,029	233.3	16 / 109				
015	1,500	1,029	235.6	23 / 32				
027	2,749	923	241.8	22 / 44				
033	3,290	923	246.1	53 / 33				
039	3,855	923	247.6	37 / 158				
044	4,374	923	249.1	5 / 175				
049	4,860	923	250.9	31 / 53				
053	5,340	923	252.5	94 / 16				
058	5,775	923	253.9	12 / 22				
063	6,275	853	256.4	28 / 8				
068	6,775	853	258.5	60 / 15				
073	7,275	853	260.2	41 / 74				
078	7,775	853	262.2	4 / 159				
083	8,275	853	264.0	40 / 103				
088	8,775	853	266.4	38 / 80				
092	9,228	853	268.9	77 / 34				
098	9,793	764	271.0	70 / 110				
103	10,342	764	272.6	3 / 116				
108	10,801	764	275.4	45 / 99				
113	11,314	764	278.1	35 / 76				
118	11,821	764	280.5	111 / 6				
123	12,321	764	282.3	66 / 34				
128	12,801	764	284.2	81 / 7				
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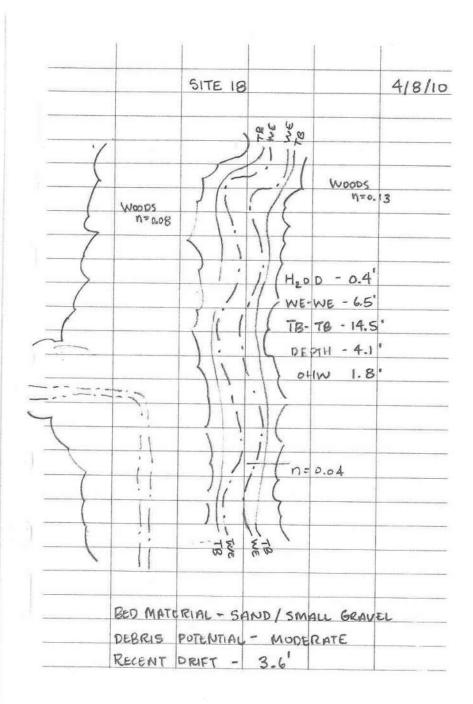
**Table 17 - Limited Detailed Flood Hazard Data** 

		Limited Detailed Floo				
Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water- Surface Elevation (feet NAVD 88)	Non-Encroachment Width Left/Right from Strean Centerline		
133	13,331	660	286.7	7 / 128		
138	13,812	660	288.8	49 / 51		
143	14,269	660	291.3	93 / 11		
1 <mark>.</mark> 48	14,769	517	293.7	40 / 31		
8 53	15,269	517	296.7	2 / 108		
158	15.793	517	300.3	2 / 99		
162	16,224	517	304.6	2 / 61		
167	16,728	517	309.3	46 / 26		
172	17,234	452	311.9	22 / 4		
177	17,734	452	315.0	50 / 10		
183	18,276	410	318.9	4 / 27		
187	18,745	410	323.1	8 / 14		
192	19,212	410	328.5	17 / 13		
197	19,743	287	331.8	27/9		
202	20,196	287		4/7		
		287	336.3			
206	20,648	287	341.5	20 / 60		
211	21,068	287	344.7	14 / 13		
216	21,565	287	347.7	15 / 90		
221	22,065	287	350.5	6 / 4		
226	22,633	201	354.7	25 / 45		
Hodges Creek (Basin 8,		2,390				
154	15,401	2,390	221.9	120 / 50		
160	15,980	2,390	223.6	52 / 27		
163	16,293	2,390	226.0	18 / 143		
170	16,975	2,390	229.8	17 / 21		
175	17,537	2,390	234.8	39 / 65		
180	18,008	· ·	236.8	20 / 173		
183	18,307	1,880	237.7	29 / 92		
191	19,054	1,880	247.9	102 / 23		
195	19,534	1,880	254.2	34 / 48		
200	19,952	1,780	267.4	34 / 27		
204	20,369	1,780	273.2	21 / 41		
209	20,933	1,780	277.4	53 / 41		
214	21,377	1,780	280.9	29 / 25		
222	22,160	1,780	290.5	93 / 130		
226	22,626	1,450	290.6	212 / 86		
230	23,047	1,450	290.8	154 / 64		
235	23,516	1,450	291.8	90 / 156		
241	24,117	1,450	295.5	170 / 33		
246	24,623	1,450	300.1	15 / 100		
250	25,030	1,450	302.7	132 / 43		
255	25,521	816	304.5	185 / 48		
262	26,210	816	308.5	12 / 32		
269	26,852	816	313.8	92 / 51		
273	27,336	756	317.4	76 / 12		

NEUSE RIVER BASIN

2B .0300 SITE 18

			Class	
Name of Stream	Description	Class	Date	Index No.
Juniper Creek	From source to Little Creek	C; NSW	05/01/88	27-43-15-10-1
Guffy Branch	From source to Little Creek	C; NSW	05/01/88	27-43-15-10-2
Ditch Branch	From source to Guffy Branch	C; NSW	05/01/88	27-43-15-10-2-1
Buffalo Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-11
Mill Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-12
Beaverdam Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-13
Cow Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-14
Shop Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-15
Steep Hill Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-16
Arters Branch	From source to Neuse River	C; NSW	05/01/88	27-44
Black Creek (Partins Pond, Panther Lake)	From source to dam at Panther Lake	B;NSW	05/01/88	27-45-(1)
Black Creek	From dam at Panther Lake to mouth of Sassarixa Creek	C;NSW	05/01/88	27-45-(2)
Little Black Creek	From source to Black Creek	C; NSW	05/01/88	27-45-3
Hooks Branch	From source to Black Creek	C; NSW	05/01/88	27-45-4
McCullens Branch (McCullers Branch)	From source to Black Creek	C;NSW	05/01/88	27-45-5
Camp Branch	From source to Black Creek	C; NSW	05/01/88	27-45-6
Dicks Branch	From source to Black Creek	C; NSW	05/01/88	
Hardee Mill Branch	From source to Black Creek	C; NSW	05/01/88	
Pole Branch	From source to Black Creek	C; NSW	05/01/88	
Reedy Creek	From source to Black Creek	C; NSW		27-45-10
Gum Swamp	From source to Black Creek	C; NSW	05/01/88	
Black Creek (Holts Lake)	From mouth of Sassarixa	B; NSW	05/01/88	
Black Creek (noits bake)	Creek to dam at Holts Lake	B, N3W	03/01/00	27-43-(12)
Sassarixa Creek (Sassarixa Swamp)	From source to Black Creek	C; NSW	05/01/88	27-45-13
Black Creek	From dam at Holts Lake to Neuse River	C;NSW	05/01/88	27-45-(14)
Polecat Branch	From source to Neuse River	C; NSW	05/01/88	27-46
Mill Branch	From source to Polecat Branch	C; NSW	05/01/88	
Miry Branch	From source to Neuse River	C:NSW	05/01/88	27-47
Polecat Branch	From source to Neuse River	C; NSW	05/01/88	
Gar Gut	From source to Neuse River	C; NSW	05/01/88	
NEUSE RIVER	From a point 1.7 miles upstream of Bawdy Creek to a point 0.8 mile upstream of Little River	WS-IV;NSW		27-(49.5)
Bawdy Creek	From source to a point 0.9 mile below Johnston County SR 1007	C;NSW	05/01/88	27-50-(0.5)
Bawdy Swamp	From source to Bawdy Creek	C; NSW	05/01/88	27-50-1
Quicosin Swamp	From source to Bawdy Creek	C; NSW	05/01/88	
Bawdy Creek	From a point 0.9 mile below Johnston County SR 1007 to Neuse River	WS-IV;NSW		27-50-(3)
Raccoon Swamp	From source to Neuse River	WS-IV; NSW	08/03/92	27-51



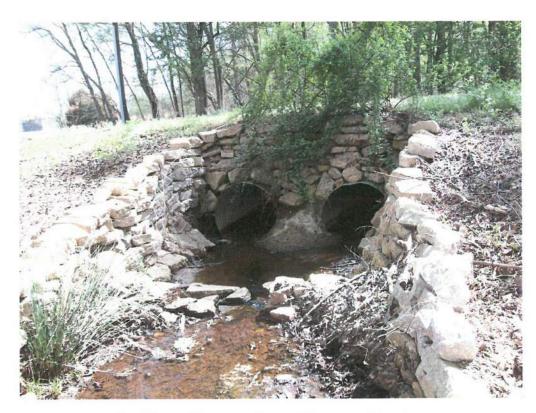


Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing

Page 1 of 3



Looking at Upstream Face of Upstream Structure (2 @ 36" RCP)

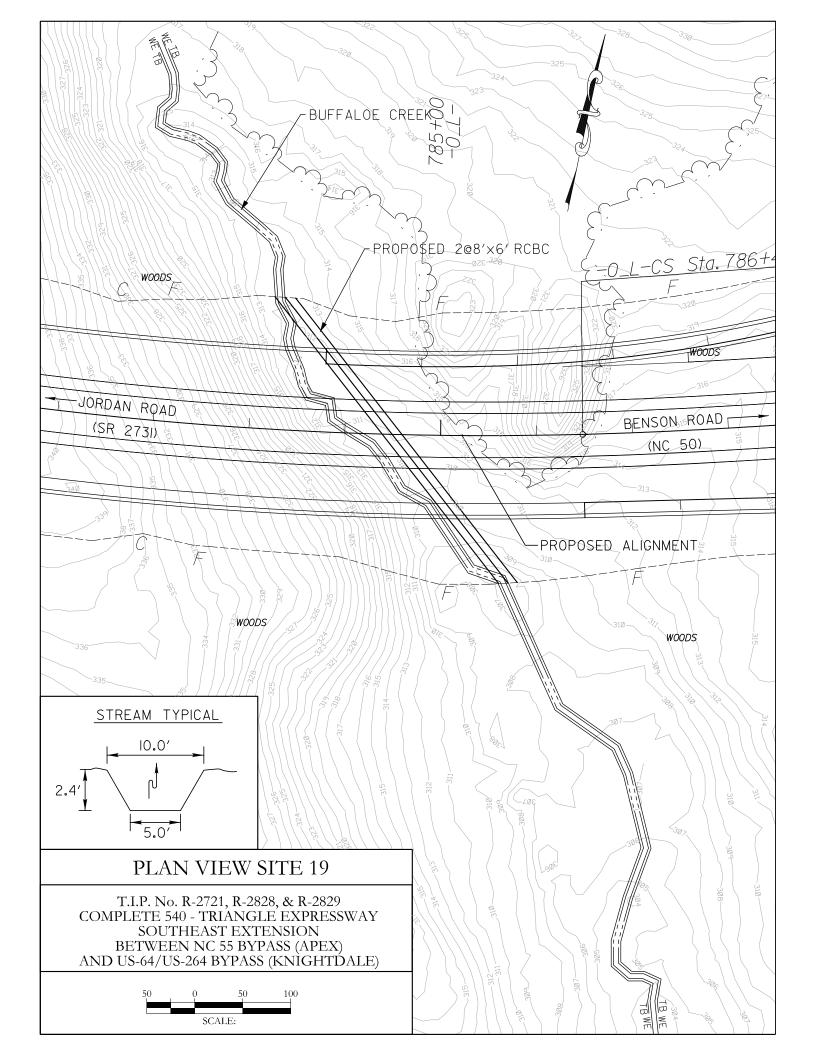


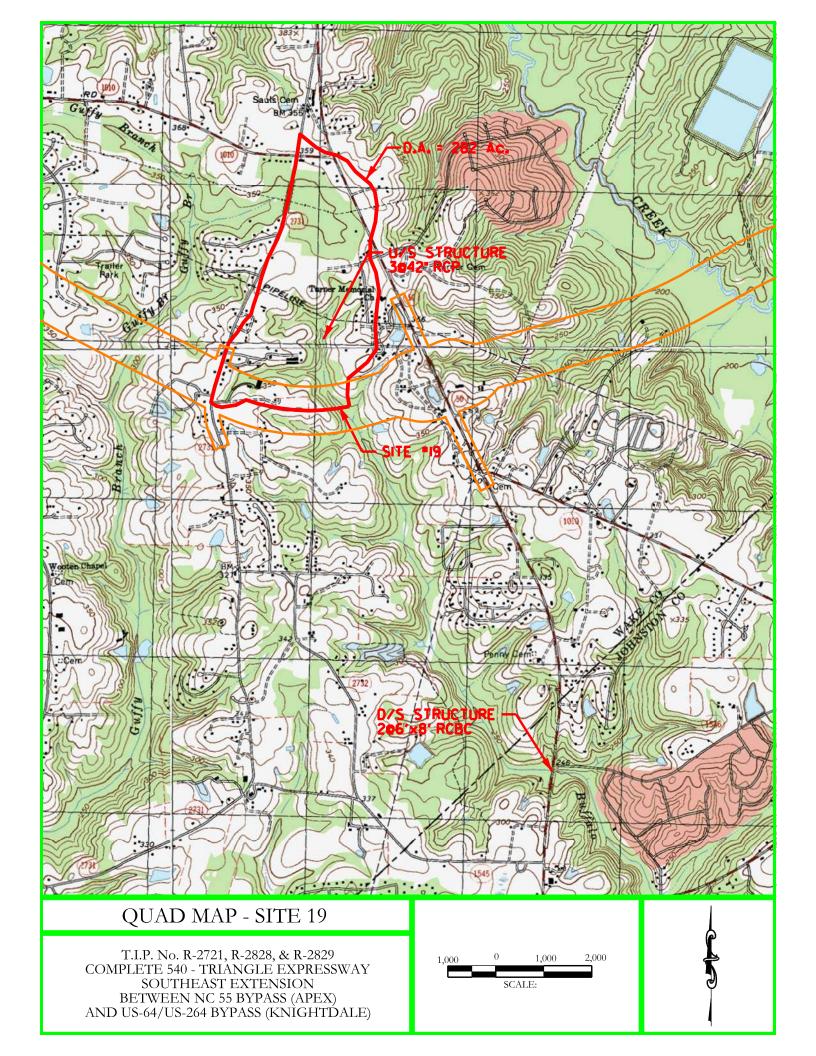
Looking at Downstream Face of Upstream Structure



Looking at Downstream Channel of Upstream Structure

## Site 19





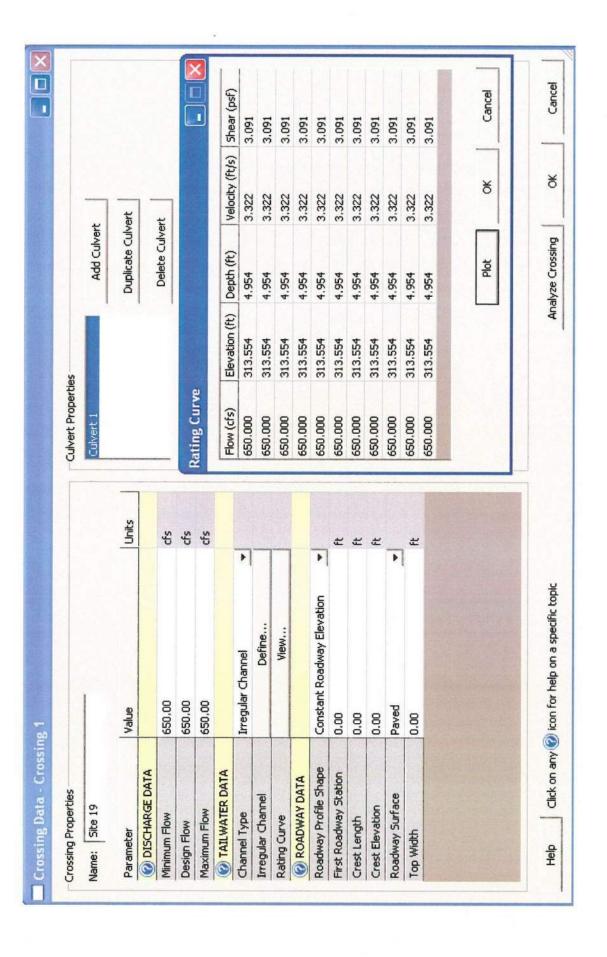
	Site #19		
		<b>REGION: BLUE RIDGE</b>	Rep. 01-4207
North Carolina		STREAM NAME: Buffalo Creek West	METHOD USED:
Nor			sq. miles
		xpressway SE Ext.	0.44
	<b>214</b>	<b>30JECT NAME: Triangle Express</b>	Drainage Area =
	6/17/2014	PROJECT	ENGLISH

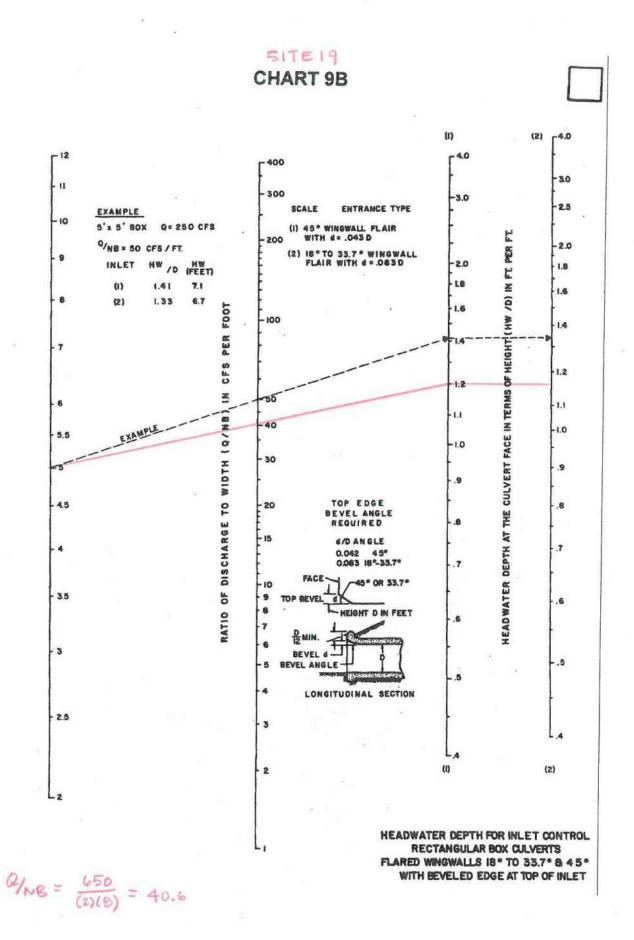
<b>USGS RUR</b>	<b>JSGS RURAL REGRESSION EQU</b>	SSION EQU	ATIONS (OLD)	RUR	SAL EQUA	TIONS Rep	RURAL EQUATIONS Report 01-4207
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cfs)	(cts)	(cfs)		(cfs)	(cts)	(cfs)
2YR	16.27	41.31	81.66	2YR	75.86	37.23	18.67
5YR	26.62	92.40	143.08	5YR	138.81	76.59	31.21
10YR	35.08	142.19	193.48	10YR	193.96	113.47	41.14
25YR	46.53	233.90	272.76	25YR	280.31	172.69	55.54
50YR	56.40	321.31	340.74	50YR	357.43	228.15	68.05
100YR	67.35	434.22	424.10	100YR	445.98	294.06	81.29
200YR	82.78	575.11	514.86	200YR	547.59	371.85	96.80
500YR	96.62	813.03	677.56	500YR	705.91	496.59	119.77

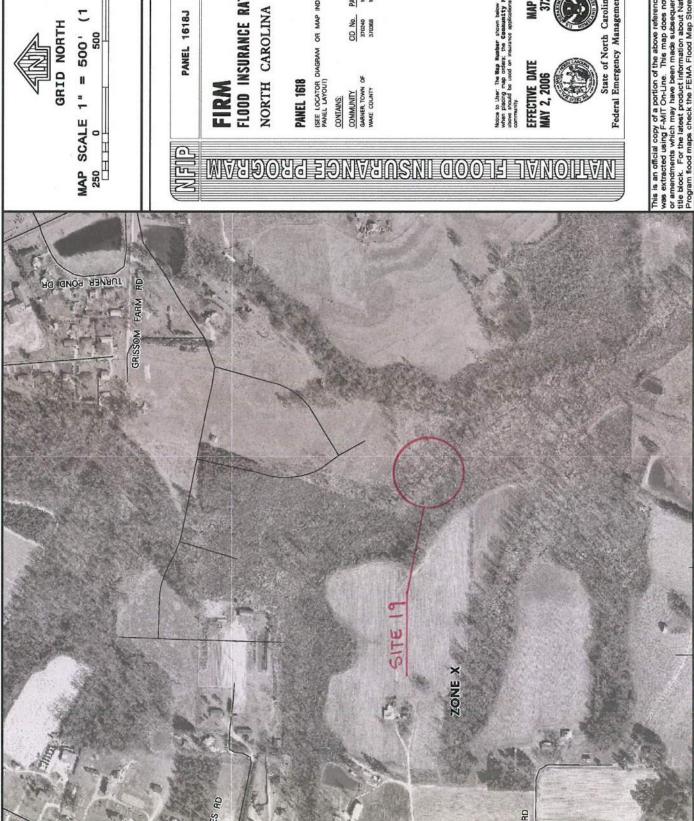
# **USGS URBAN REGRESSION EQUATIONS**

										(Based on 2.80xQ10)	
ノニくつぎょ			Blue Ridge	(cfs)	337.78	416.11	538.65	640.77	778.40	1165.11	1115.17
COOR CARANTAL CARACTERISTS		for comparison)	<b>Coastal Plain</b>	(cfs)	240.17	326.24	476.33	611.02	793.60	913.46	1294.95
		are used only	Sand Hills	(cfs)	66.06	107.98	130.88	149.27	172.15	302.34	225.79
2000	BDF= 11	(These Equations are used only for comparison)	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

	FEMA	FREQUENCY Disharges		10YR	50YR	100YR	100YR	500YR	
IS (% Impervious) USGS Fact Sheet 007-00		面	) (cis) 11 284.37			56 646.00 650	39 727.61	70 1046.93 (Based on 2.80xQ10)	15 1368.49 (Based on 3.66xQ10)
<b>IC REGRESSION EQUATIONS (%</b>		Sand Hills Coastal Plain	(CIS) (CIS) 176.00 251.11						832.84 1253.15
NC REGRES	% Impervious =	FREQUENCY	\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\	10YR	25YR	50YR	100YR	200YR	500YR









GRID NORTH

(000'9:

**PANEL 1618J** 

**FIRM** FLOOD INSURANCE RATE MAP NORTH CAROLINA

PANEL 1618

(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT) CONTAINS

COMMUNITY GARNER, TOWN OF WAKE COUNTY

MAP NUMBER 3720161800J EFFECTIVE DATE MAY 2, 2006

State of North Carolina Federal Emergency Management Agency

.0315

NEUSE RIVER BASIN

5	TE	E	19

			Class	
Name of Stream	Description	Class	Date	Index No.
uniper Creek	From source to Little Creek	C; NSW	05/01/88	27-43-15-10-1
auffy Branch	From source to Little Creek	C; NSW	05/01/88	27-43-15-10-2
Ditch Branch	From source to Guffy Branch	C; NSW	05/01/88	27-43-15-10-2-1
Buffalo Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-11
ill Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-12
eaverdam Branch	From source to Middle Creek	C;NSW	05/01/88	27-43-15-13
Cow Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-14
Shop Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-15
Steep Hill Branch	From source to Middle Creek	C; NSW		27-43-15-16
Arters Branch	From source to Neuse River	C; NSW	05/01/88	27-44
Black Creek (Partins Pond, Panther Lake)	From source to dam at Panther Lake	B;NSW	and the second	27-45-(1)
Black Creek	From dam at Panther Lake to mouth of Sassarixa Creek	C;NSW	05/01/88	27-45-(2)
ittle Black Creek	From source to Black Creek	C; NSW	05/01/88	27-45-3
looks Branch	From source to Black Creek	C;NSW	05/01/88	27-45-4
McCullens Branch (McCullers Branch)	From source to Black Creek	C; NSW	05/01/88	27-45-5
Camp Branch	From source to Black Creek	C; NSW	05/01/88	27-45-6
Dicks Branch	From source to Black Creek	C; NSW	05/01/88	
Mardee Mill Branch	From source to Black Creek	C; NSW	05/01/88	
Pole Branch	From source to Black Creek	C; NSW	05/01/88	
Reedy Creek	From source to Black Creek	C; NSW	05/01/88	
Sum Swamp	From source to Black Creek	C; NSW	05/01/88	
Glack Creek (Holts Lake)	From mouth of Sassarixa	B; NSW	05/01/88	
stack creek (notes bake)	Creek to dam at Holts Lake	2,11011	33, 32, 33	
Sassarixa Creek (Sassarixa Swamp)	From source to Black Creek	C; NSW	05/01/88	27-45-13
Black Creek	From dam at Holts Lake to Neuse River	C; NSW	05/01/88	27-45-(14)
Polecat Branch	From source to Neuse River	C; NSW	05/01/88	27-46
Mill Branch	From source to Polecat Branch	C; NSW	05/01/88	27-46-1
Aire Branch	From source to Neuse River	C; NSW	05/01/88	27-47
Airy Branch		C; NSW	05/01/88	
Polecat Branch	From source to Neuse River From source to Neuse River	C;NSW	05/01/88	
Gar Gut NEUSE RIVER	From source to Neuse River From a point 1.7 miles upstream of Bawdy Creek to a point 0.8 mile upstream of Little River	WS-IV;NSW	and the same of the same	27-(49.5)
Bawdy Creek	From source to a point 0.9 mile below Johnston County SR 1007	C;NSW	05/01/88	27-50-(0.5)
Bawdy Swamp	From source to Bawdy Creek	C;NSW	05/01/88	27-50-1
Quicosin Swamp	From source to Bawdy Creek	C; NSW	05/01/88	27-50-2
Bawdy Creek	From a point 0.9 mile below Johnston County SR 1007 to Neuse River	WS-IV;NSW	08/03/92	27-50-(3)
Raccoon Swamp	From source to Neuse River	WS-IV; NSW	08/03/92	27-51

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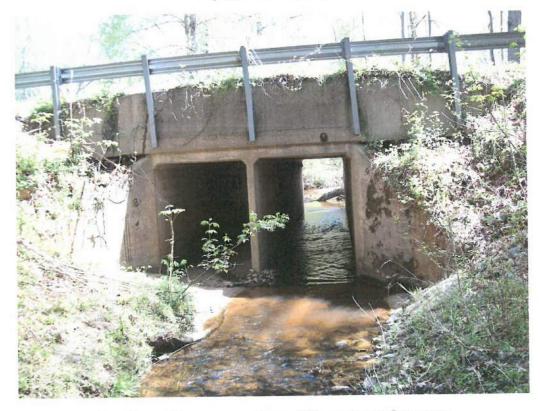
Looking Upstream from Proposed Crossing



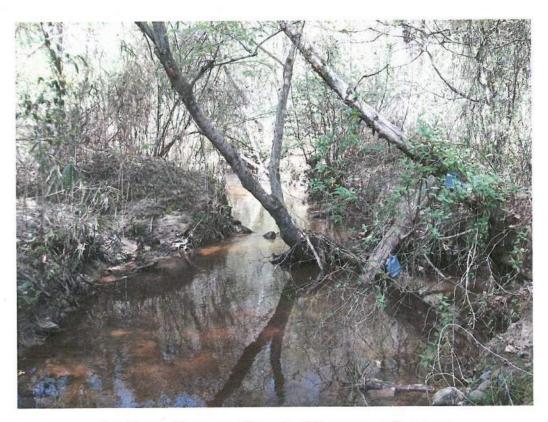
Looking Downstream from Proposed Crossing



Looking at Upstream Face of Downstream Structure (2 @ 6' x 8' RCBC)

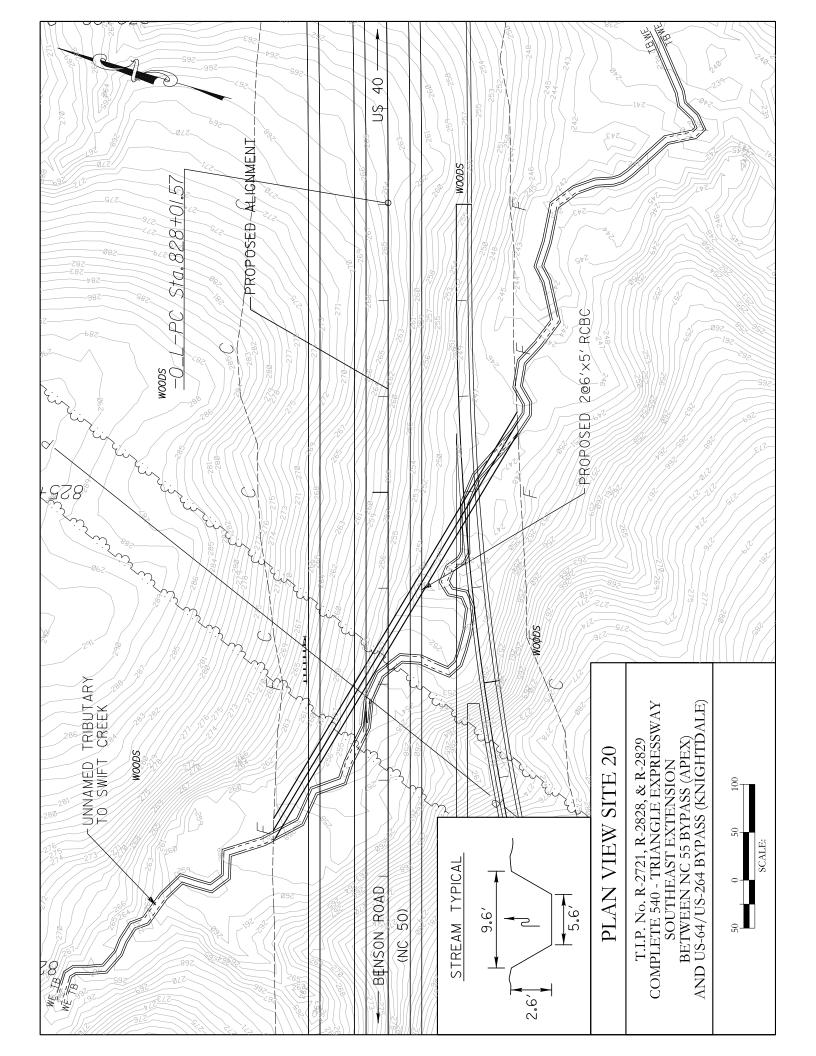


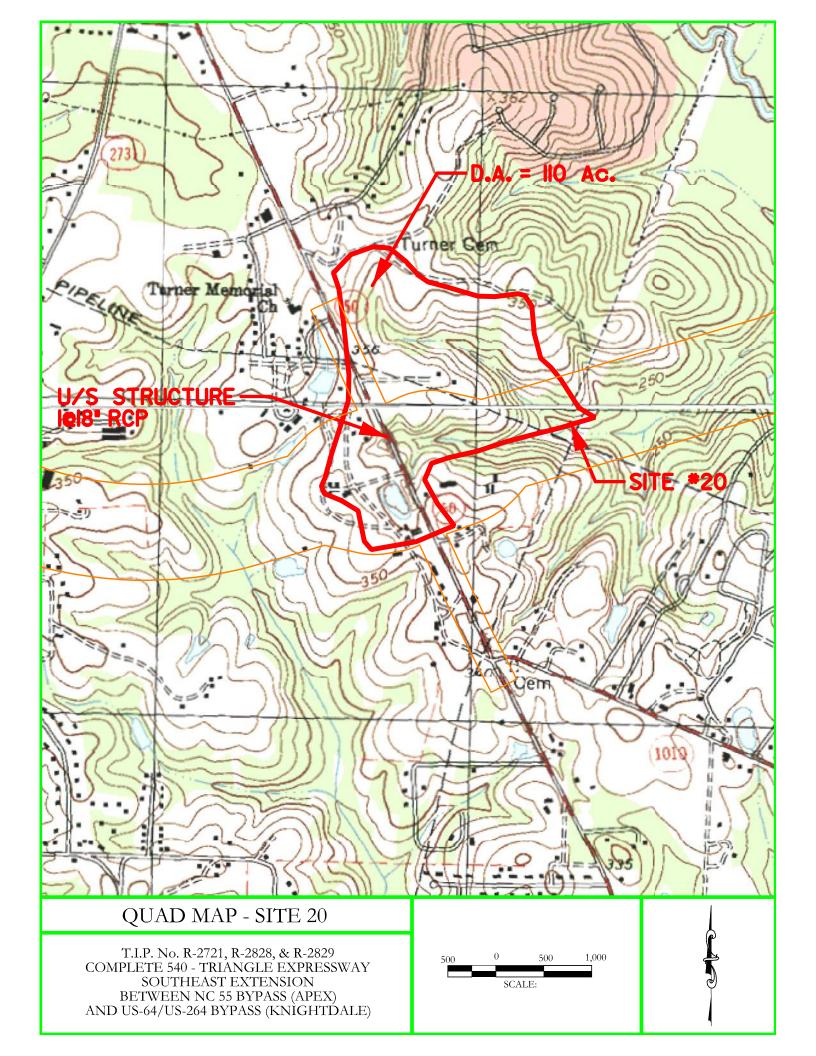
Looking at Downstream Face of Downstream Structure



Looking at Upstream Channel of Downstream Structure

# Site 20





7/8/2010

PROJECT NAME: Triangle Expressway SE Ext.

ENGLISH Drainage Area = 0.17

STREAM NAME: Unnamed Trib to Swift Creek sq. miles

REGION: BLUE RIDGE

01-4207	
Rep.	
USED:	
400	

Drainage Area = 0.	0.17 sq. miles		METHOD USED:	: Rep. 01-4207	
SGS RURAL REGRESSION EQUATION	S	ONS (OLD) RUI	RAL EQUA	ATIONS Rep	oort 01-4207
Sand Hills Coastal Plain Blue Ridge	dg	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
(cfs)	_		(cts)	(cts)	(cfs)
22.65	02	2YR	38.91	19.63	9.49
53.13		SYR	72.92	41.87	16.03
		10YR	103.35	63.22	21.20
141.03		25YR	151.79	98.26	28.73
197.08	1.5	SOYR	195.40	131.55	35.27
32.60 270.67 230.10		100YR	246.14	171.66	42.26
363.31		200YR	304.82	219.57	50.41
522.97		500YR	397.08	297.43	62.50

# **USGS URBAN REGRESSION EQUATIONS**

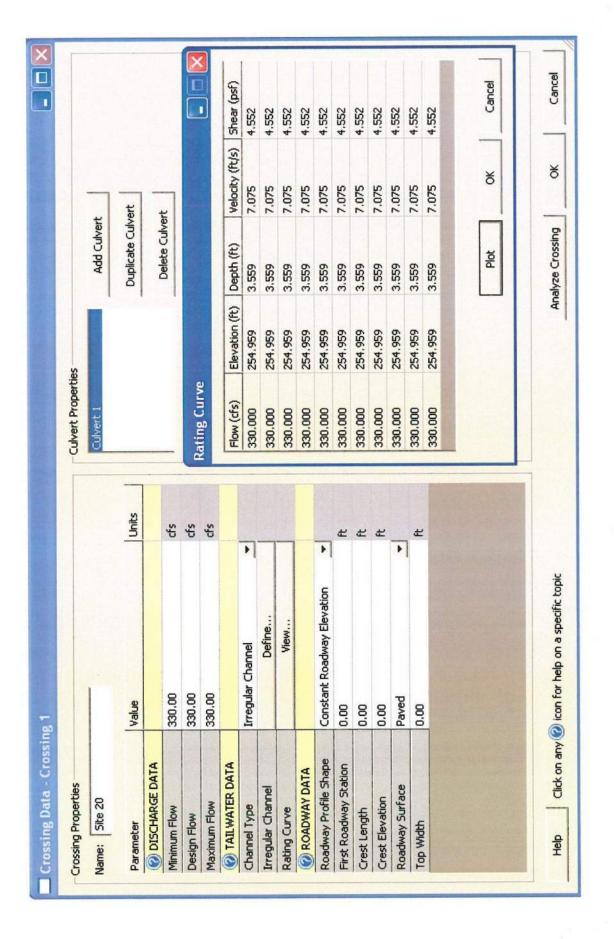
BDF=

(These Equations are used only for comparison)

FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	
	(cts)	(cts)	(cts)	
5YR	44.78	132.68	174.82	
10YR	53.19	184.10	216.85	
25YR	64.09	275.54	283.76	
50YR	72.24	356.58	336.75	
100YR	82.33	467.02	408.78	
200YR	148.93	515.49	607.18	(Based on 2.80xQ10
SOOVR	105.72	774.52	589.22	

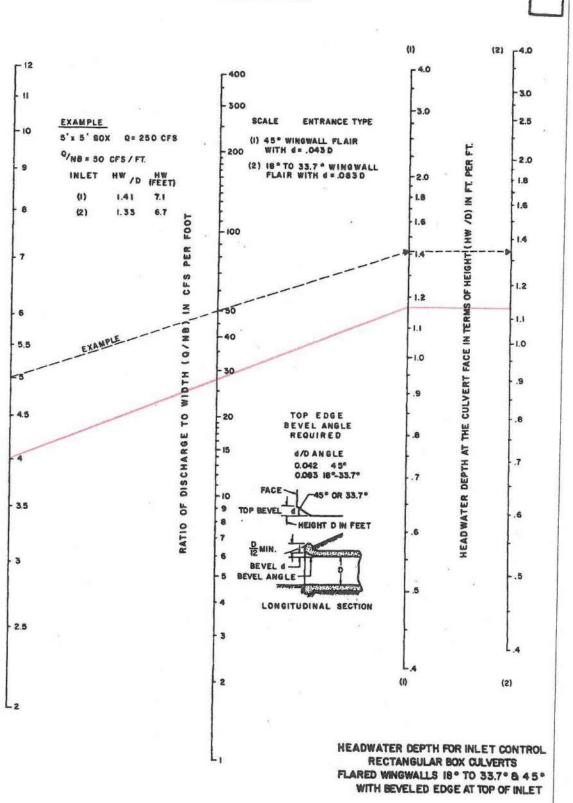
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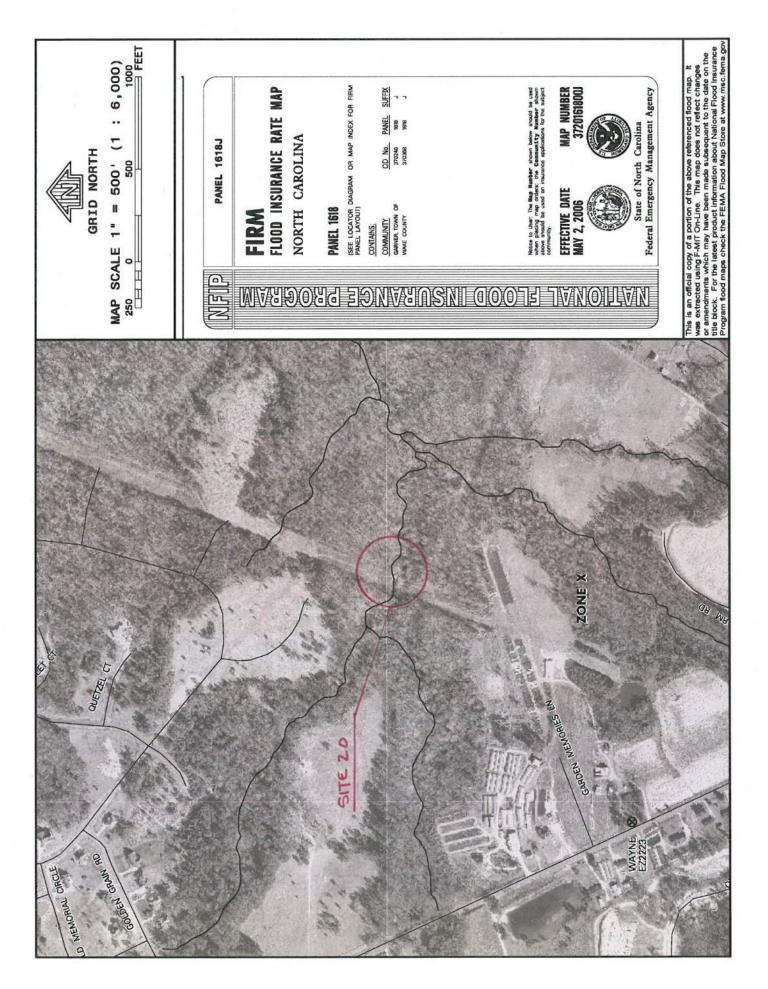
FREQUENCY         Sand Hills         Coastal Plain         Blue Ridge         Discharge Used         FREQUENCY         Disharge           5YR         (cfs)         (cfs)	% Impervious =	20				FEN	EMA
(cfs)         (cfs)         (cfs)           79.61         118.55         130.98           106.55         168.46         178.79           150.96         281.03         285.09           180.07         341.16         333.60           207.69         402.47         382.21           298.35         471.68         500.60         (Based on 2.80xQ10)           389.98         616.55         654.36         (Based on 3.66xQ10)	FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Discharge Used	FREQUENCY	Disharges
79.61 118.55 130.98 106.55 168.46 178.79 150.96 281.03 285.09 180.07 341.16 333.60 330 207.69 402.47 382.21 298.35 471.68 500.60 (Based on 2.80xQ10) 389.98 616.55 654.36 (Based on 3.66xQ10)		(cfs)	(cfs)	(cfs)			
106.55     168.46     178.79       150.96     281.03     285.09       180.07     341.16     333.60       207.69     402.47     382.21       298.35     471.68     500.60     (Based on 2.80xQ10)       389.98     616.55     654.36     (Based on 3.66xQ10)	5YR	79.61	118.55	130.98			
150.96 281.03 285.09 180.07 341.16 333.60 330 207.69 402.47 382.21 298.35 471.68 500.60 (Based on 2.80xQ10) 389.98 616.55 654.36 (Based on 3.66xQ10)	10YR	106.55	168.46	178.79		10YR	
180.07 341.16 333.60 330 207.69 402.47 382.21 298.35 471.68 500.60 (Based on 2.80xQ10) 389.98 616.55 654.36 (Based on 3.66xQ10)	25YR	150.96	281.03	285.09		50YR	
207.69 402.47 382.21 298.35 471.68 500.60 (Based on 2.80xQ10) 389.98 616.55 654.36 (Based on 3.66xQ10)	50YR	180.07	341.16	333.60	330	100YR	2000
298.35 471.68 500.60 (Based on 2.80xQ10) 389.98 616.55 654.36 (Based on 3.66xQ10)	100YR	207.69	402.47	382.21		100YR	
389.98 616.55 654.36 (	200YR	298.35	471.68	500.60	(Based on 2.80xQ10)	500YR	10000
	SUOYR	389.98	616.55	654.36	(Based on 3.66xQ10)		



SITE 20







.0315 NEUSE RIVER BASIN

SITE 20

			Class	
Name of Stream	Description	Class	Date	Index No.
Unnamed Tributary to Swift Creek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)
Innamed Tributary to Swift reek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)
wift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)
Buck Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)
Buck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)
Reedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)
Reedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)
Swift Creek	From dam at Lake Benson to Neuse River	C;NSW	05/01/88	27-43-(8)
Mahlers Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-9
Neal Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-10
White Oak Creek (Austin Pond)	From source to Swift Creek	C; NSW	05/01/88	27-43-11
Little Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-12
Cooper Branch	From source to Swift Creek	C;NSW	05/01/88	27-43-13
STATE OF THE STATE	From source to Swift Creek	C; NSW	05/01/88	27-43-14
Middle Creek	From source to backwaters of Sunset Lake	C;NSW	05/01/88	27-43-15-(1)
Middle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	27-43-15-(2)
Basal Creek [(Bass Lake, (Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	27-43-15-3
Middle Creek	From dam at Sunset Lake to Swift Creek	C; NSW	05/01/88	27-43-15-(4)
Rocky Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-4.5
Camp Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-5
Bells Lake	Entire lake and connecting stream to Middle Creek	C;NSW	05/01/88	27-43-15-6
Mills Branch	From source to Middle Creek	C;NSW	05/01/88	27-43-15-7
Terrible Creek (Johnsons Pond)	From source to dam at Johnsons Pond	B;NSW	05/01/88	27-43-15-8-(1)
Terrible Creek	From dam at Johnsons Pond to Middle Creek	C;NSW	05/01/88	27-43-15-8-(2)
Panther Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-9

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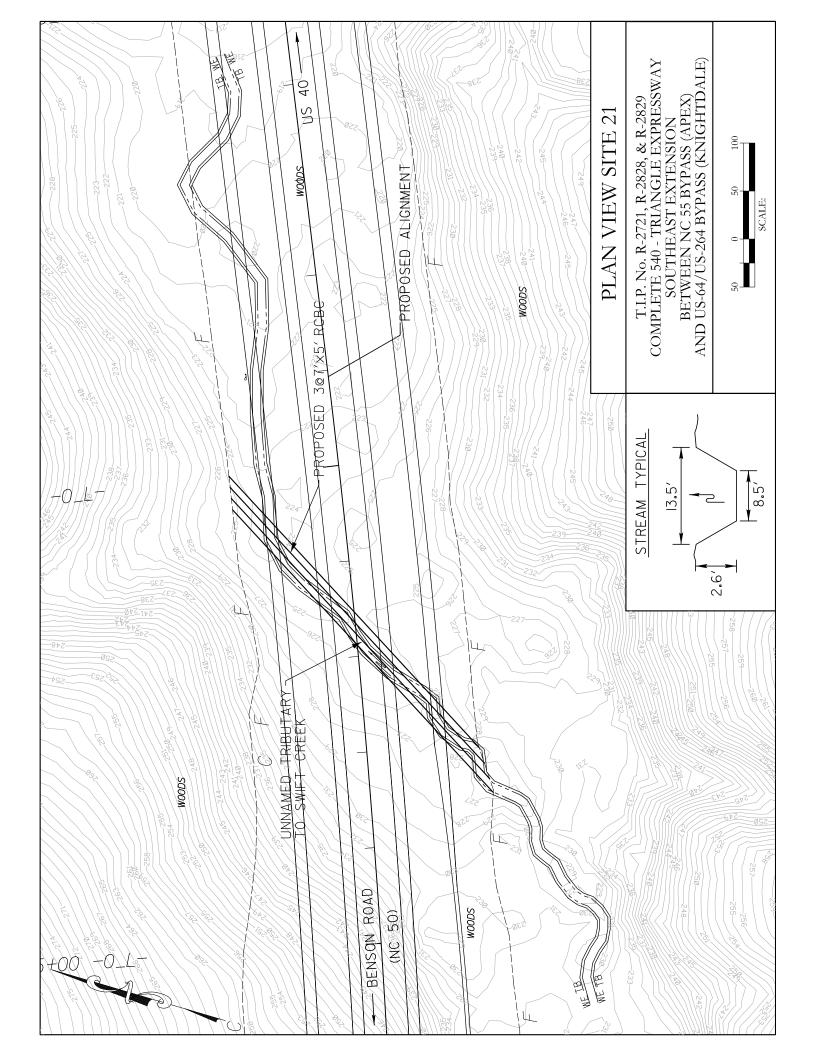
Looking Upstream from Proposed Crossing

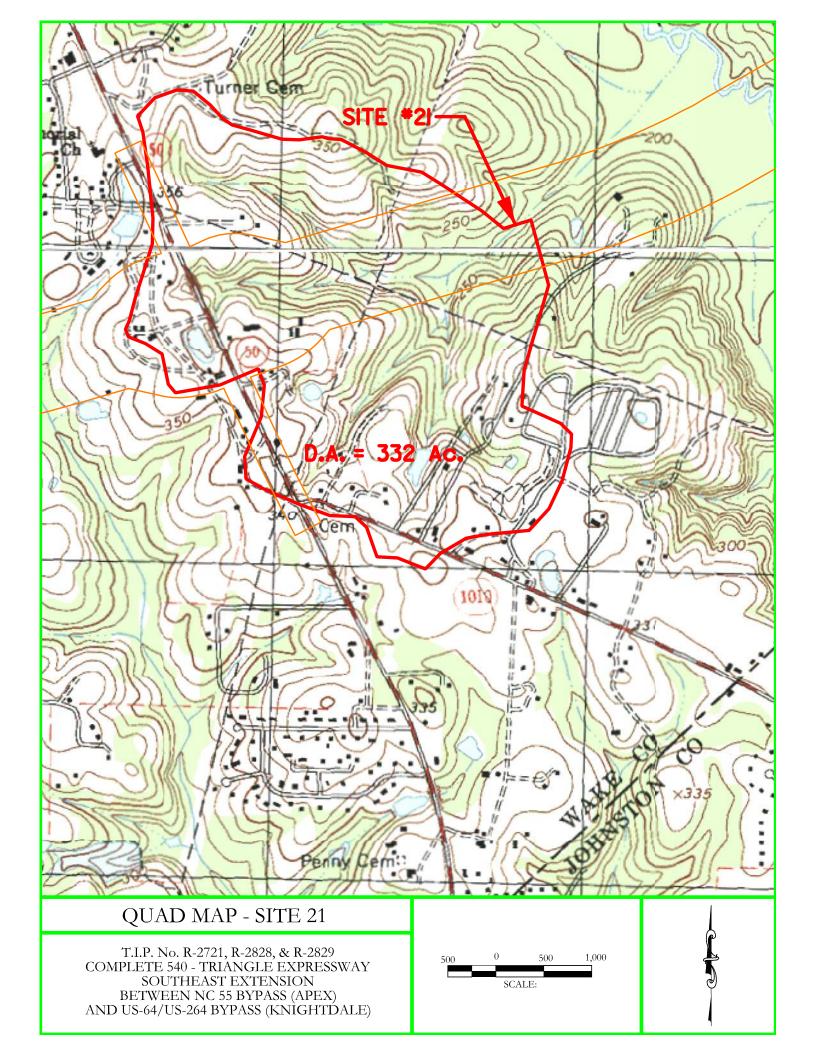


Looking Downstream from Proposed Crossing

Page 1 of 1

# Site 21





REGION: BLUE RIDGE Rep. 01-4207 METHOD USED: STREAM NAME: Unnamed Tributary to Swift Creek sq. miles PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = 7/8/2010 ENGLISH

USGS RUR	AL REGRE	SSION EQU	ATIONS (OLD)	RUR	AL EQUA	TIONS Rep	ort 01-4207
FREQUENCY Sand Hills	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cfs)	(cfs)	(cfs)		(cfs)	(cts)	(cfs)
2YR	18.39	45.91	91.65	2YR	85.30	41.67	21.03
5YR	30.12	101.84	160.02	5YR	155.44	85.16	35.09
10YR	39.69	156.11	216.22	10YR	216.64	125.75	46.21
25YR	52.75	255.64	304.30	25YR	312.20	190.68	62.35
50YR	64.00	350.12	379.82	50YR	397.43	251.32	76.37
100YR	76.50	471.81	472.19	100YR	495.06	323.22	91.19
200YR	94.05	623.44	572.86	200YR	606.94	407.91	108.55
500YR	110.03	878.56	751.88	500YR	780.98	543.38	134.27

# **USGS URBAN REGRESSION EQUATIONS**

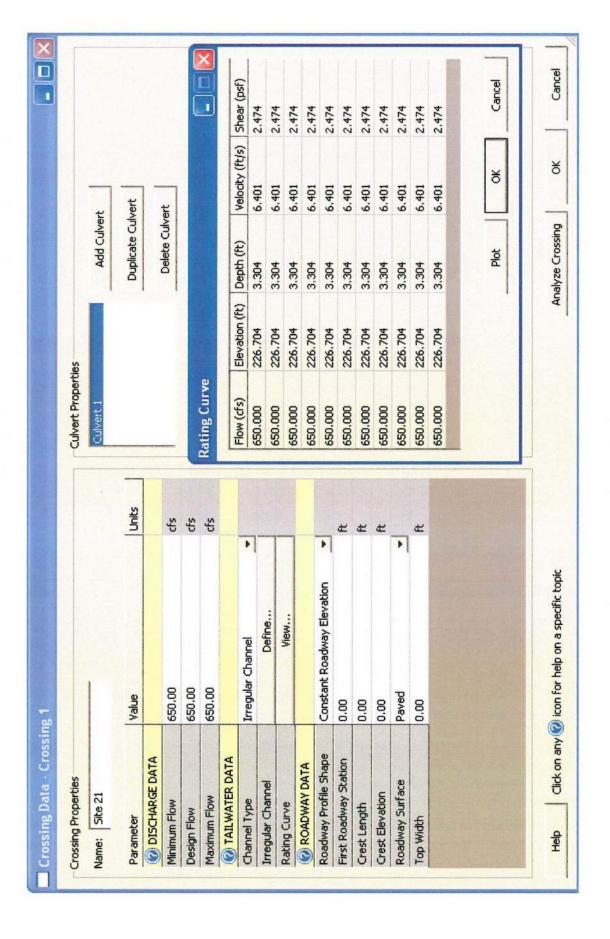
BDF=

								(Based on 2.80xQ10)	
	8	(cfs)							1247.42
for comparison)	Coastal Plain	(cfs)	266.56	360.73	524.41	671.66	871.06	1010.04	1417.31
s are used only	Sand Hills	(cfs)	103.07	122.28	148.37	169.57	195.97	342.39	257.99
(These Equation	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR 257.99 1417.31

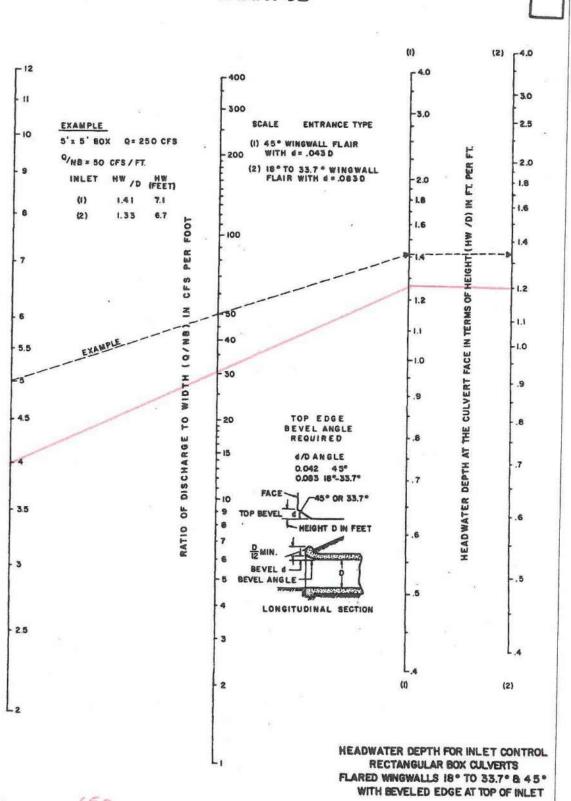
002-00	F	FREQUENCY			10YR	SOYR	100YR	100YR	500YR	
IONS (% Impervious) USGS Fact Sheet 007-00		Blue Ridge Discharge Used					650		(Based on 2.80xQ10)	(Based on 3.66xQ10)
Impervior		Blue Ridge	(cfs)	280.46	371.85	564.50	653.93	741.70	1041.19	1360.99
		Coastal Plain	(cfs)	246.58	338.81	531.52	636.64	741.87	948.67	1240.05
SSION EQUA	20	Sand Hills	(cfs)	174.13	227.14	310.15	367.07	420.06	635.98	831.32
NC REGRES	% Impervious =	FREQUENCY		SYR	10YR	25YR	50YR	100YR	200YR	500YR

Disharges

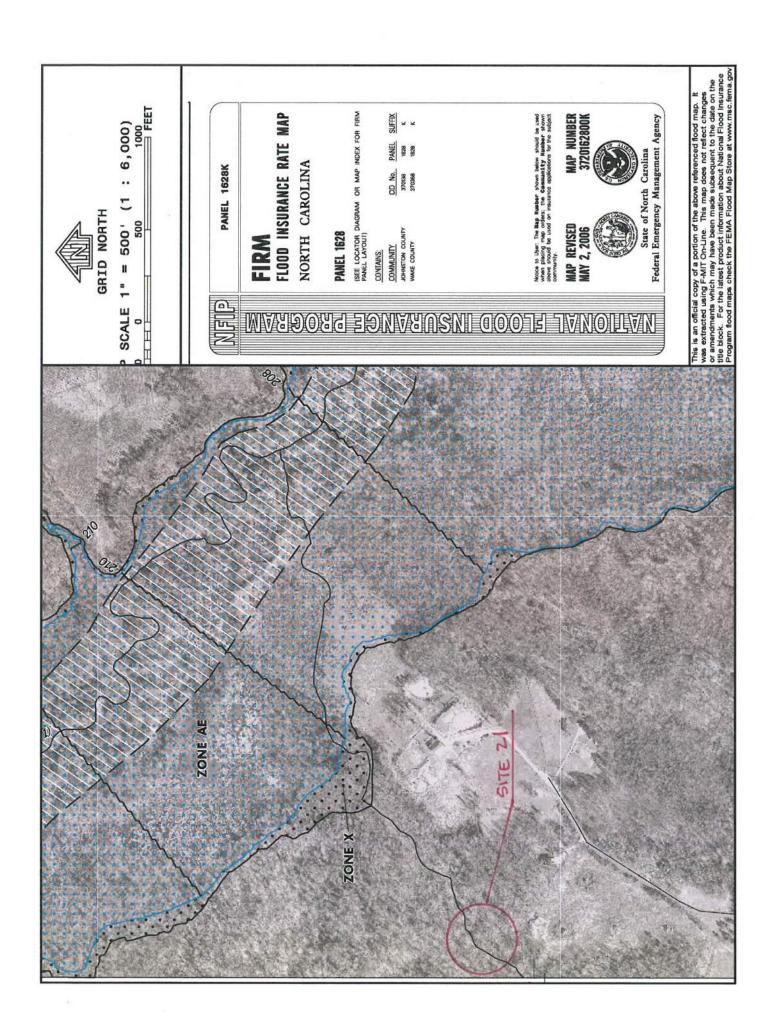
FEMA



## **CHART 9B**



 $Q_{NB} = \frac{650}{(3)(7)} = 31.0$ 



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NEUSE RIVER BASIN

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		2
		4

V			Class	
Name of Stream	Description	Class	Date	Index No.
Unnamed Tributary to Swift Creek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)
Unnamed Tributary to Swift Creek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)
Swift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)
Buck Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)
Buck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)
Reedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)
Reedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)
Swift Creek	From dam at Lake Benson to Neuse River	C;NSW	05/01/88	27-43-(8)
Mahlers Creek	From source to Swift Creek	C;NSW	05/01/88	27-43-9
Neal Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-10
White Oak Creek (Austin Pond)	From source to Swift Creek	C; NSW	05/01/88	27-43-11
Little Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-12
Cooper Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-13
Reedy Branch (Little Branch)	From source to Swift Creek	C; NSW	05/01/88	27-43-14
Middle Creek	From source to backwaters of Sunset Lake	C; NSW	05/01/88	27-43-15-(1)
Middle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B; NSW	05/01/88	27-43-15-(2)
Basal Creek [(Bass Lake, (Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	27-43-15-3
Middle Creek	From dam at Sunset Lake to Swift Creek	C;NSW	05/01/88	27-43-15-(4)
Rocky Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-4.5
Camp Branch	From source to Middle Creek	C; NSW		27-43-15-5
Bells Lake	Entire lake and connecting stream to Middle Creek	C;NSW	05/01/88	27-43-15-6
Mills Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-7
Terrible Creek (Johnsons Pond)	From source to dam at Johnsons Pond	B; NSW	05/01/88	27-43-15-8-(1)
Terrible Creek	From dam at Johnsons Pond to Middle Creek	C; NSW	05/01/88	27-43-15-8-(2)
Panther Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-9
Little Creek	From source to Middle Creek	C; NSW		27-43-15-10

# PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wales PROJECT NUMBER R 2721 6 R 2020
COUNTY Wake PROJECT NUMBER R-2721 & R-2828
STREAM <u>Unnamed Tributary to Swift Creek</u> ROUTE <u>New Location</u> (Site 21)
ASSESSMENT PREPARED BY Mulkey, INC. DATE 6/11/2010 (MLH)
HYDROLOGIC EVALUATION
NEAREST GAGING STATION ON THIS STREAM (NONE $\underline{X}$ )
ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: Yes
FLOOD DATA: $Q_{10} \ \underline{370} \ \text{CFS}  \text{EST. BKWTR.} \ \underline{N/A} \ \text{FT.}  Q_{25} \ \underline{600} \ \text{CFS}  \text{EST. BKWTR.} \ \underline{N/A} \ \text{FT.} \\ Q_{50} \ \underline{650} \ \text{CFS}  \text{EST. BKWTR.} \ \underline{N/A} \ \text{FT.}  Q_{100} \ \underline{750} \ \text{CFS}  \text{EST. BKWTR.} \ \underline{N/A} \ \text{FT.} \\ Q_{500} \ \underline{1,400} \ \text{CFS}  \text{EST. BKWTR.} \ \underline{N/A} \ \text{FT.}$
DRAINAGE AREA 0.52 Sq.Mi. METHOD USED TO COMPUTE Q: USGS Urban Regression
PROPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: LOW MODERATE X HIGH
COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: YES NO X
EXPLANTION: A maximum one foot rise in the natural base flood is allowed, but this rise should not affect any existing insurable structures.
LIST BUILDINGS IN FLOOD PLAIN: None LOCATION:
UPSTREAM LAND USE Residential
ANTICIPATE ANY CHANGE? No
ANY FLOOD ZONING? (FIA STUDIES, ETC.) YES $\underline{X}$ NO
TYPE OF STUDY: FEMA – FEMA – non-regulated Zone X
REGULATORY FLOODWAY WIDTH N/A
COMMENTS:

## TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 19,600 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 49,100 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? $\underline{\text{N/A}}$
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS  NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Wehadkee TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service

## **ENVIRONMENTAL CONSIDERATIONS**

LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: <u>Culvert is buried 1 foot to allow for fish passage.</u>

### MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED
ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
ALTERNATIVES
RECOMMENDED DESIGN <u>3@7'x5' RCBC</u>
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING <u>84 Sq. Ft.</u>
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO $\underline{X}$ DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR A maximum one foot rise in the natural base flood.
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:

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		11/1/	BEAVER	VAIM
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BED M	ATERIAL -	SILT		
	IS POTEN		MaDeadTe	м
			TOPERRIE	-
KECKN	TPRIFT	= N/a		



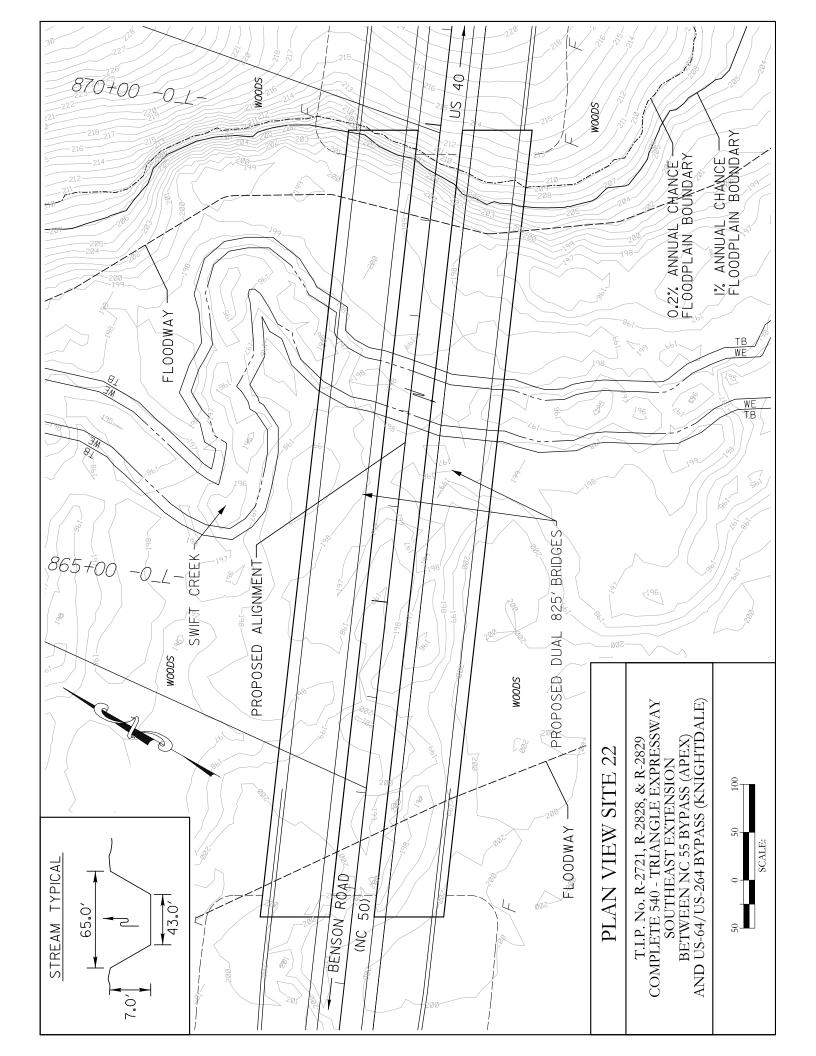
Looking Upstream from Proposed Crossing

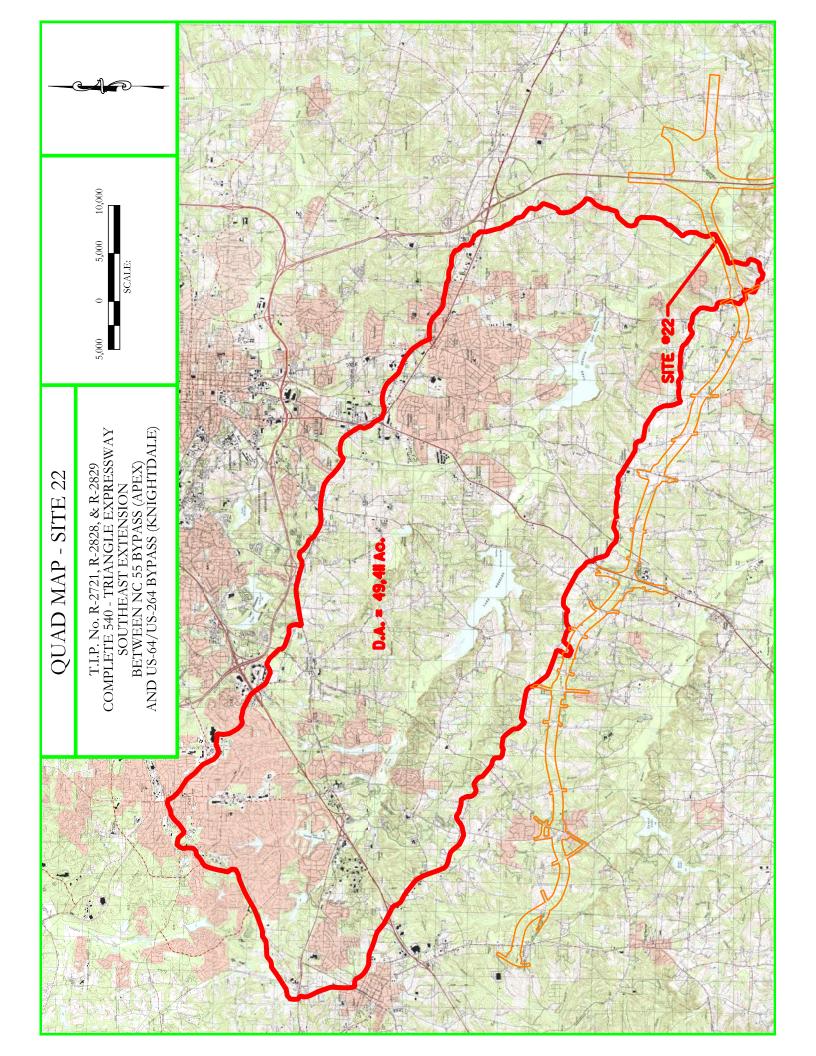


Looking Downstream from Proposed Crossing

Page 1 of 1

# Site 22





S	REGION: BLUE RIDGE	Rep. 01-4207
	STREAM NAME: Swift Creek	METHOD USED:
		sd. miles
	ny SE Ext.	77.2
010	NAME: Triangle Expresswa	Drainage Area =
7/13/20	PROJECT	ENGLISH

<b>USGS RUR</b>	ISGS RURAL REGRE	SSION EQU	ATIONS (OLD)	RUR	AL EQUA	TIONS Rep	oort 01-4207	
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills	
	(cts)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)	
2YR	718.42	1082.26	2902.06	2YR	2853.92	1205.79	739.65	
5YR	1206.37	1869.73	4562.00	5YR	4589.15	2038.11	1168.19	
10YR	1605.92	2554.82	6011.90	10YR	5934.02	2722.97	1507.98	
25YR	2254.80	3655.28	8048.34	25YR	7854.53	3698.82	1994.29	
50YR	2819.13	4575.42	9797.77	50YR	9511.16	4545.66	2418.38	
100YR	3472.34	5663.16	11761.61	100YR	11269.82	5478.19	2844.57	
200YR	4290.14	6977.27	13986.42	200YR	13208.64	6510.85	3352.39	
500YR	5382.91	8941.31	16945.88	500YR	16086.68	8046.47	4105.34	

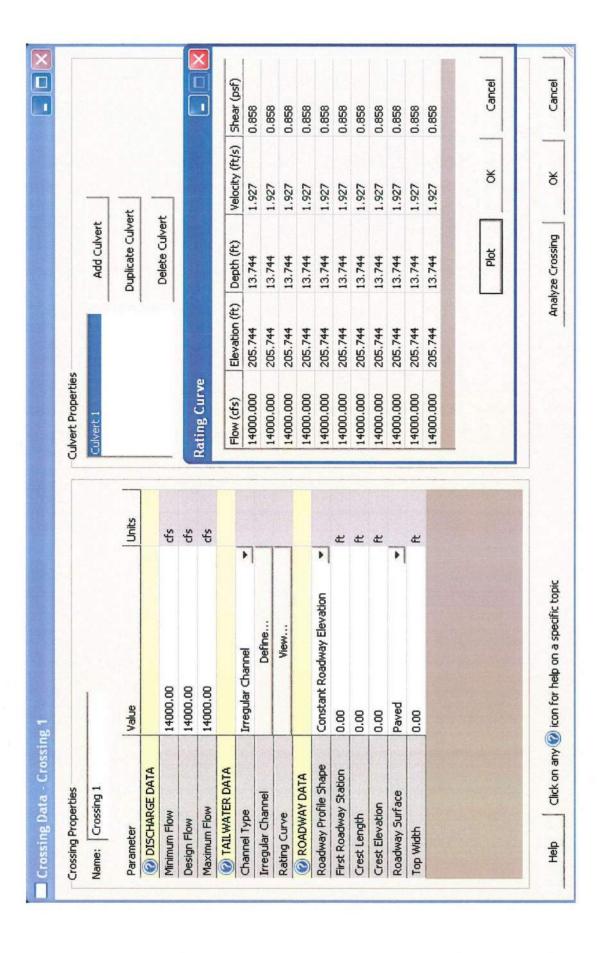
# **USGS URBAN REGRESSION EQUATIONS**

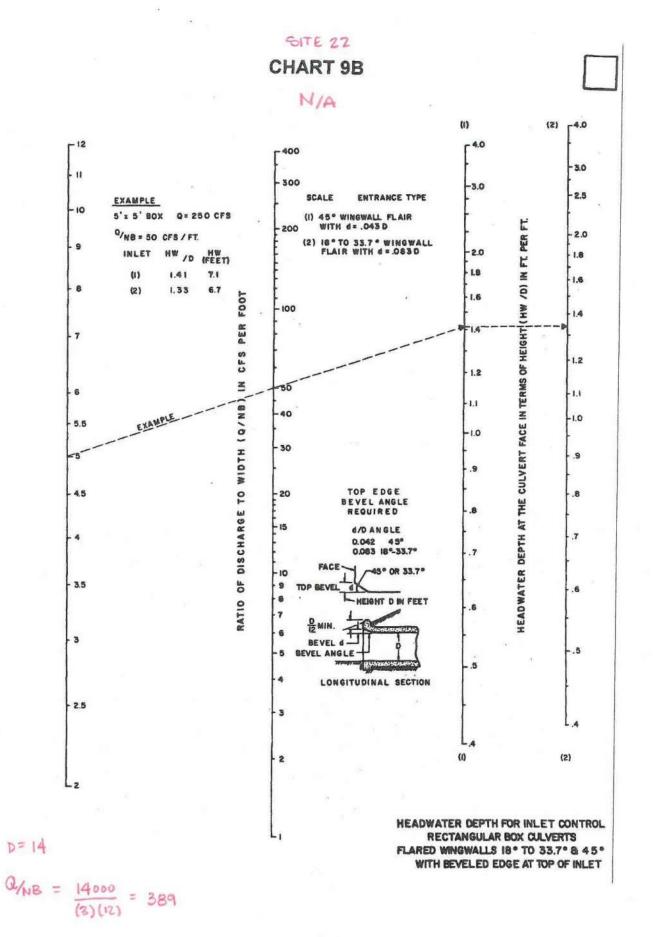
BDF=

<ul> <li>These Equations are used only for comparison)</li> </ul>	is are used only	for comparison)		
FREQUENCY	Sand Hills	Coastal Plain		0.42
	(cfs)	(cfs)	(cfs)	
5YR	4288.99	6036.53		
10YR	5062.32	7305.39		
25YR	6335.76	9325.00	17533.84	
50YR	7703.05	11402.98	21129.16	
100YR	9475.76	14151.81	25768.34	
200YR	14174.49	20455.09	40216.66	(Based
500YR	13946.48	21143.63	35716.00	

on 2.80xQ10)

	EMA	Disharges			4200	7600	0096	16300	ı	
	FE	FREQUENCY			10YR	50YR	100YR	500YR		
vious) USGS Fact Sheet 007-00		Discharge Used					14000		(Based on 2.80xQ10)	(Based on 3.66xQ10)
Impervio		Blue Ridge	(cfs)	9597.68	11032.86	13205.99	14495.11	15584.44	30892.02	40380.28
ION EQUATIONS (%		Coastal Plain	(cfs)	7409.61	8652.20	10129.55	11324.86	12384.99	24226.15	31667.04
SSION EQ	25	Sand Hills	(cfs)	6552.93	7522.77	8557.31	9692.71	10619.92	21063.76	27533.34
NC REGRE	% Impervious =	FREQUENCY		5YR	10YR	25YR	SOYR	100YR	200YR	500YR





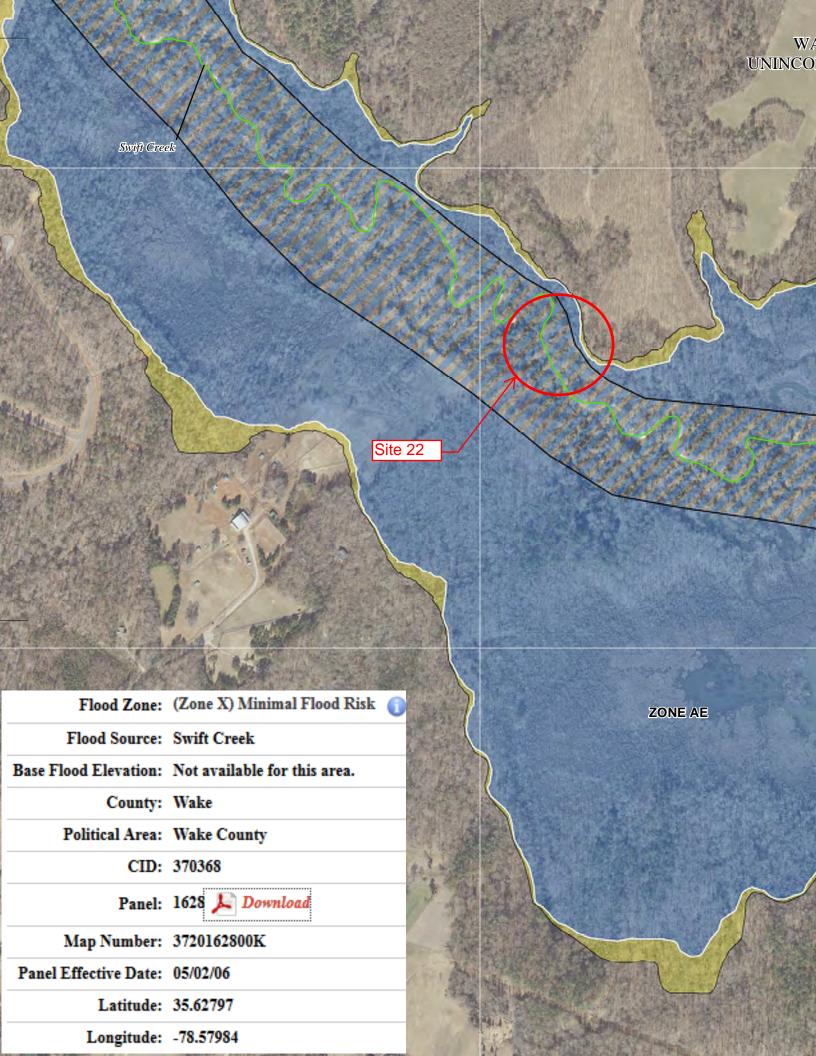
# PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake	PROJECT NUMBER R-272	21 & R-2828
STREAM Swift Creek (Site 22)	ROUTE New Location	
` ,	DBY <u>Mulkey, INC.</u> DATE (MLH)	E <u>6/11/2010</u>
	HYDROLOGIC EVALUA	ATION
NEAREST GAGING STAT Swift Creek at SR 1555 Nea		(NONE) <u>USGS 0208773375</u>
ARE FLOOD STUDIES AV	AILABLE ON THIS STREA	M: Yes
FLOOD DATA:		
$\begin{array}{cccc} Q_{10} & \underline{11,000} \text{ CFS} & EST. \text{ BK} \\ Q_{50} & \underline{14,000} \text{ CFS} & EST. \text{ BK} \\ Q_{500} & \underline{40,000} \text{ CFS} & EST. \text{ BK} \end{array}$	WTR. <u>N/A</u> FT. Q <sub>100</sub> <u>16,000</u>	OCFS EST. BKWTR. N/A FT. OCFS EST. BKWTR. N/A FT.
DRAINAGE AREA <u>76.9 Sq</u>	<u>.Mi. METHOD USED TO CC</u>	OMPUTE Q: <u>USGS Urban Regression</u>
<u>P</u>	ROPERTY RELATED EVAL	<u>LUATIONS</u>
DAMAGE POTENTIAL: L	OW MODERATE	<u>X</u> HIGH
COULD THIS BE SI	IGNIFICANTLY INCREASE	D BY PROPOSED
ENCROACHMENT	: YES	NO <u>X</u>
· · · · · · · · · · · · · · · · · · ·	naximum one foot rise in the national any existing insurable structure	atural base flood is allowed, but this res.
LIST BUILDINGS I	N FLOOD PLAIN: None	LOCATION:
UPSTREAM LAND ANTICIPATE ANY		
ANY FLOOD ZONI	NG? (FIA STUDIES, ETC.)	YES <u>X</u> NO
TYPE OF STUDY:	FEMA – Special Flood Hazard	d Zone AE
REGULATORY FLO	OODWAY WIDTH <u>305 ft. Se</u>	ction 1581 (AS NOTED IN FIS)
COMMENTS:		

## TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 19,600 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 49,100 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? <u>N/A New Location</u> LENGTH OF DETOUR <u>N/A</u> MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? <u>N/A</u>
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS  NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE <u>X</u> ) LENGTH ELEVATION EMBANKMENT: SOIL TYPE <u>Congaree</u> TYPE SLOPE COVER <u>Vegetation</u>
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service
ENVIRONMENTAL CONSIDERATIONS
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN:
MISCELLANEOUS COMMENTS
IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED

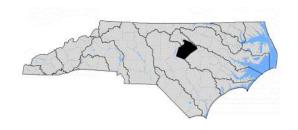
ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? $\underline{\text{No}}$
COMMENTS:
<u>ALTERNATIVES</u>
RECOMMENDED DESIGN Dual 825' Dual Bridges
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO $\underline{X}$ DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:



# PRELIMINARY FLOOD INSURANCE STUDY

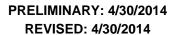
## FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

State of North Carolina

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 9, "Flooding Sources Studied by Detailed Methods: Redelineated", lists all flooding sources that were studied by detailed methods for the prestatewide FIS and redelineated for previous FISs. These flooding sources were not part of this revision and their effective analyses remain valid.

Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	Riverine	Sources	Affected Communities	
	From	То		
Basin 10, Stream 2	The confluence with Little River (Basin 10, Stream 1)	Approximately 0.9 mile upstream of confluence with Little River (Basin 10, Stream 1)	Rdu Wake County	
Basin 10, Stream 3	The confluence with Little River (Basin 10, Stream 1)	Moss Road	Rdu Wake County	
Buffalo Branch (Basin 10, Stream 22)	The confluence with Little River (Basin 10, Stream 1)	Morphus Bridge Road	Rdu Town Of Wendell Wake County	
Buffalo Creek (Basin 9, Stream 1)	The Wake/Johnston County boundary	Robertsons Pond Dam	Rdu Town Of Wendell Wake County	
Kit Creek	The Chatham/Wake County Boundary	Approximately 475 feet upstream of Railroad	Rdu Town Of Cary Wake County	
Little Creek (Basin 11, Stream 2)	The Wake/Johnston County boundary	Cemetery Road	Rdu Town Of Zebulon Wake County	
Middle Creek	The confluence with Swift Creek	Approximately 0.7 mile upstream of confluence of Middle Creek Tributary	Rdu Town Of Apex Town Of Cary Town Of Fuquay-Varina Town Of Holly Springs Wake County	
Panther Branch (Basin 22, Stream 2)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.5 mile upstream of Banks Road	Rdu Wake County	
Panther Creek	The Chatham/Wake County Boundary	Approximately 1.0 mile upstream of Green Level to Durham Road	Town Of Cary	
plar Greek (Basin 13, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 900 Feet upstream of Fayetteville Street	Rdu Town Of Knightdale Wake County	
Swift Creek	The confluence with the Neuse River	The confluence of Yates Branch (Basin 20, Stream 13)	Rdu Town Of Garner Wake County	
White Oak Creek	The confluence with Swift Creek	Approximately 0.4 mile upstream of Pergo Parkway	Rdu Town Of Clayton Town Of Garner Wake County	

Table 10, "Flooding Sources Studied by Detailed Methods: Limited Detailed", lists all flooding sources within the county that were studied by limited detailed methods for either this FIS or previous FISs.

Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed

Source	Riverine	Sources	Affected Communties
	From	То	
Bachelor Branch (Basin 28, Stream 6)	The confluence with White Oak Creek	Approximately 530 feet upstream of Highway 55	Rdu Town Of Cary Wake County
Basin 11, Stream 7	The Wake/Johnston County boundary	Approximately 0.4 mile upstream of Wake/Johnston County boundary	Rdu Wake County
Basin 14, Stream 2	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.4 mile upstream of Lake Myra Road	Rdu Wake County
Basin 14, Stream 3	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.7 mile upstream of confluence with Marks Creek (Basin 14, Stream 1)	Rdu Town Of Knightdale Town Of Wendell Wake County
Basin 20, Stream 5	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 1.7 miles upstream of confluence with Swift Creek (Basin 20, Stream 1)	Rdu Wake County
Basin 28, Stream 7	The confluence with Basin 28, Stream 8	Approximately 0.4 mile upstream of confluence with Basin 28, Stream 8	Town Of Cary
Beddingfield Creek	Approximately 0.4 mile upstream of the confluence with Neuse River	Approximately 0.2 mile upstream of Shotwell Road	Rdu Town Of Clayton Wake County
Big Branch	The confluence with Harris Reservoir	Approximately 0.9 mile upstream of Highway 1	Rdu Town Of Apex Wake County
Black Creek	Approximately 260 feet upstream of State HWY 210	Approximately 1.0 mile upstream of dam along Black Creek (Basin 23, Stream 1)	Rdu Town Of Fuquay-Varina Wake County

Table 21 - Floodway Data

	Table 21 - Floodway Data								
Floodwa Cross Section	y Source Distance (Feet	Midth (Fast)	Floodway Section Area	Moon Valasit	Pogulaton:		ter Surface Eleva		Increase
Cross Section	Above Mouth)	Width (Feet)	(Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
036	3,560	150	762	2.8	243.1	*	243.1	243.9	0.8
049	4,930	90	445	4.5	247.9	*	247.9	248.8	0.9
057	5,730	130	651	3.1	251.7	*	251.7	252.4	0.7
063	6,315	140	964	1.9	255.8	*	255.8	256.5	0.7
077	7,710	120	598	3.0	257.8	*	257.8	258.7	0.9
084	8,375	90	435	4.1	260.5	*	260.5	261.2	0.7
093	9,320	100	478	3.8	264.8	*	264.8	265.5	0.7
101	10,130	70	330	4.8	268.9	*	268.9	269.6	0.7
109	10,890	90	406	3.9	273.1	*	273.1	274.1	1.0
120	12,030	140	472	3.3	279.6	*	279.6	280.1	0.5
132	13,210	140	461	3.4	286.4	*	286.4	287.0	0.6
136	13,565	140	952	1.5	291.2	*	291.2	291.6	0.4
143	14,300	110	374	3.5	291.9	*	291.9	292.7	0.8
161	16,085	100	351	3.1	303.9	*	303.9	304.6	0.7
Panther Cree	k								
126	12,614	142	807	2.8	245.5	*	245.5	246.3	0.8
127	12,660	190	1,175	2.0	251.5	*	251.5	251.5	0.0
144	14,400	180	1,044	1.9	252.3	*	252.3	252.5	0.2
156	15,620	420	4,111	0.4	261.2	*	261.2	261.3	0.1
Poplar Creek	(Basin 13, Stre	eam 1)	Ī	Ī	I		I		ı
015	1,530	200	791	4.5	165.4 <sup>1</sup>	*	154.9	155.9	1.0
2 edy Branch	n (Basin 27, St	ream 5)	Ī	I	1	1	I		I
סוט \	1,017	605	3,079	1.0	238.7	*	238.7	239.7	1.0
017	1,666	250	910	3.3	239.4	*	239.4	240.3	0.9
Swift Creek									
1435	143,473	1,090	12,492	0.8	202.5	*	202.5	203.4	0.9
	outary (#1) to S		420	2.6	244.7		244.7	245.7	1.0
098	9,769	118	420	3.6	214.7	_	214.7	215.7	1.0
100 White Oak Cr	10,035	48	259	5.9	216.4	<u></u>	216.4	217.4	1.0
088	8,804	588	4,690	1.3	238.01	*	233.7	234.7	1.0
096	9,645	790	6,444	1.0	238.0 1	*	234.2	234.7	1.0
				0.8	238.0 1	*			1.0
105	10,545	1,065	7,654		238.0 1	*	234.6	235.6	
119	11,886	950	5,187	1.2	238.0 1	*	235.4	236.3	1.0
125	12,466	815	4,803	1.3	238.0 <sup>1</sup>	*	236.0	236.9	1.0
130	12,997	630	3,846	1.6			236.6	237.6	1.0
258	25,831	240	1,206	2.2	222.5		222.5	223.2	0.7
282	28,170	140	670	3.4	234.3		234.3	235.3	1.0
330	32,980	370	1,834	1.2	249.7	*	249.7	250.1	0.4

<sup>&</sup>lt;sup>1</sup>Elevation includes backwater effects

<sup>&</sup>lt;sup>2</sup>Feet above county boundary

<sup>\*</sup> Future conditions not computed for this stream

# **FLOOD INSURANCE STUDY**

## FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





**Table 13 - Summary of Discharges** 

Table 13 - Summ	ary of DIS	Discharges (cfs)				
Location	Drainage Area	10% Annual	2% Annual	1% Annual	Annual 0.2% Annual	
	(square miles)	Chance	Chance	Chance	Chance	
At mouth	1.20	*	*	1,450	*	
At Wade Avenue	0.50	*	*	1,050	*	
Southwest Prong Beaverdam Creek (Basin 18, Stream 29)	T	1				
At mouth	1.90	*	*	1,900	*	
At Brooks Avenue	1.20	*	*	1,550	*	
At Wade Avenue	0.50	*	*	1,050	*	
Spring Branch (Basin 6, Stream 6)	T	Ī	1			
At mouth	1.00	*	*	1,120	*	
At East Holding Ave	0.30	*	*	360	*	
Stirrup Iron Creek	T	I				
At mouth <sup>14</sup>	25.60	*	*	2,735	*	
Just upstream of Brier Creek (Basin 18, Stream 14) <sup>14</sup>	12.30	*	*	2,235	*	
Just upstream of Basin 18, Stream 13	9.40	*	*	1,150	*	
Just downstream of NRCS Dam No. 5A	8.70	*	*	165	*	
At Wake/Durham County boundary	8.50	*	*	3,500	*	
2 traight Branch (Basin 20, Stream 23)			1			
At mouth	1.10	*	*	1,150	*	
At US Route 64/1	0.50	*	*	750	*	
Swift Creek						
At County boundary	79.10	*	*	11,900	*	
At Lake Benson Dam	66.20	*	*	10,800	*	
At Old Stage Road	55.20	*	*	9,600	*	
At confluence of Yates Branch	41.66	*	*	4,550	*	
Approximately 1.0 mile upstream of confluence of Yates Branch (Basin 20, Stream 13)	39.06	*	*	4,560	*	
Approximately 1.8 miles upstream of confluence of Yates Branch (Basin 20, Stream 13)	38.45	*	*	4,580	*	
Approximately 250 feet upstream of Fayetteville Highway	36.77	*	*	4,580	*	
Approximately 1,060 feet downstream of Lake Wheeler Road	35.79	*	*	4,610	*	
Approximately 170 feet upstream of Lake Wheeler Road	35.73	*	*	8,480	*	
Approximately 500 feet downstream of confluence of Dutchmans Branch (Basin 20, Stream 17)	26.60	*	*	8,170	*	
Approximately 0.5 mile upstream of confluence of Basin 20, Stream 20	24.63	*	*	9,270	*	
Approximately 0.8 mile upstream of confluence of Basin 20, Stream 20	22.49	*	*	9,370	*	
Approximately 0.5 mile downstream of Holly Springs Road	21.38	*	*	9,420	*	
At Holly Springs Road	19.18	*	*	9,230	*	
At confluence of Lens Branch	13.44	*	*	7,540	*	
Approximately 225 feet upstream of Kildare Farm Road	12.80	*	*	7,650	*	
Approximately 1,580 feet downstream of confluence of Swift Creek Trib No. 7 (Basin 20, Stream 24)	10.39	*	*	6,800	*	
At confluence of Swift Creek Tributary No. 7 (Basin 20, Stream 24)	5.44	*	*	3,550	*	
At US Highway 1	5.12	*	*	4,230	*	
Approximately 530 feet upstream of US Highway 64	2.75	*	*	1,970	*	
Swift Creek Tributary No. 7 (Basin 20, Stream 24)						
At mouth <sup>15</sup>	5.00	*	*	2,350	*	
	•	•	•	•	·	

**Table 16 - Roughness Coefficients** 

Stream	Channel "n"	Overbank "n"		
Panther Creek	0.030 to 0.070	0.070 to 0.130		
Perry Creek (Basin 10, Stream 19)	0.042	0.130		
Perry Creek (Basin 15, Stream 26)	0.032 to 0.052	0.100 to 0.200		
Reedy Branch (Basin 27, Stream 5)	0.045 to 0.050	0.100 to 0.200		
Reedy Branch Tributary (Basin 27, Stream 6)	0.045 to 0.050	0.100 to 0.200		
Richland Creek	0.038 to 0.070	0.035 to 0.200		
Richland Creek Tributary	0.040	0.100 to 0.200		
Richland Creek Tributary 2	0.050	0.070 to 0.130		
Rocky Branch (Basin 30, Stream 5)	0.030 to 0.070	0.070 to 0.110		
Rocky Ford Branch (Basin 24, Stream 5)	0.030 to 0.070	0.070 to 0.110		
ith Creek	0.048	0.100 to 0.150		
pes Creek	0.042 to 0.045	0.120 to 0.130		
Stirrup Iron Creek	0.045 to 0.068	0.080 to 0.170		
Swift Creek	0.040 to 0.072	0.035 to 0.240		
Sycamore Creek (Basin 18, Stream 6)	0.030 to 0.070	0.070 to 0.150		
Thomas Creek	0.050	0.145		
Turkey Creek (Basin 18, Stream 5)	0.030 to 0.070	0.070 to 0.150		
Turkey Creek Tributary	0.046	0.100 to 0.150		
Unnamed Tributary (#1) to Swift Creek	0.045 to 0.060	0.050 to 0.150		
Utley Creek	0.050	0.147		
Walnut Creek (Basin 30, Stream 1)	0.038 to 0.050	0.100 to 0.200		
White Oak Creek	0.035 to 0.050	0.035 to 0.150		
White Oak Creek (Basin 26, Stream 1)	0.050	0.150		

For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained using digital elevation data obtained with LIDAR technology developed as part of the North Carolina Statewide Floodplain Mapping Program. The hydraulic model is prepared using this digital elevation data, without surveying bathymetric or structural data. Where bridge or culvert data are readily available, such as from the North Carolina Department of Transportation, these data have been reflected in the hydraulic model. If these structural data are not readily available, field measurements of these structures were made to approximate their geometry in the hydraulic models. In addition, this method does not include field surveys that determine specifics on channel and floodplain characteristics. A limited detailed study is a "buildable" product that can be upgraded to a fully detailed study at a later date by verifying stream channel characteristics, bridge and culvert opening geometry, and by analyzing multiple recurrence intervals.

The results of the HEC-RAS computations are tabulated for all cross sections (Table 17, "Limited Detailed Flood Hazard Data"). Flood Profiles have not been developed for streams studied by limited detailed methods. Water-surface elevation rasters were developed for steams studied by limited detailed methods. In addition, floodways for streams studied by limited detailed methods are not delineated on the FIRM. However, the 1% annual chance water-surface elevations, flood discharges, and non-encroachment widths from the limited detailed studies for every modeled cross section are given in Table 17. The non-encroachment widths given at modeled cross sections can be used by communities to enforce floodplain management ordinances that meet the requirement defined in 44 CFR 60.3(c)(10).

Between cross sections for streams studied by limited detailed methods, 1% annual chance water-surface elevations can be calculated by mathematical interpolation using the distance along the stream centerline. Non-encroachment widths and, therefore, the location of a non-encroachment area boundary between cross sections should be determined based on either 1) mathematical interpolation, or 2) the non-encroachment width at the upstream or downstream cross section, whichever is larger. If the width determined by this second method is wider than the Special Flood Hazard Area (SFHA) or the 1% annual chance floodplain delineated on the FIRM for this location along the stream, the non-encroachment area shall be considered to be coincident with the SFHA. A full detailed study incorporating field survey data in the HEC-RAS hydraulic model may be submitted for a Letter of Map Revision (LOMR) request to map a regulatory floodway along a section of a stream in lieu of applying the non-encroachment widths listed in Table 17.

**Table 17 - Limited Detailed Flood Hazard Data** 

Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water- Surface Elevation (feet NAVD 88)	Non-Encroachment Width (feet) Left/Right from Stream Centerline		
Adams Branch (Basin 30, Stream 9)						
196	19,551	1,093	274.6	24 / 54		
197	19,681	1,093	275.6	35 / 40		

Table 21 - Floodway Data

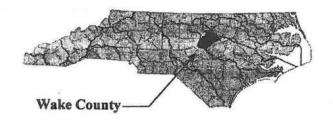
Floodway	y Source	Table 21 - Floodway Data  Floodway Water Surface Elevation							
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
175	17,540	50	212	0.8	292.2	*	292.2	293.0	0.8
180	18,030	41	216	0.8	292.3	*	292.3	293.1	0.8
_	ch (Basin 20, S	Stream 23)	1	T	1				
2	1,950	174	1,331	0.9	366.5	*	366.5	366.5	0.0
034	3.395	375	5.172	0.1	391.6	*	391.6	391.6	0.0
Swift Creek			ı	I					
1445	144,485	1,090	9,478	1.3	202.1	*	202.1	202.7	0.6
1581	158,130	305	3,678	3.2	220.0	*	220.0	220.9	0.9
1651	165,050	335	3,992	2.7	224.9	*	224.9	225.9	1.0
1658	165,760	370 <sup>10</sup>	16,395	0.7	238.0	*	238.0	238.0	0.0
1828	182,775	1,240	10,913	0.9	245.6	*	245.6	245.8	0.2
1901	190,090	1,240	11,576	0.8	245.6	246.0	245.6	245.8	0.2
1915	191,516	1,320	10,623	0.4	246.0	246.4	246.0	246.2	0.2
1920	192,042	1,420	10,823	0.4	246.0	246.4	246.0	246.2	0.2
1928	192,778	1,325	9,780	0.5	246.1	246.5	246.1	246.3	0.2
1934	193,389	1,230	8,569	0.5	246.2	246.5	246.2	246.4	0.2
1938	193,832	1,220	7,720	0.6	246.2	246.6	246.2	246.5	0.2
1948	194,763	1,250	7,763	0.6	246.4	246.7	246.4	246.6	0.2
1955	195,550	1,240	6,527	0.7	246.5	246.9	246.5	246.8	0.3
1970	197,039	1,100	4,810	0.9	247.3	247.7	247.3	247.7	0.4
1976	197,649	1,220	4,332	1.0	247.5	248.0	247.5	248.0	0.4
1986	,		,	1.1	248.0	248.4	248.0	248.6	0.4
	198,554	1,050	4,149						
1997	199,666	765	3,699	1.2	248.6	248.9	248.6	249.5	0.9
2006	200,615	825	3,523	1.3	249.1	249.4	249.1	250.1	1.0
2013	201,300	620	3,780	1.2	249.5	249.8	249.5	250.5	1.0
2019	201,907	550	2,605	1.8	249.7	250.0	249.7	250.7	1.0
2030	203,040	490	1,811	2.5	250.4	250.6	250.4	251.3	0.9
2048	204,835	530	2,114	2.2	252.3	252.7	252.3	252.9	0.6
2058	205,790	740	2,393	1.9	253.2	253.6	253.2	253.7	0.5
2067	206,702	570	1,503	3.0	254.3	254.6	254.3	254.6	0.4
2075	207,523	710	1,655	2.8	255.7	255.9	255.7	256.1	0.4
2091	209,116	650	2,052	2.2	258.9	259.1	258.9	259.1	0.3
	211,103	575	2,690	1.7	262.4	262.6	262.4	263.2	0.8
2116	211,570	430	2,467	1.9	263.3	263.6	263.3	263.8	0.5
2121	212,081	340	1,994	2.3	263.7	264.0	263.7	264.2	0.5
2136	213,608	1,545	24,733	0.3	289.4	289.8	289.4	289.4	0.0
2151	215,087	1,931	31,285	0.3	289.4	289.8	289.4	289.4	0.0
2179	217,930	1,697	28,088	0.3	289.4	289.8	289.4	289.4	0.0
2204	220,417	1,490	25,038	0.3	289.4	289.8	289.4	289.4	0.0
2227	222,727	1,717	29,347	0.3	289.7	290.2	289.7	289.7	0.0
	223,518	1,935	15,367	0.5	289.7	290.2	289.7	289.7	0.0
2251	225,128	1,625	13,321	0.6	289.8	290.2	289.8	289.8	0.0
	225,815	1,175	8,021	1.2	289.8	290.2	289.8	289.8	0.0
2265	226,458	900	5,607	1.6	289.9	290.2	289.9	289.9	0.0

### FLOOD INSURANCE STUDY

A Report of Flood Hazards in

WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 7 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





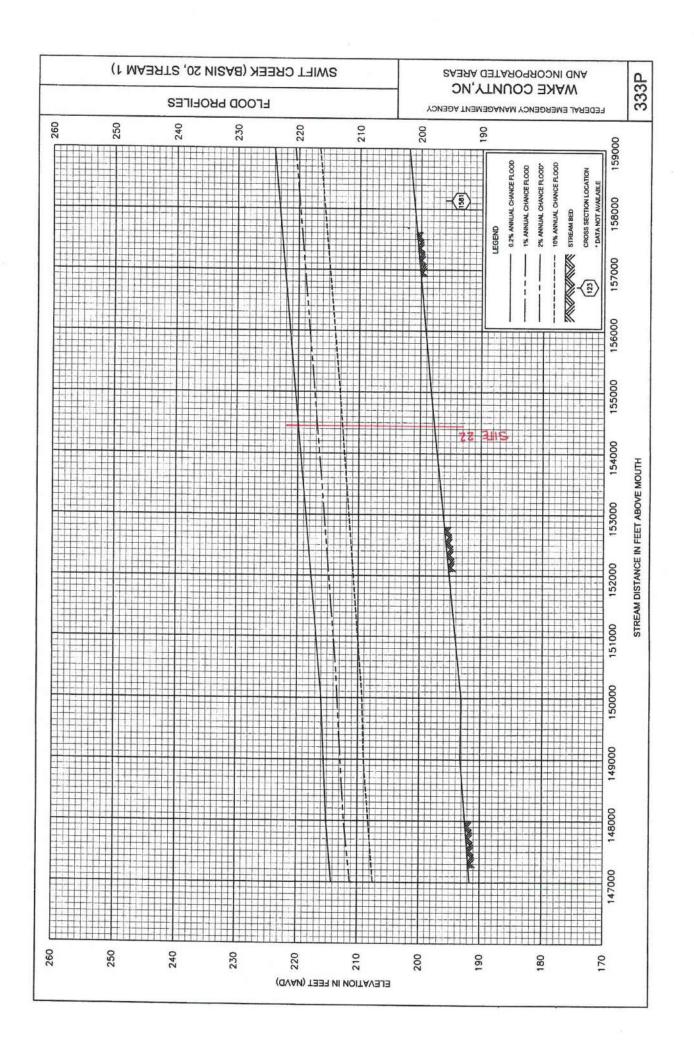
May 2, 2006

Federal Emergency Management Agency State of North Carolina

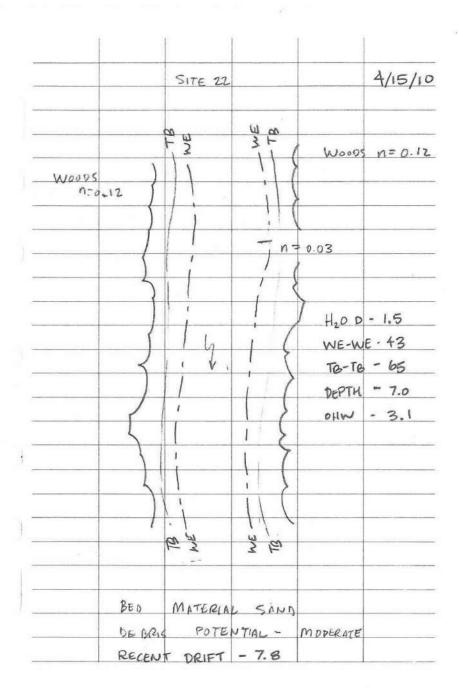
Flood Insurance Study Number 37183CV007A

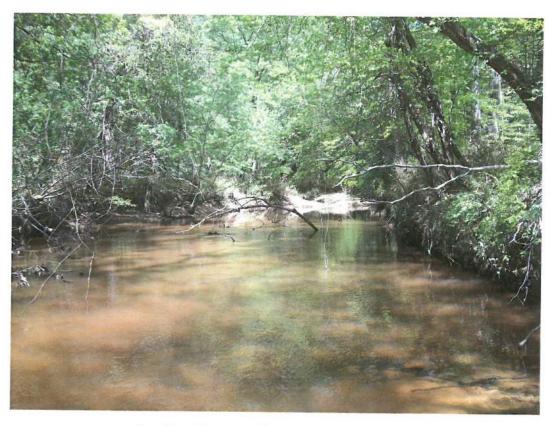
www.fema.gov and www.ncfloodmaps.com





and the safety and			Class	
Name of Stream	Description	Class	Date	Index No.
Unnamed Tributary to Swift Creek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)
Unnamed Tributary to Swift Creek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)
Swift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)
Buck Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)
Buck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)
Reedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)
Reedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)
Swift Creek	From dam at Lake Benson to Neuse River	C;NSW	05/01/88	27-43-(8)
Mahlers Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-9
Neal Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-10
White Oak Creek (Austin Pond)	From source to Swift Creek	C; NSW	05/01/88	27-43-11
Little Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-12
Cooper Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-13
Reedy Branch (Little Branch)	From source to Swift Creek	C; NSW	05/01/88	27-43-14
Middle Creek	From source to backwaters of Sunset Lake	C;NSW	05/01/88	27-43-15-(1)
Middle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B; NSW	05/01/88	27-43-15-(2)
Basal Creek [(Bass Lake, (Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	27-43-15-3
Middle Creek	From dam at Sunset Lake to Swift Creek	C;NSW	05/01/88	27-43-15-(4)
Rocky Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-4.5
Camp Branch	From source to Middle Creek	C; NSW	05/01/88	
Bells Lake	Entire lake and connecting stream to Middle Creek	C; NSW	05/01/88	27-43-15-6
Mills Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-7
Terrible Creek (Johnsons Pond)	From source to dam at Johnsons Pond	B; NSW	05/01/88	27-43-15-8-(1
Terrible Creek	From dam at Johnsons Pond to Middle Creek	C; NSW	05/01/88	27-43-15-8-(2
Panther Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-9
Little Creek	From source to Middle Creek	C; NSW		27-43-15-10



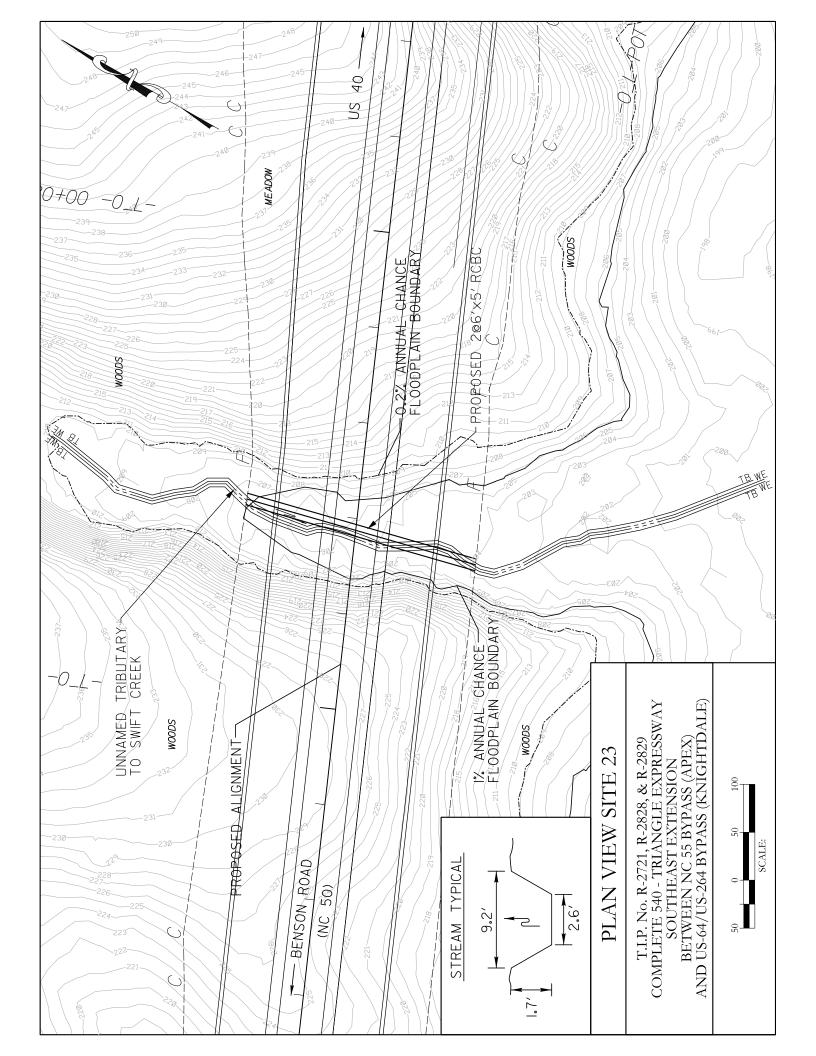


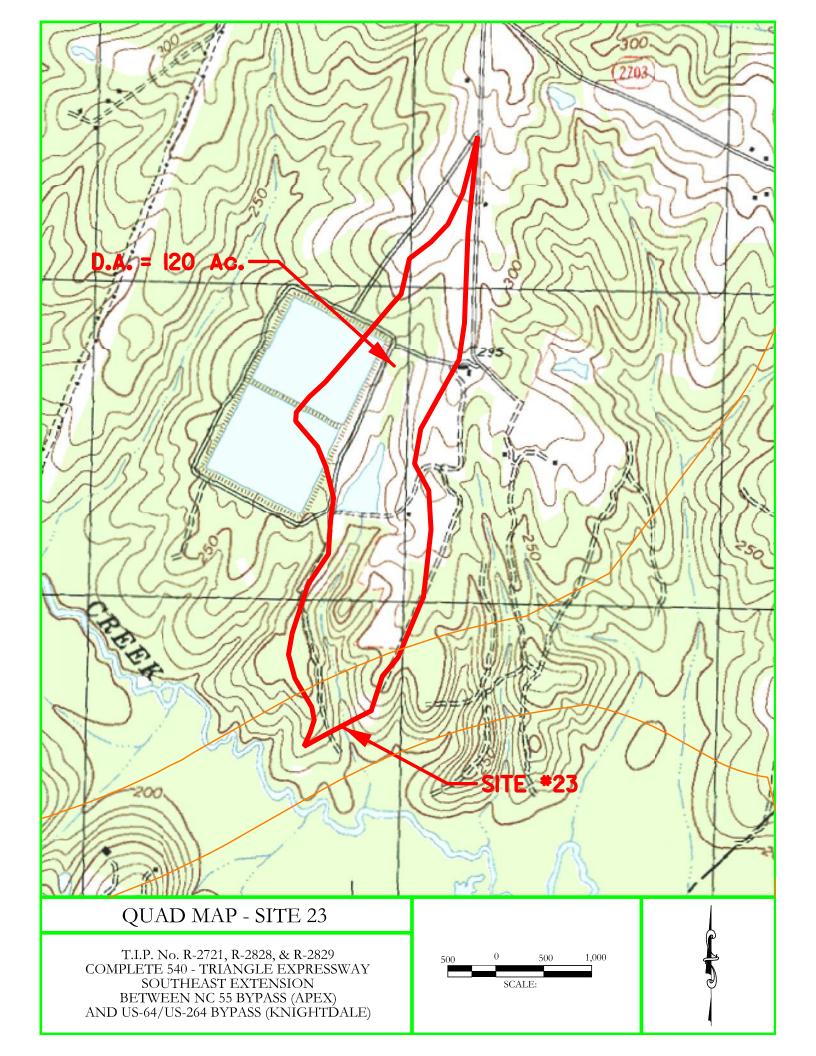
Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing

Page 1 of 1





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REGION: BLUE RIDGE STREAM NAME: Unnamed Trib to Swift Creek PROJECT NAME: Triangle Expressway SE Ext.

Drainage Area = 0.19 sq. miles		sq. miles			METHOD USED:	: Rep. 01-4207	
JSGS RURAL REGRESSION EQUATIONS (OLD)	SSION EQUATIONS (	ATIONS (	(OLD)	RUF	RURAL EQUAT	IONS	Report 01-4207
Sand Hills Coastal Plain Blue Ridge	-	Blue Ridg	9	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
(cfs)		(cfs)	ř		(cfs)	(cfs)	(cfs)
24.30		45.71		ZYR	42.07	21.16	10.27
56.68		81.51		5YR	78.62	44.94	17.33
88.92		110.69		10YR	111.25	67.70	22.91
24.77 149.63 157.36		157.36		25YR	163.08	104.96	31.03
208.68		197.41		SOYR	209.70	140.30	38.09
286.06		247.15		100YR	263.86	182.82	45.62
383.36		301.05		200YR	326.44	233.52	54.41
550.67		401.55		500YR	424.72	315.81	67.44

## **USGS URBAN REGRESSION EQUATIONS**

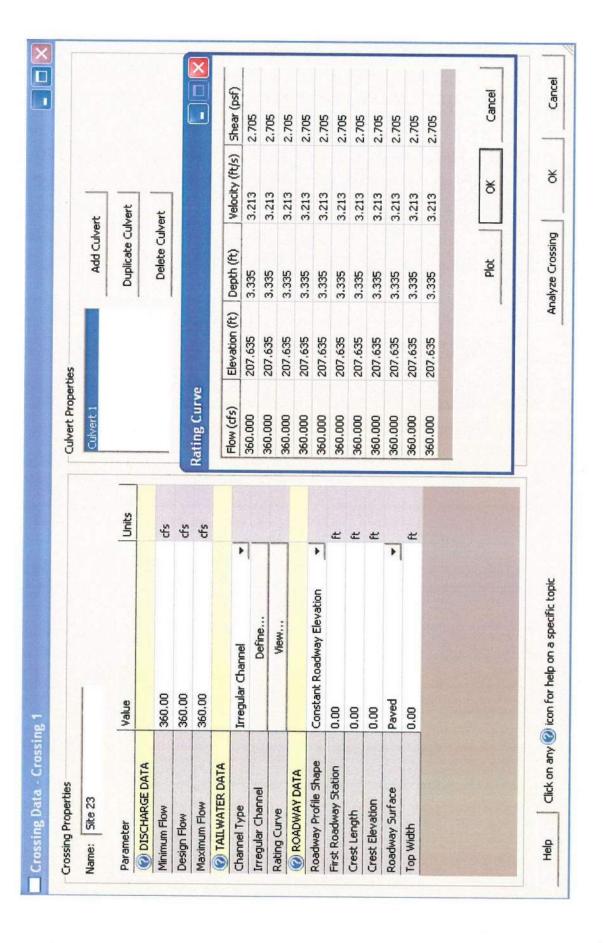
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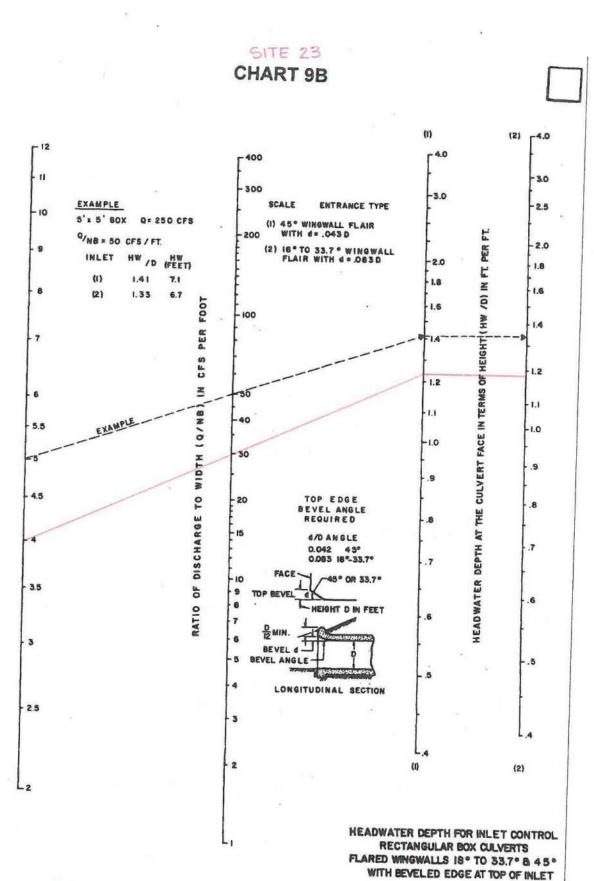
(These Equations are used only for comparison)

	dge		32	)3	35	70	7.7	27 (Based on 2.80xQ10)	36
	-	(cfs)							
or companison)	Coastal Plain	(cfs)	142.22	196.85	293.76	379.76	496.90	551.17	822.51
is alle used oilly	Sand Hills	(cfs)	48.65	57.78	29.69	78.64	89.75	161.79	115.53
( Illese Ednanoi	FREQUENCY	(cfs) (cfs)	5YR	10YR	25YR	50YR	100YR	200YR	500YR

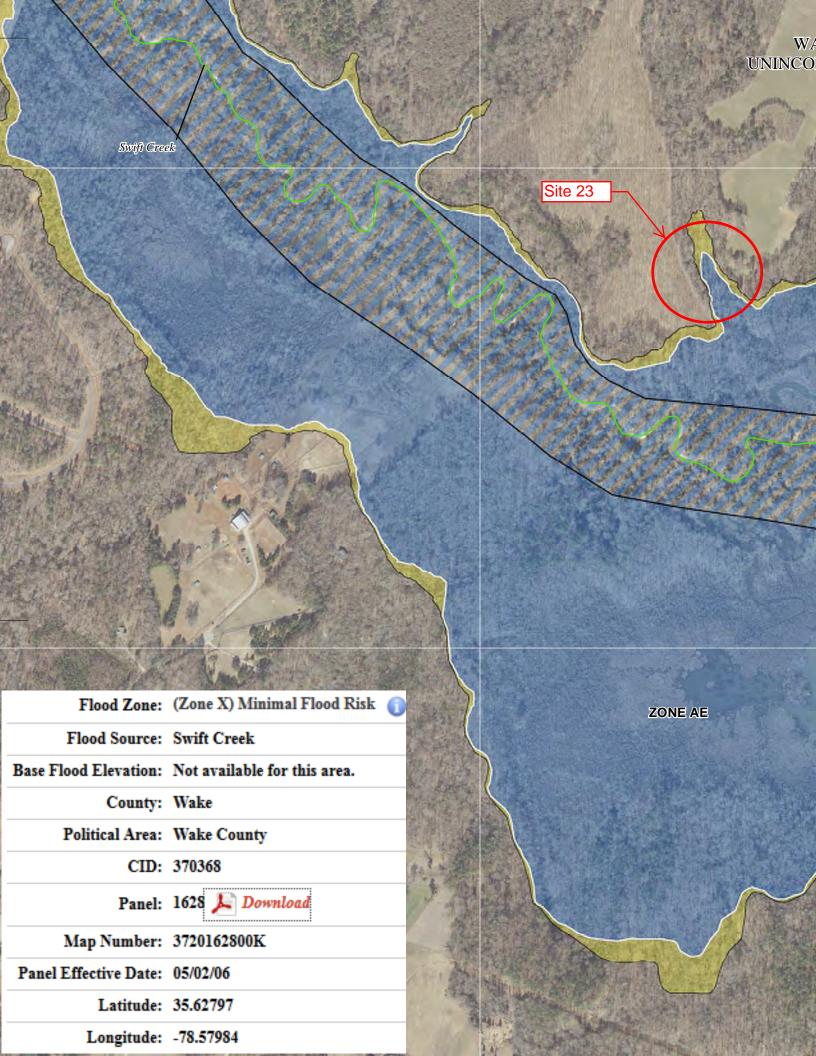
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FEMA	REQUENCY Disharges			10YR	50YR	100YR	100YR	500YR	
	置								
	Discharge Used					360		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	Blue Ridge	(cts)	141.29	192.30	305.14	356.71	408.26	538.43	703.81
	Coastal Plain	(cts)	127.51	180.58	299.42	363.00	427.71	505.63	660.94
20	Sand Hills	(cts)	86.06	114.89	162.17	193.30	222.76	321.68	420.48
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR





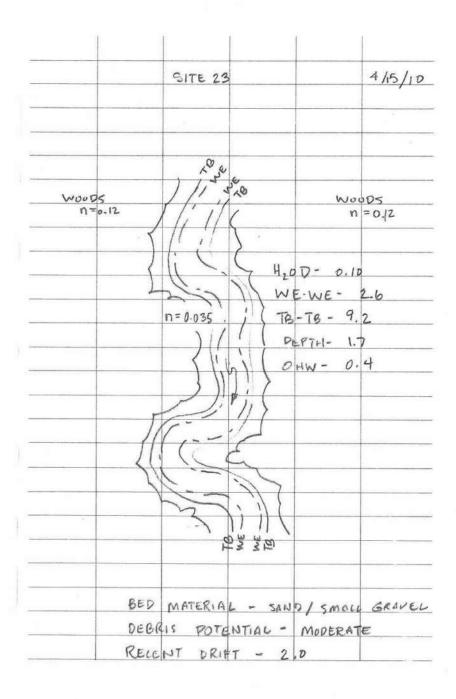
$$Q_{NB} = \frac{360}{(2)(6)} = 30$$



.0315 NEUSE RIVER BASIN

SITE 23

			Class	
Name of Stream	Description	Class	Date	Index No.
Onnamed Tributary to Swift Treek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)
nnamed Tributary to Swift reek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)
wift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)
uck Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)
Buck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)
Reedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)
Reedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)
Swift Creek	From dam at Lake Benson to Neuse River	C;NSW	05/01/88	27-43-(8)
Mahlers Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-9
Weal Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-10
White Oak Creek (Austin Pond)	From source to Swift Creek	C; NSW	05/01/88	27-43-11
Little Creek	From source to Swift Creek	C;NSW	05/01/88	27-43-12
Cooper Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-13
Reedy Branch (Little Branch)	From source to Swift Creek	C; NSW	05/01/88	27-43-14
Middle Creek	From source to backwaters of Sunset Lake	C; NSW	05/01/88	27-43-15-(1)
Middle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	27-43-15-(2)
Basal Creek [(Bass Lake, (Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	27-43-15-3
Middle Creek	From dam at Sunset Lake to Swift Creek	C;NSW	05/01/88	27-43-15-(4)
Rocky Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-4.5
Camp Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-5
Bells Lake	Entire lake and connecting stream to Middle Creek	C; NSW	05/01/88	27-43-15-6
Mills Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-7
Terrible Creek (Johnsons Pond)	From source to dam at Johnsons Pond	B;NSW	05/01/88	27-43-15-8-(1)
Terrible Creek	From dam at Johnsons Pond to Middle Creek	C;NSW	05/01/88	27-43-15-8-(2)
Panther Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-9
			and the second	



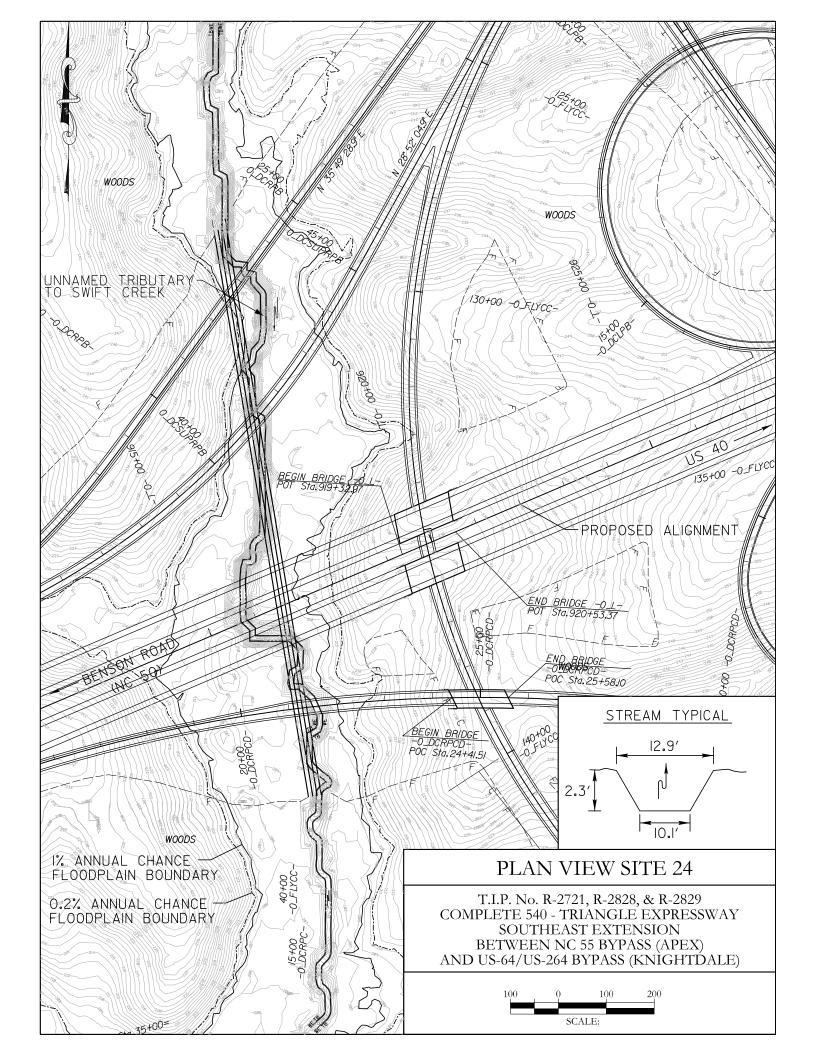


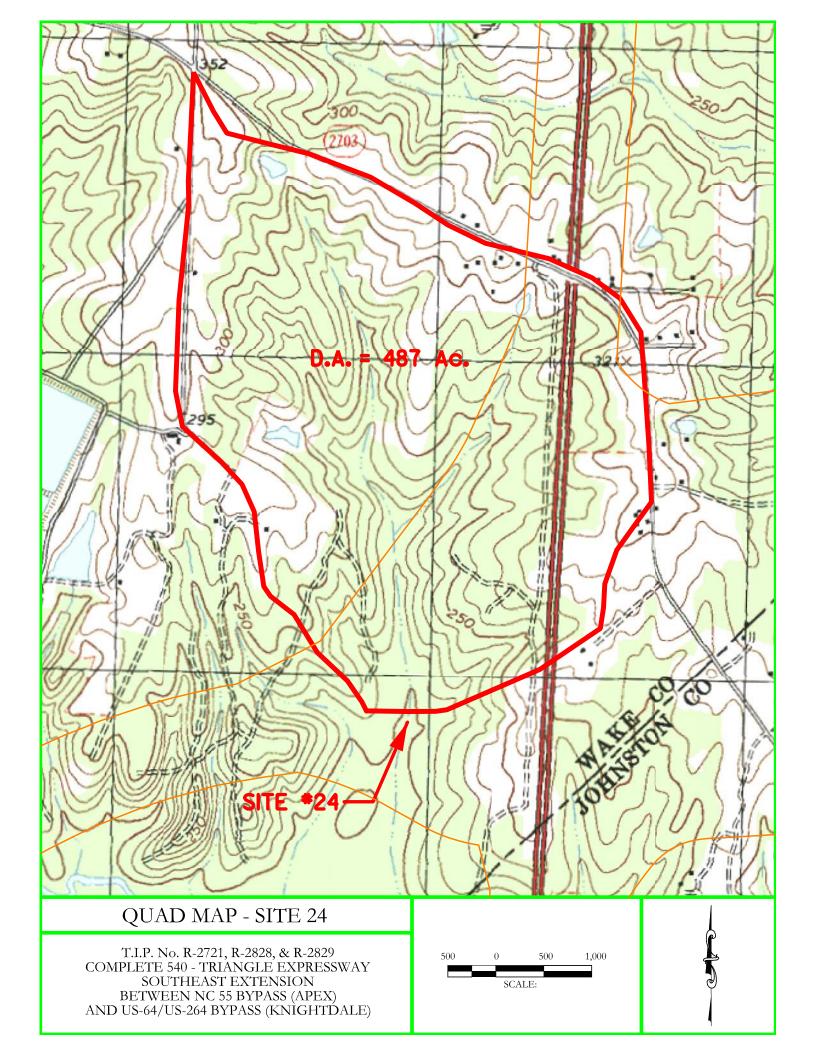
Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing

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PROJECT NAME: Triangle E

LOSGS RURAL REGRESSION EQUATIONS (OLD)         RURAL EQUATIONS Report 01-4207           FREQUENCY         Sand Hills         Coastal Plain         Blue Ridge         FREQUENCY         Blue Ridge         Coastal Plain         Sand Hills           2YR         (cfs)         (cfs)         (cfs)         (cfs)         (cfs)         (cfs)         (cfs)           2YR         24.29         58.35         119.13         2VR         111.34         53.79         27.55           5YR         39.85         127.00         206.35         5VR         278.28         100.97         100.97         108.37         45.79           10YR         52.56         193.00         278.28         100.97         278.51         158.80         60.21           50YR         425.53         486.08         500.77         505.72         313.08         99.27           100YR         100.7         766.77         503.35         140.83           500YR         147.82         1047.72         952.41         500YR         766.77         503.35         140.83	PROJECT NAM ENGLISH [	PROJECT NAME: Triangle Expressway SE Ext.	ssway SE Ext. 0.76	Sq. miles	STREAM NAME: Unnamed Trib to Swift Creek es	Creek METHOD USED:	Rep. 01-4207	REGION: BLUE RIDGE 01-4207	
Sand Hills         Coastal Plain         Blue Ridge         FREQUENCY         Blue Ridge         Coastal Plain           (cfs)         (cfs)	USGS RUF	RAL REGRES	SSION EQU	ATIONS (OLD)	RUR	AL EQUA		ort 01-4207	10000
(cfs)         (cfs)         (cfs)         (cfs)         (cfs)           24.29         58.35         119.13         2VR         111.34         53.79           24.29         58.35         119.13         2VR         111.34         53.79           39.85         127.00         206.35         5VR         200.97         108.37           52.56         193.00         278.28         107.8         278.51         158.80           70.15         312.82         390.17         25VR         398.78         238.80           85.30         425.53         486.08         50VR         505.72         313.08           102.20         569.74         602.69         100VR         627.57         400.67           125.68         748.86         730.06         200VR         766.77         503.35           147.82         1047.72         952.41         500VR         982.54         666.71	FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge		Sand Hills	
24.29     58.35     119.13     27R     111.34     53.79       39.85     127.00     206.35     5YR     200.97     108.37       52.56     193.00     278.28     10YR     278.51     158.80       70.15     312.82     390.17     25YR     398.78     238.80       85.30     425.53     486.08     50YR     505.72     313.08       102.20     569.74     602.69     100YR     627.57     400.67       125.68     748.86     730.06     200YR     766.77     503.35       147.82     1047.72     952.41     500YR     982.54     666.71		(cts)	(cts)	(cfs)		(cfs)	(cfs)	(cfs)	
39.85 127.00 206.35 5 5YR 200.97 108.37 5.56 193.00 278.28 10YR 278.51 158.80 70.15 312.82 390.17 255YR 398.78 238.80 50YR 505.72 313.08 102.20 569.74 602.69 730.06 627.57 400.67 147.82 1047.72 952.41 500YR 982.54 666.71	2YR	24.29	58.35	119.13	2YR	111.34	53.79	27.55	
52.56     193.00     278.28     10YR     278.51     158.80       70.15     312.82     390.17     25YR     398.78     238.80       85.30     425.53     486.08     50YR     505.72     313.08       102.20     569.74     602.69     100YR     627.57     400.67       125.68     748.86     730.06     200YR     766.77     503.35       147.82     1047.72     952.41     500YR     982.54     666.71	5YR	39.85	127.00	206.35	SYR	200.97	108.37	45.79	
70.15 312.82 390.17 25YR 398.78 238.80 85.30 425.53 486.08 50YR 505.72 313.08 102.20 569.74 602.69 730.06 200YR 766.77 503.35 147.82 1047.72 952.41 500YR 982.54 666.71	10YR	52.56	193.00	278.28	10YR	278.51	158.80	60.21	
85.30 425.53 486.08 50YR 505.72 313.08 102.20 569.74 602.69 100YR 627.57 400.67 125.68 748.86 730.06 200YR 766.77 503.35 147.82 1047.72 952.41 500YR 982.54 666.71	25YR	70.15	312.82	390.17	25YR	398 78	238.80	81 11	
102.20 569.74 602.69 100YR 627.57 400.67 125.68 748.86 730.06 200YR 766.77 503.35 147.82 1047.72 952.41 500YR 982.54 666.71	50YR	85.30	425.53	486.08	SOYR	505 72	313.08	99 27	
125.68 748.86 730.06 200YR 766.77 503.35 147.82 1047.72 952.41 500YR 982.54 666.71	100YR	102.20	569.74	602.69	100YR	627.57	400.67	118.40	
147.82 1047.72 952.41 500YR 982.54 666.71	200YR	125.68	748.86	730.06	200YR	766 77	503.35	140.83	
	500YR	147.82	1047.72	952.41	500YR	982.54	666.71	174.06	

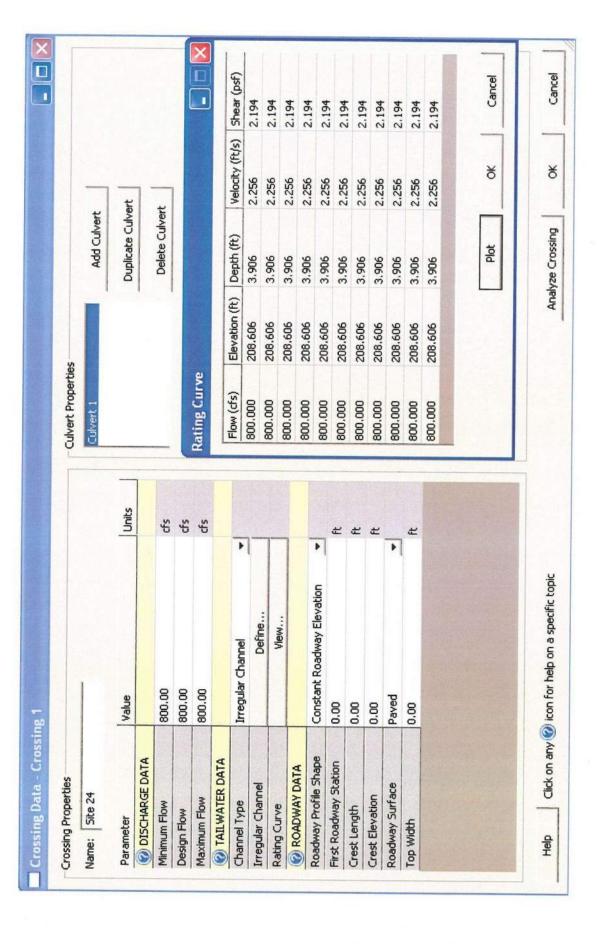
## **USGS URBAN REGRESSION EQUATIONS**

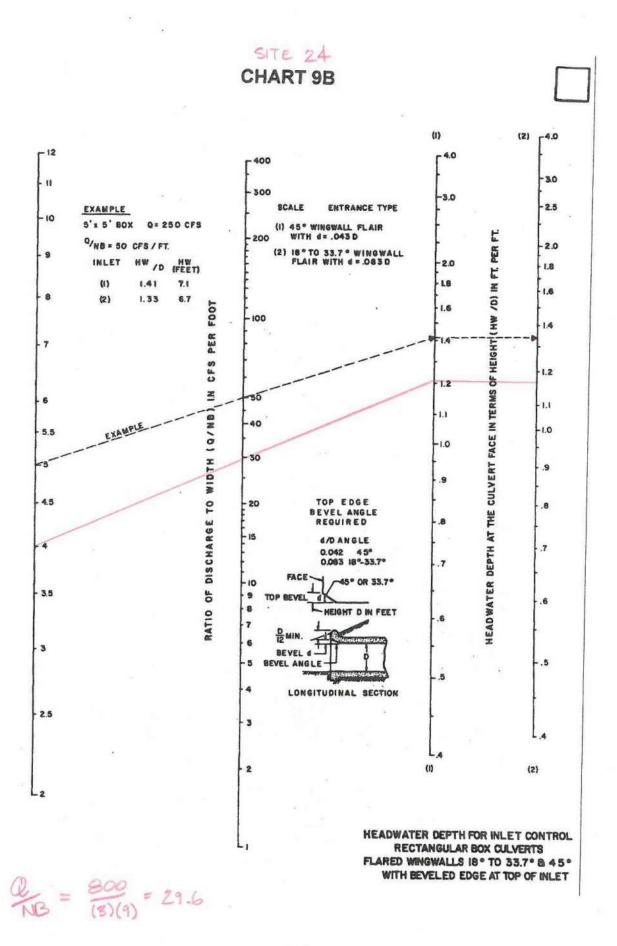
(These Equations are used only for comparison)

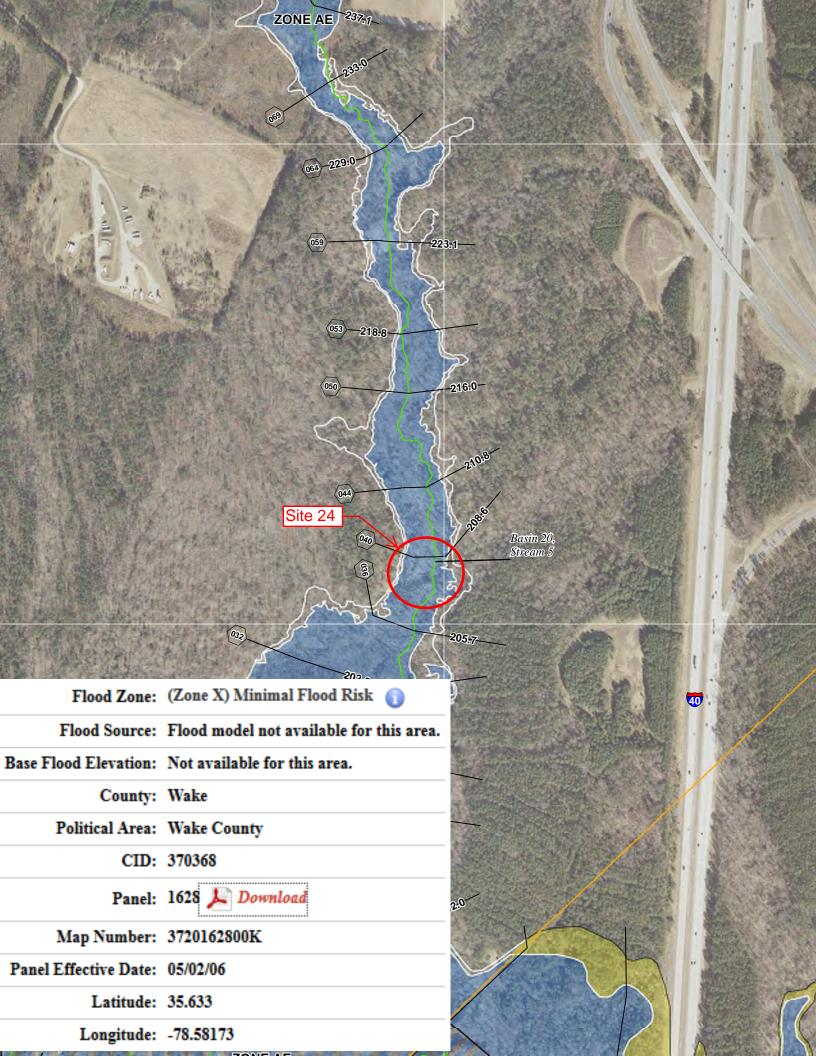
lue Ridge	(cfs)	493.21	605.18	778.56	927.43	1127.09	1694.51 (Based on 2.80xQ10)	
oastal Plain E	(cfs)	337.77	453.24	652.43	832.69	1076.31	1269.08	1739.97
Sand Hills C	(cfs)	136.77	162.21	197.28	226.53	263.04	454.19	349.23
FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

# NC REGRESSION EQUATIONS (% Impervious) USGS Fact Sheet 007-00

(cfs) 363.16 476.79 711.80 821.77 8200 1335.00 (Based on 2.80xQ10) 1745.04 (Based on 3.66xQ10)	00					1
S00   Sased on 2.80xQ10   Based on 3.66xQ10   Based on 3.66xQ10	ρ,					щ
(cfs) 363.16 476.79 711.80 821.77 928.89 1335.00 (Based on 2.80xQ10) 1745.04 (Based on 3.66xQ10)	Sand Hills	Coastal Plain	Blue Ridge	Discharge Used	FREDUENCY	١s
363.16 476.79 711.80 821.77 928.89 1335.00 1745.04	(cts)	(cfs)	(cfs)			
476.79 711.80 821.77 <b>[</b> 928.89 1335.00 (	227.11	316.16	363.16			
711.80 821.77 <b>[</b> 928.89 1335.00 (	293.67	429.50	476.79		DAUL	
821.77 928.89 1335.00 1745.04	396.01	659.87	711.80		A101	
928.89 1335.00 1745.04	467.45	786.79	821.77	800	100VR	
1335.00	533.51	913.02	928.89		10078	
1745.04	822.28	1202.61	1335.00	(Based on 2.80xQ10)	SOUVE	
	1074.84	1571.98	1745.04	(Based on 3.66xQ10)	11000	



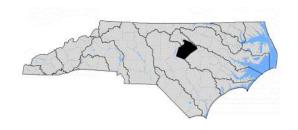




## PRELIMINARY FLOOD INSURANCE STUDY

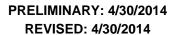
### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

State of North Carolina

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 9, "Flooding Sources Studied by Detailed Methods: Redelineated", lists all flooding sources that were studied by detailed methods for the prestatewide FIS and redelineated for previous FISs. These flooding sources were not part of this revision and their effective analyses remain valid.

Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	Riverine Sources		Affected Communities
	From	То	
Basin 10, Stream 2	The confluence with Little River (Basin 10, Stream 1)	Approximately 0.9 mile upstream of confluence with Little River (Basin 10, Stream 1)	Rdu Wake County
Basin 10, Stream 3	The confluence with Little River (Basin 10, Stream 1)	Moss Road	Rdu Wake County
Buffalo Branch (Basin 10, Stream 22)	The confluence with Little River (Basin 10, Stream 1)	Morphus Bridge Road	Rdu Town Of Wendell Wake County
Buffalo Creek (Basin 9, Stream 1)	The Wake/Johnston County boundary	Robertsons Pond Dam	Rdu Town Of Wendell Wake County
Kit Creek	The Chatham/Wake County Boundary	Approximately 475 feet upstream of Railroad	Rdu Town Of Cary Wake County
Little Creek (Basin 11, Stream 2)	The Wake/Johnston County boundary	Cemetery Road	Rdu Town Of Zebulon Wake County
Middle Creek	The confluence with Swift Creek	Approximately 0.7 mile upstream of confluence of Middle Creek Tributary	Rdu Town Of Apex Town Of Cary Town Of Fuquay-Varina Town Of Holly Springs Wake County
Panther Branch (Basin 22, Stream 2)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.5 mile upstream of Banks Road	Rdu Wake County
Panther Creek	The Chatham/Wake County Boundary	Approximately 1.0 mile upstream of Green Level to Durham Road	Town Of Cary
Poplar Creek (Basin 13, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 900 Feet upstream of Fayetteville Street	Rdu Town Of Knightdale Wake County
Swift Creek	The confluence with the Neuse River	The confluence of Yates Branch (Basin 20, Stream 13)	Rdu Town Of Garner Wake County
White Oak Creek	The confluence with Swift Creek	Approximately 0.4 mile upstream of Pergo Parkway	Rdu Town Of Clayton Town Of Garner Wake County

Table 10, "Flooding Sources Studied by Detailed Methods: Limited Detailed", lists all flooding sources within the county that were studied by limited detailed methods for either this FIS or previous FISs.

Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed

	Source	Riverine	Affected Communties	
		From	То	
	Bachelor Branch (Basin 28, Stream 6)	The confluence with White Oak Creek	Approximately 530 feet upstream of Highway 55	Rdu Town Of Cary Wake County
	Basin 11, Stream 7	The Wake/Johnston County boundary	Approximately 0.4 mile upstream of Wake/Johnston County boundary	Rdu Wake County
	Basin 14, Stream 2	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.4 mile upstream of Lake Myra Road	Rdu Wake County
Site 24	Basin 14, Stream 3	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.7 mile upstream of confluence with Marks Creek (Basin 14, Stream 1)	Rdu Town Of Knightdale Town Of Wendell Wake County
	Basin 20, Stream 5	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 1.7 miles upstream of confluence with Swift Creek (Basin 20, Stream 1)	Rdu Wake County
	Basin 28, Stream 7	The confluence with Basin 28, Stream 8	Approximately 0.4 mile upstream of confluence with Basin 28, Stream 8	Town Of Cary
	Beddingfield Creek	Approximately 0.4 mile upstream of the confluence with Neuse River	Approximately 0.2 mile upstream of Shotwell Road	Rdu Town Of Clayton Wake County
	Big Branch	The confluence with Harris Reservoir	Approximately 0.9 mile upstream of Highway 1	Rdu Town Of Apex Wake County
	Black Creek	Approximately 260 feet upstream of State HWY 210	Approximately 1.0 mile upstream of dam along Black Creek (Basin 23, Stream 1)	Rdu Town Of Fuquay-Varina Wake County

### 5.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for floods of the selected recurrence intervals for each flooding source studied. Hydrologic analyses are typically performed at the watershed level. Depending on factors such as watershed size and shape, land use and urbanization, and natural or man-made storage, various models or methodologies may be applied. For details on the county's hydrologic analyses, the hydrologic report is available by request.

A summary of the drainage area-peak discharge relationships for the flooding sources studied by detailed methods is shown in Table 13, "Summary of Discharges".

**Table 13 - Summary of Discharges** 

Flooding Source	<b>,</b>	onar goo	Dischar	ges (cfs)	
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Basin 10, Stream 2					
Just downstream of tributary draining pond near County boundary	0.50	*	*	701	*
Basin 14, Stream 2					
At confluence with Marks Creek (Basin 14, Stream 1)	2.54	*	*	1,340	*
Approximately 0.4 mile upstream of confluence with Marks Creek (Basin 14, Stream 1)	2.45	*	*	1,310	*
Approximately 0.4 mile downstream of Lake Myra Road	1.47	*	*	947	*
Basin 14, Stream 3					
At confluence with Marks Creek (Basin 14, Stream 1)	0.39	*	*	410	*
Basin 19, Stream 3					
At mouth	2.40	*	*	1,795	*
Basin 20, Stream 5					
Approximately 600 feet downstream of Wake/Johnston County boundary	0.87	*	*	433	*
Approximately 1.0 mile upstream of Wake/Johnston County boundary	0.61	*	*	353	*
Basin 28, Stream 7					
24 confidence with Basin 28, Stream 8	0.50	*	*	806	*
Approximately 0.4 mile upstream of confluence with Basin 28, Stream 8	0.20	*	*	462	*
Basin 28, Stream 8					
Approximately 1,060 feet downstream of Mills Road	1.00	481	860	1,030	1,530
Approximately 1,060 feet upstream of Mills Road	0.70	440	785	932	1,380
Just downstream of Hendricks Road	0.40	305	526	623	899
Beaver Creek			_		_
At Chatham/Wake County boundary	19.20	*	*	5,890	*
Approximately 1,060 feet upstream of Chatham/Wake County boundary	17.50	*	*	5,810	*
Just upstream of New Hill Olive Chapel Road	16.50	*	*	5,730	*
Approximately 530 feet upstream of New Hill Olive Chapel Road	16.40	*	*	7,040	*
Approximately 0.4 mile upstream of New Hill Olive Chapel Road	15.40	*	*	6,960	*
At confluence of Reedy Branch	11.10	2,790	4,480	5,310	8,460
Big Branch		ı			
Approximately 0.5 mile upstream of Shearon Harris Road	1.20	*	*	844	*
Approximately 0.5 mile downstream of Highway 1	1.10	*	*	766	*
Approximately 1,060 feet downstream of Highway 1	0.90	*	*	694	*
Approximately 220 feet upstream of Highway 1	0.40	*	*	418	*
Approximately 530 feet upstream of Highway 1	0.40	*	*	394	*
Approximately 0.6 mile upstream of Highway 1	0.20	*	*	251	*
Approximately 1,580 feet upstream of Highway 1	0.20	*	*	286	*

Table 13 - Summary of Discharges

		<del></del>			
Flooding Source			Dischar	ges (cfs)	
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Thomas Creek					
Approximately 1.0 mile downstream of Highway 1	1.60	*	*	992	*
Approximately 0.7 mile downstream of Highway 1	0.80	*	*	649	*
Approximately 0.4 mile downstream of Highway 1	0.70	*	*	606	*

The stillwater elevations have been determined for the 1% [add 10%, 2%, and 0.2% here if that data is available] annual chance flood for the flooding sources studied by detailed methods and are summarized in Table 14, "Summary of Stillwater Elevations."

**Table 14 - Summary of Stillwater Elevations** 

Flooding Source	FIRM Panel Number(s)	Elevations (feet NAVD)			
		10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Harris Reservoir	3720060600	*	*	252	*

Table 15, "Gage Information" is not applicable in Wake County.

### 5.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the flood elevations for the selected recurrence intervals. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles and/or Water-surface elevation rasters. For stream segments for which BFEs were computed, selected cross-section locations are also shown on the FIRM. Flood Profiles and/or Water-surface elevation rasters were developed showing computed water-surface elevations for floods of the selected recurrence intervals.

Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles and/or Water-surface elevation rasters or in the Floodway Data tables in the FIS Report. For construction and/or floodplain management purposes, users are encouraged to use the flood elevation data presented in the FIS in conjunction with the data shown on the FIRM.

The hydraulic analyses for this FIS were based on unobstructed flow. The flood elevations shown on the Flood Profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

For details on the county's hydraulic analyses, the hydraulic report is available by request.

For the streams studied by detailed methods, water surface elevations of floods of the selected recurrence intervals were computed through use of the Army Corps of Engineers' HEC RAS step backwater computer program. The hydraulic analyses were based on unobstructed flow. The flood elevations shown on the Profiles and/or Water-surface elevation rasters are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail. The computer models were calibrated using historic high water data collected during field investigations.

The cross section geometries were obtained from a combination of digital elevation data obtained by Light Detection and Ranging (LIDAR) and field surveys. All bridges, dams, and culverts were field surveyed to obtain elevation data and structural geometry. Natural floodplain cross sections were surveyed approximately every 4000 feet along the detail study reaches to obtain the channel geometry between bridges and culverts. Overbank cross section data for the backwater analyses were obtained from recently flown LIDAR data.

Channel roughness factors (Manning's "n") used in the hydraulic computations were made in the field by an engineer where stream access was possible, with orthophotos used to supplement areas that could not be accessed. The channel and overbank "n" values for all of the streams studied by detailed methods are shown in Table 16, "Roughness Coefficients".

Table 16 - Roughness Coefficients

Table 10 Reagnifices 500	1110101110	
Stream	Channel "n"	Overbank "n"
Bachelor Branch (Basin 28, Stream 6)	0.050	0.140 to 0.155
Basin 11, Stream 7	0.042	0.130
Basin 14, Stream 2	0.045	0.100
Basin 14, Stream 3	0.050	0.130
Basin 20, Stream 5	0.047	0.130
Basin 28, Stream 7	0.050 to 0.055	0.150 to 0.155
Basin 28, Stream 8	0.047 to 0.050	0.100 to 0.200

be coincident with the SFHA. A full detailed study incorporating field survey data in the HEC-RAS hydraulic model may be submitted for a Letter of Map Revision (LOMR) request to map a regulatory floodway along a section of a stream in lieu of applying the non-encroachment widths listed in Table 17.

**Table 17 - Limited Detailed Flood Hazard Data** 

Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water- Surface Elevation (feet NAVD 88)	Non-Encroachment Width (feet) Left/Right from Stream Centerline
Bachelor Branch (Basin	28, Stream 6)			
033	3,349	2,580	278.3	9 / 403
040	3,984	2,580	280.0	71 / 347
Basin 11, Stream 7				
001	123	406	278.1	14 / 61
004	358	406	281.4	4 / 27
006	602	406	283.4	24 / 21
009	862	406	284.9	25 / 4
011	1,055	406	292.6	-9,999 / -9,999
011	1,080	406	292.6	-9,999 / -9,999
014	1,428	406	293.0	150 / 60
017	1,709	406	295.6	15 / 15
021	2,051	406	301.3	32 / 4
022	2,154	406	306.7	-9,999 / -9,999
022	2,179	406	306.7	-9,999 / -9,999
024	2,384	406	308.2	110 / 40
Basin 14, Stream 2	,			
009	936	1,335	183.0 <sup>1</sup>	14 / 128
016	1,632	1,335	184.0	14 / 114
024	2,434	1,306	187.6	72 / 83
031	3,074	1,306	190.9	83 / 13
037	3,741	1,306	193.8	83 / 30
043	4,330	1,306	195.3	78 / 69
049	4,945	1,306	196.8	132 / 25
057	5,724	947	200.1	12 / 107
065	6,522	947	205.0	41 / 17
071	7,124	947	207.7	12 / 80
078	7,777	947	214.9	-9,999 / -9,999
078	7,817	947	214.9	18 / 18
Basin 14, Stream 3	1 7-			
004	386	410	202.5	14 / 79
009	864	410	205.9	14 / 19
018	1,775	410	213.2	5/5
023	2,311	410	220.2	5/5
029	2,918	410	227.6	5/5
035	3,466	410	235.5	5/5
039	3,867	410	243.8	5/4
Basin 20, Stream 5	1-1	·	, ···	1
018	1,815	756	202.01	5 / 112
025	2,497	756	202.01	153 / 10
028	2,818	756	202.01	4 / 496
032	3,224	756	202.01	62 / 31
036	3,565	756	205.7	21 / 61
040	3,997	756	208.6	4 / 105
040	0,001		200.0	J=7 100

.0315 NEUSE RIVER BASIN

SITE 24

	The state of the s		Class	
Name of Stream	Description	Class	Date	Index No.
Innamed Tributary to Swift Treek (Yates Mill Pond)	From dam at Silver Lake to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-5-(1.5)
nnamed Tributary to Swift reek	From a point 0.5 mile upstream of mouth to Swift Creek	WS-III;NSW,CA	08/03/92	27-43-5-(2)
wift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	27-43-(5.5)
Buck Branch	From source to a point 0.6 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-6-(1)
Buck Branch	From a point 0.6 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-6-(2)
Reedy Branch	From source to a point 0.5 mile upstream of mouth	WS-III;NSW	08/03/92	27-43-7-(1)
Reedy Branch	From a point 0.5 mile upstream of mouth to Lake Benson, Swift Creek	WS-III;NSW,CA	08/03/92	27-43-7-(2)
wift Creek	From dam at Lake Benson to Neuse River	C;NSW	05/01/88	27-43-(8)
Mahlers Creek	From source to Swift Creek	C;NSW	05/01/88	27-43-9
Meal Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-10
White Oak Creek (Austin Pond)	From source to Swift Creek	C; NSW	05/01/88	27-43-11
Little Creek	From source to Swift Creek	C; NSW	05/01/88	27-43-12
Cooper Branch	From source to Swift Creek	C; NSW	05/01/88	27-43-13
Reedy Branch (Little Branch)	From source to Swift Creek	C; NSW	05/01/88	27-43-14
Middle Creek	From source to backwaters of Sunset Lake	C; NSW	05/01/88	27-43-15-(1)
Middle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	27-43-15-(2)
Basal Creek [(Bass Lake, (Mills Pond)]	From source to Sunset Lake, Middle Creek	B; NSW	05/01/88	27-43-15-3
Middle Creek	From dam at Sunset Lake to Swift Creek	C; NSW	05/01/88	27-43-15-(4)
Rocky Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-4.5
Camp Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-5
Bells Lake	Entire lake and connecting stream to Middle Creek	C; NSW	05/01/88	27-43-15-6
Mills Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-7
Terrible Creek (Johnsons Pond)	From source to dam at Johnsons Pond	B; NSW	05/01/88	27-43-15-8-(1)
Terrible Creek	From dam at Johnsons Pond to Middle Creek	C;NSW	05/01/88	27-43-15-8-(2)
Panther Branch	From source to Middle Creek	C; NSW	05/01/88	27-43-15-9
	From source to Middle Creek	C; NSW	CONTRACTOR WINDS	27-43-15-10

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### PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake PROJECT NUMBER R-2721 & R-2828
STREAM <u>Unnamed Tributary to Swift Creek</u> ROUTE <u>New Location</u> (Site 24)
ASSESSMENT PREPARED BY Mulkey, INC. DATE 6/11/2010 (MLH)  HYDROLOGIC EVALUATION
NEAREST GAGING STATION ON THIS STREAM (NONE X)
ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: Yes
FLOOD DATA: $Q_{10} = 480 \text{ CFS} = \text{EST. BKWTR. } \frac{N/A}{A} \text{ FT.} \qquad Q_{25} = 700 \text{ CFS} = \text{EST. BKWTR. } \frac{N/A}{A} \text{ FT.} \qquad Q_{50} = 800 \text{ CFS} = \text{EST. BKWTR. } \frac{N/A}{A} \text{ FT.} \qquad Q_{500} = 1,700 \text{ CFS} = \text{EST. BKWTR. } \frac{N/A}{A} \text{ FT.} \qquad Q_{500} = 1,700 \text{ CFS} = \text{EST. BKWTR. } \frac{N/A}{A} \text{ FT.} \qquad Q_{500} = 1,700 \text{ CFS} = 1,700  $
DRAINAGE AREA 0.76 Sq.Mi. METHOD USED TO COMPUTE Q: USGS Urban Regression
PROPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: LOW MODERATE X HIGH
COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: YES NO X
EXPLANTION: A maximum one foot rise in the natural base flood is allowed, but this rise should not affect any existing insurable structures.
LIST BUILDINGS IN FLOOD PLAIN: None LOCATION:
UPSTREAM LAND USE <u>Residential</u> ANTICIPATE ANY CHANGE? <u>No</u>
ANY FLOOD ZONING? (FIA STUDIES, ETC.) YES $\underline{X}$ NO
TYPE OF STUDY: FEMA - Special Flood Hazard Zone AE
REGULATORY FLOODWAY WIDTH N/A (No Floodway)
COMMENTS:

### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 19,600 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 49,100 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? $\underline{\text{N/A}}$
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS  NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR
FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Wehadkee TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service
ENVIRONMENTAL CONSIDERATIONS
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: <u>Culvert will be buried 1' to allow for fish passage.</u>
MISCELLANEOUS COMMENTS
IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED

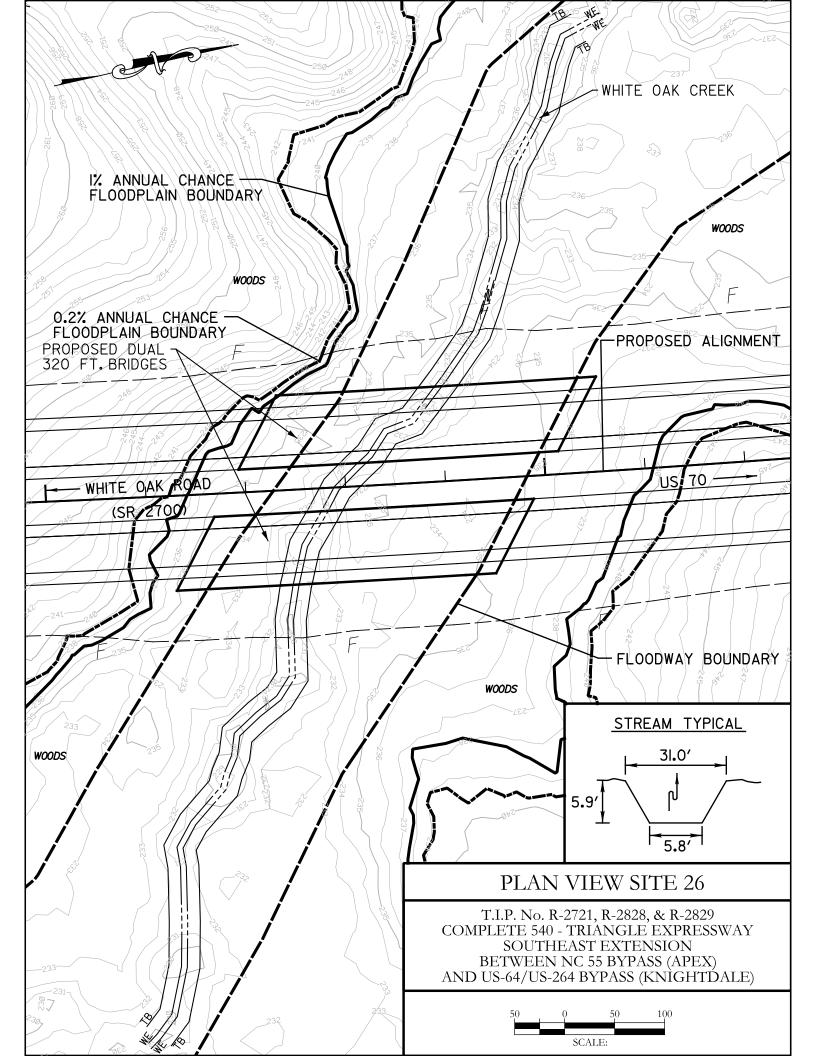
ARE BANKS STABLE? <u>Yes</u> PROTECTION NEEDED <u>No</u>
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
ALTERNATIVES
RECOMMENDED DESIGN <u>3@9'x5' RCBC</u>
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING 108 Sq. Ft
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YESNO X DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:

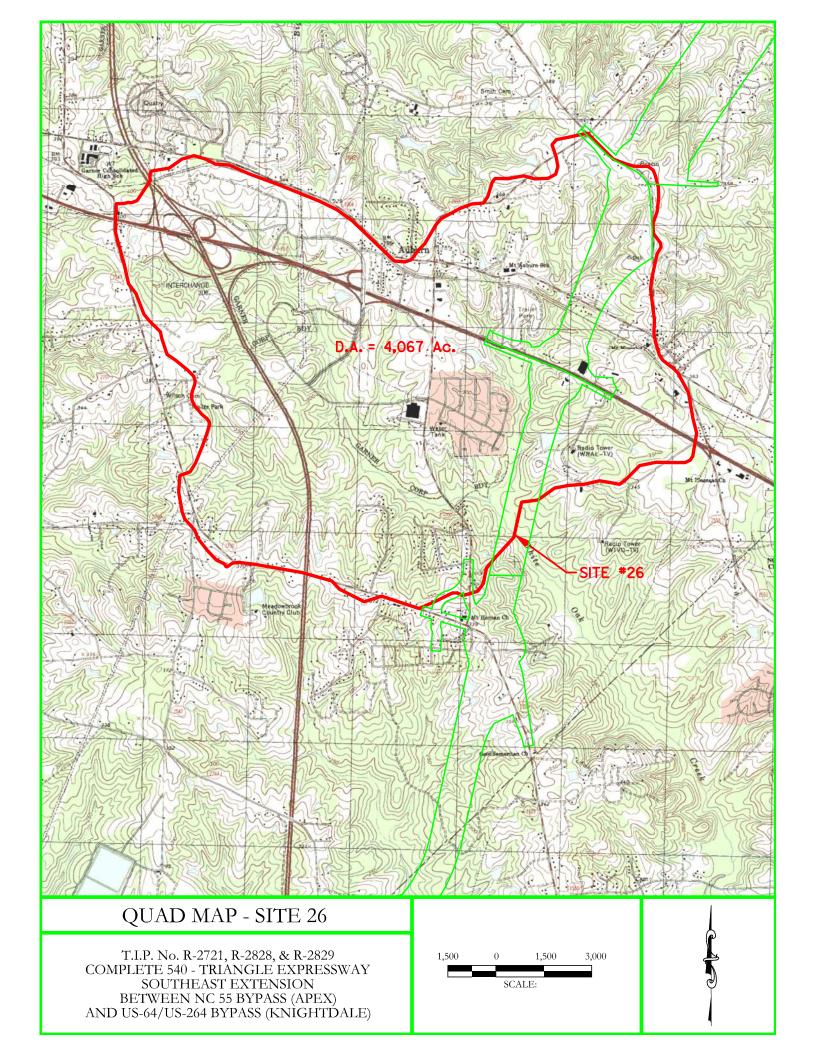


Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing





sq. miles PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = ENGLISH

STREAM NAME: White Oak Creek

**North Carolina** 

REGION: BLUE RIDGE

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City   City	UATIONS (OLD)    Blue Ridge	ESSION EQUATIONS (OLD)         FREQUE           cfs)         (cfs)         EREQUE           (cfs)         (cfs)         223.21         27R           436.92         855.68         57R           632.31         1141.80         10YR           967.80         1567.23         25YR           1267.13         1931.88         50YR           1636.41         2360.00         100YR           2087.88         2834.60         200YR
ATIONS (OLD)  Blue Ridge (cfs) 516.51 855.68 1141.80 1567.23 1931.88 2360.00 2834.60		
	Coastal Plain (cfs) 223.21 436.92 632.31 967.80 1267.13 1636.41 2087.88	AL REGRESSION EQUI           Sand Hills         Coastal Plain           (cfs)         (cfs)           115.13         223.21           190.93         436.92           252.89         632.31           345.45         967.80           425.49         1267.13           516.28         2087.88           536.28         2087.88

# **USGS URBAN REGRESSION EQUATIONS**

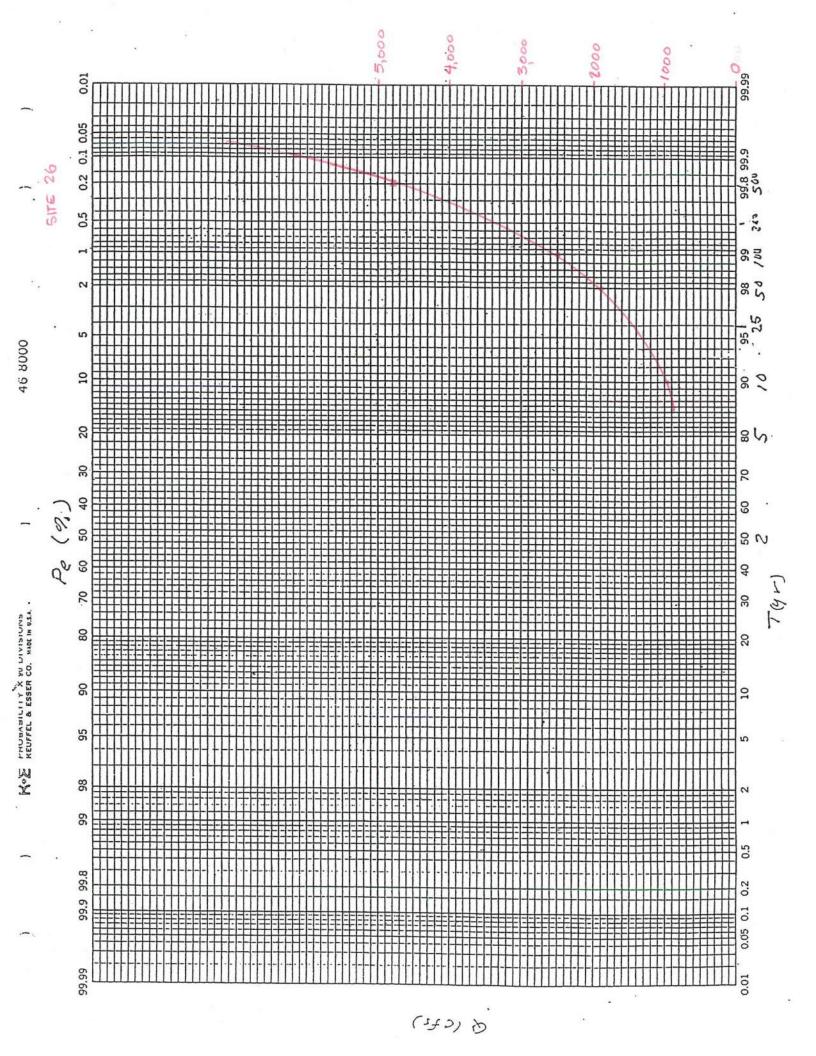
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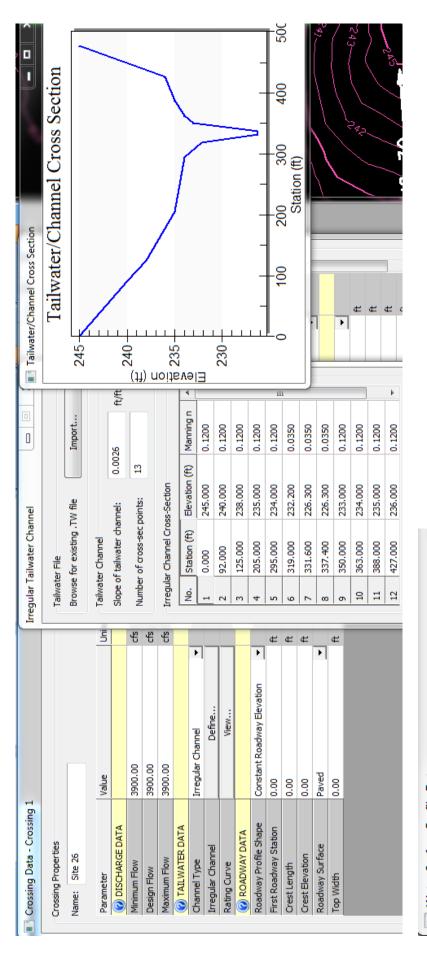
(These Equations are used only for comparison)

								(Based on 2.80xQ10)	
		(cfs)				3899.29	4746.41	7259.53	6684.74
ioi compansoni)	Sand Hills Coastal Plain	(cfs)	1270.25	1625.51	2214.18	2770.95	3515.35	4551.44	5480.79
AIS AIR USED OILLY	Sand Hills	(cts)	665.97	788.09	971.18	1144.83	1365.04	2206.65	1900.22
( These Eduations	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

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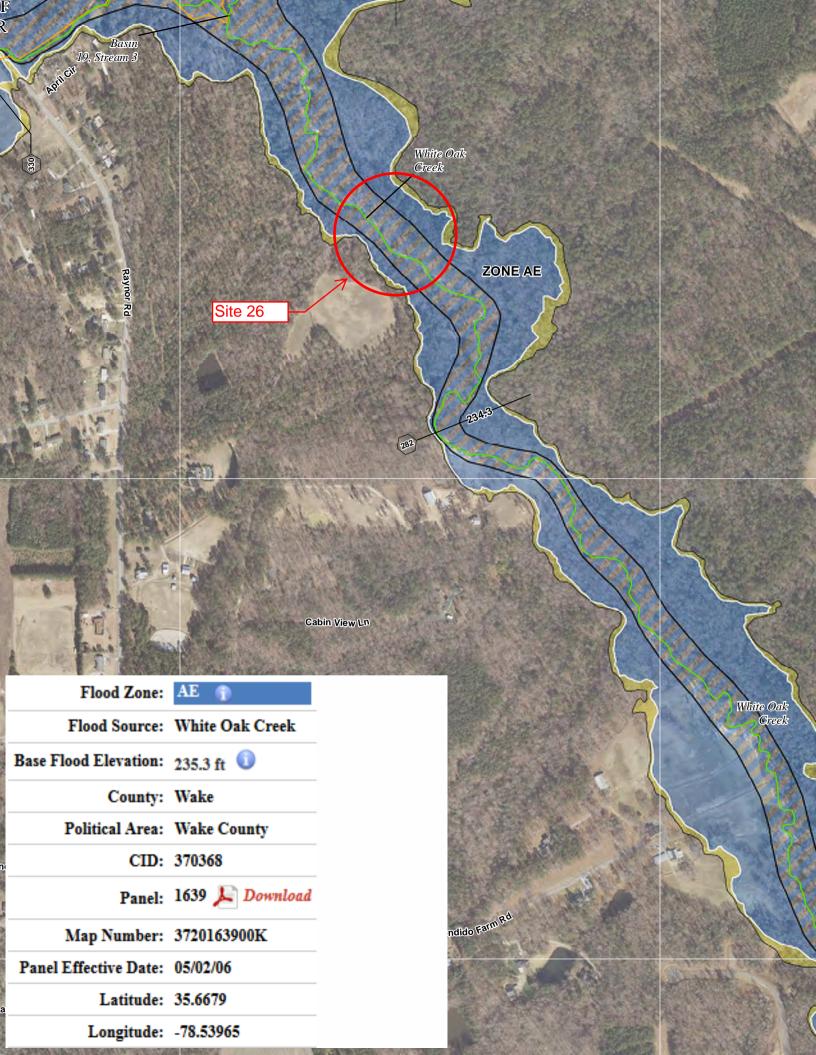
ΑÞ	Disharges				2,970	3,350		l	
FEMA	FREQUENCY			10YR	50YR	100YR	500YR		
								(01	(01
	<b>Slue Ridge Discharge Used</b>					3900		(Based on 2.80xQ10)	0016.56 (Based on 3.66xQ10)
	<b>Blue Ridge</b>	(cfs)	2291.63	2736.77	3523.12	3881.30	4192.31	7662.94	10016.56
	Coastal Plain	(cts)	1887.90	2313.24	2993.82	3384.71	3737.33	6477.08	8466.46
40	Sand Hills	(cts)	1492.11	1766.28	2102.30	2378.11	2604.62	4945.59	6464.60
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR





Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s) Shear (psf)	Shear (psf)
3900,000	238.341	12.041	3.254	1.954
3900.000	238.341	12.041	3.254	1.954
3900.000	238.341	12.041	3.254	1.954
3900.000	238.341	12.041	3.254	1.954
3900.000	238.341	12.041	3.254	1.954
3900.000	238.341	12.041	3.254	1.954
3900.000	238.341	12.041	3.254	1.954
3900.000	238.341	12.041	3.254	1.954
3900.000	238.341	12.041	3.254	1.954
3900.000	238.341	12.041	3.254	1.954
3900,000	238.341	12.041	3.254	1.954

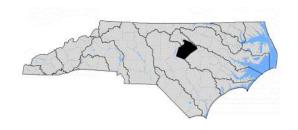
Effective depth is 12' which means actual structure depth is 13'. Therefore, a culvert option is eliminated and site requires a bridge.



# PRELIMINARY FLOOD INSURANCE STUDY

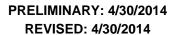
## FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

State of North Carolina

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 9, "Flooding Sources Studied by Detailed Methods: Redelineated", lists all flooding sources that were studied by detailed methods for the prestatewide FIS and redelineated for previous FISs. These flooding sources were not part of this revision and their effective analyses remain valid.

Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	Riverine	Sources	Affected Communities
	From	То	
Basin 10, Stream 2	The confluence with Little River (Basin 10, Stream 1)	Approximately 0.9 mile upstream of confluence with Little River (Basin 10, Stream 1)	Rdu Wake County
Basin 10, Stream 3	The confluence with Little River (Basin 10, Stream 1)	Moss Road	Rdu Wake County
Buffalo Branch (Basin 10, Stream 22)	The confluence with Little River (Basin 10, Stream 1)	Morphus Bridge Road	Rdu Town Of Wendell Wake County
Buffalo Creek (Basin 9, Stream 1)	The Wake/Johnston County boundary	Robertsons Pond Dam	Rdu Town Of Wendell Wake County
Kit Creek	The Chatham/Wake County Boundary	Approximately 475 feet upstream of Railroad	Rdu Town Of Cary Wake County
Little Creek (Basin 11, Stream 2)	The Wake/Johnston County boundary	Cemetery Road	Rdu Town Of Zebulon Wake County
Middle Creek	The confluence with Swift Creek	Approximately 0.7 mile upstream of confluence of Middle Creek Tributary	Rdu Town Of Apex Town Of Cary Town Of Fuquay-Varina Town Of Holly Springs Wake County
Panther Branch (Basin 22, Stream 2)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.5 mile upstream of Banks Road	Rdu Wake County
Panther Creek	The Chatham/Wake County Boundary	Approximately 1.0 mile upstream of Green Level to Durham Road	Town Of Cary
Poplar Creek (Basin 13, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 900 Feet upstream of Fayetteville Street	Rdu Town Of Knightdale Wake County
Swift Creek	The confluence with the Neuse River	The confluence of Yates Branch (Basin 20, Stream 13)	Rdu Town Of Garner Wake County
White Oak Creek	The confluence with Swift Creek	Approximately 0.4 mile upstream of Pergo Parkway	Rdu Town Of Clayton Town Of Garner Wake Countv

Site 26

Table 10, "Flooding Sources Studied by Detailed Methods: Limited Detailed", lists all flooding sources within the county that were studied by limited detailed methods for either this FIS or previous FISs.

Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed

Source	Riverine	Sources	Affected Communties
	From	То	
Bachelor Branch (Basin 28, Stream 6)	The confluence with White Oak Creek	Approximately 530 feet upstream of Highway 55	Rdu Town Of Cary Wake County
Basin 11, Stream 7	The Wake/Johnston County boundary	Approximately 0.4 mile upstream of Wake/Johnston County boundary	Rdu Wake County
Basin 14, Stream 2	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.4 mile upstream of Lake Myra Road	Rdu Wake County
Basin 14, Stream 3	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.7 mile upstream of confluence with Marks Creek (Basin 14, Stream 1)	Rdu Town Of Knightdale Town Of Wendell Wake County
Basin 20, Stream 5	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 1.7 miles upstream of confluence with Swift Creek (Basin 20, Stream 1)	Rdu Wake County
Basin 28, Stream 7	The confluence with Basin 28, Stream 8	Approximately 0.4 mile upstream of confluence with Basin 28, Stream 8	Town Of Cary
Beddingfield Creek	Approximately 0.4 mile upstream of the confluence with Neuse River	Approximately 0.2 mile upstream of Shotwell Road	Rdu Town Of Clayton Wake County
Big Branch	The confluence with Harris Reservoir	Approximately 0.9 mile upstream of Highway 1	Rdu Town Of Apex Wake County
Black Creek	Approximately 260 feet upstream of State HWY 210	Approximately 1.0 mile upstream of dam along Black Creek (Basin 23, Stream 1)	Rdu Town Of Fuquay-Varina Wake County

### **Table 16 - Roughness Coefficients**

Stream	Channel "n"	Overbank "n"
Beaver Creek	0.043 to 0.050	0.100 to 0.200
Beddingfield Creek	0.050	0.130
Big Branch	0.050	0.140
Black Creek	0.025 to 0.060	0.030 to 0.150
Buckhorn Creek	0.040 to 0.048	0.145
Buffalo Creek (Basin 9, Stream 1)	0.030 to 0.070	0.035 to 0.140
Buffalo Creek West	0.045 to 0.052	0.030 to 0.140
Cary Branch	0.040	0.140
Guffy Branch (Basin 21, Stream 4)	0.047	0.130
Jim Branch	0.045	0.145
Juniper Branch (Basin 21, Stream 2)	0.045	0.110 to 0.130
Kit Creek	0.030 to 0.070	0.070 to 0.110
Little Beaver Creek	0.045 to 0.055	0.100 to 0.220
Little Black Creek	0.030 to 0.070	0.070 to 0.130
Little Creek (Basin 11, Stream 2)	0.030 to 0.080	0.070 to 0.150
Little Creek (Into Middle Creek)	0.033 to 0.047	0.095 to 0.140
Little River	0.040 to 0.066	0.070 to 0.240
Marks Creek	0.025 to 0.070	0.070 to 0.130
Middle Creek	0.042 to 0.050	0.030 to 0.140
Mill Branch	0.050	0.030 to 0.150
Mill Creek (South)	0.035 to 0.060	0.040 to 0.160
Moccasin Creek	0.030 to 0.070	0.070 to 0.220
Morris Branch	0.030 to 0.050	0.100 to 0.200
Nancy Branch	0.045 to 0.050	0.120 to 0.150
Neuse River	0.035 to 0.060	0.055 to 0.250
Norris Branch	0.048	0.145
Panther Creek	0.030 to 0.070	0.070 to 0.130
Reedy Branch (Basin 27, Stream 5)	0.045 to 0.050	0.100 to 0.200
Snipes Creek	0.042 to 0.045	0.120 to 0.130
Swift Creek	0.040 to 0.072	0.035 to 0.240
Thomas Creek	0.050	0.145
Unnamed Tributary (#1) to Swift Creek	0.045 to 0.060	0.050 to 0.150
White Oak Creek	0.035 to 0.050	0.035 to 0.150

### Site 26

For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained using digital elevation data obtained with LIDAR technology developed as part of the North Carolina Statewide Floodplain Mapping Program. The hydraulic model is prepared using this digital elevation data, without surveying bathymetric or structural data. Where bridge or culvert data are readily available, such as from the North Carolina Department of Transportation, these data have been reflected in the hydraulic model. If these structural data are not readily available, field measurements of these structures were made to approximate their geometry in the hydraulic models. In addition, this method does not include field surveys that determine specifics on channel and floodplain characteristics. A limited detailed study is a "buildable" product that can be upgraded to a fully detailed study at a later date by verifying stream channel characteristics, bridge and culvert opening geometry, and by analyzing multiple recurrence intervals.

The results of the HEC-RAS computations are tabulated for all cross sections (Table 17, "Limited Detailed Flood Hazard Data"). Flood Profiles have not been developed for streams studied by limited detailed methods. Water-surface elevation rasters were developed for steams studied by limited detailed methods. In addition, floodways for streams studied by limited detailed methods are not delineated on the FIRM. However, the 1% annual chance water-surface elevations, flood discharges, and non-encroachment widths from the limited detailed studies for every modeled cross section are given in Table 17. The non-encroachment widths given at modeled cross sections can be used by communities to enforce floodplain management ordinances that meet the requirement defined in 44 CFR 60.3(c)(10).

Between cross sections for streams studied by limited detailed methods, 1% annual chance water-surface elevations can be calculated by mathematical interpolation using the distance along the stream centerline. Non-encroachment widths and, therefore, the location of a non-encroachment area boundary between cross sections should be determined based on either 1) mathematical interpolation, or 2) the non-encroachment width at the upstream or downstream cross section, whichever is larger. If the width determined by this second method is wider than the Special Flood Hazard Area (SFHA) or the 1% annual chance floodplain delineated on the FIRM for this location along the stream, the non-encroachment area shall be considered to

Table 21 - Floodway Data

Floodwa	y Source		Floodway			Wa	ter Surface Eleva	ation	
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
036	3,560	150	762	2.8	243.1	*	243.1	243.9	0.8
)49	4,930	90	445	4.5	247.9	*	247.9	248.8	0.9
057	5,730	130	651	3.1	251.7	*	251.7	252.4	0.7
063	6,315	140	964	1.9	255.8	*	255.8	256.5	0.7
077	7,710	120	598	3.0	257.8	*	257.8	258.7	0.9
084	8,375	90	435	4.1	260.5	*	260.5	261.2	0.7
093	9,320	100	478	3.8	264.8	*	264.8	265.5	0.7
101	10,130	70	330	4.8	268.9	*	268.9	269.6	0.7
109	10,890	90	406	3.9	273.1	*	273.1	274.1	1.0
120	12,030	140	472	3.3	279.6	*	279.6	280.1	0.5
132	13,210	140	461	3.4	286.4	*	286.4	287.0	0.6
136	13,565	140	952	1.5	291.2	*	291.2	291.6	0.4
143	14,300	110	374	3.5	291.9	*	291.9	292.7	0.8
161	16,085	100	351	3.1	303.9	*	303.9	304.6	0.7
Panther Creel	k								
126	12,614	142	807	2.8	245.5	*	245.5	246.3	0.8
127	12,660	190	1,175	2.0	251.5	*	251.5	251.5	0.0
144	14,400	180	1,044	1.9	252.3	*	252.3	252.5	0.2
156	15,620	420	4,111	0.4	261.2	*	261.2	261.3	0.1
Poplar Creek	(Basin 13, Stre	eam 1)		r	ı		r	1	
015	1,530	200	791	4.5	165.4 <sup>1</sup>	*	154.9	155.9	1.0
Reedy Branch	n (Basin 27, St	ream 5)	ı	ı	1	T	I	T	ı
010	1,017	605	3,079	1.0	238.7	*	238.7	239.7	1.0
017	1,666	250	910	3.3	239.4	*	239.4	240.3	0.9
Swift Creek	I	1	1	I			I	1	I
1435	143,473	1,090	12,492	0.8	202.5	*	202.5	203.4	0.9
Jnnamed Trib	outary (#1) to S	Swift Creek				I		I	
098	9,769	118	420	3.6	214.7	*	214.7	215.7	1.0
100	10,035	48	259	5.9	216.4	*	216.4	217.4	1.0
White Oak Cr									
088	8,804	588	4,690	1.3	238.01	*	233.7	234.7	1.0
)96	9,645	790	6,444	1.0	238.01	*	234.2	235.3	1.0
105	10,545	1,065	7,654	0.8	238.01	*	234.6	235.6	1.0
119	11,886	950	5,187	1.2	238.01	*	235.4	236.3	1.0
125	12,466	815	4,803	1.3	238.01	*	236.0	236.9	1.0
130	12,997	630	3,846	1.6	238.01	*	236.6	237.6	1.0
258	25,831	240	1,206	2.2	222.5	*	222.5	223.2	0.7
282	28,170	140	670	3.4	234.3	*	234.3	235.3	1.0
330 1	32,980	370	1,834	1.2	249.7	*	249.7	250.1	0.4

Site 26 Hevation includes backwater effects

<sup>&</sup>lt;sup>2</sup>Feet above county boundary

<sup>\*</sup> Future conditions not computed for this stream

# **FLOOD INSURANCE STUDY**

## FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





**Table 13 - Summary of Discharges** 

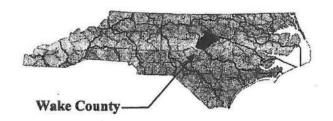
Table 13 - Summa	ary of Dis	charges	5: 1	( ( )	
Flooding Source Location	Drainage Area	10% Annual	Dischar 2% Annual	ges (cfs) 1% Annual	0.2% Annual
Location	(square miles)	Chance	Chance	Chance	Chance
Approximately 530 feet downstream of Lake Dam Road	7.00	*	*	2,150	*
At Lake Johnson Dam	6.92	*	*	6,020	*
Approximately 1.3 miles upstream of Lake Johnson Dam	5.35	*	*	4,230	*
Approximately 1.6 miles upstream of Lake Johnson Dam	4.36	*	*	3,480	*
Approximately 2.0 miles upstream of Lake Johnson Dam	3.55	*	*	2,800	*
At Interstate 40	2.92	*	*	2,340	*
Approximately 0.4 mile downstream of Cary Towne Boulevard	2.01	*	*	2,210	*
Approximately 530 feet upstream of Cary Towne Boulevard	1.36	*	*	1,870	*
Approximately 1,580 feet downstream of York Street	1.12	*	*	1,780	*
West Fork Mine Creek (Basin 18, Stream 33)				_	_
At mouth	3.50	*	*	2,070	*
Wheelers Creek (Basin 10, Stream 25)					
At mouth	1.70	*	*	1,430	*
Approximately 0.6 mile upstream of State Road 97	1.00	*	*	1,020	*
At pond	0.10	*	*	310	*
White Oak Creek					
At County boundary	7.90	*	*	3,350	*
Just ups ream of Basin 19, Stream 3	3.80	*	*	2,220	*
proximately 0.7 mile upstream of Raynor Road just upstream of tributary	2.20	*	*	1,700	*
White Oak Creek (Basin 26, Stream 1)	1			1.,	
At the confluence with Utley Creek	15.90	*	*	4,191	*
Approximately 0.6 mile upstream of the confluence with Utley Creek	15.50	*	*	4,136	*
Approximately 0.0 mile upstream of the confidence with other creek  Approximately 0.4 mile downstream of Holly Springs New Hill Road	15.40	*	*	4,122	*
Approximately 220 feet downstream of Holly Springs New Hill Road	14.70	*	*	4,004	*
Approximately 220 feet downstream of Holly Springs New Hill Road	13.30	*	*	3,756	*
Approximately 1,580 feet downstream of confluence with Big Branch (Basin 26,	12.70	*	*	3,652	*
Stream 5)	12.70			0,002	
Approximately 1,060 feet upstream of confluence with Big Branch (Basin 26, Stream	1.60	*	*	990	*
5)					
Approximately 0.5 mile upstream of confluence with Big Branch (Basin 26, Stream 5)	1.40	*	*	924	*
Approximately 1,580 feet downstream of Woods Creek Road	1.00	*	*	758	*
Approximately 200 feet downstream of Woods Creek Road	1.00	*	*	728	*
Approximately 740 feet upstream of Woods Creek Road	0.90	*	*	680	*
Approximately 0.4 mile upstream of Woods Creek Road	0.80	*	*	638	*
Approximately 1,580 feet downstream of Highway 1	0.70	*	*	576	*
Approximately 810 feet downstream of Highway 1	0.50	*	*	472	*
Approximately 1,060 feet upstream of Highway 1	0.30	*	*	377	*
Wildcat Branch (Basin 30, Stream 4)	T	T	1		
At mouth	2.10	*	*	1,400	*
Just downstream of Railroad	1.90	*	*	1,300	*
Just upstream of Railroad	1.90	*	*	1,700	*
Just downstream of fork near Montlawn Cemetery	1.40	*	*	1,550	*
Yates Branch (Basin 20, Stream 13)					
At mouth	13.40	*	*	4,920	*
At Railroad	10.40	*	*	4,315	*

# FLOOD INSURANCE STUDY

A Report of Flood Hazards in

## WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 7 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





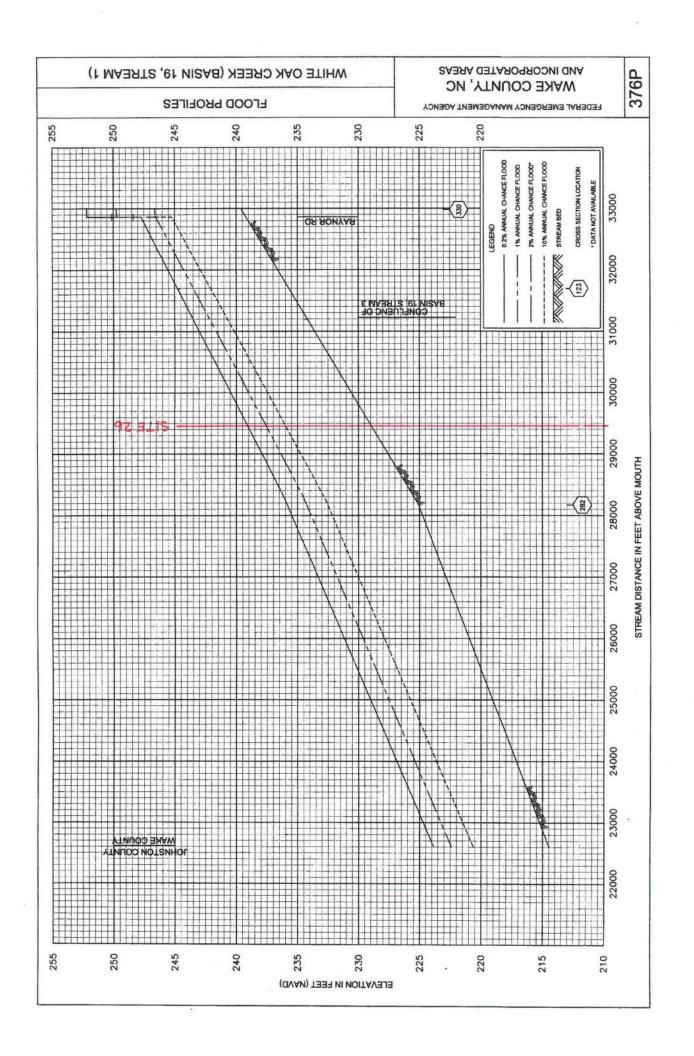
May 2, 2006

Federal Emergency Management Agency State of North Carolina

> Flood Insurance Study Number 37183CV007A

www.fema.gov and www.ncfloodmaps.com





# PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake PROJECT NUMBER R-2721, R-2828, & R-2829
STREAM White Oak Creek ROUTE New Location
(Site 26) ASSESSMENT PREPARED BY <u>Mulkey, INC.</u> DATE <u>6/11/2010</u> (MLH)
HYDROLOGIC EVALUATION
NEAREST GAGING STATION ON THIS STREAM (NONE <u>X</u> )
ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: No
FLOOD DATA: $Q_{10} \ \underline{N/A} \ CFS = EST. \ BKWTR. \ \underline{N/A} \ FT. \qquad Q_{25} \ \underline{N/A} \ CFS = EST. \ BKWTR. \ \underline{N/A} \ FT. \\ Q_{50} \ \underline{N/A} \ CFS = EST. \ BKWTR. \ \underline{N/A} \ FT. \\ Q_{500} \ \underline{N/A} \ CFS = EST. \ BKWTR. \ \underline{N/A} \ FT.$
DRAINAGE AREA 6.35 Sq.Mi. METHOD USED TO COMPUTE Q: USGS Urban Regression
PROPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: LOW MODERATE X HIGH
COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: YES NO X
EXPLANTION: A floodway modification may be required at this site.
LIST BUILDINGS IN FLOOD PLAIN: None LOCATION:
UPSTREAM LAND USE <u>Residential</u> ANTICIPATE ANY CHANGE? <u>No</u>
ANY FLOOD ZONING? (FIA STUDIES, ETC.) YES X NO
TYPE OF STUDY: FEMA – Special Flood Hazard Zone AE
REGULATORY FLOODWAY WIDTH 140 ft. Section 282 (AS NOTED IN FIS)
COMMENTS:

### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 23,800 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 51,900 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? <u>N/A New Location</u> LENGTH OF DETOUR <u>N/A</u> MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? N/A
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS  NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.  LEVEES AGGRADATION/DEGRADATION RESERVOIRS DIVERSIONS DRAINAGE DISTRICT NAVIGATION BACKWATER FROM ANOTHER SOURCE EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION  EMBANKMENT: SOIL TYPE Wehadkee TYPE SLOPE COVER Vegetation  COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service

### ENVIRONMENTAL CONSIDERATIONS

LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: <u>Buried culverts 1 foot to allow for fish passage.</u>

### MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES $\_\_$ NO $\underline{X}$ PROTECTION NEEDED $\_\_$
ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
<u>ALTERNATIVES</u>
RECOMMENDED DESIGN: 320' Dual Bridges
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO $\underline{X}$ DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:

Name of Stream	Description	Curr. Class	Date	Basin	Stream Index # 5ITE 26
Swift Creek (Lake Wheeler)	From source to a point 0.6 mile upstream of Wake County SR 1006	WS-III;NSW	08/03/92	Neuse	27-43-(1)
Swift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	Neuse	27-43-(5.5)
Swift Creek	From dam at Lake Benson to Neuse River	C;NSW	05/01/88	Neuse	27-43-(8)
Neal Branch	From source to Swift Creek	C; NSW	05/01/88	Neuse	27-43-10
White Oak Creek (Austin Pond)	From source to Swift Creek	C;NSW	05/01/88	Neuse	27-43-11
Little Creek	From source to Swift Creek	C;NSW	05/01/88	Neuse	27-43-12
Middle Creek	From source to backwaters of Sunset Lake	C;NSW	05/01/88	Neuse	27-43-15-(1)
Middle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	Neuse	27-43-15-(2)
Middle Creek	From dam at Sunset Lake to Swift Creek	C;NSW	05/01/88	Neuse	27-43-15-(4)
Little Creek	From source to Middle Creek	C;NSW	05/01/88	Neuse	27-43-15-10
Juniper Creek	From source to Little Creek	C;NSW	05/01/88	Neuse	27-43-15-10-1
Guffy Branch	From source to Little Creek	C;NSW	05/01/88	Neuse	27-43-15-10-2
Ditch Branch	From source to Guffy Branch	C; NSW	05/01/88	Neuse	27-43-15-10-2-1
Buffalo Branch	From source to Middle Creek	C; NSW	05/01/88	Neuse	27-43-15-11
Basal Creek [(Bass Lake, (Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	Neuse	27-43-15-3
Rocky Branch	From source to Middle Creek	C;NSW	05/01/88	Neuse	27-43-15-4.5
Camp Branch	From source to Middle Creek	C; NSW	05/01/88	Neuse	27-43-15-5
Bells Lake	Entire lake and connecting stream to Middle Creek	C;NSW	05/01/88	Neuse	27-43-15-6
Mills Branch	From source to Middle Creek	C;NSW	05/01/88	Neuse	27-43-15-7
Terrible Creek (Johnsons Pond)	From source to dam at Johnsons Pond	B;NSW	05/01/88	Neuse	27-43-15-8-(1)
Terrible Creek	From dam at Johnsons Pond to Middle Creek	C; NSW	05/01/88	Neuse	27-43-15-8-(2)
Panther Branch	From source to Middle Creek	C;NSW	05/01/88	Neuse	27-43-15-9

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Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing



Looking at Upstream Channel of Downstream Structure.



Looking at Upstream Face of Downstream Structure (NCDOT #141).

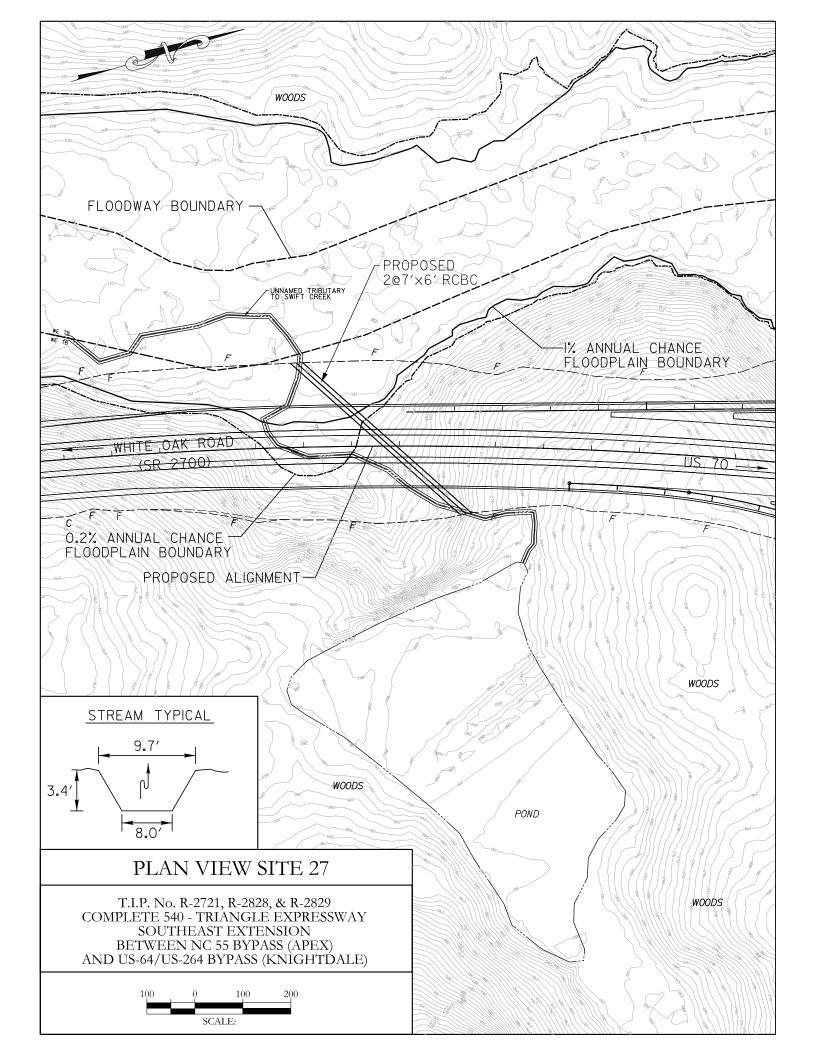


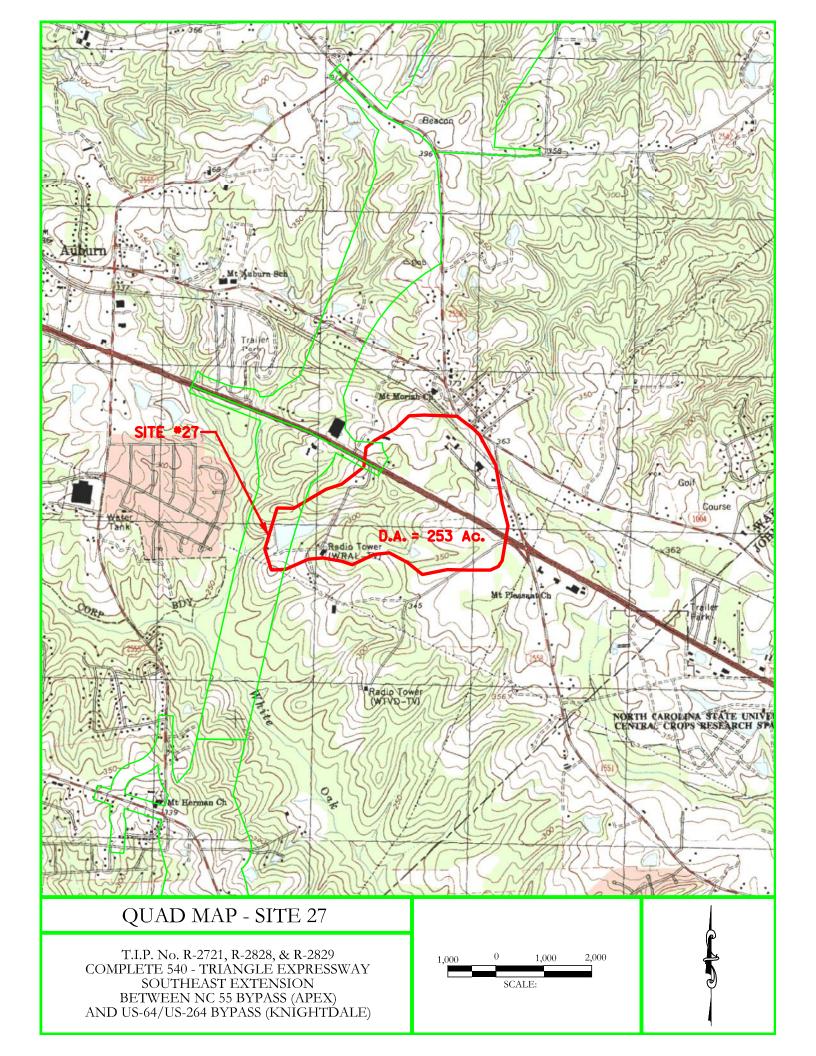
Looking at Downstream Face of Downstream Structure (NCDOT #141).



Looking at Downstream Channel of Downstream Structure.

# **Site 27**





# **North Carolina**

PROJECT NAME: Triangle Expressway SE Ext. 6/16/2014

ENGLISH

0.40 Drainage Area =

STREAM NAME: Unnamed Trib to White Oak Creek sq. miles

REGION: BLUE RIDGE 007-00 METHOD USED:

USGS RURAL REGRESSION EQUATIONS (OLD)  RURAL EQUATIONS Report 01-4207	Blue Ridge FREQUE	(cfs)	76.45 2YR 70.95 34.92	134.22 5YR 130.14 72.09	181.60 107R 182.10 107.01	256.25 25YR 263.59 163.20	320.27 50YR 336.44 215.90	398.89 420.19 278.62	484.44 516.36 352.73	
RAL REGRE	Sand Hills	(cfs)	15.17	24.82	32.69	43.32	52.47	62.62	76.97	
<b>ISGS RUI</b>	REQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	

# **USGS URBAN REGRESSION EQUATIONS**

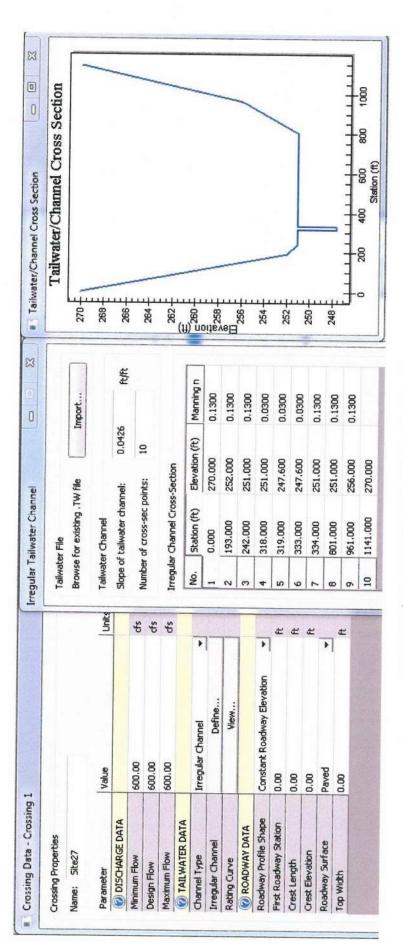
BDF=

(These Equations are used only for comparison)

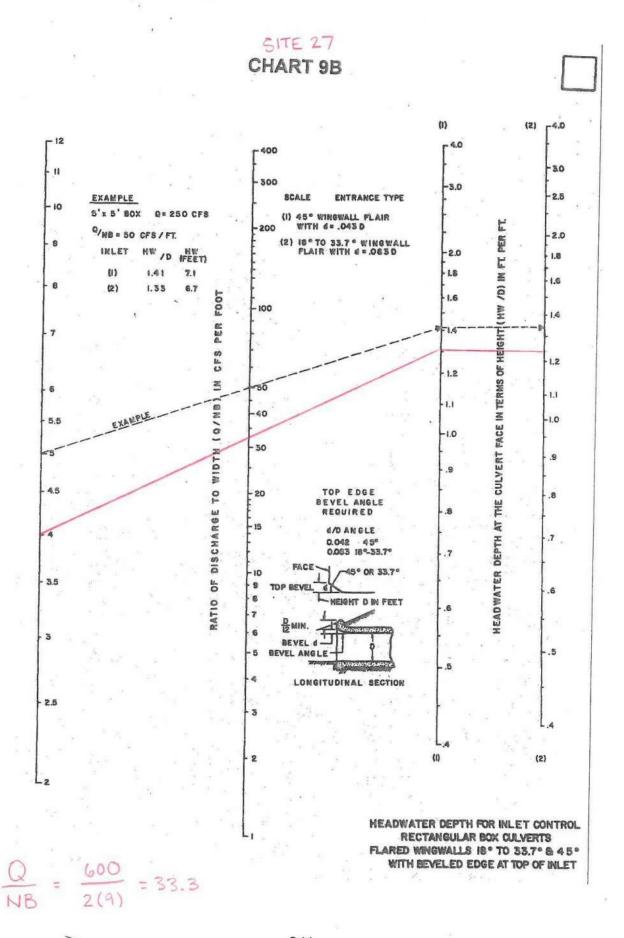
							(Based on 2.80xQ10)	
Blue Ridge	(cfs)	316.20	389.80	505.14	92.009	729.74	1091.44	1046.10
Coastal Plain	(cfs)	226.30	308.06	450.90	578.92	752.53	862.56	1229.93
Sand Hills	(cfs)	84.75	100.58	121.84	138.80	159.88	281.63	209.26
FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

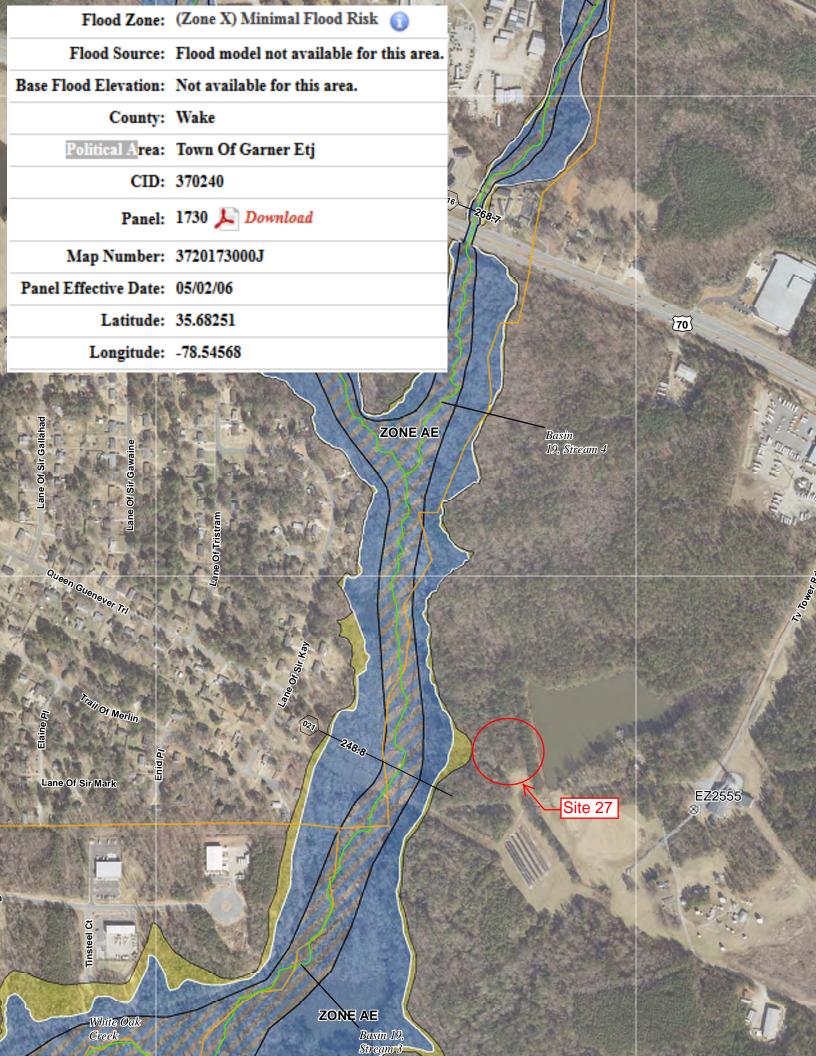
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FEMA	FREQUENCY Disharges			10YR	50YR	100YR	500YR		
	Blue Ridge Discharge Used					009		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	Blue Ridge	(cts)	266.50	351.28	530.02	86.609	687.63	983.57	1285.67
	Coastal Plain	(cfs)	235.91	322.59	504.45	600.75	696.14	903.26	1180.69
25	Sand Hills	(cts)	164.64	213.33	288.69	339.27	385.67	597.33	780.79
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR



Flow (cfs)	Elevation (ft) Depth (ft)	Depth (ft)	Velocity (ft/s)   Shear (psf)	Shear (psf)
000'009	250.151	2.551	15,945	6.781
000'009	250,151	2.551	15,945	6.781
000'009	250.151	2,551	15.945	6.781
000'009	250.151	2.551	15,945	6.781
000'009	250.151	2,551	15,945	6.781
000'009	250.151	2.551	15,945	6,781
000'009	250.151	2.551	15,945	6.781
000'009	250.151	2.551	15,945	6.781
900,000	250.151	2,551	15,945	6.781
900,000	250,151	2,551	15,945	6.781
900.009	250,151	2.551	15,945	6.781





Name of Stream	Description	Curr. Class	Date	Basin	Stream Index # SITE 27
Swift Creek (Lake Wheeler)	From source to a point 0.6 mile upstream of Wake County SR 1006	WS-III;NSW	08/03/92	Neuse	27-43-(1)
Swift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	Neuse	27-43-(5.5)
Swift Creek	From dam at Lake Benson to Neuse River	C; NSW	05/01/88	Neuse	27-43-(8)
Neal Branch	From source to Swift Creek	C;NSW	05/01/88	Neuse	27-43-10
White Oak Creek (Austin Pond)	From source to Swift Creek	C;NSW	05/01/88	Neuse	27-43-11
Little Creek	From source to Swift Creek	C;NSW	05/01/88	Neuse	27-43-12
Middle Creek	From source to backwaters of Sunset Lake	C;NSW	05/01/88	Neuse	27-43-15-(1)
Middle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B; NSW	05/01/88	Neuse	27-43-15-(2)
Middle Creek	From dam at Sunset Lake to Swift Creek	C;NSW	05/01/88	Neuse	27-43-15-(4)
Little Creek	From source to Middle Creek	C;NSW	05/01/88	Neuse	27-43-15-10
Juniper Creek	From source to Little Creek	C;NSW	05/01/88	Neuse	27-43-15-10-1
Guffy Branch	From source to Little Creek	C;NSW	05/01/88	Neuse	27-43-15-10-2
Ditch Branch	From source to Guffy Branch	C; NSW	05/01/88	Neuse	27-43-15-10-2-1
Buffalo Branch	From source to Middle Creek	C; NSW	05/01/88	Neuse	27-43-15-11
Basal Creek [(Bass Lake, (Mills Pond)]	From source to Sunset Lake, Middle Creek	B;NSW	05/01/88	Neuse	27-43-15-3
Rocky Branch	From source to Middle Creek	C;NSW	05/01/88	Neuse	27-43-15-4.5
Camp Branch	From source to Middle Creek	C; NSW	05/01/88	Neuse	27-43-15-5
Bells Lake	Entire lake and connecting stream to Middle Creek	C;NSW	05/01/88	Neuse	27-43-15-6
Mills Branch	From source to Middle Creek	C;NSW	05/01/88	Neuse	27-43-15-7
Terrible Creek (Johnsons Pond)	From source to dam at Johnsons Pond	B;NSW	05/01/88	Neuse	27-43-15-8-(1)
Terrible Creek	From dam at Johnsons Pond to Middle Creek	C;NSW	05/01/88	Neuse	27-43-15-8-(2)
Panther Branch	From source to Middle Creek	C;NSW	05/01/88	Neuse	27-43-15-9

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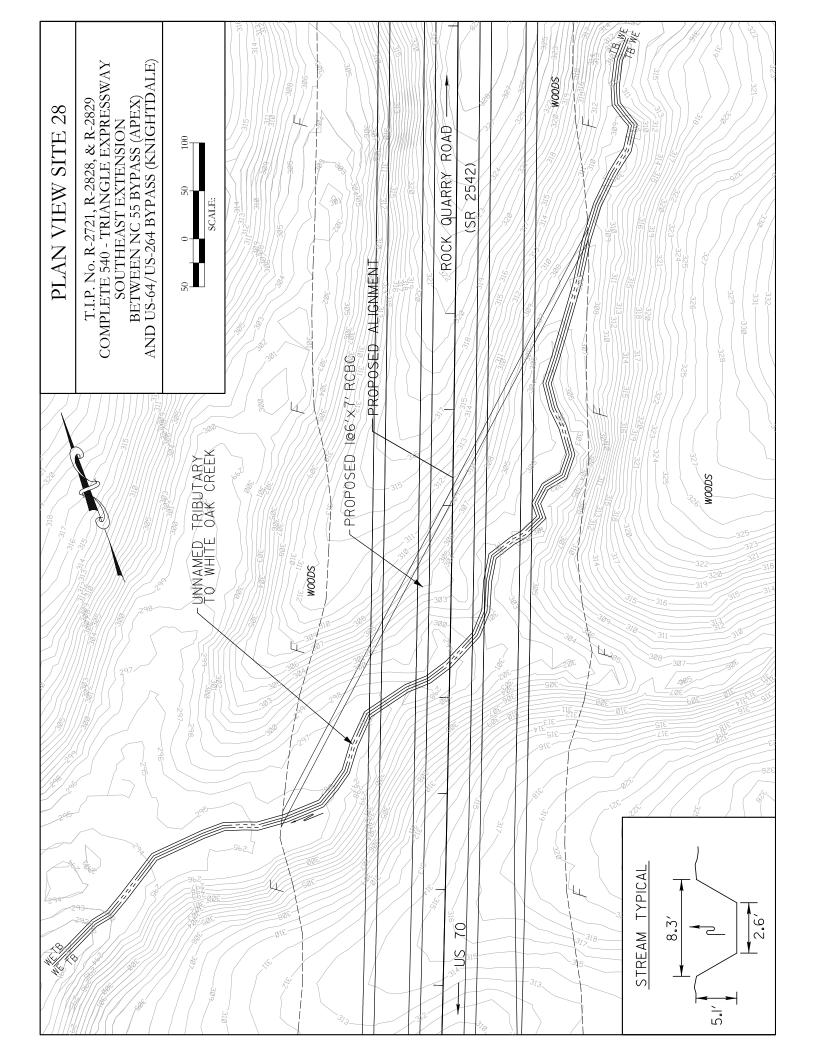


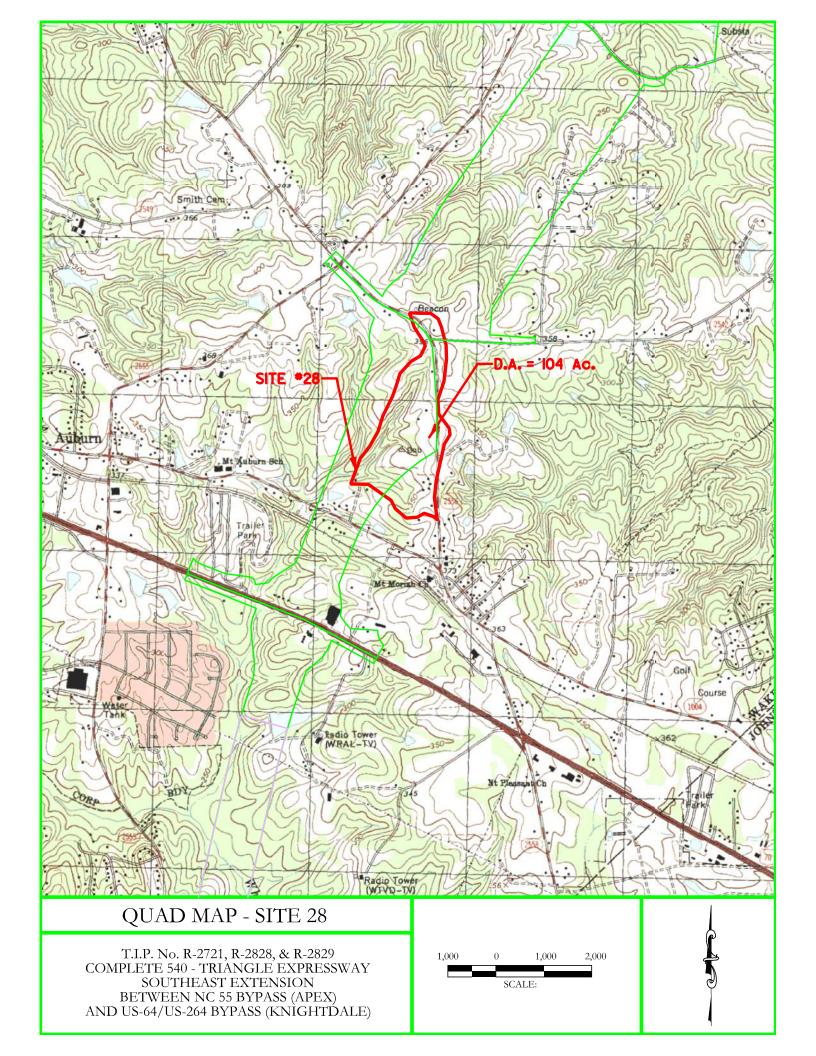
Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing

# Site 28





REGION: BLUE RIDGE Rep. 01-4207 METHOD USED: STREAM NAME: Unnamed Trib to White Oak Creek sd. miles 0.16 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = 11/24/2010 ENGLISH

<b>USGS RUR</b>	<b>JSGS RURAL REGRE</b>	SSION EQU	ATIONS (OLD)	RUR	RAL EQUA	ATIONS Rep	oort 01-4207
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)
2YR	7.75	21.80	40.59	2YR	37.29	18.85	60.6
5YR	12.62	51.28	72.65	5YR	69.98	40.29	15.36
10YR	16.59	80.78	98.74	10YR	99.28	60.91	20.32
25YR	21.77	136.55	140.61	25YR	145.97	94.79	27.55
50YR	26.22	191.04	176.54	SOYR	188.02	127.01	33.82
100YR	31.13	262.64	221.30	100YR	236.99	165.87	40.53
200YR	38.22	352.82	269.74	200YR	293.65	212.31	48.36
500YR	43.98	508.46	360.78	500YR	382.78	287.87	96.69

# **USGS URBAN REGRESSION EQUATIONS**

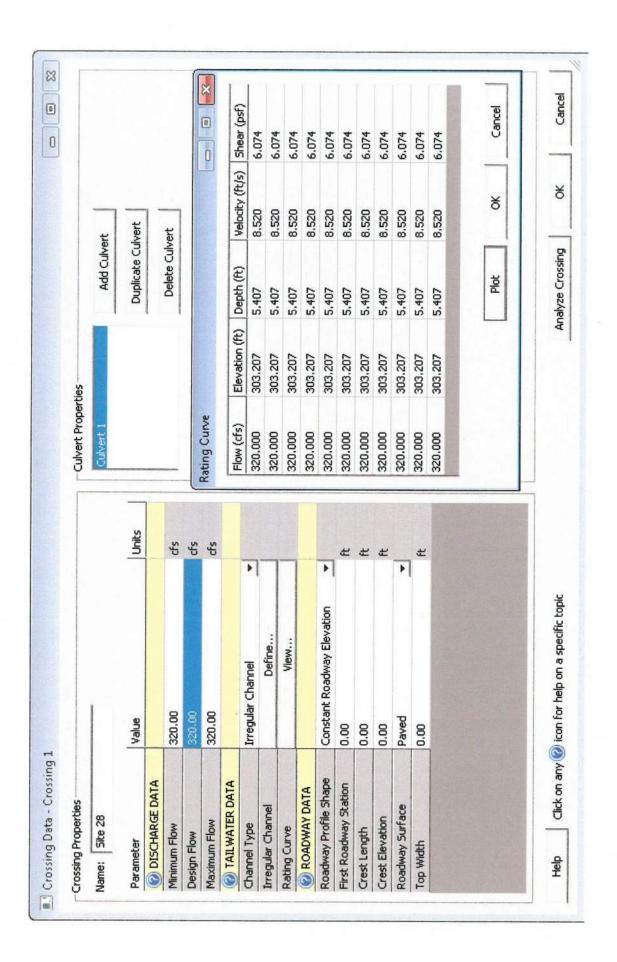
BDF=

( These Equations are used only for comparison)

ו ווססס באממונו	ים מוס מספת סווים	(incombanger)		
FREQUENCY	Sand Hills	Coastal Plain		
	(cfs)	(cfs)		
5YR	42.80	127.76		
10YR	50.84	177.51		
25YR	61.24	266.09		
SOYR	68.98	344.55		
100YR	78.55	451.50		
200YR	142.36	497.03		(Based on 2.80xQ10)
500YR	100.73	500YR 100.73 749.55	565.73	

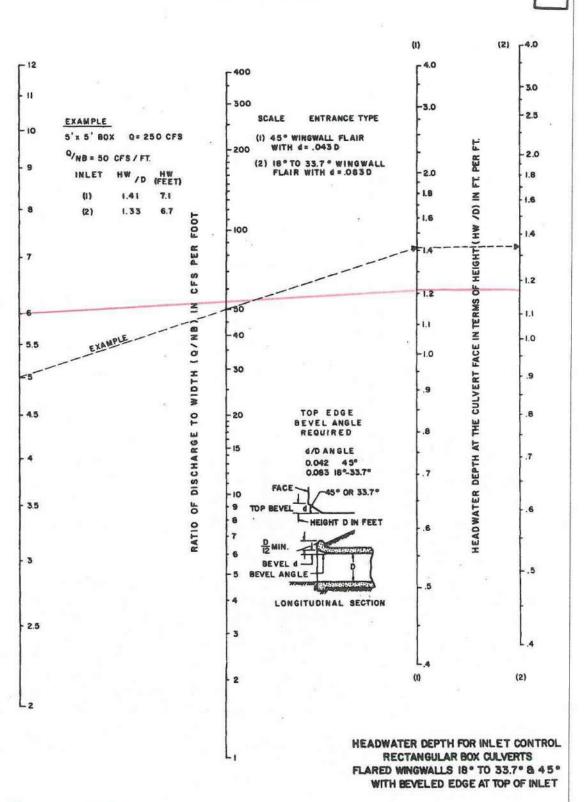
- andividual %	20				
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Blue Ridge Discharge Used	FREQUENCY
	(cfs)	(cfs)	(cfs)		
5YR	76.31	113.94	125.68		
10YR	102.27	162.19	171.83		10YR
25YR	145.18	271.48	274.73		50YR
50YR	173.25	329.81	321.65	320	100YR
100YR	199.91	389.34	368.71		500YR
200YR	286.35	454.14	481.11	(Based on 2.80xQ10)	
500YR	374.30	593.63	628.88	(Based on 3.66xQ10)	

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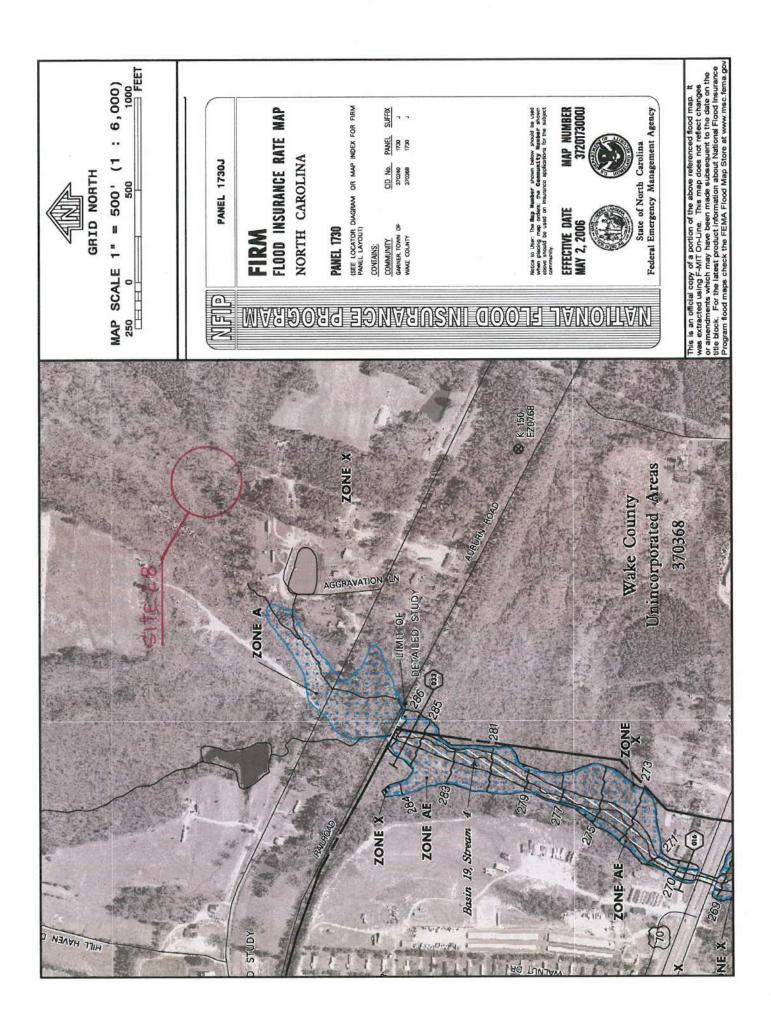


SITE 28

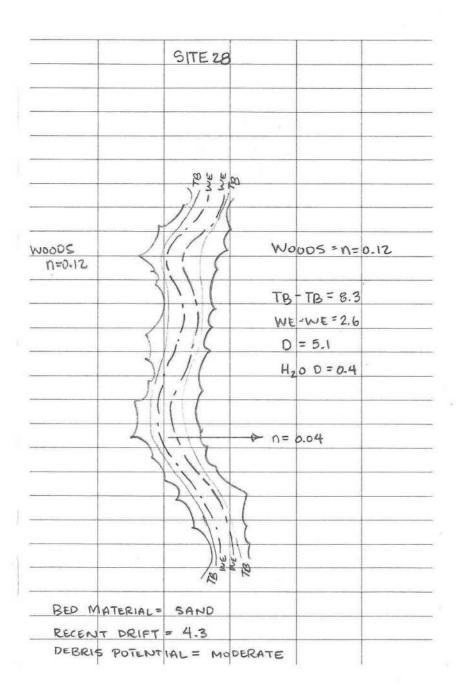


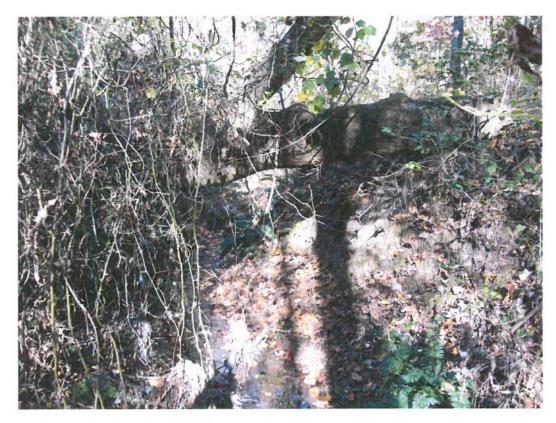


$$Q_{NB} = \frac{320}{(1)(6)} = 53.3$$



Name of Stream	Description	Curr. Class	Date	Basin	Stream Index # SITE 28
Swift Creek (Lake Wheeler)	From source to a point 0.6 mile upstream of Wake County SR 1006	WS-III;NSW	08/03/92	Neuse	27-43-(1)
Swift Creek (Lake Benson)	From a point 0.6 mile upstream of Wake County SR 1006 to dam at Lake Benson	WS-III;NSW,CA	08/03/92	Neuse	27-43-(5.5)
Swift Creek	From dam at Lake Benson to Neuse River	C;NSW	05/01/88	Neuse	27-43-(8)
Neal Branch	From source to Swift Creek	C;NSW	05/01/88	Neuse	27-43-10
White Oak Creek (Austin Pond)	From source to Swift Creek	C;NSW	05/01/88	Neuse	27-43-11
Little Creek	From source to Swift Creek	C; NSW	05/01/88	Neuse	27-43-12
Middle Creek	From source to backwaters of Sunset Lake	C;NSW	05/01/88	Neuse	27-43-15-(1)
Middle Creek (Sunset Lake)	From backwaters of Sunset Lake to dam at Sunset Lake	B;NSW	05/01/88	Neuse	27-43-15-(2)
Middle Creek	From dam at Sunset Lake to Swift Creek	C;NSW	05/01/88	Neuse	27-43-15-(4)
Little Creek	From source to Middle Creek	C;NSW	05/01/88	Neuse	27-43-15-10
Juniper Creek	From source to Little Creek	C;NSW	05/01/88	Neuse	27-43-15-10-1
Guffy Branch	From source to Little Creek	C; NSW	05/01/88	Neuse	27-43-15-10-2
Ditch Branch	From source to Guffy Branch	C;NSW	05/01/88	Neuse	27-43-15-10-2-1
Buffalo Branch	From source to Middle Creek	C;NSW	05/01/88	Neuse	27-43-15-11
Basal Creek [(Bass Lake, (Mills Pond)]	From source to Sunset Lake, Middle Creek	B; NSW	05/01/88	Neuse	27-43-15-3
Rocky Branch	From source to Middle Creek	C;NSW	05/01/88	Neuse	27-43-15-4.5
Camp Branch	From source to Middle Creek	C;NSW	05/01/88	Neuse	27-43-15-5
Bells Lake	Entire lake and connecting stream to Middle Creek	C; NSW	05/01/88	Neuse	27-43-15-6
Mills Branch	From source to Middle Creek	C;NSW	05/01/88	Neuse	27-43-15-7
Terrible Creek (Johnsons Pond)	From source to dam at Johnsons Pond	B;NSW	05/01/88	Neuse	27-43-15-8-(1)
Terrible Creek	From dam at Johnsons Pond to Middle Creek	C;NSW	05/01/88	Neuse	27-43-15-8-(2)
Panther Branch	From source to Middle Creek	C; NSW	05/01/88	Neuse	27-43-15-9





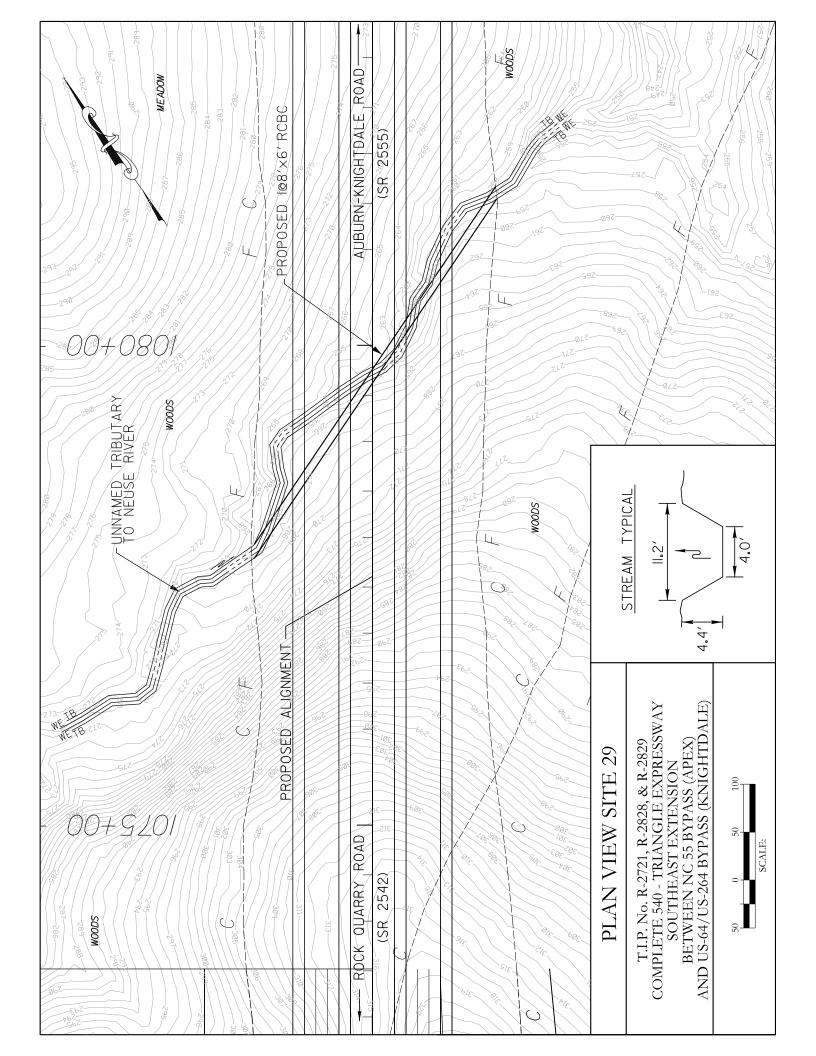
Looking Upstream from Proposed Crossing

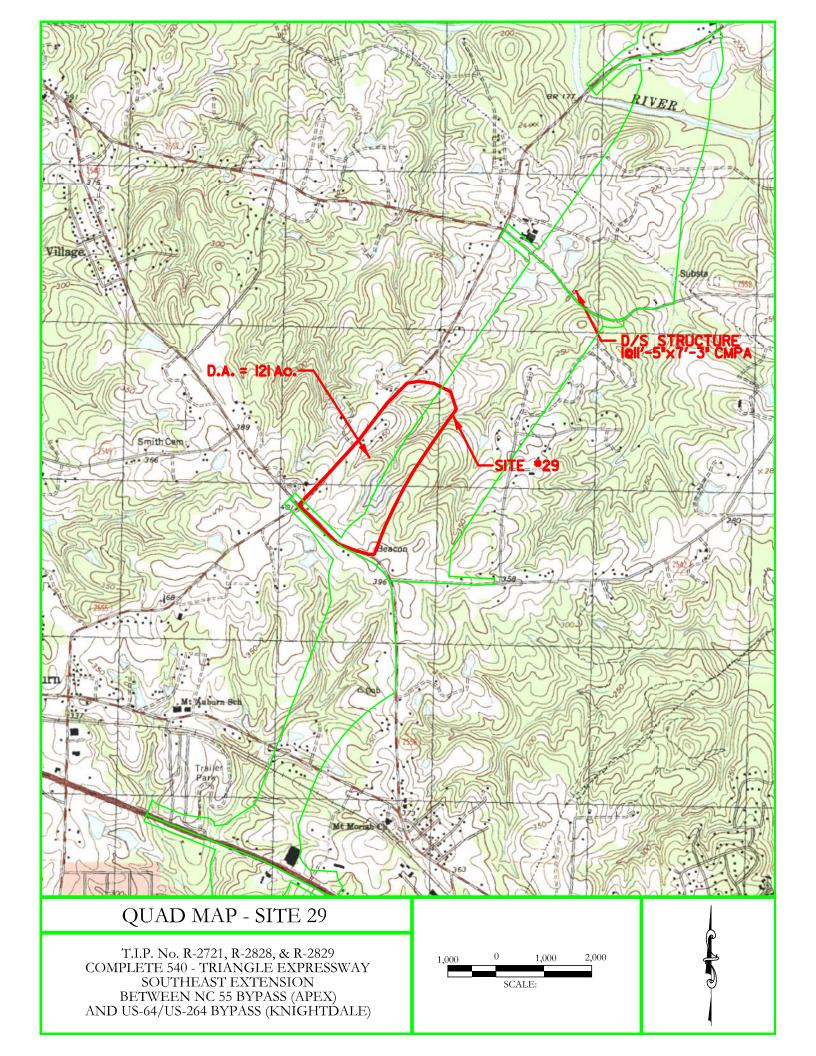


Looking Downstream from Proposed Crossing

Page 1 of 1

### Site 29





	REGION: BLUE RIDGE	Rep. 01-4207
	STREAM NAME: Unnamed Trib to Neuse River	sq. miles
010	NAME: Triangle Expressway SE Ext.	Drainage Area = 0.19
11/24/20	PROJECT NAMI	ENGLISH

<b>USGS RURAL</b>	AL REGRE	SSION EQU	ATIONS (OLD)	RUF	URAL EQUA	ATIONS Rep	oort 01-4207
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cts)	(cts)	(cfs)		(cfs)	(cfs)	(cfs)
2YR	8.79	24.30	45.71	2YR	42.07	21.16	10.27
5YR	14.33	56.68	81.51	5YR	78.62	44.94	17.33
10YR	18.84	88.92	110.69	10YR	111.25	67.70	22.91
25YR	24.77	149.63	157.36	25YR	163.08	104.96	31.03
50YR	29.87	208.68	197.41	SOYR	209.70	140.30	38.09
100YR	35.49	286.06	247.15	100YR	263.86	182.82	45.62
200YR	43.58	383.36	301.05	200YR	326.44	233.52	54.41
500YR	50.27	550.67	401.55	500YR	424.72	315.81	67.44

## **USGS URBAN REGRESSION EQUATIONS**

BDF=

(These Equations are used only for comparison)

Coastal Plain (cfs) (cfs)

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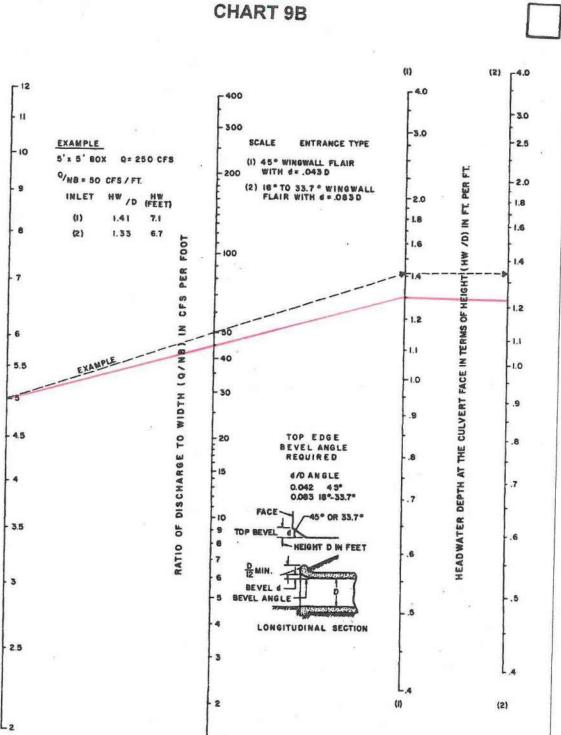
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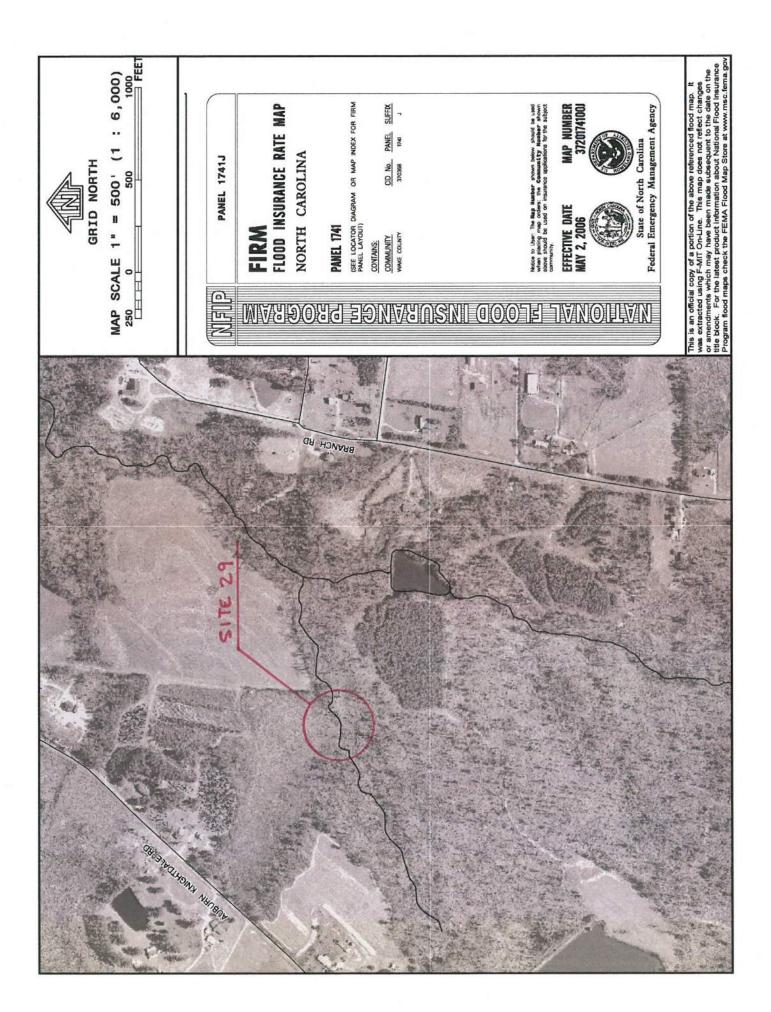
FEN	FREQUENCY			10YR	SOYR	100YR	500YR		
	Discharge Used					360		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	Blue Ridge	(cfs)	141.29	192.30	305.14	356.71	408.26	538.43	703.81
	Coastal Plain	(cfs)	127.51	180.58	299.42	363.00	427.71	505.63	660.94
20	Sand Hills	(cfs)	90.98	114.89	162.17	193.30	222.76	321.68	420.48
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	Z007R	500YR

Name: Site 29	Name and Address of the Owner, where the Owner, which is the Owner, where the Owner, which is the O		The state of the s				
			Culvert 1		Add Culvert	vert	
Parameter	Value	Duits			<b>Duplicate Culvert</b>	ulvert	
O DISCHARGE DATA							
Minimum Flow	360.00	cfs	_		Delete Culvert	lvert	
Design Flow	360.00	cfs					15
Maximum Flow	360.00	des	Rating Curve				×
(2) TAILWATER DATA			Flow (cfs)	Flevation (ft)	Denth (ft)	Velocity (ft/c)	Shear (ncf)
Channel Type	Irregular Channel	•	360.000	268.190	4.390	11.650	7
Irregular Channel	Define		360.000	268.190	4.390	11.650	6.574
Rating Curve	View		360.000	268.190	4.390	11.650	6.574
(2) ROADWAY DATA			360.000	268.190	4.390	11,650	6.574
Roadway Profile Shape	Constant Roadway Elevation	•	360.000	268.190	4.390	11.650	6.574
First Roadway Station	0.00	#	360.000	268.190	4.390	11.650	6.574
Crest Length	0.00	¥	360.000	268.190	4.390	11.650	6.574
Crest Elevation	0.00	£	360.000	268.190	4.390	11.650	6.574
Roadway Surface	Paved	٠	360.000	268.190	4.390	11.650	6.574
Top Width	0.00	# #	360.000	268.190	4.390	11.650	6.574
			360.000	268.190	4.390	11.650	6.574
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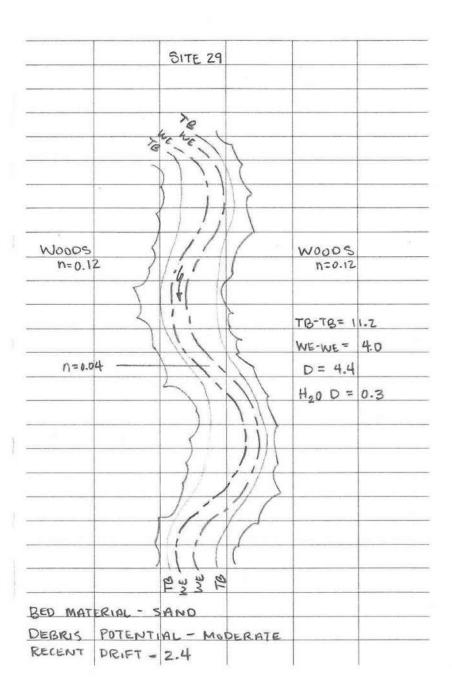




HEADWATER DEPTH FOR INLET CONTROL RECTANGULAR BOX CULVERTS FLARED WINGWALLS 18° TO 33.7° & 45° WITH SEVELED EDGE AT TOP OF INLET



Name of Stream	Description	Curr. Class	Date	Basin	Stream Index #	SITE	29
Tom Jack Creek	From source to Harris Lake, Buckhorn Cr.	C	09/01/74	Cape Fear	18-7-10		
Jim Branch	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-4		
Cary Branch	From source to Harris Lake, Buckhorn Cr.	c	09/01/74	Cape Fear	18-7-5		
Norris Branch	From source to Cary Branch	С	09/01/74	Cape Fear	18-7-5-1		
Utley Creek	From source to Harris Lake, Buckhorn Cr.	C	04/01/59	Cape Fear	18-7-5.5		
White Oak Creek	From source to Harris Lake, Buckhorn Cr.	c	04/01/59	Cape Fear	18-7-6		
Big Branch	From source to White Oak Creek	c	09/01/74	Cape Fear	18-7-6-1		
Little Branch	From source to Big Branch	c	09/01/74	Cape Fear	18-7-6-1-1		
Little White Oak Creek	From source to Harris Lake, Buckhorn Cr.	C	09/01/74	Cape Fear	18-7-7		
Big Branch	From source to Harris Lake, Buckhorn Cr.	С	04/01/59	Cape Fear	18-7-8		
Thomas Creek	From source to Harris Lake, Buckhorn Cr.	c	09/01/74	Cape Fear	18-7-9		
NEUSE RIVER	From dam at Falls Lake to a point 0.5 mile upstream of Town of Wake Forest proposed water supply intake (Former water supply intake for Burlington Mills Wake Finishing Plant)	WS-IV;NSW	07/01/04	Neuse	27-(20.7)		
NEUSE RIVER	From Town of Wake Forest proposed water supply intake to mouth of Beddingfield Creek	C;NSW	08/03/92	Neuse	27-(22.5)		
NEUSE RIVER	From a point 0.5 mile upstream of Town of Wake Forest proposed water supply intake to Town of Wake Forest proposed water supply intake	WS-IV;NSW,CA	07/01/04	Neuse	27-(22)		
NEUSE RIVER	From mouth of Beddingfield Creek to a point 0.2 mile downstream of Johnston County SR 1700	WS-V;NSW	08/03/92		27-(36)		
NEUSE RIVER (Falls Lake below normal pool elevation)	From I-85 bridge to dam at Falls Lake	WS-IV,B;NSW,CA	08/03/92	Neuse	27-(5.5)		





Looking Upstream from Proposed Crossing



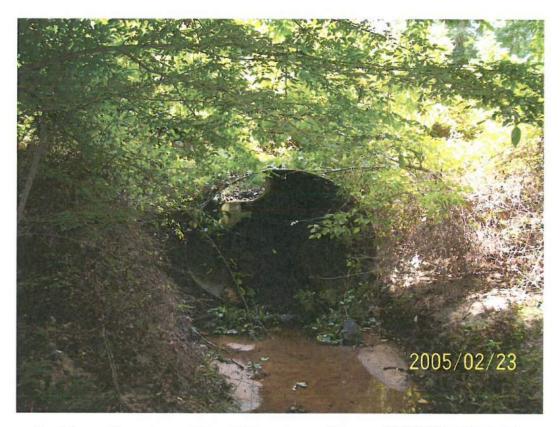
Looking Downstream from Proposed Crossing



Looking at Upstream Channel of Downstream Structure



Looking at Upstream Face of Downstream Structure 1@11'-5"x7'-3" CMPA

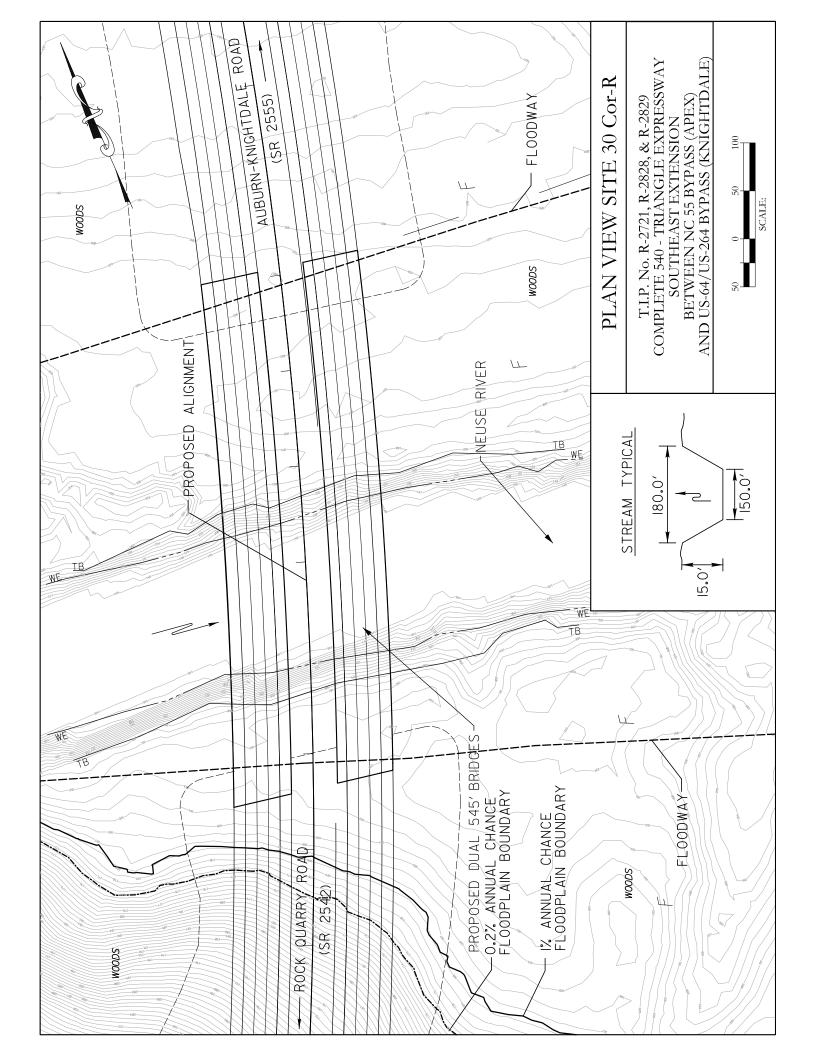


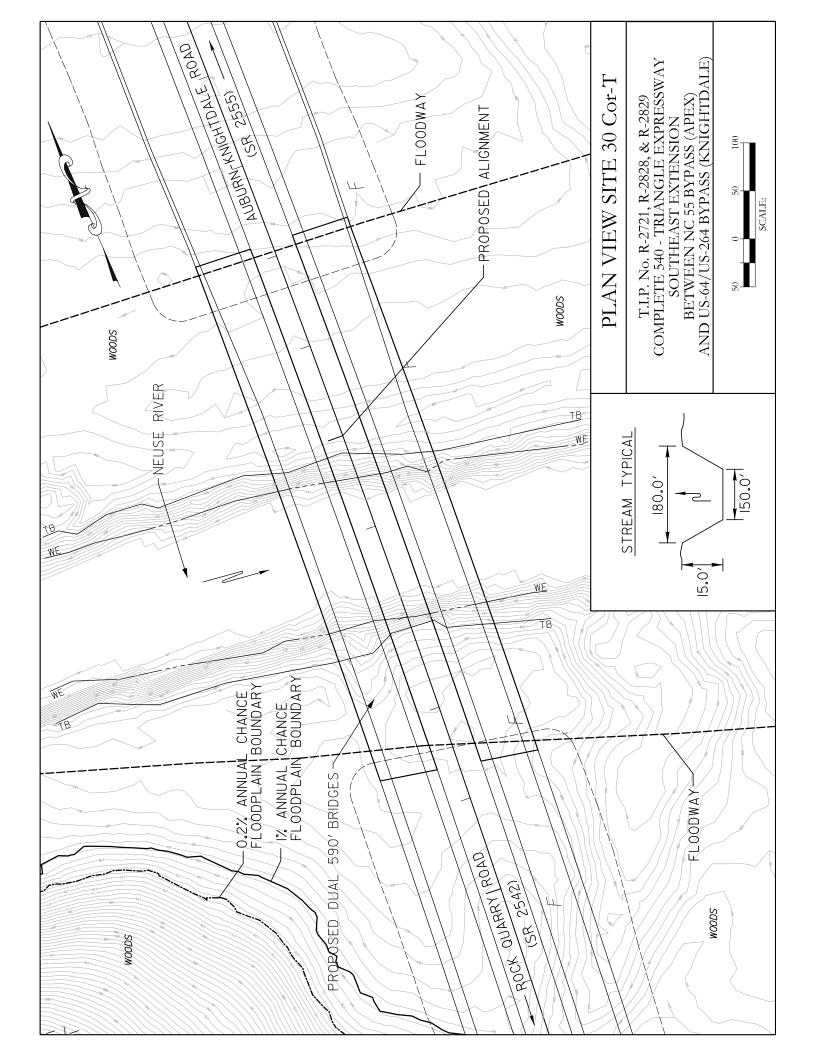
Looking at Downstream Face of Downstream Structure 1@11'-5"x7'-3" CMPA

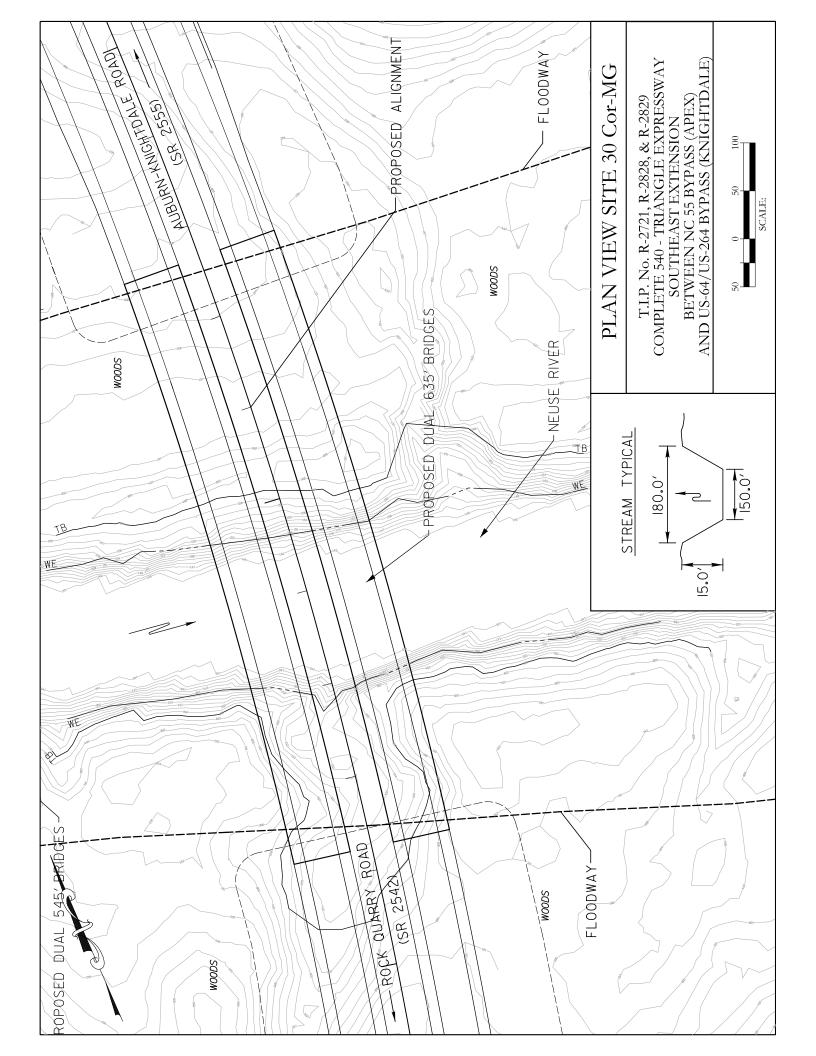


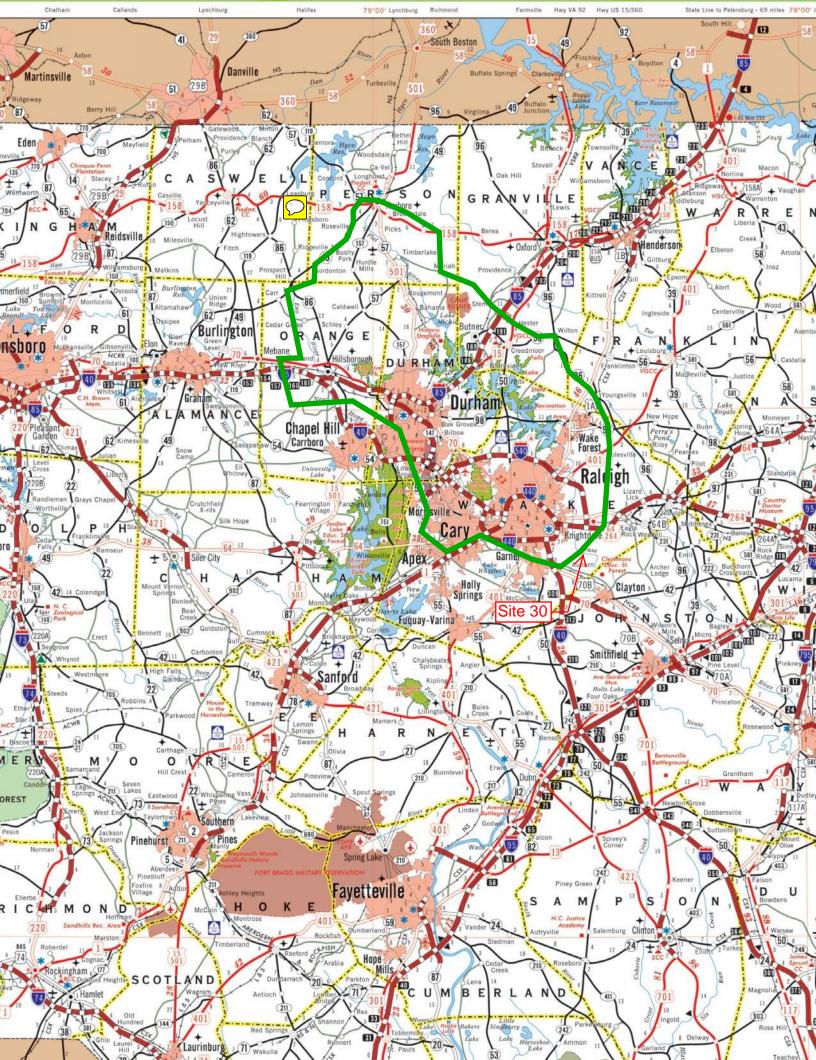
Looking at Downstream Channel of Downstream Structure

### Site 30









# P-percent chance exceedance peak-flow discharge estimate weighted for ungaged location near gaged location

To make use of this worksheet, enter the following within the yellow shaded cells: (1) the drainage area and percentages of ungaged basin within each of the hydrologic regions, and (2) station number of the nearby location.

Note:

Ungaged and gaged locations should be on the same stream.
 The drainage area for the ungaged location should between 0.5 to 1.5 times the drainage area for the gaged location.
 Station number of gaged location must be listed in Table 1 of the appropriate flood-frequency report (be sure to include leading zero where applicable).
 The adjusted ungaged estimates in this spreadsheet use only the annual peak flows prior to the 2007 water year. If estimates need to be computed using any peak flow data after the 2006 water year then refer to the weighting equations in the appropriate flood-frequency report.

UNGAGED LOCATION

Drainage area (sqmi):

Hydrologic region percentages (XX.X whole number to tenth)

1086

Hydrologic Region 1 (Ridge and Valley - Piedmont): Hydrologic Region 2 (Blue Ridge): Hydrologic Region 3 (Sand Hills): Hydrologic Region 4 (Coastal): Hydrologic Region 5 (Southwest Georgia):

100.0 percent
0.0 percent
0.0 percent
0.0 percent
0.0 percent Check sum of regions (must equal 100.0):

WARNING MESSAGES

### Adjusted ungaged estimate based on nearby gaged location

14.200 cfs rounded 17.100 cfs rounded 20,900 cfs rounded 27.100 cfs rounded 30,200 cfs rounded 34,900 cfs rounded 19,100 cfs rounded 10098 14183 17103 20872 24037 27050 30222 4% chance exceedance: 2% chance exceedance: 1% chance exceedance: 50% chance exceedance: 20% chance exceedance: 10% chance exceedance: 0.5% chance exceedance: 0.2% chance exceedance

### NEARBY GAGED LOCATION

Nearby gaged location...station number of gaged location must be listed in LPIII\_RUN GLSNet initial worksheet (be sure to include leading zero where applicable):

FOUNDE 02087500

129 Neuse River near Clayton, NC 1928-1980 53 Systematic period of record: Map identification number:

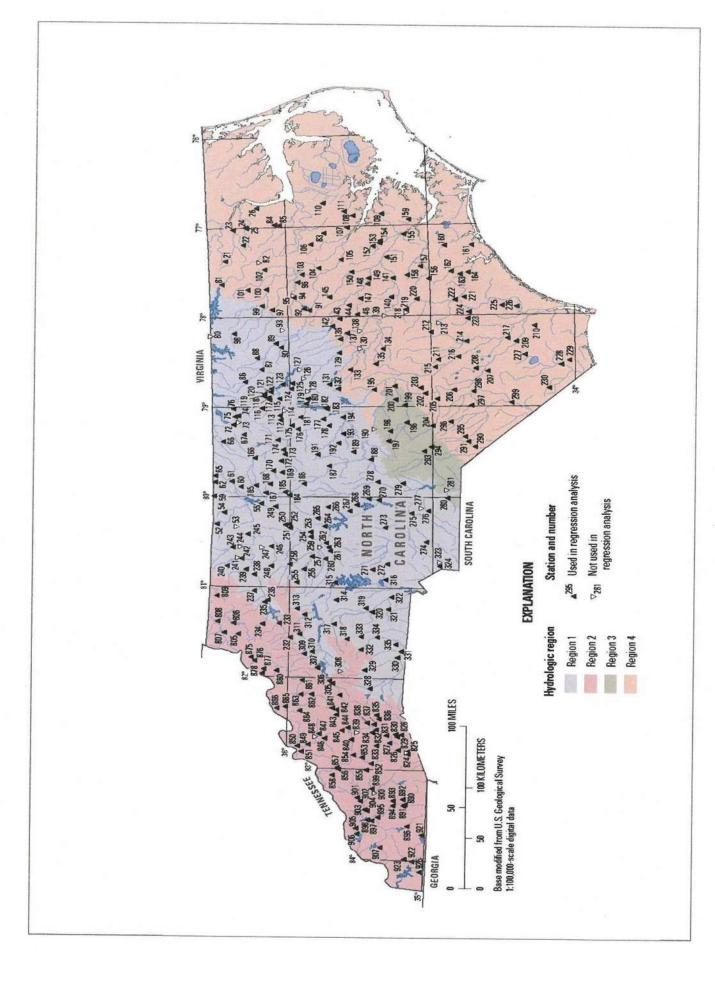
(map identification number from Table 1 in flood-frequency reports)

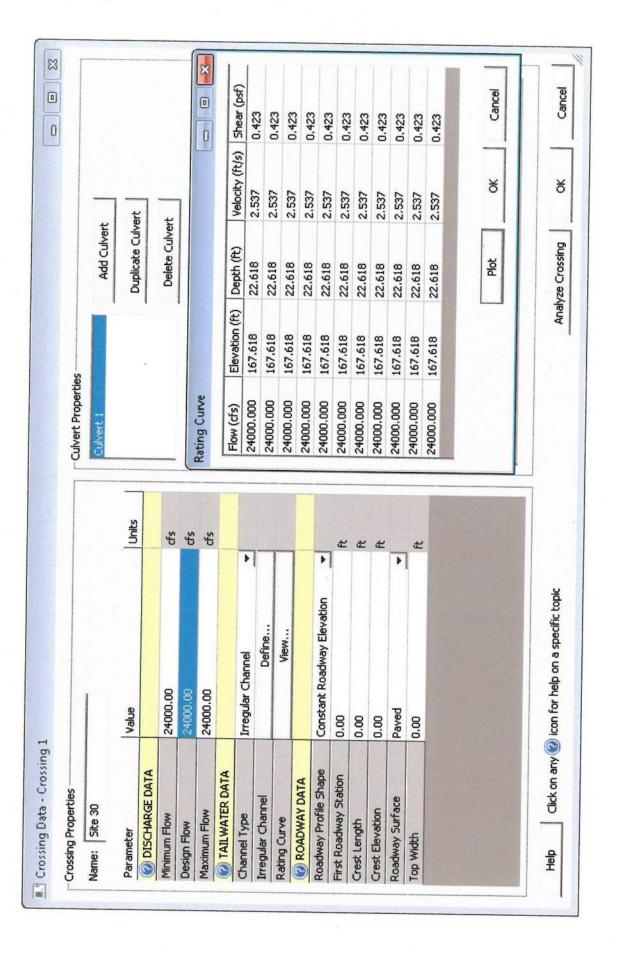
Number of systematic peaks:

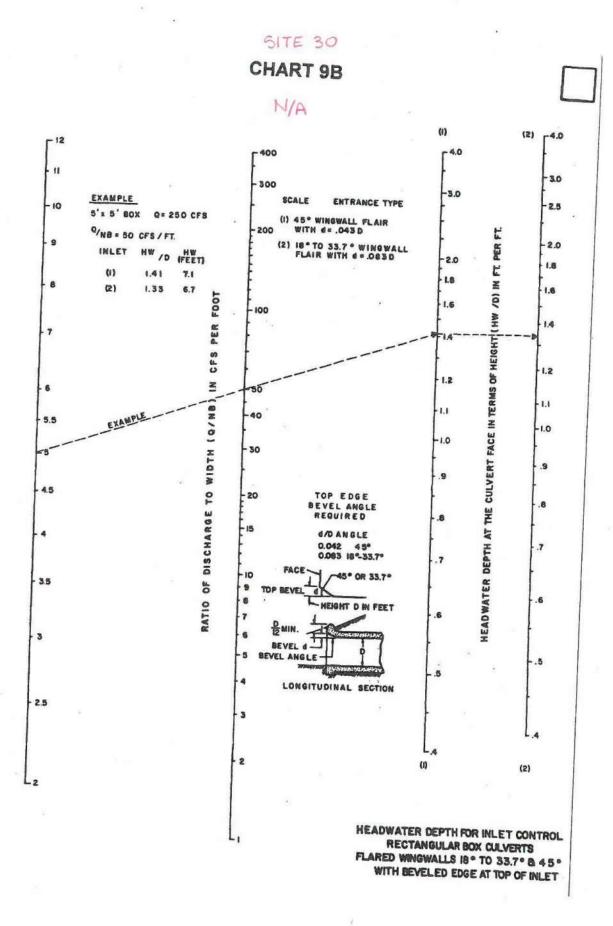
Note: For some sites, available period of record indicated above may include peaks affected by regulation that were not used in the flood-frequency analyses. Please check Table 1 in corresponding flood-frequency for additional information concerning this site. 0.94 1150 sqmi Drainage area (DA):

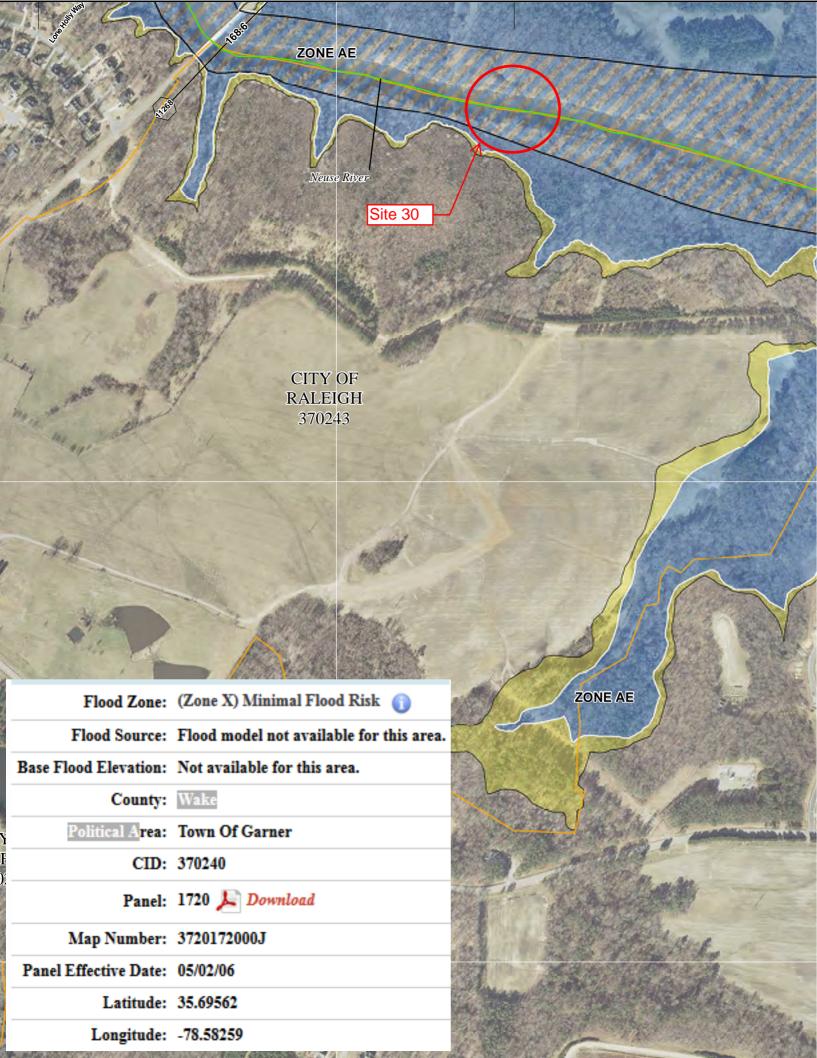
64.00 Difference in DA (absolute value) Ratio ungaged DA to gaged DA: 99.9 percent 0.0 percent 0.0 percent 0.1 percent Hydrologic Region 1 (Ridge and Valley - Pledmont): Hydrologic Region 2 (Blue Ridge): Hydrologic Region 3 (Sand Hills): Hydrologic Region 4 (Coastal): Hydrologic Region 5 (Southwest Georgia): Hydrologic region percentages

Check sum of regions (must equal 100.0);









### **FLOOD INSURANCE STUDY**

### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Table 9 - Flo	poding Sources Studied	by Detailed Methods: R		
Source		Sources	Affected Communities	
Middle Creek	From The confluence with Swift Creek	To Approximately 0.7 mile upstream of confluence of Middle Creek Tributary	Rdu Town Of Apex Town Of Cary Town Of Fuquay-Varina Town Of Holly Springs	
Millbrook Tributary to Marsh Creek (Basin 18, Stream 19)	The confluence with Marsh Creek (Basin 18, Stream 17)	East Millbrook Road	Wake County  City Of Raleigh	
Mills Branch (Basin 22, Stream 5)	The confluence with Middle Creek (Basin 22, Stream 1)	Railroad	Rdu Town Of Fuquay-Varina Wake County	
Mine Creek (Basin 18, Stream 31)	The confluence with Crabtree Creek (Basin 18, Stream 9)	The confluences of East Fork Mine Creek (Basin 18, Stream 34) and West Fork Mine Creek (Basin 12, Stream 33)	City Of Raleigh	
Morrisville Tributary (Basin 18, Stream 26)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Approximately 0.3 mile upstream of Railroad	Town Of Morrisville	
Mud Branch (Basin 4, Stream 15)	The confluence with Horse Creek (Basin 4, Stream 1)	Approximately 3.0 miles upstream of confluence with Horse Creek (Basin 4, Stream 1)	Rdu Wake County	
Neil Branch (Basin 24, Stream 8)	The confluence with Neil Creek (Basin 24, Stream 7)	East Spring Avenue	Town Of Fuquay-Varina	
Neil Creek (Basin 24, Stream 7)	The confluence with Angier Creek (Basin 24, Stream 4)	Holland Road	Town Of Fuquay-Varina	
Neuse River	Entire shoreline in Wake County	Entire shoreline within Granville County	Rdu Wake County	
Neuse River	Wayne/Lenoir County boundary	Falls of the Neuse Road	City Of Raleigh Rdu Town Of Clayton Town Of Knightdale Town Of Wake Forest Wake County	
New Light Creek	The confluence with Neuse River (Basin 15, Stream 1)	The confluence of Basin 3, Stream 8	Rdu Wake County	
Panther Branch (Basin 22, Stream 2)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.5 mile upstream of Banks Road	Rdu Wake County	
Panther Creek	The Chatham/Wake County Boundary	Approximately 1.0 mile upstream of Green Level to Durham Road	Town Of Cary	
Perry Creek East Branch (Basin 15, Stream 27)	The confluence with Perry Creek (Basin 15, stream 26)	Approximately 0.3 mile upstream of Bivens Drive	City Of Raleigh	
Pigeon House Branch (Basin 18, Stream 27)	The confluence with Crabtree Creek (Basin 18, Stream 9)	West Peace Street	City Of Raleigh	
Poplar Branch (Basin 13, Stream 2)	The confluence with Poplar Creek (Basin 13, Stream 1)	Farm Road	Town Of Knightdale	
Poplar Creek (Basin 13, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 900 Feet upstream of Fayetteville Street	Rdu Town Of Knightdale Wake County	
Powell Creek (Basin 8, Stream 7)	The confluence with Hodges Creek (Basin 8, Stream 1)	Approximately 1.3 miles upstream of Peebles Road	City Of Raleigh Rdu Town Of Rolesville Wake County	
Reedy Creek (Basin 20, Stream 11)	The confluence with Swift Creek (Basin 20, Stream 1)	Seventh Avenue	Rdu Town Of Garner Wake County	
Reedy Creek (Basin 6, Stream 8)	The confluence with Sanford Creek (Basin 6, Stream 7)	Rogers Road	Town Of Rolesville Town Of Wake Forest	
Reedy Creek Tributary (Basin 20, Stream 9)	The confluence with Reedy Creek (Basin 20, Stream 11)	Claymore Drive	Town Of Garner	
Richland Creek (Basin 18, Stream 3)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Trinity Road	City Of Raleigh	
Rocky Branch (Basin 22, Stream 8)	The confluence with Middle Creek (Basin 22, Stream 1)	Holly Springs Road	Rdu Town Of Holly Springs Wake County	
Rocky Branch (Basin 30, Stream 5)	Approximately 60 feet downstream of Western Boulevard (upstream crossing)	Approximately 900 feet upstream of Pullen Road	City Of Raleigh	
Rocky Branch (Basin 30, Stream 5)	The confluence with Walnut Creek (Basin 30, Stream 1)	Approximately 215 feet upstream of Fayetteville Road	City Of Raleigh	
Rocky Ford Branch (Basin 24, Stream 5)	The confluence with Kenneth Creek (Basin 24, Stream 2)	Approximately 0.9 mile upstream of confluence with Kenneth Creek (Basin 24, Stream 2)	Rdu Town Of Fuquay-Varina Wake County	
Sanford Creek (Basin 6, Stream 7)	The confluence with Smith Creek (Basin 6, Stream 1)	Approximately 300 feet upstream of the confluence of Basin 6, Stream 9	Rdu Town Of Rolesville Town Of Wake Forest Wake County	
Smith Creek	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 0.9 mile upstream of Oak Grove Church Road	Rdu Town Of Wake Forest Wake County	
Southeast Prong Beaverdam Creek (Basin 18, Stream 30)	The confluence with Beaverdam Creek (Basin 18, Stream 28)	Wade Avenue	City Of Raleigh	

**Table 13 - Summary of Discharges** 

Table 13 - Sumi	mary of Dis	charges		, , , ,	
Flooding Source Location	Drainage Area	10% Annual	Discha 2% Annual	rges (cfs) 1% Annual	0.2% Annual
Location	(square miles)	Chance	Chance	Chance	Chance
Approximately 1.2 miles upstream of Sheppard School Road	11.60	*	*	4,310	*
Approximately 1,060 feet downstream of Williams-White Road	10.54	*	*	4,060	*
Approximately 530 feet upstream of Williams-White Road	9.47	*	*	3,800	*
Approximately 0.6 mile downstream of Pearces Road	8.19	*	*	3,470	*
At confluence of Moccasin Creek Tributary 3	4.18	*	*	2,369	*
Approximately 1,580 feet upstream of Furney Pearce Road	2.94	*	*	1,899	*
Approximately 530 feet downstream of Henry Baker Road	2.05	*	*	1,520	*
Approximately 0.7 mile upstream of Henry Baker Road	1.29	*	*	1,130	*
Morris Branch					
At Chatham/Wake County boundary	1.40	821	1,380	1,730	2,730
Approximately 0.4 mile upstream of Chatham/Wake County boundary	1.20	707	1,300	1,630	2,490
Just downstream of Green Level to Durham Road	0.80	765	1,080	1,230	1,840
Approximately 0.7 mile upstream of Green Level to Durham Road	0.50	490	772	893	1,230
Approximately 975 feet upstream of Howard Road	0.10	155	241	277	378
Morrisville Tributary (Basin 18, Stream 26)					
At mouth	1.00	*	*	1,030	*
Approximately 1,500 feet upstream of Railroad	0.70	*	*	850	*
Mud Branch (Basin 4, Stream 15)					
At mouth	2.10	*	*	1,630	*
Neil Branch (Basin 24, Stream 8)					
At mouth	1.30	670	1,180	1,400	2,400
At East Spring Avenue	1.10	580	1,020	1,250	2,150
At SR 2767	1.10	580	1,020	1,250	2,150
Neills Creek					
At Harnett/Wake County boundary	2.10	*	*	1,187	*
Approximately 1,060 feet upstream of Harnett/Wake County boundary	2.00	*	*	1,137	*
Approximately 0.6 mile upstream of Harnett/Wake County boundary	1.80	*	*	1,057	*
At mouth	1.30	670	1,180	1,400	2,400
Approximately 0.9 mile upstream of Harnett/Wake County boundary	1.20	*	*	840	*
Neuse River					
At County boundary	1099.00	*	*	18,300	*
the design of Orabbase Orable (Paris 40, Otropes 0)	1027.00	*	*	16,700	*
Tourstream of Crabtree Creek (Basin 18, Stream 9)	883.00	*	*	13,500	*
At Falls Dam	770.00	*	*	11,100	*
New Hope Tributary to Marsh Creek (Basin 18, Stream 18)		1		,	1
At confluence with Marsh Creek (Basin 18, Stream 17)	1.43	*	*	760	*
Approximately 1,060 feet upstream of confluence with Marsh Creek (Basin 18,	1.40	*	*	976	*
Stream 17)					
Approximately 1,580 feet downstream of New Hope Church Road	1.16	*	*	1,160	*
Approximately 530 feet upstream of New Hope Church Road	0.62	*	*	971	*
Approximately 330 feet upstream of Waterbury Road	0.18	*	*	639	*
New Light Creek					
Just upstream of Buckhorn Branch (Basin 3, Stream 9)	13.30	*	*	4,500	*
At confluence of Basin 3, Stream 8	10.42	*	*	3,220	*

**Table 16 - Roughness Coefficients** 

Table 16 - Roug	hness Coefficients	
Stream	Channel "n"	Overbank "n"
Big Branch	0.050	0.140
Big Branch (Basin 10, Stream 8)	0.030 to 0.070	0.070 to 0.130
Big Branch (Basin 18, Stream 21)	0.035 to 0.055	0.090 to 0.200
Big Branch (Basin 26, Stream 5)	0.050	0.140
Big Branch Tributary No. 3	0.030 to 0.070	0.070 to 0.120
Big Branch Tributary No.1 (Basin 30, Stream 6)	0.030 to 0.070	0.070 to 0.120
Black Creek	0.025 to 0.060	0.030 to 0.150
Bradley Creek (Basin 24, Stream 3)	0.030 to 0.070	0.070 to 0.110
Bridges Branch	0.050	0.130
Brier Creek (Basin 18, Stream 14)	0.024 to 0.040	0.100 to 0.200
Buckhorn Creek	0.040 to 0.048	0.145
Buffalo Creek (Basin 9, Stream 1)	0.030 to 0.070	0.035 to 0.140
Buffalo Creek West	0.045 to 0.052	0.030 to 0.140
Burdens Creek	0.042 to 0.050	0.100 to 0.200
Cary Branch	0.040	0.140
Cedar Fork (Basin 10, Stream 15)	0.420 to 0.042	0.130
Clark Branch (Basin 28, Stream 3)	0.050	0.150
Coles Branch (Basin 18, Stream 24)	0.030 to 0.070	0.070 to 0.200
Crabtree Creek (Basin 18, Stream 9)	0.030 to 0.070	0.070 to 0.150
Crabtree Creek Tributary No. 6 (Basin 18, Stream 20)	0.030 to 0.070	0.070 to 0.130
Fowlers Mill Creek (Basin 10, Stream 12)	0.042	0.130
Guffy Branch (Basin 21, Stream 4)	0.047	0.130
Hatchet Grove Tributary (Basin 18, Stream 25)	0.030 to 0.070	0.070 to 0.130
Hodges Creek (Basin 8, Stream 1)	0.030 to 0.070	0.070 to 0.160
Hominy Creek (Basin 10, Stream 7)	0.030 to 0.070	0.070 to 0.130
Horse Creek	0.042 to 0.050	0.080 to 0.150
Horse Creek Tributary 1	0.048	0.120 to 0.150
Jack Branch (Basin 28, Stream 4)	0.055	0.155
Jim Branch	0.045	0.145
Juniper Branch (Basin 21, Stream 2)	0.045	0.110 to 0.130
Kenneth Branch (Basin 24, Stream 6)	0.030 to 0.070	0.070 to 0.150
Kenneth Creek	0.030 to 0.070	0.070 to 0.160
Kit Creek	0.030 to 0.070	0.070 to 0.110
Kit Creek Tributary 2 (Basin 29, Stream 8)	0.030 to 0.070	0.070 to 0.110
Lakemont Tributary (Basin 18, Stream 22)	0.050 to 0.062	0.120 to 0.200
Ledge Creek	0.050	0.150
Little Beaver Creek	0.045 to 0.055	0.100 to 0.220
Little Beaverdam Creek (Basin 2, Stream 2)	0.030 to 0.070	0.070 to 0.150
Little Black Creek	0.030 to 0.070	0.070 to 0.130
Little Branch (Basin 26, Stream 3)	0.040	0.148
Little Brier Creek (Basin 18, Stream 15)	0.030 to 0.070	0.070 to 0.130
Little Brier Creek East (Basin 18, Stream 16)	0.030 to 0.070	0.070 to 0.140
Little Creek (Basin 11, Stream 2)	0.030 to 0.080	0.070 to 0.150
Little Creek (Into Middle Creek)	0.033 to 0.047	0.095 to 0.140
Little River	0.040 to 0.066	0.070 to 0.240
Little White Oak Creek (Basin 26, Stream 9)	0.035 to 0.050	0.148
Little White Oak Creek Tributary 2	0.040	0.140
Marks Creek	0.025 to 0.070	0.070 to 0.130
Marsh Creek (Basin 18, Stream 17)	0.038 to 0.060	0.090 to 0.200
Middle Creek	0.042 to 0.050	0.030 to 0.140
Mill Branch	0.050	0.140
Mills Branch (Basin 22, Stream 5)	0.030 to 0.070	0.070 to 0.130
Mingo Creek (Basin 12, Stream 2)	0.041 to 0.044	0.100 to 0.200
Moccasin Creek	0.030 to 0.070	0.070 to 0.220
Morris Branch	0.030 to 0.070 0.030 to 0.050	0.100 to 0.200
Neil Branch (Basin 24, Stream 8)	0.030 to 0.030 0.030 to 0.070	0.070 to 0.130
Neil Creek (Basin 24, Stream 7)	0.030 to 0.070	0.070 to 0.110
Neil Creek (Basin 24. Stream 7) Neuse River		
New Hope Tributary to Marsh Creek (Basin 18, Stream 18)	0.035 to 0.060	0.055 to 0.250
	0.040 to 0.065	0.110 to 0.200
W Lefght Creek	0.040 to 0.070	0.070 to 0.150
Norris Branch	0.048	0.145

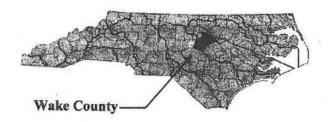
			Tal	ole 21 - Fl	oodway D	ata			
	y Source		Floodway	T			ter Surface Eleva		
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
132	13,230	293	2,397	0.3	421.8	*	421.8	421.8	0.0
140	14,000	80	138	5.0	421.8	*	421.8	421.8	0.0
149	14,860	359	3,739	0.2	447.2	*	447.2	447.2	0.0
156	15,590	40 10	137	4.8	447.2	*	447.2	447.2	0.0
Neil Branch (I	Basin 24, Strea	ım 8)	T	I	T	ı	I	ı	ı
002	210	70	358	3.9	319.3 <sup>1</sup>	*	318.6	319.3	0.7
021	2,100	50	157	8.3	329.1	*	329.1	329.1	0.0
028	2,780	120	257	5.1	338.4	*	338.4	338.4	0.0
031	3,090	110	221	5.9	339.5	*	339.5	339.5	0.0
032	3,200	110	204	6.2	340.5	*	340.5	340.5	0.0
Neil Creek (Ba	asin 24, Strean	n 7)	Ī	I	Ī	ı	I	ı	ı
003	340	210	442	4.8	307.1 <sup>1</sup>	*	303.4	304.4	1.0
006	560	150	791	2.7	307.1 <sup>1</sup>	*	306.7	307.6	0.9
013	1,300	200	359	5.7	311.4	*	311.4	311.4	0.0
016	1,560	210	450	4.6	313.0	*	313.0	313.0	0.0
028	2,840	70	294	4.7	321.2	*	321.2	321.2	0.0
Neuse River									
11056	1,105,557	340	5,809	3.2	162.7	*	162.7	162.9	0.2
11166	1,116,640	500	7,573	2.4	165.9	*	165.9	166.2	0.3
11268	1,126,775	340	5,618	3.1	168.6	*	168.6	168.8	0.2
Site 30	1,131,990	300	5,189	3.3	170.3	*	170.3	170.5	0.2
11413	1,141,325	350	5,809	2.9	173.5	*	173.5	173.8	0.3
11464	1,146,390	400	5,404	3.1	174.6	*	174.6	175.0	0.4
11474	1,147,390	500	1,105	1.9	174.9	*	174.9	175.3	0.4
11493	1,149,335	300	5,203	2.6	175.2	*	175.2	175.6	0.4
11548	1,154,790	700	7,809	1.7	176.4	*	176.4	176.8	0.4
11574	1,157,375	329	6,099	2.2	176.7	*	176.7	177.1	0.4
11603	1,160,345	600	7,517	1.8	177.3	*	177.3	177.7	0.4
11733	1,173,340	350	4,305	3.0	186.5	*	186.5	187.1	0.6
11812	1,181,225	350	4,661	2.8	189.4	*	189.4	190.2	0.8
11913	1,191,290	700	8,917	1.5	192.1	*	192.1	193.0	0.9
11971	1,197,075	345	4,420	2.8	193.3	*	193.3	194.3	1.0
12065	1,206,540	250	3,908	3.1	197.1	*	197.1	197.9	0.8
12157	1,215,740	1,100	9,689	1.2	199.8	*	199.8	200.7	0.9
12199	1,219,870	400	5,242	2.2	200.8	*	200.8	201.6	0.8
12208	1,220,835	280	4,017	2.9	201.1	*	201.1	201.9	0.8
12237	1,223,740	500	5,927	1.9	202.0	*	202.0	202.8	0.8
12377	1,237,675	402	4,099	2.8	205.5	*	205.5	206.4	0.9
	butary to Mars	l.	•	•	,	1	,	,	1
009	942	17	85	10.7	214.8 <sup>1</sup>	*	211.2	211.2	0.0
016	1,451	315	431	2.4	216.9	*	216.9	216.9	0.0
022	2,026	240	904	1.0	217.2	*	217.2	217.2	0.0
028	2,643	58	120	8.2	217.3	*	217.3	217.9	0.6
033	3,275	90	240	4.3	224.3	226.1	224.3	224.3	0.0
037	3,744	25	160	6.4	227.1	227.6	227.1	227.3	0.2
	1 - 3 - 1 - 1			1	1	1		1	1

### FLOOD INSURANCE STUDY

A Report of Flood Hazards in

### WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 6 OF 7**

Community Name	Community Number	River Basin Cape Fear/Neuse	
Apex, Town of	370467		
Cary, Town of	370238	Cape Fear/Neuse	
Fuquay-Varina, Town of	370239	Cape Fear	
Garner, Town of	370240	Neuse	
Holly Springs, Town of	370403	Cape Fear/Neuse	
Knightdale, Town of	370241	Neuse	
Morrisville, Town of	370242	Cape Fear/Neuse	
Raleigh, City of	370243	Neuse	
Rolesville, Town of	370468	Neuse	
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse	
Wake Forest, Town of	370244	Neuse	
Wendell, Town of	370245	Neuse	
Zebulon, Town of	370246	Neuse	





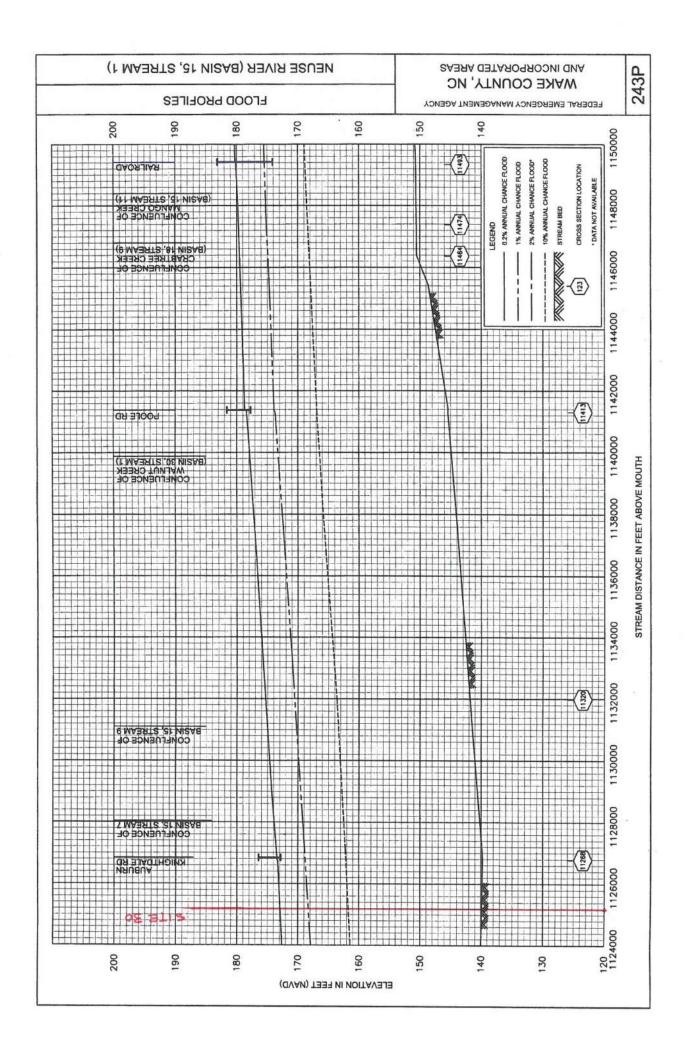
May 2, 2006

Federal Emergency Management Agency State of North Carolina

> Flood Insurance Study Number 37183CV006A

www.fema.gov and www.ncfloodmaps.com





### PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake	PROJECT NUMBER	R-2721, R-2828.	& R-2829
STREAM Neuse River	ROUTE New Location		
(Site 30) ASSESSMENT PREPAREI	DBY <u>Mulkey, INC.</u> I (MLH)	DATE <u>1/9/2014</u>	
	HYDROLOGIC EVA	ALUATION	
NEAREST GAGING STAT	ION ON THIS STREAM	M(NONE	<u>X</u> )
ARE FLOOD STUDIES AV	AILABLE ON THIS ST	REAM: Yes	
FLOOD DATA: Q <sub>10</sub> 17,000 CFS EST. BK Q <sub>50</sub> 24,000 CFS EST. BK Q <sub>500</sub> 35,000 CFS EST. BK	WTR. <u>N/A</u> FT. Q <sub>100</sub> <u>2</u> WTR. <u>N/A</u> FT.	7,000 CFS E	ST. BKWTR. <u>N/A</u> FT
DRAINAGE AREA <u>1,086 S</u> <u>Regression</u>	q.Mi. METHOD USED	TO COMPUTE	Q: <u>USGS Urban</u>
<u>P</u>	ROPERTY RELATED E	EVALUATIONS	
DAMAGE POTENTIAL: LO	OW MODER	ATE X H	IGH
COULD THIS BE SI	GNIFICANTLY INCRE	ASED BY PRO	POSED
ENCROACHMENT:	YES	NO X	
EXPLANTION: A flo	oodway modification ma	y be required at t	this site.
LIST BUILDINGS IN	N FLOOD PLAIN: None	LOCATIO	ON:
UPSTREAM LAND ANTICIPATE ANY	Residential		
ANY FLOOD ZONII	NG? (FIA STUDIES, ET	C.) YES X	NO
TYPE OF STUDY: 1	FEMA – Special Flood H	lazard Zone AE	
REGULATORY FLO	OODWAY WIDTH 540 f	ft. Section 11147	80
COMMENTS:			

### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 19,600 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 49,100 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? $\underline{\text{N/A}}$
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS  NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.  LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE  EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Chewacla TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service
ENVIRONMENTAL CONSIDERATIONS

LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN:

### MISCELLANEOUS COMMENTS

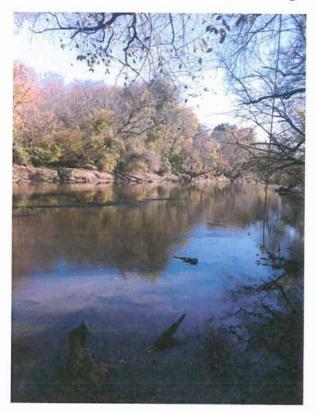
IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED
ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? $\underline{\text{No}}$
COMMENTS:
ALTERNATIVES
RECOMMENDED DESIGN <u>Dual 545' Bridges Cor-R</u> <u>Dual 590' Bridges Cor-T</u> <u>Dual 635' Bridges Cor-MG</u>
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING 17,370 Sq. Ft.
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO $\underline{\mathbf{x}}$ DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:

Name of Stream	Description	Curr. Class	Date	Basin	Stream Index #	SITE 30
Tom Jack Creek	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear		3110
Jim Branch	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-4	
Cary Branch	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-5	
Norris Branch	From source to Cary Branch	С	09/01/74	Cape Fear	18-7-5-1	
Utley Creek	From source to Harris Lake, Buckhorn Cr.	С	04/01/59	Cape Fear	18-7-5.5	
White Oak Creek	From source to Harris Lake, Buckhorn Cr.	С	04/01/59	Cape Fear	18-7-6	
Big Branch	From source to White Oak Creek	c	09/01/74	Cape Fear	18-7-6-1	
Little Branch	From source to Big Branch	С	09/01/74	Cape Fear	18-7-6-1-1	
Little White Oak Creek	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-7	
Big Branch	From source to Harris Lake, Buckhorn Cr.	С	04/01/59	Cape Fear	18-7-8	
Thomas Creek	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-9	
NEUSE RIVER	From dam at Falls Lake to a point 0.5 mile	WS-IV;NSW	07/01/04	Neuse	27-(20.7)	
	upstream of Town of Wake Forest proposed water supply intake (Former water supply					
	intake for Burlington Mills Wake Finishing Plant)					
NEUSE RIVER	From Town of Wake Forest proposed water supply intake to mouth	C;NSW	08/03/92	Neuse	27-(22.5)	
	of Beddingfield Creek					
NEUSE RIVER	From a point 0.5 mile upstream of Town of Wake Forest proposed	WS-IV; NSW, CA	07/01/04	Neuse	27-(22)	
	water supply intake to Town of Wake Forest proposed water supply intake					
NEUSE RIVER	From mouth of Beddingfield Creek to a point 0.2 mile	WS-V;NSW	08/03/92	Neuse	27-(36)	
	downstream of Johnston County SR 1700					
NEUSE RIVER (Falls Lake below normal	From I-85 bridge to dam at Falls Lake	WS-IV,B;NSW,CA	08/03/92	Neuse	27-(5.5)	
pool elevation)						

Neus	Neuse River Basin	asin		10-digit Watershed	0302020110		Swift Creek	reek
AU <	AU Number	Name		Description		Length or Area Units	Classification	Category
	Category	/ Rating	Use	Reason for Rating	Parameter		Year	
> 27-	27-43-(1)d	Swift Creek		From Lake Wheeler Dam to a point 0.6 i 1006	am to a point 0.6 mile upstream of Wake County SR	2.4 FW Miles	WS-III;NSW	ις
	<sub>2</sub>	Impaired	Aquatic Life	Poor Bioclassification	n Ecological/biological Integrity Benthos	tegrity Benthos	2008	
> 27-	27-43-(5.5)a	Swift Creek (Lake Benson)		From a point 0.6 mile upstream of Wak Lake Benson	upstream of Wake County SR 1006 to backwaters of	l 0.9 FW Miles	WS-III;NSW,CA	rv
	2	Impaired	Aquatic Life	Poor Bioclassification	n Ecological/biological Integrity Benthos	tegrity Benthos	2008	
				12-digit Subwatershed	030202011005		Little	Little Creek
> 27-	27-43-12	Little Creek		From source to Swift Creek		11.4 FW Miles	C;NSW	ī.
	2	Impaired	Aquatic Life	Fair Bioclassification	Ecological/biological Integrity Benthos	tegrity Benthos	1998	
				12-digit Subwatershed	030202011003		Whiteoak Creek	Creek
> 27-	27-43-(8)a	Swift Creek		From dam at Lake Benson to Little Creek	je V	20.6 FW Miles	C;NSW	rv
	5	Impaired	Aquatic Life	Fair Bioclassification	Ecological/biological Integrity Benthos	tegrity Benthos	2012	
Neus	Neuse River Basin	asin		10-digit Watershed	0302020111	Wal	Walnut Creek-Neuse River	River
				12-digit Subwatershed	030202011104		Mill Creek-Neuse Rive	se Rive
> 27-	27-(38.5)	NEUSE RIVER		From a point 0.2 mile downstream of Johnston Co 1.4 mile downstream of Johnston County SR 1908	downstream of Johnston County SR 1700 to point of Johnston County SR 1908	9.7 FW Miles	WS-IV;NSW	ហ
	Ŋ	Impaired	Aquatic Life	Standard Violation	Copper		2012	
				12-digit Subwatershed	030202011103		Poplar Creek-Neuse Rive	se Rive
> 27-	27-(22.5)c	NEUSE RIVER		From Crabtree Creek to Auburn Knightdale Road	dale Road	3.9 FW Miles	C;NSW	Ŋ
	5	Impaired	Aquatic Life	Standard Violation	Copper		2008	
	2	Impaired	Aquatic Life	Standard Violation	Turbidity		2010	
	2	Impaired	Fish Consumption	ption Standard Violation	PCB		2010	



Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing

Page 1 of 2

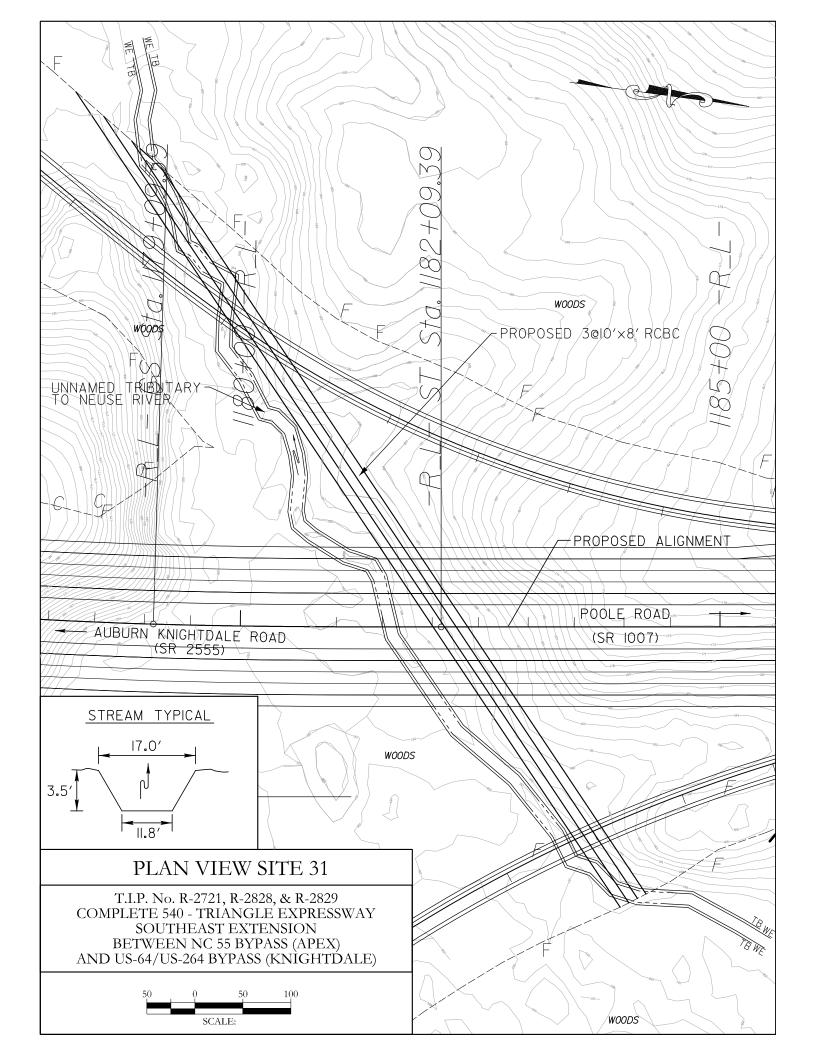


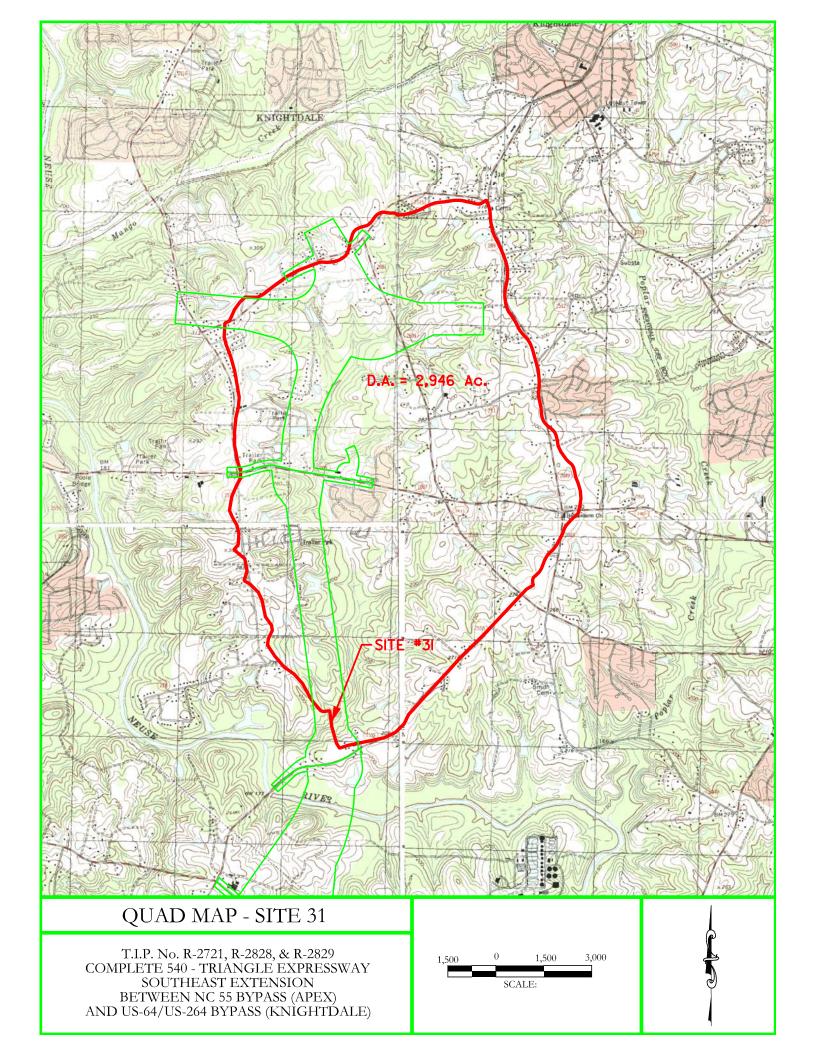
Looking at Upstream Channel of Upstream Structure (NCDOT # 237)



Looking at Downstream Channel of Upstream Structure (NCDOT # 237)

# Site 31





Site # 31

REGION: BLUE RIDGE Rep. 01-4207 METHOD USED: STREAM NAME: Unnmaed Trib to the Neuse River sq. miles 4.60 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = 11/24/2010 ENGLISH

FREQUENCY         Sand Hills         Coastal Plain         Blue Ridge         FREQUENCY         Blue Ridge         Coastal Plain         Sand Hill           (cfs)         (cfs)<	USGS RUR	AL REGRE	SSION EQU	ATIONS (OLD)	RUR	AL FOLLA	TIONS Ren	70CF-01-4207	
(cfs) (cfs) (cfs) (cfs) (cfs) 413.36 (cfs) 2YR 394.08 180.69 (689.44 5YR 679.99 339.97 921.47 10YR 917.26 480.57 1268.89 25YR 1273.75 694.58 1918.15 100YR 1933.66 1110.11 2306.86 200YR 2324.58 1364.79 2923.99 500YR 2923.99	FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills	8
413.36 2YR 394.08 180.69 689.44 5YR 679.99 339.97 921.47 10YR 917.26 480.57 1268.89 1566.64 50YR 1918.15 1918.15 2306.86 200YR 2324.58 1364.79 2923.99 500YR 2923.99 1759.57		(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(ofe)	
689.44  921.47  1268.89  1566.64  1918.15  2306.86  2923.99  339.97  480.57  480.57  1273.75  694.58  1586.54  1918.15  2007R  2324.58  1364.79  2923.99	2YR	90.90	182.06	413.36	2YR	394 08	180.69	00 30	
921.47 10YR 917.26 480.57 1268.89 25YR 1273.75 694.58 1566.64 500YR 1933.66 1110.11 2306.86 200YR 2324.58 1364.79 2923.99 500YR 2923.99 500YR 2923.99	5YR	150.50	362.17	689.44	5YR	679 99	339.07	161 77	
1268.89 25YR 1273.75 694.58 1566.64 500YR 1933.66 1110.11 2306.86 200YR 2324.58 1364.79 2923.99 500YR 2923.99	10YR	199.22	528.04	921.47	10VR	917.26	480.57	211.10	
1566.64 500YR 1586.53 887.98 1918.15 2306.86 200YR 2324.58 1364.79 2923.99 1759.57	25YR	271.17	815.26	1268.89	26VP	1273.75	604.58	202.19	
1918.15 2306.86 2923.99 1759.57	50YR	333.35	1073.63	1566.64	SOVE	1586 53	887.08	244.40	
2306.86 200YR 2324.58 1364.79 2923.99 57	100YR	403.70	1394.13	1918.15	100YR	1933.66	1110 11	744.47	
2923.99 500YR 2920.29 1759.57	200YR	497.37	1786.81	2306.86	200YR	2324 58	1364 79	480.01	
	500YR	299.90	2415.83	2923.99	500YR	2920 29	1759 57	596.41	

# **USGS URBAN REGRESSION EQUATIONS**

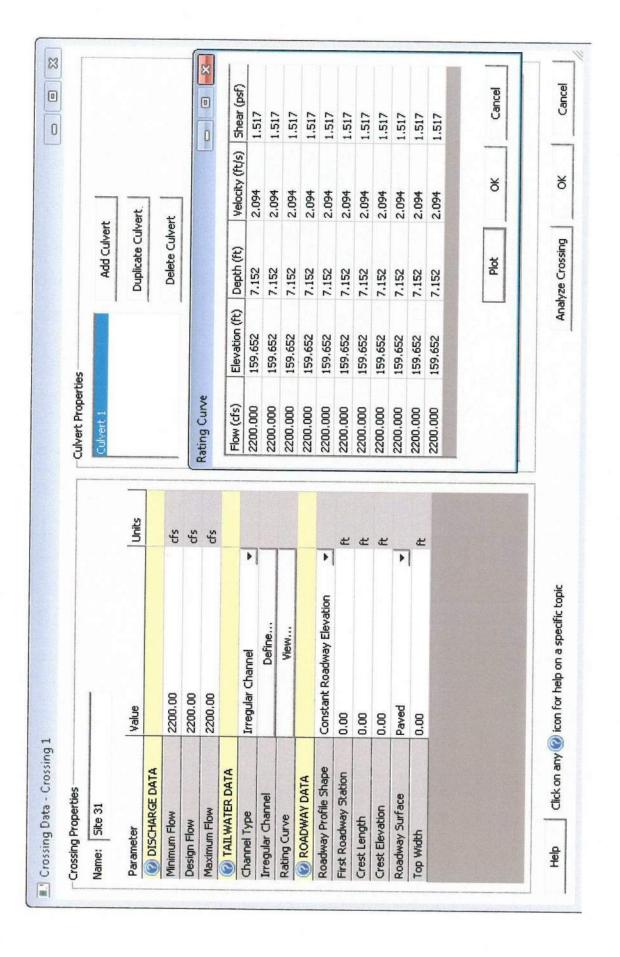
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(These Equations are used only for comparison)

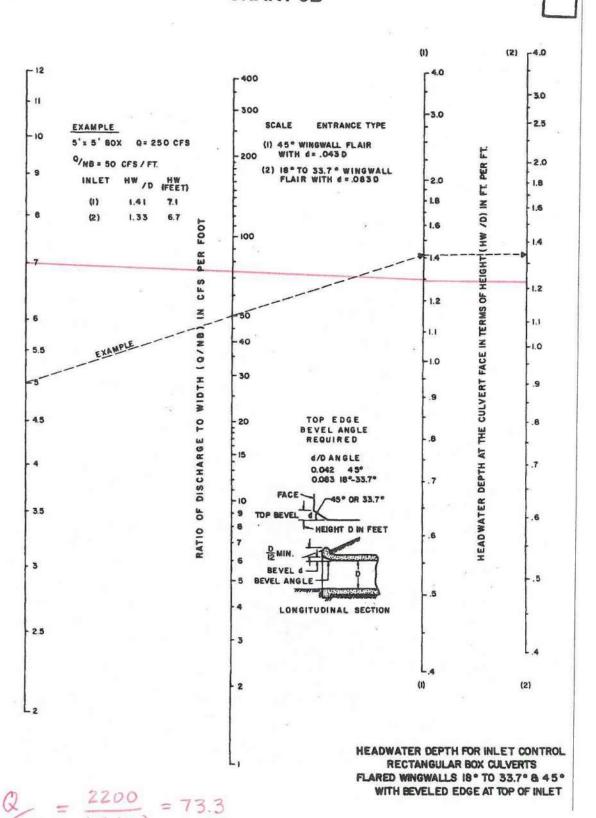
							(Based on 2.80xQ10)	
Blue Ridge	(cfs)	1716.34	2078.69	2620.12	3135.20	3815.38	5820.34	5384.60
Sand Hills Coastal Plain	(cfs)	1038.78	1338.92	1839.16	2308.51	2937.00	3748.98	4604.34
Sand Hills	(cts)	523.66	619.90	762.38	895.13	1063.02	1735.71	1469.18
FREQUENCY		SYR	10YR	25YR	50YR	100YR	200YR	500YR

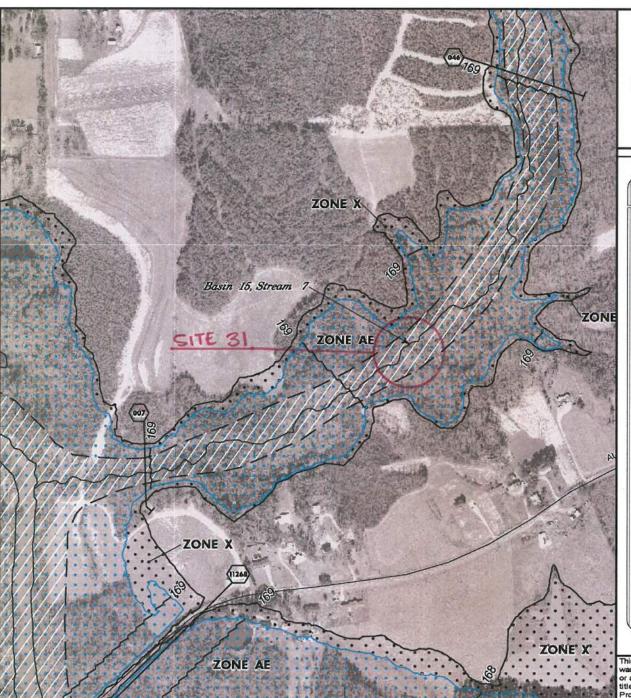
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000000000000000000000000000000000000000		Blue Ridge Discharge Used	(cts)	1049.88	1337.07	1886.50	2167.72	2437.40	3743.79 (Based	L2201 72 COOL
		Coastal Plain	(cts)	872.20	1141.14	1624.40	1917.38	2205.34	3195.18	1176 56
STOCK	15	Sand Hills	(cts)	679.42	856.83	1113.79	1313.28	1496.37	2399.13	3136 01
	% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR



### **CHART 9B**







MAP SCALE 1" = 500' (1 : 6,000)

50 0 500 1000 FEET

### PANEL 1742J

# FIRM FLOOD INSURANCE RATE MAP NORTH CAROLINA

### **PANEL 1742**

(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT)

### CONTAINS:

HONNAL FLOXOLD HINSTURANNES PROXERAM

CID No.	PANEL	SUFFIX
370241	1742	3
370243	1742	٦
370368	1742	٦
	370241 370243	370241 1742 370243 1742

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

## MAY 2, 2006

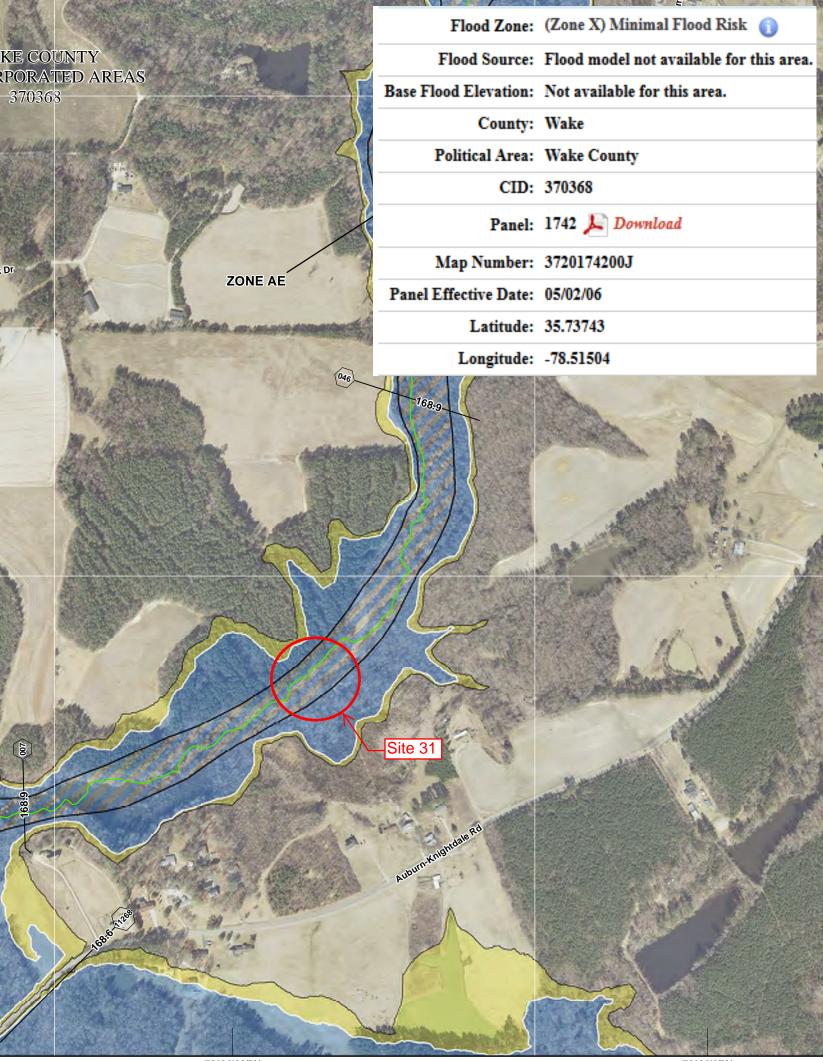






State of North Carolina Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MiT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



# **FLOOD INSURANCE STUDY**

### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 9, "Flooding Sources Studied by Detailed Methods: Redelineated", lists all flooding sources that were studied by detailed methods for the prestatewide FIS and redelineated for previous FISs. These flooding sources were not part of this revision and their effective analyses remain valid.

Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	ooding Sources Studied	Sources Sources	Affected Communities
Source	From	To	Allected Communities
Adams Branch (Basin 30, Stream 9)	The confluence with Big Branch Tributary No. 1 (Basin 30, Stream 6)	Corwin Road	Town Of Garner
Angier Creek (Basin 24, Stream 4)	The confluence with Kenneth Creek (Basin 24, Stream 2)	Railroad	Town Of Fuquay-Varina
Armory Tributary (Basin 18, Stream 38)	The confluence with Richland Creek (Basin 18, Stream 3)	Approximately 0.5 mile upstream of confluence with Richland Creek (Basin 18, Stream 3)	City Of Raleigh
Austin Creek (Basin 6, Stream 10)	The confluence with Smith Creek (Basin 6, Stream 1)	Approximately 350 feet upstream of Averette Road	Rdu Town Of Wake Forest Wake County
Bagwell Branch (Basin 20, Stream 10)	The confluence with Swift Creek (Basin 20, Stream 1)	NC Route 50	Town Of Garner
Basal Creek (Basin 22, Stream 16)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.8 mile upstream of State Road 55	Rdu Town Of Fuquay-Varina Town Of Holly Springs Wake County
Basin 10, Stream 10	The confluence with Little River (Basin 10, Stream 1)	Highway 96/Zebulon Road	Rdu Wake County
Basin 10, Stream 2	The confluence with Little River (Basin 10, Stream 1)	Approximately 0.9 mile upstream of confluence with Little River (Basin 10, Stream 1)	Rdu Wake County
Basin 10, Stream 3	The confluence with Little River (Basin 10, Stream 1)	Moss Road	Rdu Wake County
Basin 10, Stream 5	The confluence with Little River (Basin 10, Stream 1)	Lizard Lick Rd	Rdu Wake County
Basin 10, Stream 6	The confluence with Little River (Basin 10, Stream 1)	Lizard Lick Rd	Rdu Wake County
Basin 10, Stream 9	The confluence with Little River (Basin 10, Stream 1)	Zebulon Road	Rdu Wake County
Basin 12, Stream 3	The confluence with Beaverdam Creek (Basin 12, Stream 1)	Old Crews Road	Town Of Knightdale
Basin 15, Stream 22	The confluence with Neuse River (Basin 15, Stream 1)	Forestville Road	City Of Raleigh
Basin 15, Stream 25	The confluence with Neuse River (Basin 15, Stream 1)	The intersection between Forestville Rd and Mitchell Mill Road	City Of Raleigh
Basin 15, Stream 28	The confluence with Perry Creek (Basin 15, stream 26)	Approximately 0.7 mile upstream of Berkshire Downs Drive	City Of Raleigh
Basin 15, Stream 32	The confluence with Falls Lake	Just upstream of Raven Ridge Road	Rdu Wake County
Basin 15, Stream 33	The confluence with Honeycutt Creek (Basin 15, Stream 31)	Approximately 0.3 mile upstream of Honeycutt Road	Rdu Wake County
Basin 15, Stream 7	The confluence with Neuse River (Basin 15, Stream 1)	Clifton Road	Rdu Town Of Knightdale Wake County
Basin 15, Stream 8	The confluence with Basin 15, Stream 7	Grasshopper Road	Rdu Wake County
basin 15, Stream 9	The confluence with Neuse River (Basin 15, Stream 1)	Battle Ridge Road	Rdu Wake County
Basin 16, Stream 2	The confluence with Upper Barton Creek (Basin 16, Stream 1)	State Route 50	Rdu Wake County
Basin 16, Stream 5	The confluence with Upper Barton Creek (Basin 16, Stream 1)	Approximately 0.2 mile upstream of State Route 50	Rdu Wake County
Basin 17, Stream 4	The confluence with Lower Barton Creek (Basin 17, Stream 1)	Old Creedmoor Road	Rdu Wake County
Basin 18, Stream 13	The confluence with Stirrup Iron Creek (Basin 18, Stream 12)	Sorrell Grove Church Road	Town Of Morrisville
Basin 18, Stream 4	The confluence with Turkey Creek (Basin 18, Stream 5)	Approximately 0.3 mile upstream of Lynn Road	City Of Raleigh
Basin 18, Stream 8	The confluence with Sycamore Creek (Basin 18, Stream 6)	Approximately 0.6 mile upstream of West Gate Road	City Of Raleigh
Basin 19, Stream 3	The confluence with White Oak Creek (Basin 19, Stream 1)	Railroad	Rdu Town Of Garner Wake County
Basin 20, Stream 20	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 0.8 mile upstream of confluence with Swift Creek (Basin 20, Stream 1)	Rdu Wake County
Basin 20, Stream 7	The confluence with Mahlers Creek (Basin 20, Stream 6)	Bryan Road	Town Of Garner
Basin 20, Stream 8	The confluence with Basin 20, Stream 7	Bryan Road	Town Of Garner
Basin 22, Stream 20	The confluence with Terrible Creek (Basin 22, Stream 19)	Approximately 1.0 mile upstream of confluence with Terrible Creek (Basin 22, Stream 19)	Town Of Fuquay-Varina

**Table 13 - Summary of Discharges** 

Table 13 - Summ	, 01 013	J. I. G.	Dischar	rges (cfs)	
Location	Drainage Area	10% Annual	2% Annual	1% Annual	0.2% Annual
Approximately 0.4 mile upstream of confluence with Marks Creek (Basin 14, Stream	(square miles) 2.45	* Chance	* Chance	1,310	* Chance
1)					1.
Approximately 0.4 mile downstream of Lake Myra Road	1.47	*	*	947	*
Basin 14, Stream 3		Ι			I
At confluence with Marks Creek (Basin 14, Stream 1)	0.39	*	*	410	*
Basin 15, Stream 22					<u> </u>
At mouth	1.60	*	*	1,410	*
At Forestville Road	0.80	*	*	950	*
Basin 15, Stream 25					1
At mouth	1.40	*	*	1,300	*
Approximately 700 feet upstream of Wake Crossroads	0.40	*	*	680	*
Basin 15, Stream 28		_			
At mouth	4.00	*	*	2,300	*
At U.S. Route 1	3.10	*	*	2,000	*
Basin 15, Stream 32					
At mouth	2.10	*	*	1,600	*
At Raven Ridge Road	1.60	*	*	1,410	*
Basin 15, Stream 33					
At mouth	0.90	*	*	1,000	*
Approximately 1,500 feet upstream of Honeycutt Road	0.70	*	*	975	*
Just downstream of Honeycutt Road	0.70	*	*	830	*
Basin 15, Stream 7					
At mouth	4.70	*	*	2,490	*
Just downstream of Basin 15, Stream 8	3.20	*	*	2,080	*
pproximately 500 feet downstream of Clifton Road	0.90	*	*	890	*
Basin 15, Stream 8	12.22	l		1222	
At mouth	1.10	*	*	1,160	*
	11.10			1,100	
Basin 15, Stream 9	1.20	*	*	1.450	T <sub>*</sub>
At mouth	1.20			1,150	
Basin 16, Stream 2			1.	1	1.
At mouth	2.10	*	*	1,600	*
Approximately 0.4 mile upstream of mouth just upstream of tributary	1.60	*	*	1,350	*
Just downstream of tributary just downstream of State Route 50	0.70	*	*	890	*
Just upstream of tributary just downstream of State Road 50	0.40	*	*	650	*
Basin 16, Stream 5					
At mouth <sup>1</sup>	1.60	*	*	1,050	*
Just downstream of State Route 50 <sup>1</sup>	1.40	*	*	920	*
Just upstream of State Route 50	1.40	*	*	1,180	*
Just downstream of tributary just upstream of State Route 50	1.20	*	*	1,100	*
Just upstream of tributary just upstream of State Route 50	0.30	*	*	590	*
Basin 17, Stream 4					
At mouth	2.40	*	*	1,750	*
At Baileywick Road	1.40	*	*	1,170	*
Just upstream of Baileywick Road	0.70	*	*	880	*

Table 21 - Floodway Data

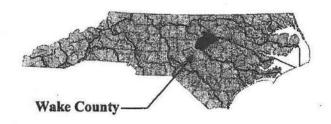
				oodway D				
Source /Foot	Width (Fast)	Floodway	Moon Valasit	Pogulator:		ter Surface Eleva		Increase
Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
4,490	85	537	1.6	305.1	*	305.1	305.2	0.1
am 7				T				T
700	145	413	6.0	168.9 <sup>1</sup>	*	154.6	154.6	0.0
4,570	285	1,020	2.4	168.9 <sup>1</sup>	*	165.7	165.7	0.0
10,180	320	812	2.4	182.2	*	182.2	182.2	0.0
12,500	195	1,251	1.5	198.5	*	198.5	199.0	0.5
15,300	385	394	4.9	208.0	*	208.0	208.0	0.0
am 8								
1,730	85	297	3.9	186.6	*	186.6	187.6	1.0
3,800	135	467	2.5	193.8	*	193.8	194.8	1.0
5,500	135	219	5.3	207.6	*	207.6	207.6	0.0
am 9								
500	210	242	4.8	171.1	*	171.1	172.1	1.0
2,450	90	455	2.5	180.3	*	180.3	181.3	1.0
4,665	70	155	7.4	195.3	*	195.3	195.3	0.0
am 2				1				
6,970	95	258	5.2	287.4	*	287.4	288.1	0.7
7,400	100	545	0.5	292.0	*	292.0	292.8	0.8
am 5		Г	Г	T			1	T
600	415	6,441	0.2	282.5	*	282.5	283.1	0.6
3,410	140	561	1.6	290.8	*	290.8	291.1	0.3
4,550	150	235	4.6	296.5	*	296.5	296.9	0.4
am 4		Г	Г	T			1	T
2,770	90	376	4.7	301.1	*	301.1	302.0	0.9
7,320	125	485	3.6	330.5	*	330.5	331.1	0.6
8,420	119	198	5.9	338.3	*	338.3	338.3	0.0
10,744	160	150	5.9	362.4	*	362.4	362.4	0.0
am 13				T				T
1,590	95	219	2.4	288.1	*	288.1	289.1	1.0
1,875	180	497	1.1	289.0	*	289.0	289.9	0.9
2,290	115	128	4.1	289.5	*	289.5	290.3	0.8
am 4				ı				ı
1,290	60	315	4.9	287.7	*	287.7	288.7	1.0
3,690	50	407	3.8	304.3	*	304.3	304.4	0.1
6,040	105	187	6.2	318.4	*	318.4	318.4	0.0
am 8								
110	570	424	3.1	358.4 <sup>1</sup>	*	358.4	357.7	-0.7
670	54	432	4.4	365.2	*	365.2	365.3	0.1
1,200	0	0	0.0	363.0	*	363.0	0.0	0.0
2,140	100	692	2.6	374.4	*	374.4	374.4	0.0
2,850	100	540	3.3	375.5	*	375.5	376.0	0.5
3,910	100	432	4.2	380.4	*	380.4	380.6	0.2
			4.0	388.9	*	388.9	200.4	0.5
5,720	120	395	4.3	300.9		300.9	389.4	0.5
5,720 7,573	230	2,220	0.7	409.8	*	409.8		0.3
					*		410.1	
	Above Mouth)  4,490  am 7  700  4,570  10,180  12,500  15,300  am 8  1,730  3,800  5,500  am 9  500  2,450  4,665  am 2  6,970  7,400  am 5  600  3,410  4,550  am 4  2,770  7,320  8,420  10,744  am 13  1,590  1,875  2,290  am 4  1,290  3,690  6,040  am 8  110  670  1,200  2,140	Above Mouth)  4,490	Above Mouth) (Square Feet)  4,490 85 537  am 7  700 145 413  4,570 285 1,020  10,180 320 812  12,500 195 1,251  15,300 385 394  am 8  1,730 85 297  3,800 135 467  5,500 135 219  am 9  500 210 242  2,450 90 455  4,665 70 155  am 2  3,970 95 258  7,400 100 545  am 5  600 415 6,441  3,410 140 561  4,550 150 235  am 4  2,770 90 376  7,320 125 485  8,420 119 198  10,744 160 150  am 13  1,590 95 219  1,875 180 497  2,290 115 128  am 4  1,290 60 315  am 8  110 570 424  1,200 0 0  2,140 100 692	Above Mouth)  (Square Feet)  (Feet Per Second)  4,490  85  537  1.6  1.700  145  413  6.0  4,570  285  1,020  2.4  10,180  320  812  2.4  12,500  195  1,251  1.5  13,300  385  394  4.9  15,300  385  394  4.9  1730  85  297  3.9  3.800  135  467  2.5  5,500  135  219  5.3  189  500  210  242  4.8  2,450  90  455  2.5  4,665  70  155  7.4  180  190  1415  1,6441  0.2  3,410  140  561  1,6  4,550  150  235  4,6  16  17,720  90  376  4,7  3,220  125  485  3,6  3,420  119  198  5,9  10,744  160  150  5,9  115  128  4,1  1290  60  315  4,9  3,690  50  407  3,8  3,690  50  407  3,8  407  407  400  407  407  408  407  408  407  409  407  400  407  400  407  400  407  400  407  400  407  400  407  400  407  400  407  400	Above Mouth)    Square Feet    Second	Above Mouth)  (Square Feet) (Feet Per Second)  (A4.90  A5 537  A5 305.1  A5 305.1  A4.490  A5 537  A5 305.1  A5 305.	Above Mouth)  (Square Feet)  (Square Feet)  (See Per Second)  (Square Feet)  (Squ	Above Mouth)  (Square Feet) (Seeper Second) (Second) (Square Feet) (Second)

# FLOOD INSURANCE STUDY

A Report of Flood Hazards in

## WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 1 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





May 2, 2006

Federal Emergency Management Agency State of North Carolina

> Flood Insurance Study Number 37183CV001A

www.fema.gov and www.ncfloodmaps.com



### Section 5.0 - Engineering Methods

**Table 10-Roughness Coefficients** 

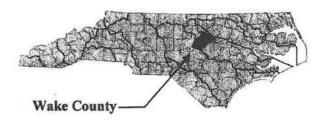
Table 10 Roughiles.		a Contract of the same
Stream	Channel "n"	Overbank "n"
Basin 3, Stream 6	0.030 - 0.070	0.070 - 0.110
Basin 3, Stream 8	0.030 - 0.070	0.070 - 0.110
Basin 4, Stream 3	0.030 - 0.070	0.070 - 0.110
Basin 4, Stream 13	0.030 - 0.070	0.070 - 0.110
Basin 6, Stream 9	0.030 - 0.070	0.070 - 0.110
Basin 10, Stream 2	0.030 - 0.070	0.070 - 0.110
Basin 10, Stream 3	0.030 - 0.070	0.070 - 0.110
Basin 10, Stream 5	0.030 - 0.070	0.070 - 0.180
Basin 10, Stream 6	0.030 - 0.070	0.070 - 0.110
Basin 10, Stream 9	0.030 - 0.070	0.070 - 0.110
Basin 10, Stream 10	0.030 - 0.070	0.070 - 0.110
Basin 10, Stream 13	0.045	0.130
Basin 10, Stream 14	0.050	0.150
Basin 11, Stream 4	0.047	0.140
Basin 11, Stream 7	0.042	0.130
Basin 12, Stream 3	0.024 - 0.070	0.070 - 0.150
Basin 14, Stream 2	0.045	0.100
Basin 14, Stream 3	0.050	0.130
61TE 31	0.030 - 0.070	0.070 - 0.110
Basin 15, Stream 8	0.030 - 0.070	0.070 - 0.110
Basin 15, Stream 9	0.030 - 0.070	0.070 - 0.110
Basin 15, Stream 22	0.030 - 0.070	0.070 - 0.110
Basin 15, Stream 25	0.030 - 0.070	0.070 - 0.110
Basin 15, Stream 28	0.030 - 0.070	0.070 - 0.110
Basin 15, Stream 32	0.030 - 0.070	0.070 - 0.110
Basin 15, Stream 33	0.030 - 0.070	0.070 - 0.110
Basin 16, Stream 2	0.030 - 0.070	0.070 - 0.110
Basin 16, Stream 5	0.030 - 0.070	0.070 - 0.110
Basin 17, Stream 4	0.030 - 0.070	0.070 - 0.110
Basin 18, Stream 4	0.030 - 0.070	0.070 - 0.130
Basin 18, Stream 7	0.055	0.150
Basin 18, Stream 8	0.030 - 0.070	0.070 - 0.110
Basin 18, Stream 13	0.024 - 0.070	0.070 - 0.150
Basin 18, Stream 13 Tributary	0.050	0.150
Basin 18, Stream 16	0.030 - 0.070	0.070 - 0.130
Basin 19, Stream 3	0.030 - 0.070	0.070 - 0.110
Basin 19, Stream 4	0.030 - 0.070	0.070 - 0.110
Basin 20, Stream 5	0.047	0.130
Basin 20, Stream 7	0.030 - 0.070	0.070 - 0.130
Basin 20, Stream 8	0.030 - 0.070	0.070 - 0.110
Basin 20, Stream 20	0.030 - 0.070	0.070 - 0.110

# FLOOD INSURANCE STUDY

A Report of Flood Hazards in

WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 3 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





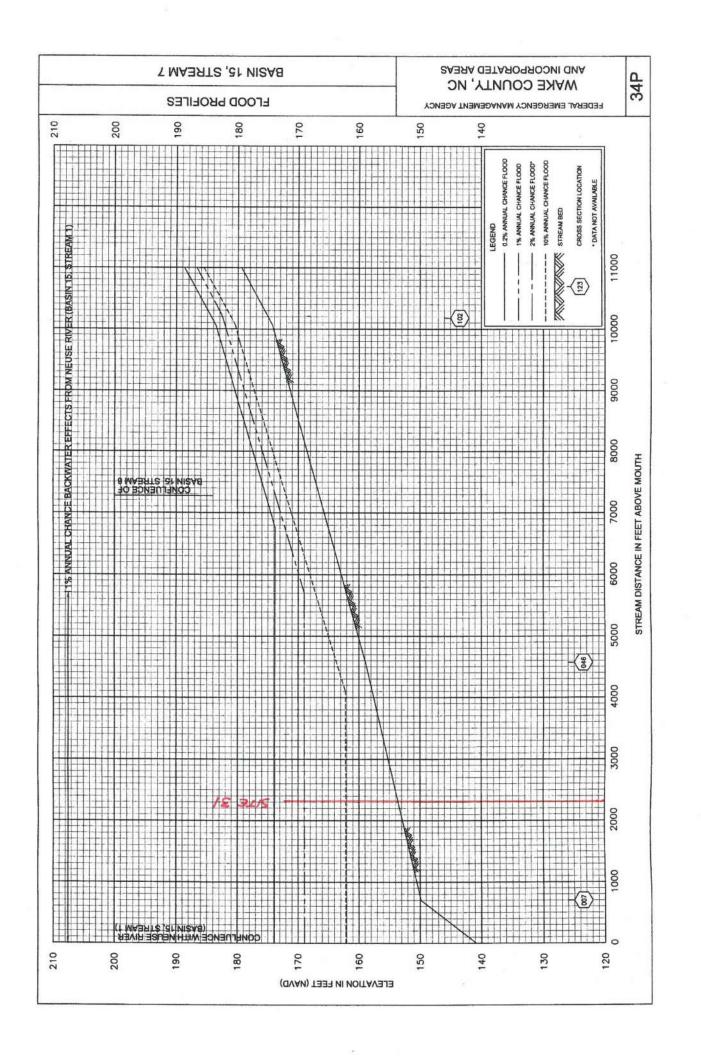
May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV003A

www.fema.gov and www.ncfloodmaps.com





# PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake PROJECT NUMBER R-2721, R-2828, & R-2829
STREAM Unnamed Tributary to Neuse River ROUTE New Location
(Site 31) ASSESSMENT PREPARED BY Mulkey, INC. DATE 6/11/2010 (MLH)
HYDROLOGIC EVALUATION
NEAREST GAGING STATION ON THIS STREAM (NONE $\underline{X}$ )
ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: No
FLOOD DATA: Q <sub>10</sub> 950 CFS EST. BKWTR. N/A FT. Q <sub>25</sub> 1,450 CFS EST. BKWTR. N/A FT. Q <sub>50</sub> 1,900 CFS EST. BKWTR. N/A FT. Q <sub>500</sub> 4,800 CFS EST. BKWTR. N/A FT. Q <sub>500</sub> 4,800 CFS EST. BKWTR. N/A FT.
DRAINAGE AREA 4.60 Sq.Mi. METHOD USED TO COMPUTE Q: USGS Urban Regression
PROPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: LOW MODERATE X HIGH
COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: YES NO X
EXPLANTION: A floodway modification may be required at this site.
LIST BUILDINGS IN FLOOD PLAIN: None LOCATION:
UPSTREAM LAND USE <u>Residential</u> ANTICIPATE ANY CHANGE? <u>No</u>
ANY FLOOD ZONING? (FIA STUDIES, ETC.) YES $\underline{X}$ NO
TYPE OF STUDY: FEMA - Special Flood Hazard Zone AE
REGULATORY FLOODWAY WIDTH 140 ft. Section 282 (AS NOTED IN FIS)
COMMENTS:

### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 31,300 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 69,200 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? N/A
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS  NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.  LEVEES AGGRADATION/DEGRADATION RESERVOIRS DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE  EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Chewacla TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service
ENVIRONMENTAL CONSIDER ATIONS

LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: Buried culverts 1 foot to allow for fish passage.

### **MISCELLANEOUS COMMENTS**

IS THERE UNUSUAL SCOUR POTENTIAL? YES $\_$ NO $\underline{X}$ PROTECTION NEEDED $\_$
ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
ALTERNATIVES
RECOMMENDED DESIGN 3@10'x8' RCBC
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING 210 Sq. Ft.
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YESNO X DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:

Name of Stream	Description	Curr. Class	Date	Basin	Stream Index #	SITE 31
Tom Jack Creek	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-10	
Jim Branch	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-4	
Cary Branch	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-5	
Norris Branch	From source to Cary Branch	С	09/01/74	Cape Fear	18-7-5-1	
Utley Creek	From source to Harris Lake, Buckhorn Cr.	С	04/01/59	Cape Fear	18-7-5.5	
White Oak Creek	From source to Harris Lake, Buckhorn Cr.	с	04/01/59	Cape Fear	18-7-6	
Big Branch	From source to White Oak Creek	С	09/01/74	Cape Fear	18-7-6-1	
Little Branch	From source to Big Branch	С	09/01/74	Cape Fear	18-7-6-1-1	
Little White Oak Creek	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-7	
Big Branch	From source to Harris Lake, Buckhorn Cr.	С	04/01/59	Cape Fear	18-7-8	
Thomas Creek	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-9	
NEUSE RIVER	From dam at Falls Lake to a point 0.5 mile upstream of Town of Wake Forest proposed water supply intake (Former water supply intake for Burlington Mills Wake Finishing Plant)	WS-IV;NSW	07/01/04	Neuse	27-(20.7)	
NEUSE RIVER	From Town of Wake Forest proposed water supply intake to mouth of Beddingfield Creek	C;NSW	08/03/92	Neuse	27-(22.5)	
NEUSE RIVER	From a point 0.5 mile upstream of Town of Wake Forest proposed water supply intake to Town of Wake Forest proposed water supply intake	WS-IV;NSW,CA	07/01/04	Neuse	27-(22)	
NEUSE RIVER	From mouth of Beddingfield Creek to a point 0.2 mile downstream of Johnston County SR 1700	WS-V;NSW	08/03/92	Neuse	27-(36)	
NEUSE RIVER (Falls Lake below normal pool elevation)	From I-85 bridge to dam at Falls Lake	WS-IV,B;NSW,CA	08/03/92	Neuse	27-(5.5)	

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Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing

Page 1 of 3

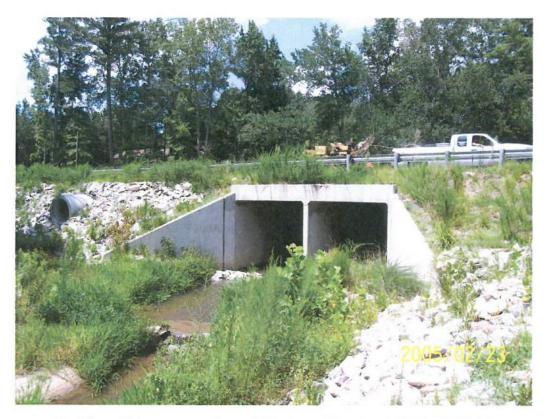


Looking at Upstream Channel of Upstream Structure.

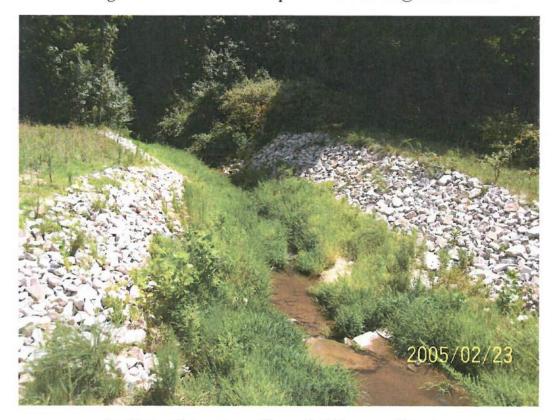


Looking at Upstream Face of Upstream Structure 2@10'x11' RCBC

Page 2 of 3

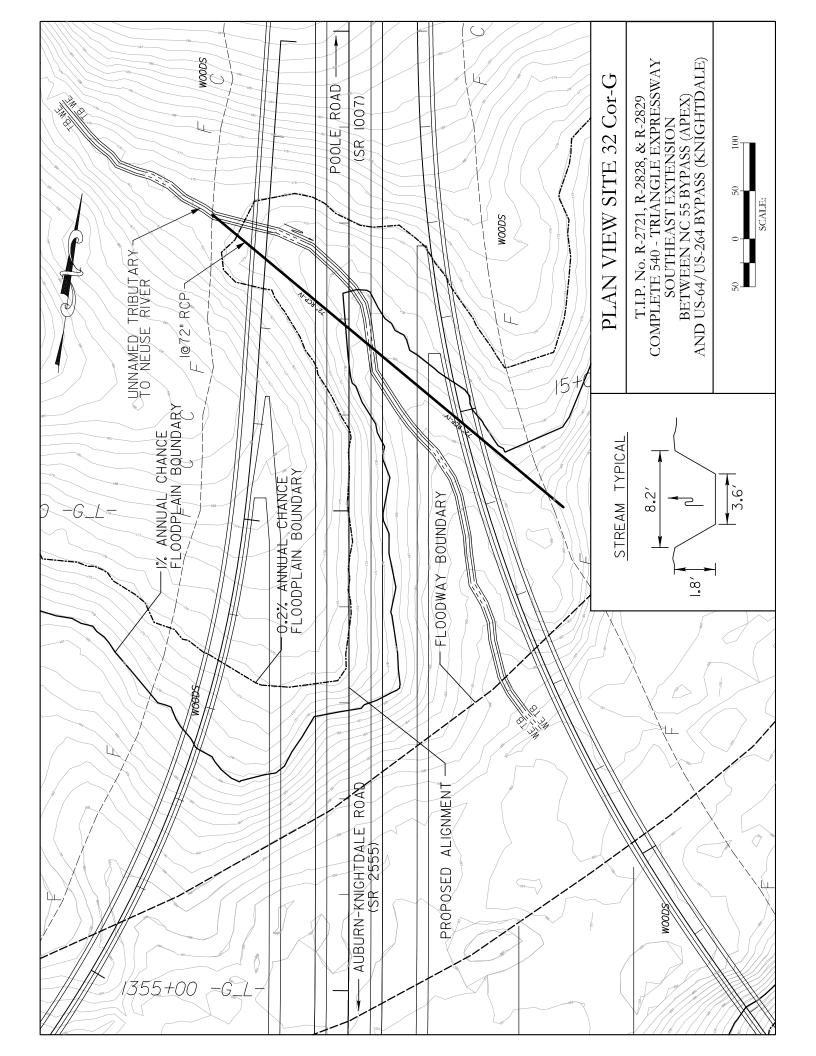


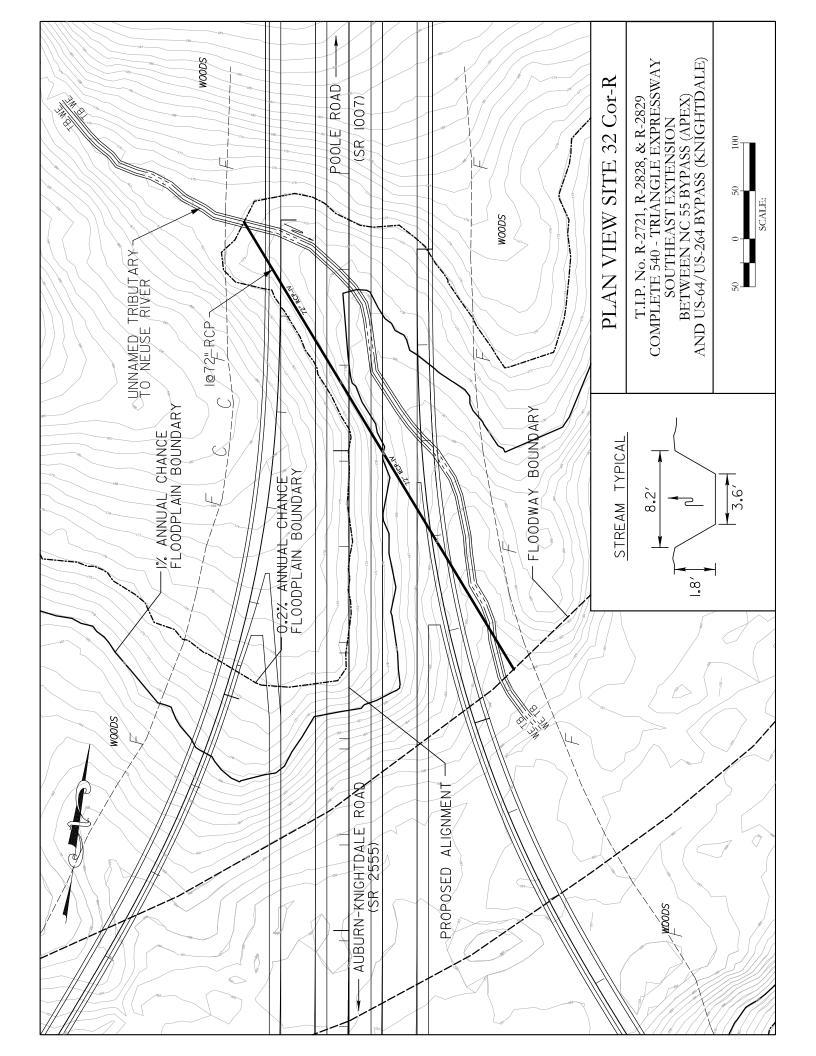
Looking at Downstream Face of Upstream Structure 2@10'x11' RCBC

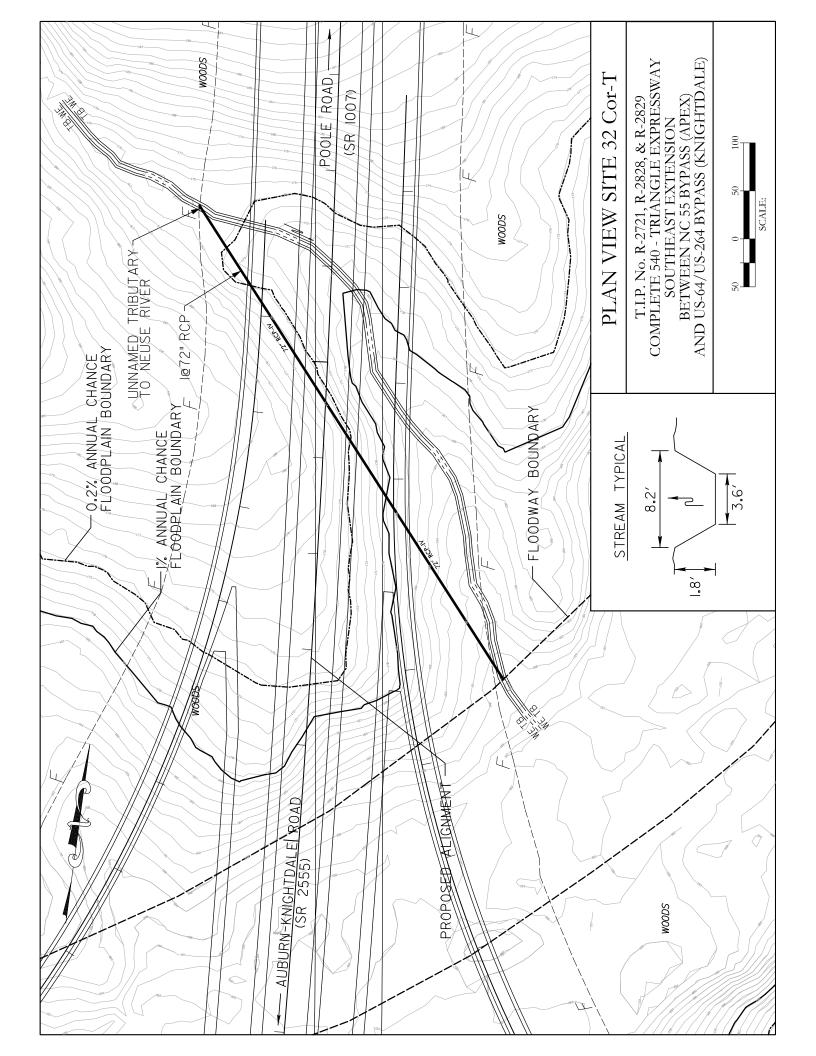


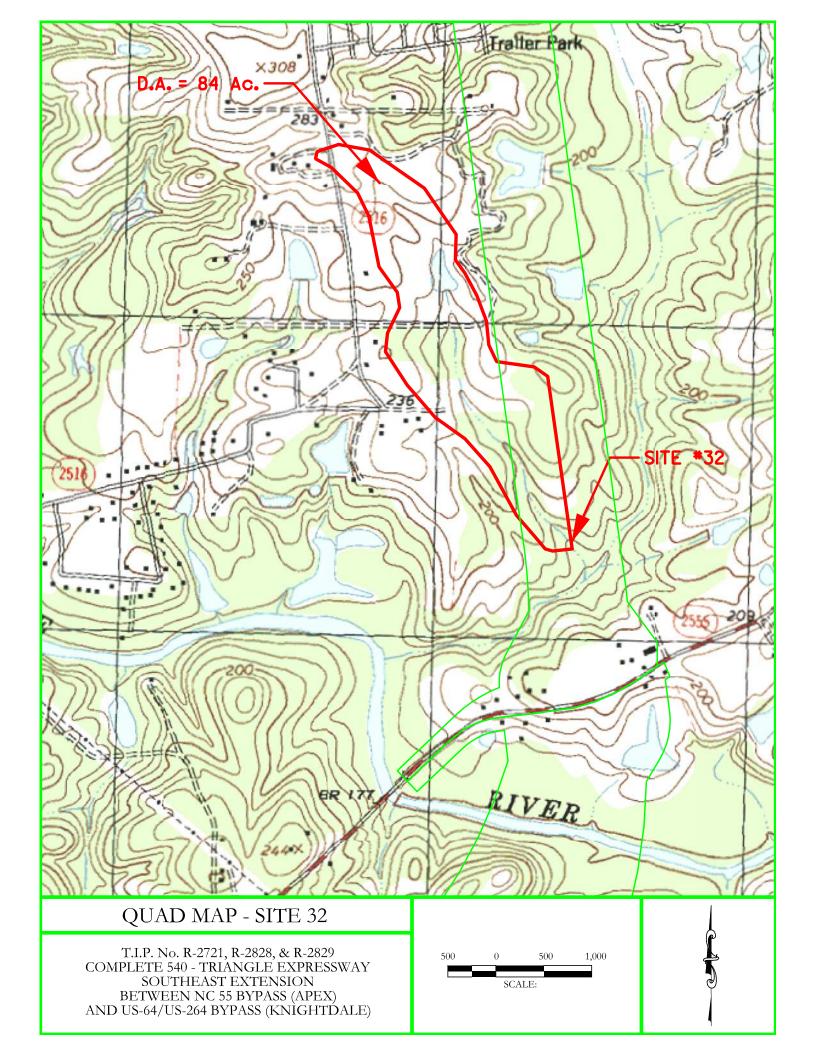
Looking at Downstream Channel of Upstream Structure

# Site 32









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	REGION: BLUE RIDGE	Rep. 01-4207
	STREAM NAME: Unnmaed Trib to the Neuse River	sq. miles METHOD USED:
11/24/2010	PROJECT NAME: Triangle Expressway SE Ext.	ENGLISH Drainage Area = 0.13

11:1	10000		· · · · · · · · · · · · · · · · · · ·	TOTAL PROPERTY OF THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NAMED IN COLUMN T		CONTRACTOR OF STREET	CHESTORIS CONTRACTORISM CONTRA	-
USGS RURAL	AL REGRE	SSION EQU	ATIONS (OLD)	RUF	URAL EQUA	LIONS	oort 01-4207	
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Pl	ain Sand Hills	
	(cts)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)	
2YR	99.9	19.11	35.16	2YR	32.23	16.39	7.84	
5YR	10.83	45.45	63.21	5YR	60.81	35.31	13.28	
10YR	14.23	71.92	86.00	10YR	86.53	53.61	17.59	
25YR	18.62	122.27	122.73	25YR	127.67	83.81	23.86	
SOYR	22.41	171.70	154.26	50YR	164.80	112.63	29.30	
100YR	26.56	236.89	193.64	100YR	208.15	147.48	35.13	
200YR	32.61	319.15	236.23	200YR	258.39	189.24	41.94	
500YR	37.42	461.76	317.00	500YR	337.59	257.39	52.02	

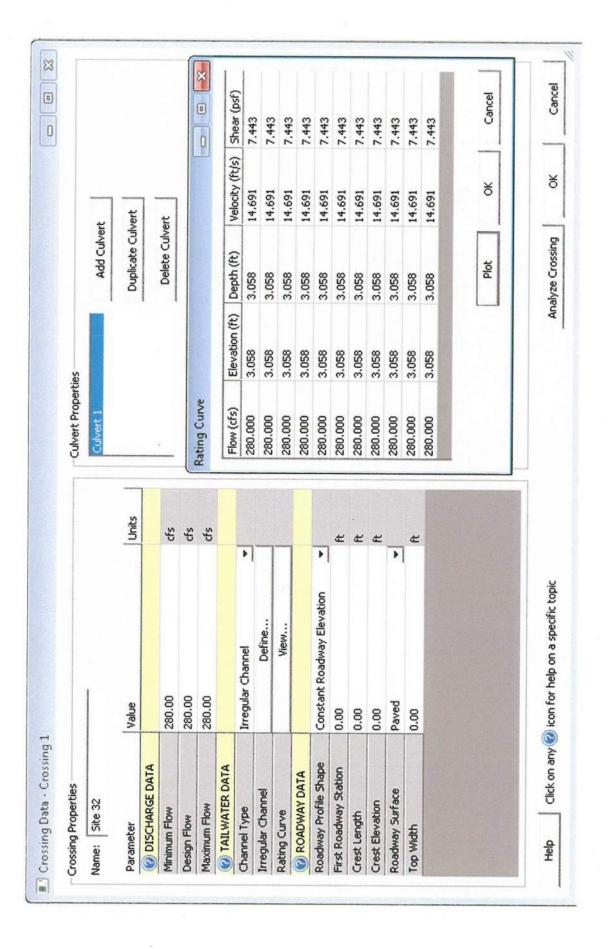
# USGS URBAN REGRESSION EQUATIONS BDF= 11

BDF= 11 (These Equations are used only for comparison)

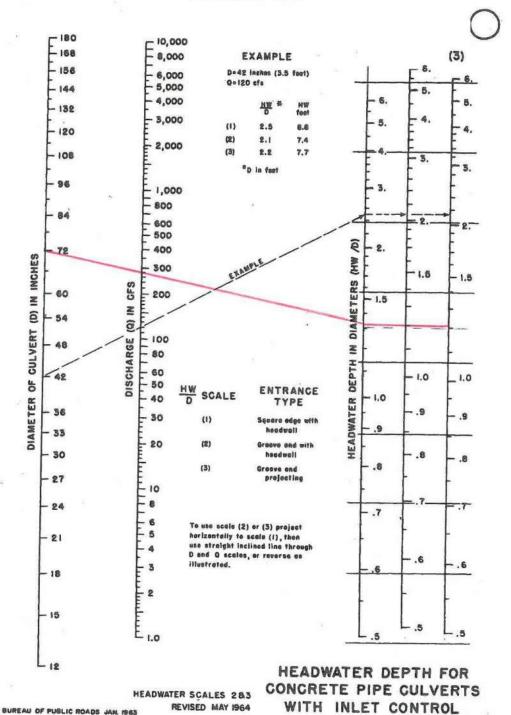
יייים באמשום	ים מוס מספם סווו	on companison)		
FREQUENCY	Sand Hills	Coastal Plain	ш	
	(cfs)	(cfs)		
5YR	36.66	112.23		
10YR	43.56	156.67		
25YR	52.40	236.11		
50YR	58.87	50YR 58.87 306.32	280.86	
100YR	98.99	402.14		
200YR	121.96	438.66		(Based on 2.80xQ10)
500YR	85.35	86.699		

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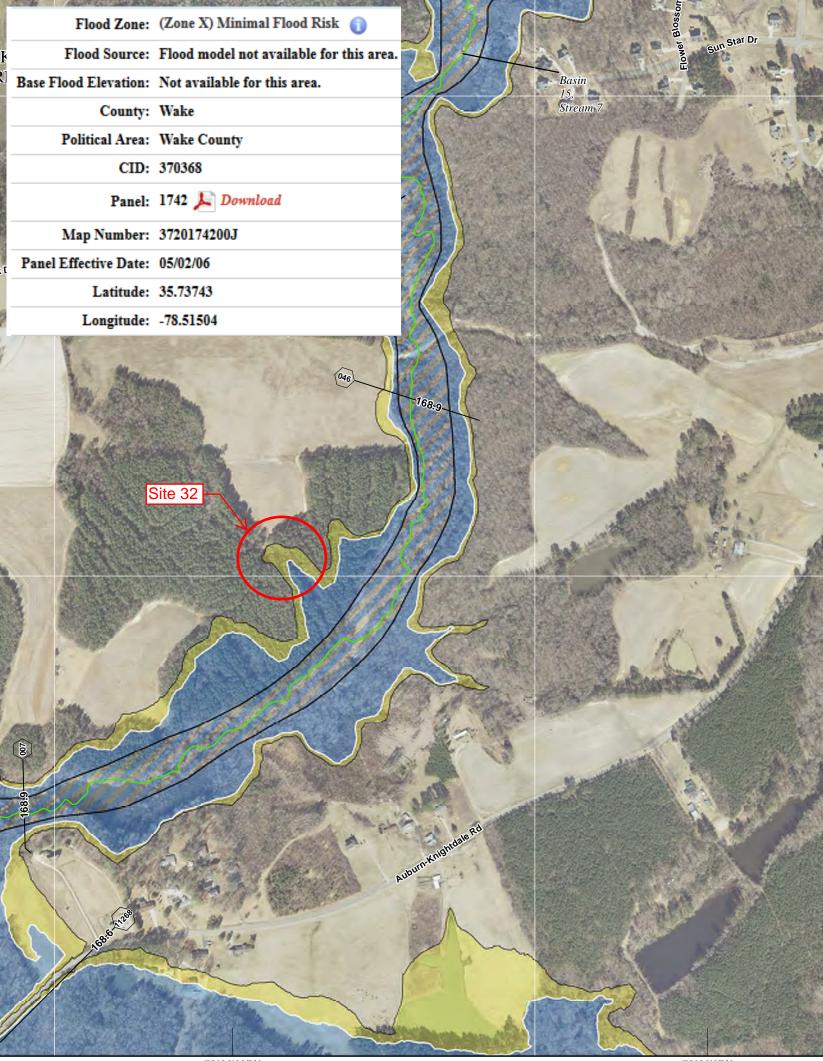
% Impervious =	20				FEMA	MA
REQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Discharge Used	FREQUENCY	Dishardes
	(cfs)	(cfs)	(cfs)			
SYR	65.98	99.45	109.11			
10YR	88.86	142.45	149.98		10YR	
25YR	127.01	241.18	241.99		SOYR	
50YR	151.79	293.73	283.85	280	100YR	
100YR	175.39	347.54	325.99		500YR	
200YR	248.80	398.87	419.93	(Based on 2.80xQ10)		ı
500YR	325.22	521.38	548.91	(Based on 3.66xQ10)		







Q= 280 cfs



### **FLOOD INSURANCE STUDY**

### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 9, "Flooding Sources Studied by Detailed Methods: Redelineated", lists all flooding sources that were studied by detailed methods for the prestatewide FIS and redelineated for previous FISs. These flooding sources were not part of this revision and their effective analyses remain valid.

Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	ooding Sources Studied	Sources Sources	Affected Communities
Source	From	To	Allected Communities
Adams Branch (Basin 30, Stream 9)	The confluence with Big Branch Tributary No. 1 (Basin 30, Stream 6)	Corwin Road	Town Of Garner
Angier Creek (Basin 24, Stream 4)	The confluence with Kenneth Creek (Basin 24, Stream 2)	Railroad	Town Of Fuquay-Varina
Armory Tributary (Basin 18, Stream 38)	The confluence with Richland Creek (Basin 18, Stream 3)	Approximately 0.5 mile upstream of confluence with Richland Creek (Basin 18, Stream 3)	City Of Raleigh
Austin Creek (Basin 6, Stream 10)	The confluence with Smith Creek (Basin 6, Stream 1)	Approximately 350 feet upstream of Averette Road	Rdu Town Of Wake Forest Wake County
Bagwell Branch (Basin 20, Stream 10)	The confluence with Swift Creek (Basin 20, Stream 1)	NC Route 50	Town Of Garner
Basal Creek (Basin 22, Stream 16)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.8 mile upstream of State Road 55	Rdu Town Of Fuquay-Varina Town Of Holly Springs Wake County
Basin 10, Stream 10	The confluence with Little River (Basin 10, Stream 1)	Highway 96/Zebulon Road	Rdu Wake County
Basin 10, Stream 2	The confluence with Little River (Basin 10, Stream 1)	Approximately 0.9 mile upstream of confluence with Little River (Basin 10, Stream 1)	Rdu Wake County
Basin 10, Stream 3	The confluence with Little River (Basin 10, Stream 1)	Moss Road	Rdu Wake County
Basin 10, Stream 5	The confluence with Little River (Basin 10, Stream 1)	Lizard Lick Rd	Rdu Wake County
Basin 10, Stream 6	The confluence with Little River (Basin 10, Stream 1)	Lizard Lick Rd	Rdu Wake County
Basin 10, Stream 9	The confluence with Little River (Basin 10, Stream 1)	Zebulon Road	Rdu Wake County
Basin 12, Stream 3	The confluence with Beaverdam Creek (Basin 12, Stream 1)	Old Crews Road	Town Of Knightdale
Basin 15, Stream 22	The confluence with Neuse River (Basin 15, Stream 1)	Forestville Road	City Of Raleigh
Basin 15, Stream 25	The confluence with Neuse River (Basin 15, Stream 1)	The intersection between Forestville Rd and Mitchell Mill Road	City Of Raleigh
Basin 15, Stream 28	The confluence with Perry Creek (Basin 15, stream 26)	Approximately 0.7 mile upstream of Berkshire Downs Drive	City Of Raleigh
Basin 15, Stream 32	The confluence with Falls Lake	Just upstream of Raven Ridge Road	Rdu Wake County
Basin 15, Stream 33	The confluence with Honeycutt Creek (Basin 15, Stream 31)	Approximately 0.3 mile upstream of Honeycutt Road	Rdu Wake County
Basin 15, Stream 7	The confluence with Neuse River (Basin 15, Stream 1)	Clifton Road	Rdu Town Of Knightdale Wake County
Basin 15, Stream 8	The confluence with Basin 15, Stream 7	Grasshopper Road	Rdu Wake County
basin 15, Stream 9	The confluence with Neuse River (Basin 15, Stream 1)	Battle Ridge Road	Rdu Wake County
Basin 16, Stream 2	The confluence with Upper Barton Creek (Basin 16, Stream 1)	State Route 50	Rdu Wake County
Basin 16, Stream 5	The confluence with Upper Barton Creek (Basin 16, Stream 1)	Approximately 0.2 mile upstream of State Route 50	Rdu Wake County
Basin 17, Stream 4	The confluence with Lower Barton Creek (Basin 17, Stream 1)	Old Creedmoor Road	Rdu Wake County
Basin 18, Stream 13	The confluence with Stirrup Iron Creek (Basin 18, Stream 12)	Sorrell Grove Church Road	Town Of Morrisville
Basin 18, Stream 4	The confluence with Turkey Creek (Basin 18, Stream 5)	Approximately 0.3 mile upstream of Lynn Road	City Of Raleigh
Basin 18, Stream 8	The confluence with Sycamore Creek (Basin 18, Stream 6)	Approximately 0.6 mile upstream of West Gate Road	City Of Raleigh
Basin 19, Stream 3	The confluence with White Oak Creek (Basin 19, Stream 1)	Railroad	Rdu Town Of Garner Wake County
Basin 20, Stream 20	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 0.8 mile upstream of confluence with Swift Creek (Basin 20, Stream 1)	Rdu Wake County
Basin 20, Stream 7	The confluence with Mahlers Creek (Basin 20, Stream 6)	Bryan Road	Town Of Garner
Basin 20, Stream 8	The confluence with Basin 20, Stream 7	Bryan Road	Town Of Garner
Basin 22, Stream 20	The confluence with Terrible Creek (Basin 22, Stream 19)	Approximately 1.0 mile upstream of confluence with Terrible Creek (Basin 22, Stream 19)	Town Of Fuquay-Varina

**Table 13 - Summary of Discharges** 

Table 13 - Summ	, 01 013	J. I. G.	Dischar	rges (cfs)	
Location	Drainage Area	10% Annual	2% Annual	1% Annual	0.2% Annual
Approximately 0.4 mile upstream of confluence with Marks Creek (Basin 14, Stream	(square miles) 2.45	* Chance	* Chance	1,310	* Chance
1)					1.
Approximately 0.4 mile downstream of Lake Myra Road	1.47	*	*	947	*
Basin 14, Stream 3		Ι			I
At confluence with Marks Creek (Basin 14, Stream 1)	0.39	*	*	410	*
Basin 15, Stream 22					<u> </u>
At mouth	1.60	*	*	1,410	*
At Forestville Road	0.80	*	*	950	*
Basin 15, Stream 25					1
At mouth	1.40	*	*	1,300	*
Approximately 700 feet upstream of Wake Crossroads	0.40	*	*	680	*
Basin 15, Stream 28		_			
At mouth	4.00	*	*	2,300	*
At U.S. Route 1	3.10	*	*	2,000	*
Basin 15, Stream 32					
At mouth	2.10	*	*	1,600	*
At Raven Ridge Road	1.60	*	*	1,410	*
Basin 15, Stream 33					
At mouth	0.90	*	*	1,000	*
Approximately 1,500 feet upstream of Honeycutt Road	0.70	*	*	975	*
Just downstream of Honeycutt Road	0.70	*	*	830	*
Basin 15, Stream 7					
At mouth	4.70	*	*	2,490	*
Just downstream of Basin 15, Stream 8	3.20	*	*	2,080	*
pproximately 500 feet downstream of Clifton Road	0.90	*	*	890	*
Basin 15, Stream 8	12.22	l		1222	
At mouth	1.10	*	*	1,160	*
	11.10			1,100	
Basin 15, Stream 9	1.20	*	*	1.450	T <sub>*</sub>
At mouth	1.20			1,150	
Basin 16, Stream 2			1.	1	1.
At mouth	2.10	*	*	1,600	*
Approximately 0.4 mile upstream of mouth just upstream of tributary	1.60	*	*	1,350	*
Just downstream of tributary just downstream of State Route 50	0.70	*	*	890	*
Just upstream of tributary just downstream of State Road 50	0.40	*	*	650	*
Basin 16, Stream 5					
At mouth <sup>1</sup>	1.60	*	*	1,050	*
Just downstream of State Route 50 <sup>1</sup>	1.40	*	*	920	*
Just upstream of State Route 50	1.40	*	*	1,180	*
Just downstream of tributary just upstream of State Route 50	1.20	*	*	1,100	*
Just upstream of tributary just upstream of State Route 50	0.30	*	*	590	*
Basin 17, Stream 4					
At mouth	2.40	*	*	1,750	*
At Baileywick Road	1.40	*	*	1,170	*
Just upstream of Baileywick Road	0.70	*	*	880	*

Table 21 - Floodway Data

				oodway D				
Source /Foot	Width (Fast)	Floodway	Moon Valasit	Pogulator:		ter Surface Eleva		Increase
Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
4,490	85	537	1.6	305.1	*	305.1	305.2	0.1
am 7				T				T
700	145	413	6.0	168.9 <sup>1</sup>	*	154.6	154.6	0.0
4,570	285	1,020	2.4	168.9 <sup>1</sup>	*	165.7	165.7	0.0
10,180	320	812	2.4	182.2	*	182.2	182.2	0.0
12,500	195	1,251	1.5	198.5	*	198.5	199.0	0.5
15,300	385	394	4.9	208.0	*	208.0	208.0	0.0
am 8								
1,730	85	297	3.9	186.6	*	186.6	187.6	1.0
3,800	135	467	2.5	193.8	*	193.8	194.8	1.0
5,500	135	219	5.3	207.6	*	207.6	207.6	0.0
am 9								
500	210	242	4.8	171.1	*	171.1	172.1	1.0
2,450	90	455	2.5	180.3	*	180.3	181.3	1.0
4,665	70	155	7.4	195.3	*	195.3	195.3	0.0
am 2				1				
6,970	95	258	5.2	287.4	*	287.4	288.1	0.7
7,400	100	545	0.5	292.0	*	292.0	292.8	0.8
am 5		Г	Г	T			1	T
600	415	6,441	0.2	282.5	*	282.5	283.1	0.6
3,410	140	561	1.6	290.8	*	290.8	291.1	0.3
4,550	150	235	4.6	296.5	*	296.5	296.9	0.4
am 4		Г	Г	T			1	T
2,770	90	376	4.7	301.1	*	301.1	302.0	0.9
7,320	125	485	3.6	330.5	*	330.5	331.1	0.6
8,420	119	198	5.9	338.3	*	338.3	338.3	0.0
10,744	160	150	5.9	362.4	*	362.4	362.4	0.0
am 13				T				T
1,590	95	219	2.4	288.1	*	288.1	289.1	1.0
1,875	180	497	1.1	289.0	*	289.0	289.9	0.9
2,290	115	128	4.1	289.5	*	289.5	290.3	0.8
am 4				ı				ı
1,290	60	315	4.9	287.7	*	287.7	288.7	1.0
3,690	50	407	3.8	304.3	*	304.3	304.4	0.1
6,040	105	187	6.2	318.4	*	318.4	318.4	0.0
am 8								
110	570	424	3.1	358.4 <sup>1</sup>	*	358.4	357.7	-0.7
670	54	432	4.4	365.2	*	365.2	365.3	0.1
1,200	0	0	0.0	363.0	*	363.0	0.0	0.0
2,140	100	692	2.6	374.4	*	374.4	374.4	0.0
2,850	100	540	3.3	375.5	*	375.5	376.0	0.5
3,910	100	432	4.2	380.4	*	380.4	380.6	0.2
			4.0	388.9	*	388.9	200.4	0.5
5,720	120	395	4.3	300.9		300.9	389.4	0.5
5,720 7,573	230	2,220	0.7	409.8	*	409.8		0.3
					*		410.1	
	Above Mouth)  4,490  am 7  700  4,570  10,180  12,500  15,300  am 8  1,730  3,800  5,500  am 9  500  2,450  4,665  am 2  6,970  7,400  am 5  600  3,410  4,550  am 4  2,770  7,320  8,420  10,744  am 13  1,590  1,875  2,290  am 4  1,290  3,690  6,040  am 8  110  670  1,200  2,140	Above Mouth)  4,490	Above Mouth) (Square Feet)  4,490 85 537  am 7  700 145 413  4,570 285 1,020  10,180 320 812  12,500 195 1,251  15,300 385 394  am 8  1,730 85 297  3,800 135 467  5,500 135 219  am 9  500 210 242  2,450 90 455  4,665 70 155  am 2  3,970 95 258  7,400 100 545  am 5  600 415 6,441  3,410 140 561  4,550 150 235  am 4  2,770 90 376  7,320 125 485  8,420 119 198  10,744 160 150  am 13  1,590 95 219  1,875 180 497  2,290 115 128  am 4  1,290 60 315  am 8  110 570 424  1,200 0 0  2,140 100 692	Above Mouth)  (Square Feet)  (Feet Per Second)  4,490  85  537  1.6  1.700  145  413  6.0  4,570  285  1,020  2.4  10,180  320  812  2.4  12,500  195  1,251  1.5  13,300  385  394  4.9  15,300  385  394  4.9  1730  85  297  3.9  3.800  135  467  2.5  5,500  135  219  5.3  189  500  210  242  4.8  2,450  90  455  2.5  4,665  70  155  7.4  180  190  1415  1,6441  0.2  3,410  140  561  1,6  4,550  150  235  4,6  16  17,720  90  376  4,7  3,220  125  485  3,6  3,8420  119  198  5,9  10,744  160  150  5,9  115  128  4,1  1290  60  315  4,9  3,690  50  407  3,8  3,690  50  407  3,8  407  407  407  407  407  407  407  40	Above Mouth)    Square Feet    Second	Above Mouth)  (Square Feet) (Feet Per Second)  (A4.90  A5 537  A5 305.1  A5 305.1  A4.490  A5 537  A5 305.1  A5 305.	Above Mouth)  (Square Feet)  (Square Feet)  (See Per Second)  (Square Feet)  (Squ	Above Mouth)  (Square Feet) (Seeper Second) (Second) (Square Feet) (Second)

Name of Stream	Description	Curr. Class	Date	Basin	Stream Index #	SITE 32
Tom Jack Creek	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-10	
Jim Branch	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-4	
Cary Branch	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-5	
Norris Branch	From source to Cary Branch	С	09/01/74	Cape Fear	18-7-5-1	
Utley Creek	From source to Harris Lake, Buckhorn Cr.	c	04/01/59	Cape Fear	18-7-5.5	
White Oak Creek	From source to Harris Lake, Buckhorn Cr.	С	04/01/59	Cape Fear	18-7-6	
Big Branch	From source to White Oak Creek	c	09/01/74	Cape Fear	18-7-6-1	
Little Branch	From source to Big Branch	С	09/01/74	Cape Fear	18-7-6-1-1	
Little White Oak Creek	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-7	
Big Branch	From source to Harris Lake, Buckhorn Cr.	С	04/01/59	Cape Fear	18-7-8	
Thomas Creek	From source to Harris Lake, Buckhorn Cr.	c	09/01/74	Cape Fear	18-7-9	
NEUSE RIVER	From dam at Falls Lake to a point 0.5 mile upstream of Town of Wake Forest proposed water supply intake (Former water supply intake for Burlington Mills Wake Finishing Plant)	WS-IV;NSW	07/01/04	Neuse	27-(20.7)	
					4	
NEUSE RIVER	From Town of Wake Forest proposed water supply intake to mouth of Beddingfield Creek	C;NSW	08/03/92	Neuse	27-(22.5)	
NEUSE RIVER	From a point 0.5 mile upstream of Town of Wake Forest proposed water supply intake to Town of Wake Forest proposed water supply intake	WS-IV;NSW,CA	07/01/04	Neuse	27-(22)	
NEUSE RIVER	From mouth of Beddingfield Creek to a point 0.2 mile downstream of Johnston County SR 1700	WS-V;NSW	08/03/92	Neuse	27-(36)	
NEUSE RIVER (Falls Lake below normal pool elevation)	From I-85 bridge to dam at Falls Lake	WS-IV,B;NSW,CA	08/03/92	Neuse	27-(5.5)	

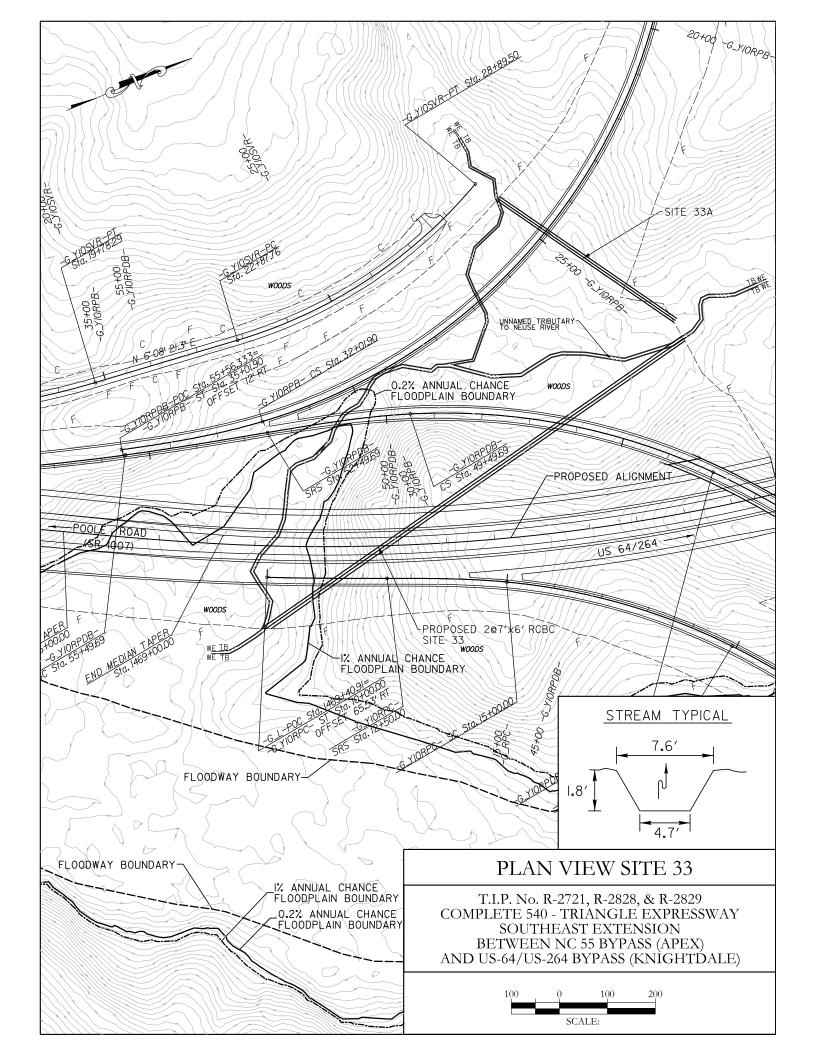
	SITE 32	
	10,6	
WOODS n=0.12		VDOPS N=0.1Z
	))/	B-TB= 8.2
	16	D= 1.8
		H <sub>20</sub> D= 0.25 OHW = 0.6
n=0.04		
	7220	
	T = NONE OBSERVED	
	NTIAL = MODERATE AL = SAND / SMAL	

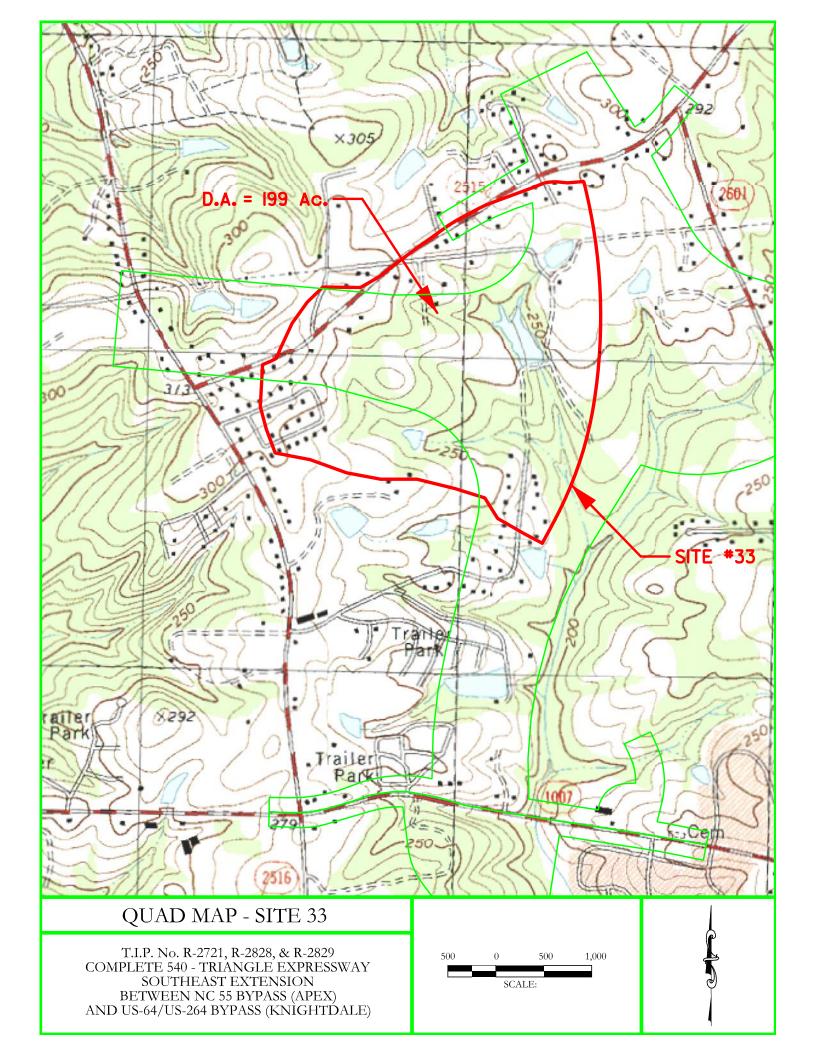


Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing





### **North Carolina**

REGION: BLUE RIDGE Rep. 01-4207 METHOD USED: STREAM NAME: Unnmaed Trib to the Neuse River sq. miles 0.31 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = 5/5/2014 ENGLISH

RURAL EQUATIONS Report 01-4207	ain Sand Hills	(cfs)	14.55	24.42	32.23	43.57	53.42	63.88	76.12	94.26
<b>ATIONS I</b>	Coastal Pl	(cfs)	29.42	61.32	91.48	140.31	186.28	241.19	306.28	411.17
RAL EQU	Blue Ridge	(cfs)	59.33	109.51	153.83	223.63	286.16	358.31	441.33	571.13
RU	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR
<u>(</u>										
ATIONS (OLD)										
<b>USGS RURAL REGRESSION EQUA</b>	Coastal Plain	(cfs)	33.11	75.36	116.91	194.14	268.38	364.85	485.62	691.10
<b>3AL REGRE</b>	Sand Hills	(cfs)	12.59	20.56	27.07	35.77	43.27	51.56	63.35	73.58
<b>USGS RUF</b>	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR

### **USGS URBAN REGRESSION EQUATIONS**

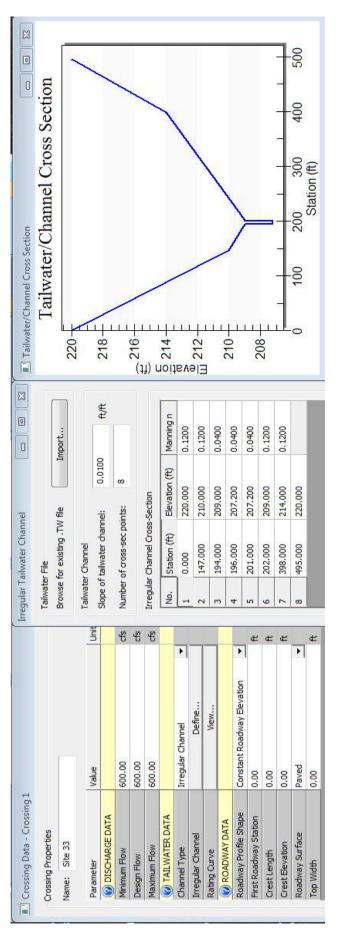
BDF= 11

(These Equations are used only for comparison)

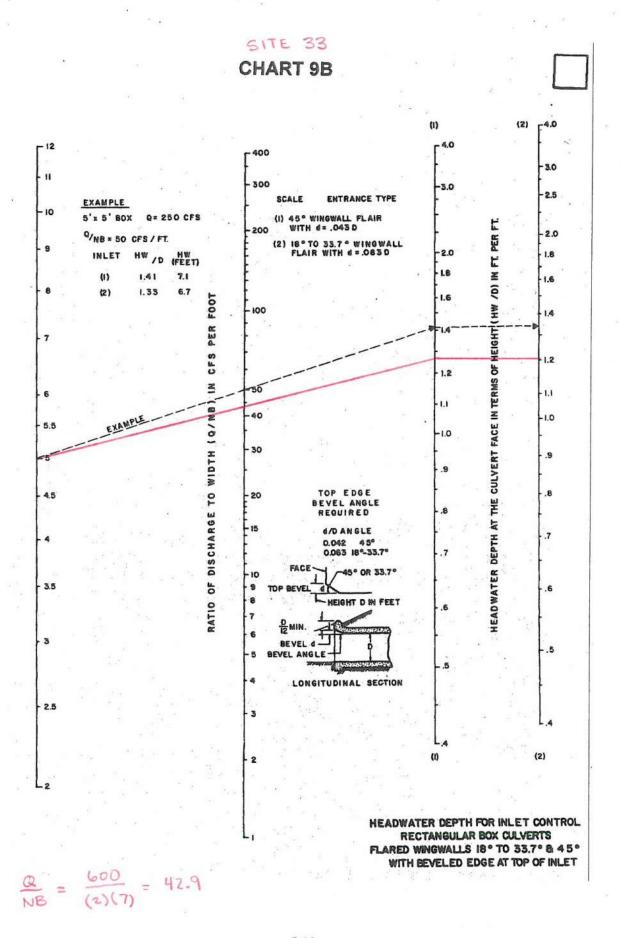
								(Based on 2.80xQ10)	
	_	(cfs)							881.68
ioi companson)	Coastal Plain	(cfs) (cfs)	193.03	264.26	389.37	501.10	652.84	739.93	1071.65
JIIS AIR USEU UIIIS	Sand Hills	(cfs)	20.08	83.20	100.62	114.26	131.20	232.95	170.75
( Hese Edualic	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

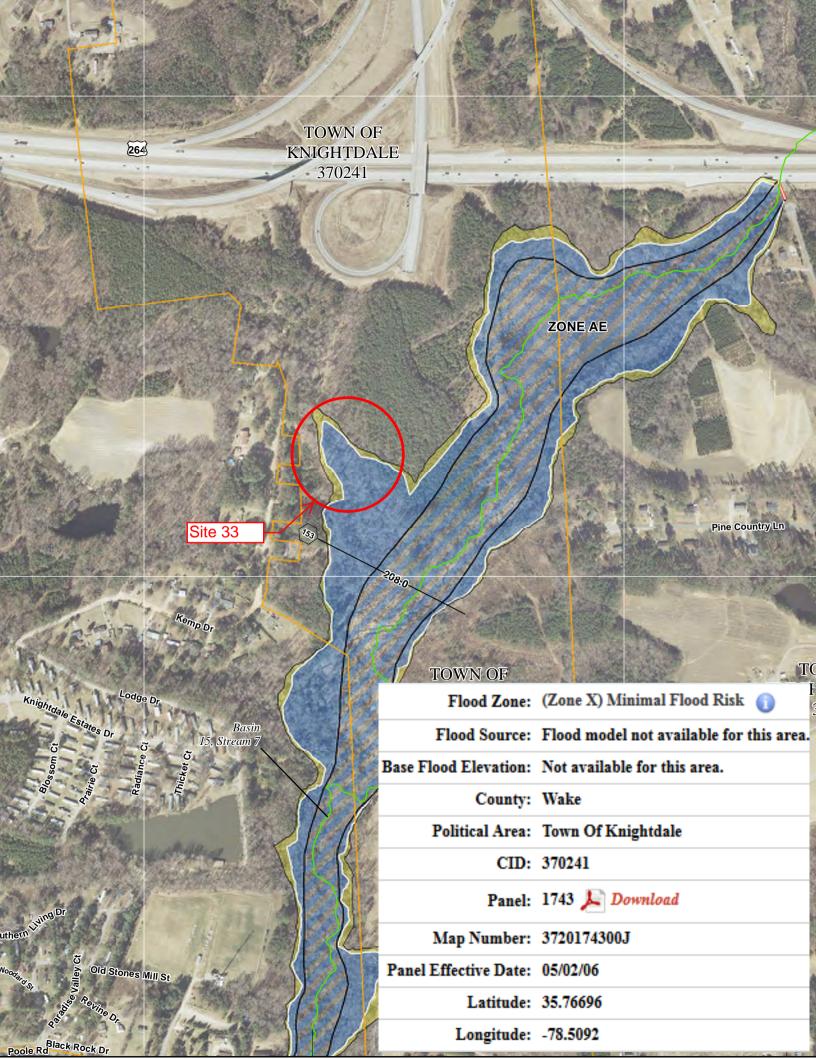
# NC REGRESSION EQUATIONS (% Impervious) USGS Fact Sheet 007-00

% Impervious =	35				FEMA	٩
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Blue Ridge Discharge Used	FREQUENCY	Disharges
	(cfs)	(cfs)	(cfs)			
5YR	166.97	242.01	271.58			
10YR	213.49	327.13	353.51		10YR	
25YR	283.70	505.17	525.26		50YR	
50YR	329.53	595.37	597.78	009	100YR	
100YR	370.50	683.06	666.85		500YR	
200YR	597.76	915.97	989.82	(Based on 2.80xQ10)		ı
500YR	781.36	1197.30	1293.83	(Based on 3.66xQ10)		



Flow (cfs)	Elevation (ft) Depth (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
000.009	211.453	4.253	2.339	2.654
900.009	211.453	4.253	2.339	2.654
900.009	211.453	4.253	2.339	2.654
900.009	211.453	4.253	2,339	2.654
900.009	211.453	4.253	2,339	2.654
000.009	211.453	4.253	2,339	2.654
900.009	211.453	4.253	2,339	2.654
000.009	211.453	4.253	2.339	2.654
000.009	211.453	4.253	2.339	2.654
000.009	211.453	4.253	2.339	2.654
900.009	211.453	4.253	2.339	2.654





### **FLOOD INSURANCE STUDY**

### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 9, "Flooding Sources Studied by Detailed Methods: Redelineated", lists all flooding sources that were studied by detailed methods for the prestatewide FIS and redelineated for previous FISs. These flooding sources were not part of this revision and their effective analyses remain valid.

Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	ooding Sources Studied	Sources Sources	Affected Communities
Source	From	To	Allected Communities
Adams Branch (Basin 30, Stream 9)	The confluence with Big Branch Tributary No. 1 (Basin 30, Stream 6)	Corwin Road	Town Of Garner
Angier Creek (Basin 24, Stream 4)	The confluence with Kenneth Creek (Basin 24, Stream 2)	Railroad	Town Of Fuquay-Varina
Armory Tributary (Basin 18, Stream 38)	The confluence with Richland Creek (Basin 18, Stream 3)	Approximately 0.5 mile upstream of confluence with Richland Creek (Basin 18, Stream 3)	City Of Raleigh
Austin Creek (Basin 6, Stream 10)	The confluence with Smith Creek (Basin 6, Stream 1)	Approximately 350 feet upstream of Averette Road	Rdu Town Of Wake Forest Wake County
Bagwell Branch (Basin 20, Stream 10)	The confluence with Swift Creek (Basin 20, Stream 1)	NC Route 50	Town Of Garner
Basal Creek (Basin 22, Stream 16)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.8 mile upstream of State Road 55	Rdu Town Of Fuquay-Varina Town Of Holly Springs Wake County
Basin 10, Stream 10	The confluence with Little River (Basin 10, Stream 1)	Highway 96/Zebulon Road	Rdu Wake County
Basin 10, Stream 2	The confluence with Little River (Basin 10, Stream 1)	Approximately 0.9 mile upstream of confluence with Little River (Basin 10, Stream 1)	Rdu Wake County
Basin 10, Stream 3	The confluence with Little River (Basin 10, Stream 1)	Moss Road	Rdu Wake County
Basin 10, Stream 5	The confluence with Little River (Basin 10, Stream 1)	Lizard Lick Rd	Rdu Wake County
Basin 10, Stream 6	The confluence with Little River (Basin 10, Stream 1)	Lizard Lick Rd	Rdu Wake County
Basin 10, Stream 9	The confluence with Little River (Basin 10, Stream 1)	Zebulon Road	Rdu Wake County
Basin 12, Stream 3	The confluence with Beaverdam Creek (Basin 12, Stream 1)	Old Crews Road	Town Of Knightdale
Basin 15, Stream 22	The confluence with Neuse River (Basin 15, Stream 1)	Forestville Road	City Of Raleigh
Basin 15, Stream 25	The confluence with Neuse River (Basin 15, Stream 1)	The intersection between Forestville Rd and Mitchell Mill Road	City Of Raleigh
Basin 15, Stream 28	The confluence with Perry Creek (Basin 15, stream 26)	Approximately 0.7 mile upstream of Berkshire Downs Drive	City Of Raleigh
Basin 15, Stream 32	The confluence with Falls Lake	Just upstream of Raven Ridge Road	Rdu Wake County
Basin 15, Stream 33	The confluence with Honeycutt Creek (Basin 15, Stream 31)	Approximately 0.3 mile upstream of Honeycutt Road	Rdu Wake County
Basin 15, Stream 7	The confluence with Neuse River (Basin 15, Stream 1)	Clifton Road	Rdu Town Of Knightdale Wake County
Basin 15, Stream 8	The confluence with Basin 15, Stream 7	Grasshopper Road	Rdu Wake County
basin 15, Stream 9	The confluence with Neuse River (Basin 15, Stream 1)	Battle Ridge Road	Rdu Wake County
Basin 16, Stream 2	The confluence with Upper Barton Creek (Basin 16, Stream 1)	State Route 50	Rdu Wake County
Basin 16, Stream 5	The confluence with Upper Barton Creek (Basin 16, Stream 1)	Approximately 0.2 mile upstream of State Route 50	Rdu Wake County
Basin 17, Stream 4	The confluence with Lower Barton Creek (Basin 17, Stream 1)	Old Creedmoor Road	Rdu Wake County
Basin 18, Stream 13	The confluence with Stirrup Iron Creek (Basin 18, Stream 12)	Sorrell Grove Church Road	Town Of Morrisville
Basin 18, Stream 4	The confluence with Turkey Creek (Basin 18, Stream 5)	Approximately 0.3 mile upstream of Lynn Road	City Of Raleigh
Basin 18, Stream 8	The confluence with Sycamore Creek (Basin 18, Stream 6)	Approximately 0.6 mile upstream of West Gate Road	City Of Raleigh
Basin 19, Stream 3	The confluence with White Oak Creek (Basin 19, Stream 1)	Railroad	Rdu Town Of Garner Wake County
Basin 20, Stream 20	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 0.8 mile upstream of confluence with Swift Creek (Basin 20, Stream 1)	Rdu Wake County
Basin 20, Stream 7	The confluence with Mahlers Creek (Basin 20, Stream 6)	Bryan Road	Town Of Garner
Basin 20, Stream 8	The confluence with Basin 20, Stream 7	Bryan Road	Town Of Garner
Basin 22, Stream 20	The confluence with Terrible Creek (Basin 22, Stream 19)	Approximately 1.0 mile upstream of confluence with Terrible Creek (Basin 22, Stream 19)	Town Of Fuquay-Varina

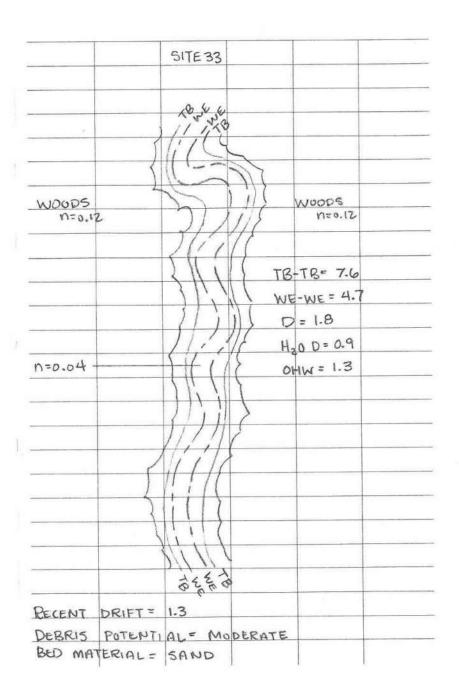
**Table 13 - Summary of Discharges** 

Table 13 - Summ	, 01 013	J. I. G.	Dischar	rges (cfs)	
Location	Drainage Area	10% Annual	2% Annual	1% Annual	0.2% Annual
Approximately 0.4 mile upstream of confluence with Marks Creek (Basin 14, Stream	(square miles) 2.45	* Chance	* Chance	1,310	* Chance
1)					1.
Approximately 0.4 mile downstream of Lake Myra Road	1.47	*	*	947	*
Basin 14, Stream 3		Ι			I
At confluence with Marks Creek (Basin 14, Stream 1)	0.39	*	*	410	*
Basin 15, Stream 22					<u> </u>
At mouth	1.60	*	*	1,410	*
At Forestville Road	0.80	*	*	950	*
Basin 15, Stream 25					1
At mouth	1.40	*	*	1,300	*
Approximately 700 feet upstream of Wake Crossroads	0.40	*	*	680	*
Basin 15, Stream 28		_			
At mouth	4.00	*	*	2,300	*
At U.S. Route 1	3.10	*	*	2,000	*
Basin 15, Stream 32					
At mouth	2.10	*	*	1,600	*
At Raven Ridge Road	1.60	*	*	1,410	*
Basin 15, Stream 33					•
At mouth	0.90	*	*	1,000	*
Approximately 1,500 feet upstream of Honeycutt Road	0.70	*	*	975	*
Just downstream of Honeycutt Road	0.70	*	*	830	*
Basin 15, Stream 7					
At mouth	4.70	*	*	2,490	*
Just downstream of Basin 15, Stream 8	3.20	*	*	2,080	*
pproximately 500 feet downstream of Clifton Road	0.90	*	*	890	*
Basin 15, Stream 8	12.22	l		1222	
At mouth	1.10	*	*	1,160	*
	11.10			1,100	
Basin 15, Stream 9	1.20	*	*	1.450	T <sub>*</sub>
At mouth	1.20			1,150	
Basin 16, Stream 2			1.	1	1.
At mouth	2.10	*	*	1,600	*
Approximately 0.4 mile upstream of mouth just upstream of tributary	1.60	*	*	1,350	*
Just downstream of tributary just downstream of State Route 50	0.70	*	*	890	*
Just upstream of tributary just downstream of State Road 50	0.40	*	*	650	*
Basin 16, Stream 5					
At mouth <sup>1</sup>	1.60	*	*	1,050	*
Just downstream of State Route 50 <sup>1</sup>	1.40	*	*	920	*
Just upstream of State Route 50	1.40	*	*	1,180	*
Just downstream of tributary just upstream of State Route 50	1.20	*	*	1,100	*
Just upstream of tributary just upstream of State Route 50	0.30	*	*	590	*
Basin 17, Stream 4					
At mouth	2.40	*	*	1,750	*
At Baileywick Road	1.40	*	*	1,170	*
Just upstream of Baileywick Road	0.70	*	*	880	*

Table 21 - Floodway Data

				oodway D				
Source /Foot	Width (Fast)	Floodway	Moon Valasit	Pogulator:		ter Surface Eleva		Increase
Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
4,490	85	537	1.6	305.1	*	305.1	305.2	0.1
am 7				T				T
700	145	413	6.0	168.9 <sup>1</sup>	*	154.6	154.6	0.0
4,570	285	1,020	2.4	168.9 <sup>1</sup>	*	165.7	165.7	0.0
10,180	320	812	2.4	182.2	*	182.2	182.2	0.0
12,500	195	1,251	1.5	198.5	*	198.5	199.0	0.5
15,300	385	394	4.9	208.0	*	208.0	208.0	0.0
am 8								
1,730	85	297	3.9	186.6	*	186.6	187.6	1.0
3,800	135	467	2.5	193.8	*	193.8	194.8	1.0
5,500	135	219	5.3	207.6	*	207.6	207.6	0.0
am 9								
500	210	242	4.8	171.1	*	171.1	172.1	1.0
2,450	90	455	2.5	180.3	*	180.3	181.3	1.0
4,665	70	155	7.4	195.3	*	195.3	195.3	0.0
am 2				1				
6,970	95	258	5.2	287.4	*	287.4	288.1	0.7
7,400	100	545	0.5	292.0	*	292.0	292.8	0.8
am 5		Г	Г	T			1	T
600	415	6,441	0.2	282.5	*	282.5	283.1	0.6
3,410	140	561	1.6	290.8	*	290.8	291.1	0.3
4,550	150	235	4.6	296.5	*	296.5	296.9	0.4
am 4		Г	Г	T			1	T
2,770	90	376	4.7	301.1	*	301.1	302.0	0.9
7,320	125	485	3.6	330.5	*	330.5	331.1	0.6
8,420	119	198	5.9	338.3	*	338.3	338.3	0.0
10,744	160	150	5.9	362.4	*	362.4	362.4	0.0
am 13				T				T
1,590	95	219	2.4	288.1	*	288.1	289.1	1.0
1,875	180	497	1.1	289.0	*	289.0	289.9	0.9
2,290	115	128	4.1	289.5	*	289.5	290.3	0.8
am 4				ı				ı
1,290	60	315	4.9	287.7	*	287.7	288.7	1.0
3,690	50	407	3.8	304.3	*	304.3	304.4	0.1
6,040	105	187	6.2	318.4	*	318.4	318.4	0.0
am 8								
110	570	424	3.1	358.4 <sup>1</sup>	*	358.4	357.7	-0.7
670	54	432	4.4	365.2	*	365.2	365.3	0.1
1,200	0	0	0.0	363.0	*	363.0	0.0	0.0
2,140	100	692	2.6	374.4	*	374.4	374.4	0.0
2,850	100	540	3.3	375.5	*	375.5	376.0	0.5
3,910	100	432	4.2	380.4	*	380.4	380.6	0.2
			4.0	388.9	*	388.9	200.4	0.5
5,720	120	395	4.3	300.9		300.9	389.4	0.5
5,720 7,573	230	2,220	0.7	409.8	*	409.8		0.3
					*		410.1	
	Above Mouth)  4,490  am 7  700  4,570  10,180  12,500  15,300  am 8  1,730  3,800  5,500  am 9  500  2,450  4,665  am 2  6,970  7,400  am 5  600  3,410  4,550  am 4  2,770  7,320  8,420  10,744  am 13  1,590  1,875  2,290  am 4  1,290  3,690  6,040  am 8  110  670  1,200  2,140	Above Mouth)  4,490	Above Mouth) (Square Feet)  4,490 85 537  am 7  700 145 413  4,570 285 1,020  10,180 320 812  12,500 195 1,251  15,300 385 394  am 8  1,730 85 297  3,800 135 467  5,500 135 219  am 9  500 210 242  2,450 90 455  4,665 70 155  am 2  3,970 95 258  7,400 100 545  am 5  600 415 6,441  3,410 140 561  4,550 150 235  am 4  2,770 90 376  7,320 125 485  8,420 119 198  10,744 160 150  am 13  1,590 95 219  1,875 180 497  2,290 115 128  am 4  1,290 60 315  am 8  110 570 424  1,200 0 0  2,140 100 692	Above Mouth)  (Square Feet)  (Feet Per Second)  4,490  85  537  1.6  1.700  145  413  6.0  4,570  285  1,020  2.4  10,180  320  812  2.4  12,500  195  1,251  1.5  13,300  385  394  4.9  15,300  385  394  4.9  1730  85  297  3.9  3.800  135  467  2.5  5,500  135  219  5.3  189  500  210  242  4.8  2,450  90  455  2.5  4,665  70  155  7.4  180  190  1415  1,6441  0.2  3,410  140  561  1,6  4,550  150  235  4,6  16  17,720  90  376  4,7  3,220  125  485  3,6  3,8420  119  198  5,9  10,744  160  150  5,9  115  128  4,1  1290  60  315  4,9  3,690  50  407  3,8  3,690  50  407  3,8  407  407  407  407  407  407  407  40	Above Mouth)    Square Feet    Second	Above Mouth)  (Square Feet) (Feet Per Second)  (A4.90  A5 537  A5 305.1  A5 305.1  A4.490  A5 537  A5 305.1  A5 305.	Above Mouth)  (Square Feet)  (Square Feet)  (See Per Second)  (Square Feet)  (Squ	Above Mouth)  (Square Feet) (Seeper Second) (Second) (Square Feet) (Second)

Name of Stream	Description	Curr. Class	Date	Basin	Stream Index #	SITE 33
Tom Jack Creek	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-10	
Jim Branch	From source to Harris Lake, Buckhorn Cr.	C	09/01/74	Cape Fear	18-7-4	
Cary Branch	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-5	
Norris Branch	From source to Cary Branch	С	09/01/74	Cape Fear	18-7-5-1	
Utley Creek	From source to Harris Lake, Buckhorn Cr.	С	04/01/59	Cape Fear	18-7-5.5	
White Oak Creek	From source to Harris Lake, Buckhorn Cr.	С	04/01/59	Cape Fear	18-7-6	
Big Branch	From source to White Oak Creek	С	09/01/74	Cape Fear	18-7-6-1	
Little Branch	From source to Big Branch	С	09/01/74	Cape Fear	18-7-6-1-1	
Little White Oak Creek	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-7	
Big Branch	From source to Harris Lake, Buckhorn Cr.	с	04/01/59	Cape Fear	18-7-8	
Thomas Creek	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-9	
NEUSE RIVER	From dam at Falls Lake to a point 0.5 mile upstream of Town of Wake Forest proposed water supply intake (Former water supply intake for Burlington Mills Wake Finishing Plant)	WS-IV;NSW	07/01/04	Neuse	27-(20.7)	
NEUSE RIVER	From Town of Wake Forest proposed water supply intake to mouth of Beddingfield Creek	C;NSW	08/03/92	Neuse	27-(22.5)	
NEUSE RIVER	From a point 0.5 mile upstream of Town of Wake Forest proposed water supply intake to Town of Wake Forest proposed water supply intake	WS-IV;NSW,CA	07/01/04	Neuse	27-(22)	
NEUSE RIVER	From mouth of Beddingfield Creek to a point 0.2 mile downstream of Johnston County SR 1700	WS-V;NSW	08/03/92	Neuse	27-(36)	
NEUSE RIVER (Falls Lake below normal pool elevation)	From I-85 bridge to dam at Falls Lake	WS-IV,B;NSW,CA	08/03/92	Neuse	27-(5.5)	



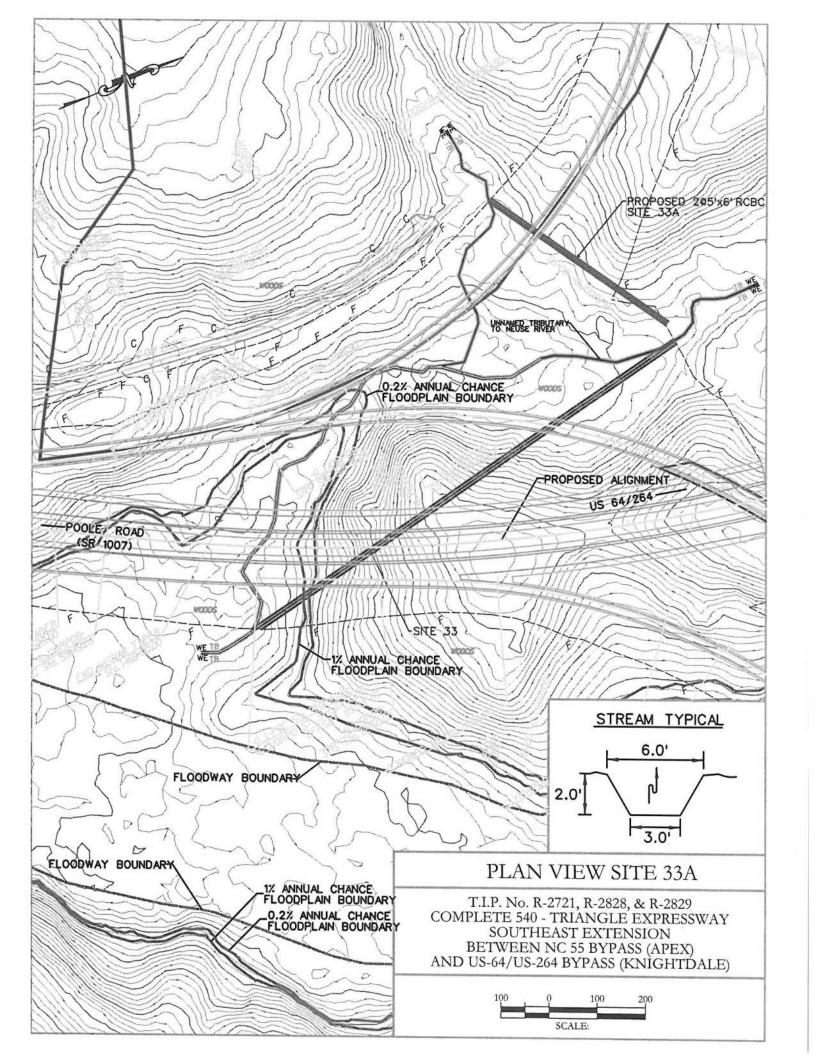


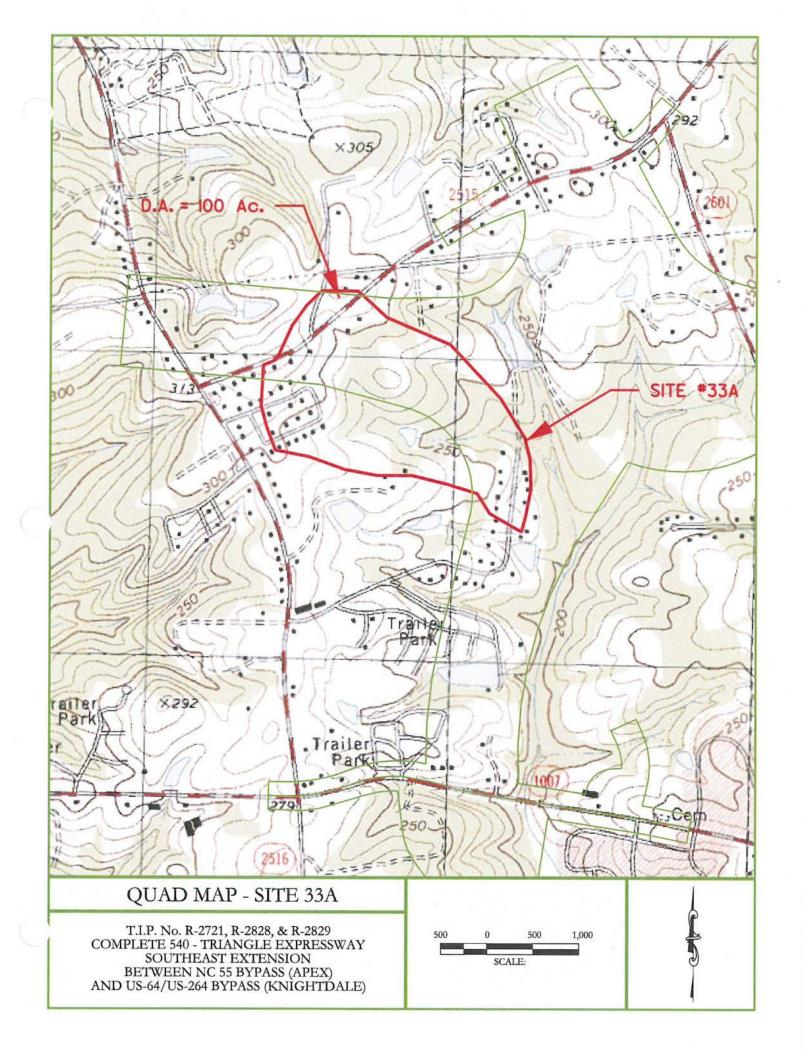
Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing

### Site 33A





REGION: BLUE RIDGE

	nmaed Trib to the Neuse River	
	xt. STREAM NAME: Unr	
14	PROJECT NAME: Triangle Expressway SE Ex	
2014	PROJECT A	

<b>USGS RUR</b>	<b>JSGS RURAL REGRESSION E</b>	SSION EQUAT	ATIONS (OLD)	RUF	RURAL EQUATIC	TIONS Rep	ort 01-4207
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain Sand Hills	Sand Hills
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)
2YR	7.75	21.80	40.59	2YR	37.29	18.85	9.09
5YR	12.62	51.28	72.65	SYR	86.69	40.29	15.36
10YR	16.59	80.78	98.74	10YR	99.28	60.91	20.32
25YR	21.77	136.55	140.61	25YR	145.97	94.79	27.55
50YR	26.22	191.04	176.54	50YR	188.02	127.01	33.82
100YR	31.13	262.64	221.30	100YR	236.99	165.87	40.53
200YR	38.22	352.82	269.74	200YR	293.65	212.31	48.36
500YR	43.98	508.46	360.78	500YR	382.78	287.87	59.96

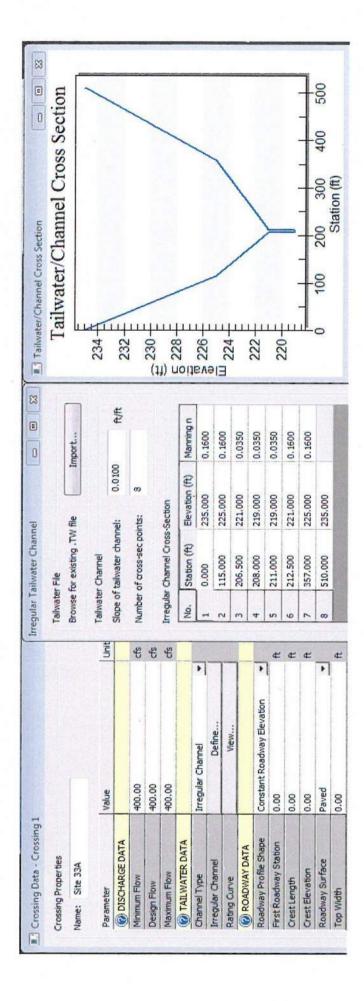
## **USGS URBAN REGRESSION EQUATIONS**

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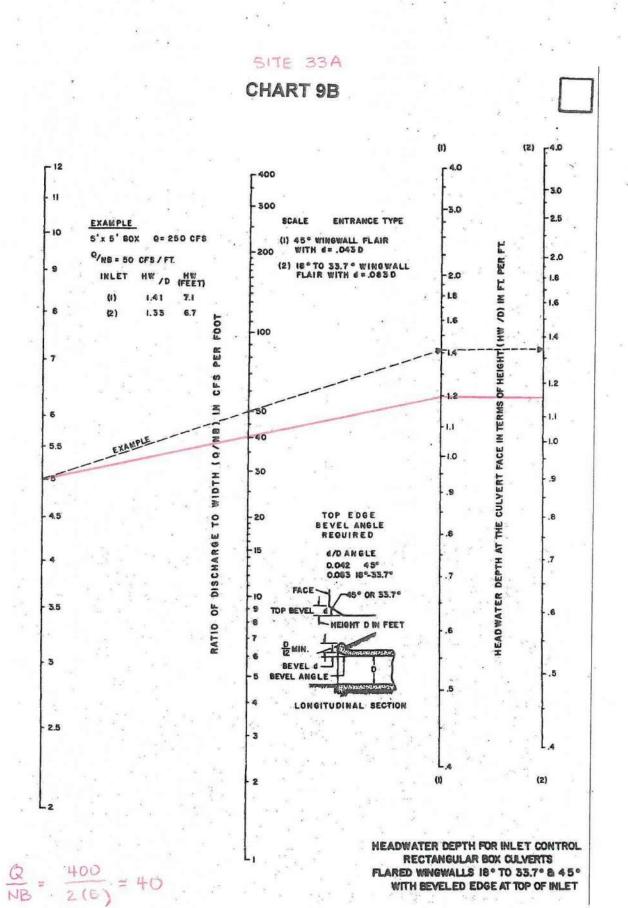
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FREQUENCY	Sand Hills	Coastal Plain	_,	
	(cts)	(cfs) (cfs)		
5YR	42.80	127.76		
10YR	50.84	177.51		
25YR	61.24	266.09		
50YR	68.98	344.55		
100YR	78.55	451.50		
200YR	142.36	497.03	582.47	(Based on 2.80xQ10)
500YR	100.73	749.55	565.73	

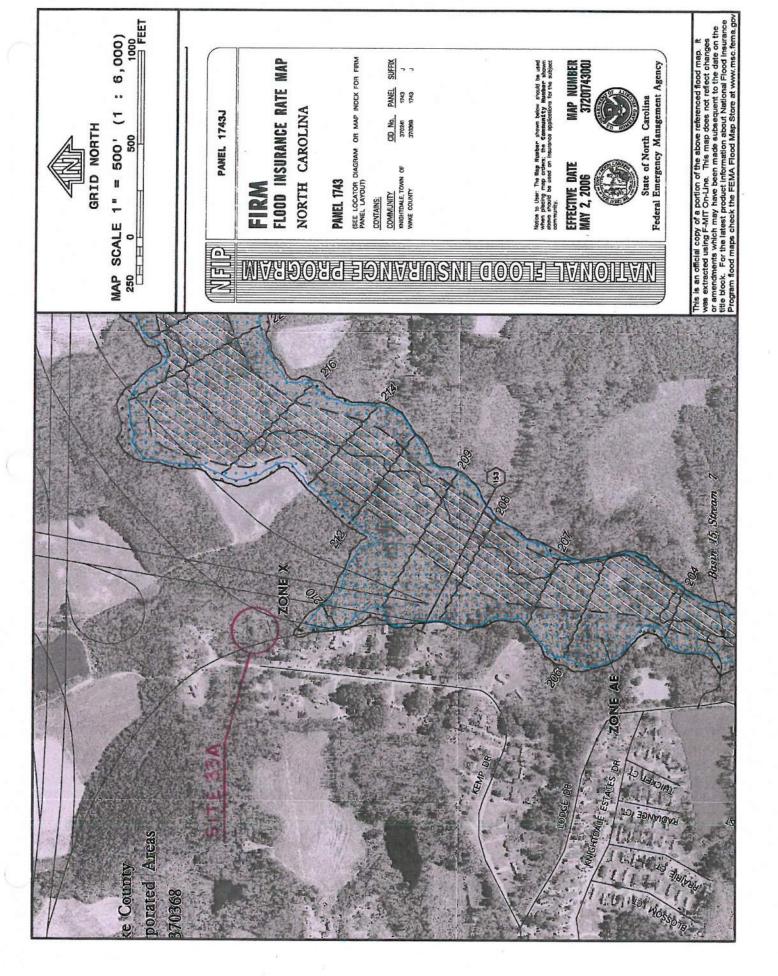
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FEMA	FREQUENCY Disharges			10YR	50YR	100YR	500YR		
	Discharge Used					400		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	Blue Ridge	(cts)	173.10	229.22	350.64	401.44	450.50	641.82	838.95
	Coastal Plain	(cfs)	156.92	216.37	346.50	411.63	475.70	605.84	791.91
35	Sand Hills	(cfs)	105.09	136.43	185.30	216.23	244.25	382.00	499.33
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR



Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
400.000	223.464	4,464	1.971	2.786
400.000	223,464	4,464	1.971	2.786
400.000	223.464	4.464	1.971	2.786
400.000	223.464	4.464	1.971	2.786
400.000	223.464	4.464	1.971	2.786
400.000	223.464	4.464	1.971	2.786
400.000	223,464	4.464	1.971	2.786
400.000	223.464	4.464	1.971	2.786
400.000	223.464	4.464	1.971	2.786
400.000	223.464	4.464	1.971	2.786
400.000	223.464	4.464	1.971	2.786





Name of Stream	Description	Curr. Class	Date	Basin	Stream Index #	SITE 35
Tom Jack Creek	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-10	
Jim Branch	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-4	
Cary Branch	From source to Harris Lake, Buckhorn Cr.	С	09/01/74	Cape Fear	18-7-5	
Norris Branch	From source to Cary Branch	c	09/01/74	Cape Fear	18-7-5-1	
Jtley Creek	From source to Harris Lake, Buckhorn Cr.	С	04/01/59	Cape Fear	18-7-5.5	
White Oak Creek	From source to Harris Lake, Buckhorn Cr.	c	04/01/59	Cape Fear	18-7-6	
sig Branch	From source to White Oak Creek	c	09/01/74	Cape Fear	18-7-6-1	
Little Branch	From source to Big Branch	c	09/01/74	Cape Fear	18-7-6-1-1	
ittle White Oak	From source to Harris Lake, Buckhorn Cr.	c	09/01/74	Cape Fear	18-7-7	
ig Branch	From source to Harris Lake, Buckhorn Cr.	<b>c</b> ,	04/01/59	Cape Fear	18-7-8	
homas Creek	From source to Harris Lake, Buckhorn Cr.	c	09/01/74	Cape Fear	18-7-9	
EUSE RIVER	From dam at Falls Lake to a point 0.5 mile upstream of Town of Wake Forest proposed water supply intake (Former water supply intake for Burlington Mills Wake Finishing Plant)	WS-IV;NSW	07/01/04	Neuse	27- (20.7)	
The state of the s				-		
EUSE RIVER	From Town of Wake Forest proposed water supply intake to mouth of Beddingfield Creek	C;NSW	08/03/92	Neuse	27- (22.5)	
EUSE RIVER	From a point 0.5 mile upstream of Town of Wake Forest proposed water supply intake to Town of Wake Forest proposed water supply intake	WS-IV;NSW,CA	07/01/04	Neuse	27- (22)	
EUSE RIVER	From mouth of Beddingfield Creek to a point 0.2 mile downstream of Johnston County SR 1700	WS-V;NSW	08/03/92	Neuse	27-(36)	
EUSE RIVER Falls Lake elow normal pol elevation)	From I-85 bridge to dam at Falls Lake	WS-IV, B; NSW, CA	08/03/92	Neuse	27-(5.5)	

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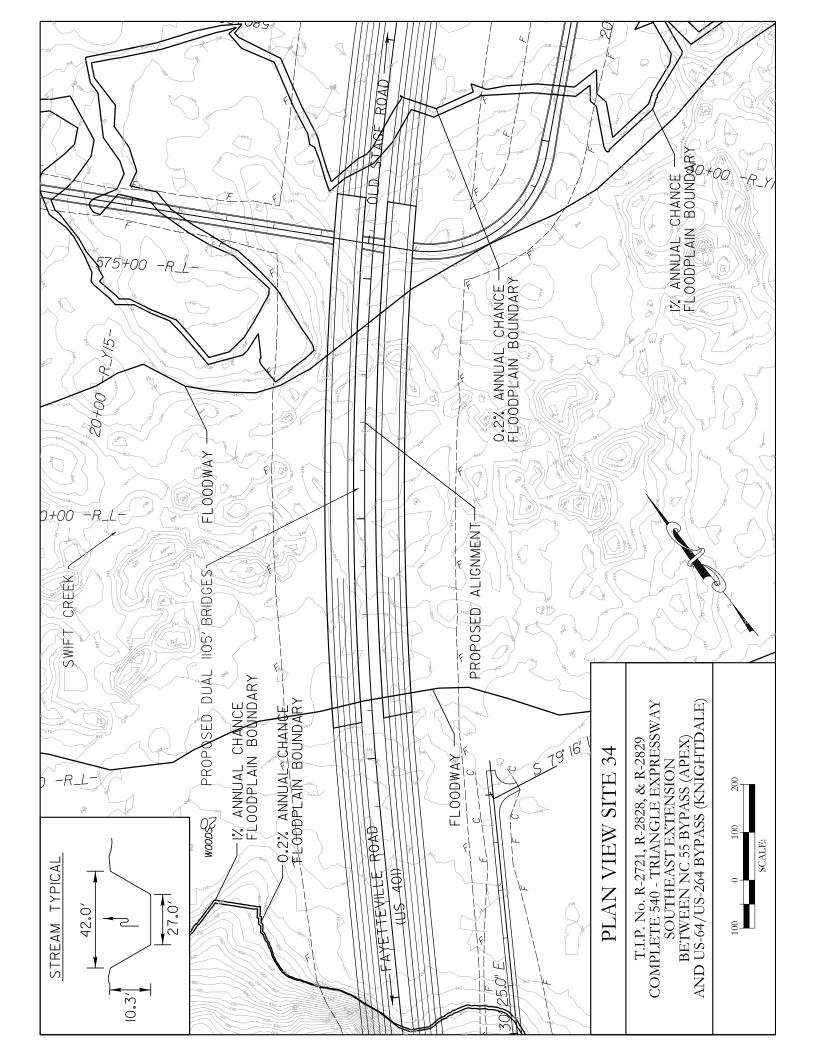


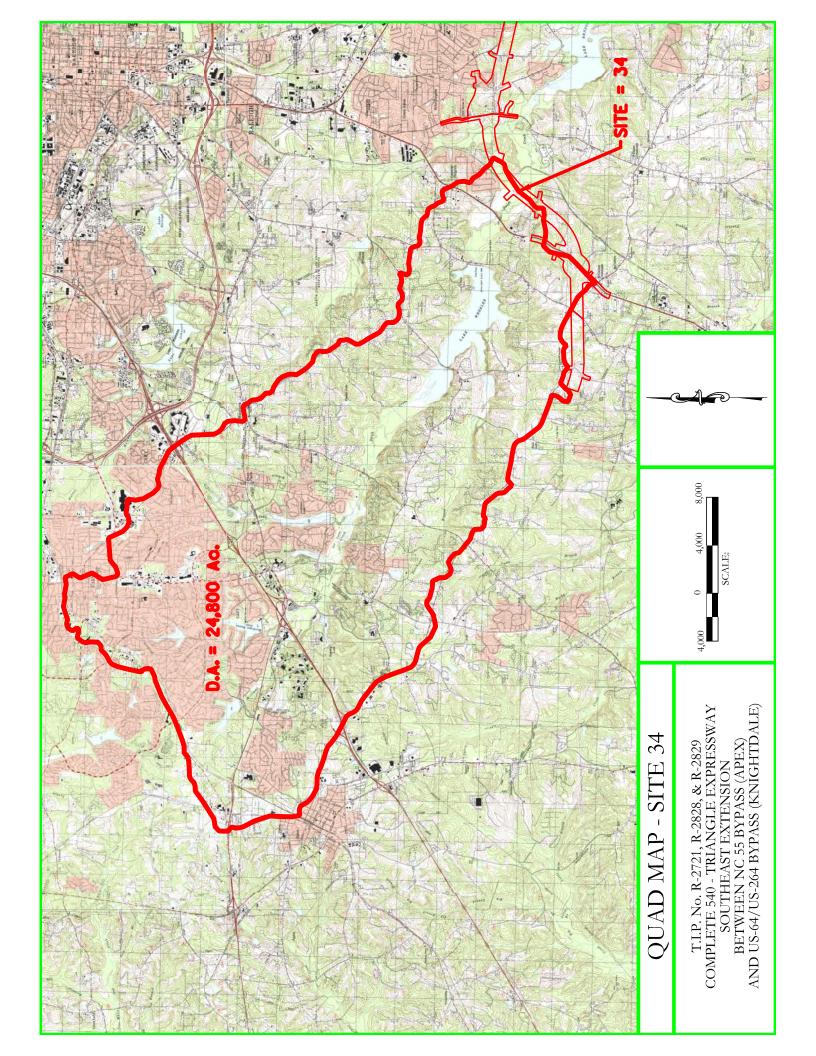
Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing

### Site 34





4/22/2014

REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00 STREAM NAME: Swift Creek sq. miles 38.75 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = ENGLISH

<b>USGS RURAL REGRESSION EQUATION</b>	AL REGRE	SSION EQUA	ATIONS (OLD)	RUF	<b>3AL EQUA</b>	TIONS Rep	RURAL EQUATIONS Report 01-4207
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)
2YR	433.47	700.08	1802.43	2YR	1759.14	758.25	452.79
5YR	725.38	1251.87	2874.71	5YR	2877.90	1315.66	720.56
10YR	964.29	1737.91	3801.43	10YR	3759.95	1782.15	932.72
25YR	1343.69	2533.20	5124.30	25YR	5035.50	2457.83	1236.92
50YR	1673.06	3210.46	6259.69	50YR	6139.73	3049.83	1502.02
100YR	2052.21	4020.54	7550.71	100YR	7325.31	3708.58	1770.38
200YR	2533.79	5001.51	9003.78	200YR	8638.96	4444.27	2089.31
500YR	3148.67	6493.89	11029.90	500YR	10601.38	5549.55	2562.11

### **USGS URBAN REGRESSION EQUATIONS**

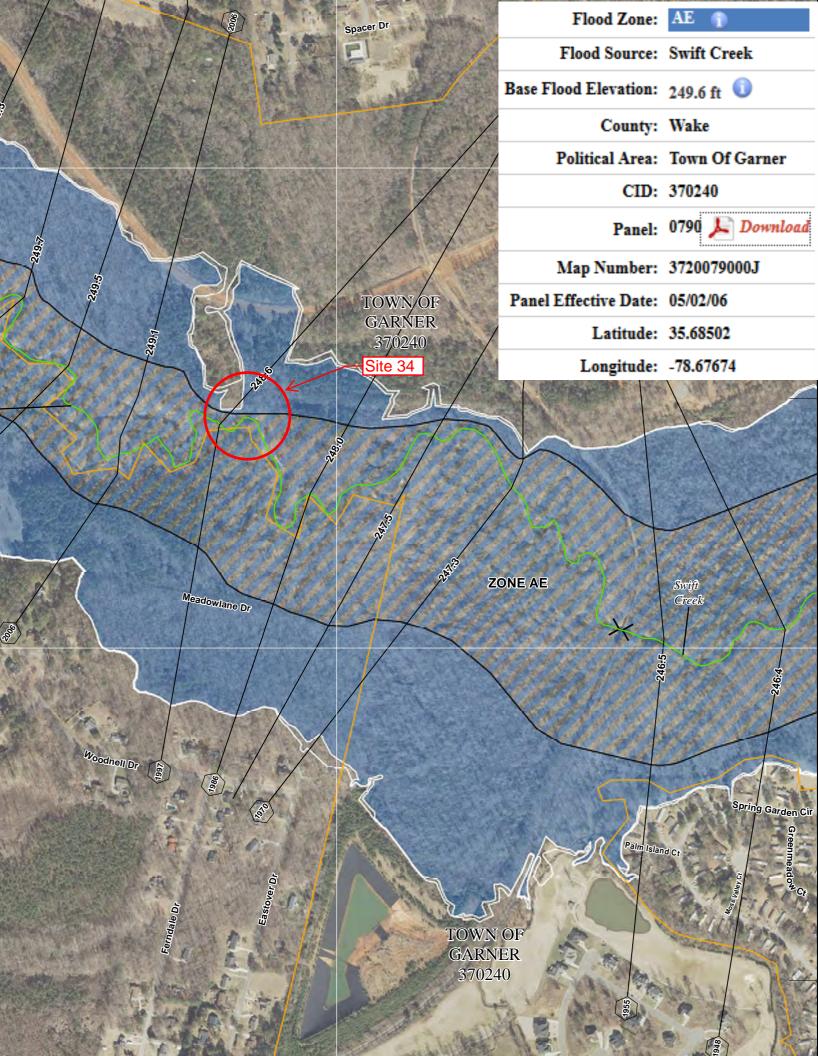
BDF= 11

(These Equations are used only for comparison)

							(Based on 2.80xQ10)	
Blue Ridge	(cfs)	7509.54	8955.53	11018.39	13254.85	16156.66	25075.49	22492.82
Coastal Plain	(cfs)	3926.52	4825.63	6271.13	7717.69	9636.40	13511.76	14567.64
FREQUENCY Sand Hills Coastal Plair	(cfs)	2565.37	3030.10	3776.15	4552.09	5551.67	8484.27	8046.35
FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

) USGS Fact Sheet 007-00
% Impervious)
<b>EQUATIONS</b> (
IC REGRESSION EQUATIONS (% Impervious)

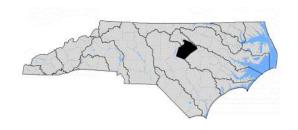
	50 Sand Hills	Coastal Plain	Blue Ridge	Blue Ridge Discharge Used	FREQUENCY	FEMA CY Disharges
(cfs)		(cfs)	(cfs)			
6012.88		7013.15	8922.79			
6741.42		8036.48	10038.00		10YR	
7426.91		9251.50	11725.19		50YR	3600
8221.86		10143.92	12595.73	13000	100YR	4560
8816.62		10887.36	13272.35		500YR	
18875.97		22502.14	28106.41	Based on 2.80xQ10)		
24673.59		29413.52	36739.09	Based on 3.66xQ10)		



## PRELIMINARY FLOOD INSURANCE STUDY

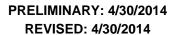
## FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

State of North Carolina

Flood Insurance Study Number

37183CV000





Table 9, "Flooding Sources Studied by Detailed Methods: Redelineated", lists all flooding sources that were studied by detailed methods for the prestatewide FIS and redelineated for previous FISs. These flooding sources were not part of this revision and their effective analyses remain valid.

Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	Riverine	Sources	Affected Communities
	From	То	
Basin 10, Stream 2	The confluence with Little River (Basin 10, Stream 1)	Approximately 0.9 mile upstream of confluence with Little River (Basin 10, Stream 1)	Rdu Wake County
Basin 10, Stream 3	The confluence with Little River (Basin 10, Stream 1)	Moss Road	Rdu Wake County
Buffalo Branch (Basin 10, Stream 22)	The confluence with Little River (Basin 10, Stream 1)	Morphus Bridge Road	Rdu Town Of Wendell Wake County
Buffalo Creek (Basin 9, Stream 1)	The Wake/Johnston County boundary	Robertsons Pond Dam	Rdu Town Of Wendell Wake County
Kit Creek	The Chatham/Wake County Boundary	Approximately 475 feet upstream of Railroad	Rdu Town Of Cary Wake County
Little Creek (Basin 11, Stream 2)	The Wake/Johnston County boundary	Cemetery Road	Rdu Town Of Zebulon Wake County
Middle Creek	The confluence with Swift Creek	Approximately 0.7 mile upstream of confluence of Middle Creek Tributary	Rdu Town Of Apex Town Of Cary Town Of Fuquay-Varina Town Of Holly Springs Wake County
Panther Branch (Basin 22, Stream 2)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.5 mile upstream of Banks Road	Rdu Wake County
Panther Creek	The Chatham/Wake County Boundary	Approximately 1.0 mile upstream of Green Level to Durham Road	Town Of Cary
Poplar Creek (Basin 13, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 900 Feet upstream of Fayetteville Street	Rdu Town Of Knightdale Wake County
Swift Creek	The confluence with the Neuse River	The confluence of Yates Branch (Basin 20, Stream 13)	Rdu Town Of Garner Wake County
White Oak Creek	The confluence with Swift Creek	Approximately 0.4 mile upstream of Pergo Parkway	Rdu Town Of Clayton Town Of Garner Wake County

Table 10, "Flooding Sources Studied by Detailed Methods: Limited Detailed", lists all flooding sources within the county that were studied by limited detailed methods for either this FIS or previous FISs.

Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed

Source	Riverine	Sources	Affected Communties
	From	То	
Bachelor Branch (Basin 28, Stream 6)	The confluence with White Oak Creek	Approximately 530 feet upstream of Highway 55	Rdu Town Of Cary Wake County
Basin 11, Stream 7	The Wake/Johnston County boundary	Approximately 0.4 mile upstream of Wake/Johnston County boundary	Rdu Wake County
Basin 14, Stream 2	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.4 mile upstream of Lake Myra Road	Rdu Wake County
Basin 14, Stream 3	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.7 mile upstream of confluence with Marks Creek (Basin 14, Stream 1)	Rdu Town Of Knightdale Town Of Wendell Wake County
Basin 20, Stream 5	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 1.7 miles upstream of confluence with Swift Creek (Basin 20, Stream 1)	Rdu Wake County
Basin 28, Stream 7	The confluence with Basin 28, Stream 8	Approximately 0.4 mile upstream of confluence with Basin 28, Stream 8	Town Of Cary
Beddingfield Creek	Approximately 0.4 mile upstream of the confluence with Neuse River	Approximately 0.2 mile upstream of Shotwell Road	Rdu Town Of Clayton Wake County
Big Branch	The confluence with Harris Reservoir	Approximately 0.9 mile upstream of Highway 1	Rdu Town Of Apex Wake County
Black Creek	Approximately 260 feet upstream of State HWY 210	Approximately 1.0 mile upstream of dam along Black Creek (Basin 23, Stream 1)	Rdu Town Of Fuquay-Varina Wake County

**Table 16 - Roughness Coefficients** 

Stream	Channel "n"	Overbank "n"
Beaver Creek	0.043 to 0.050	0.100 to 0.200
Beddingfield Creek	0.050	0.130
Big Branch	0.050	0.140
Black Creek	0.025 to 0.060	0.030 to 0.150
Buckhorn Creek	0.040 to 0.048	0.145
Buffalo Creek (Basin 9, Stream 1)	0.030 to 0.070	0.035 to 0.140
Buffalo Creek West	0.045 to 0.052	0.030 to 0.140
Cary Branch	0.040	0.140
Guffy Branch (Basin 21, Stream 4)	0.047	0.130
Jim Branch	0.045	0.145
Juniper Branch (Basin 21, Stream 2)	0.045	0.110 to 0.130
Kit Creek	0.030 to 0.070	0.070 to 0.110
Little Beaver Creek	0.045 to 0.055	0.100 to 0.220
Little Black Creek	0.030 to 0.070	0.070 to 0.130
Little Creek (Basin 11, Stream 2)	0.030 to 0.080	0.070 to 0.150
Little Creek (Into Middle Creek)	0.033 to 0.047	0.095 to 0.140
Little River	0.040 to 0.066	0.070 to 0.240
Marks Creek	0.025 to 0.070	0.070 to 0.130
Middle Creek	0.042 to 0.050	0.030 to 0.140
Mill Branch	0.050	0.030 to 0.150
Aill Creek (South)	0.035 to 0.060	0.040 to 0.160
Moccasin Creek	0.030 to 0.070	0.070 to 0.220
Morris Branch	0.030 to 0.050	0.100 to 0.200
Nancy Branch	0.045 to 0.050	0.120 to 0.150
Neuse River	0.035 to 0.060	0.055 to 0.250
Norris Branch	0.048	0.145
Panther Creek	0.030 to 0.070	0.070 to 0.130
Reedy Branch (Basin 27, Stream 5)	0.045 to 0.050	0.100 to 0.200
Snipes Creek	0.042 to 0.045	0.120 to 0.130
Swift Creek	0.040 to 0.072	0.035 to 0.240
mas Creek	0.050	0.145
amed Tributary (#1) to Swift Creek	0.045 to 0.060	0.050 to 0.150
White Oak Creek	0.035 to 0.050	0.035 to 0.150

For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained using digital elevation data obtained with LIDAR technology developed as part of the North Carolina Statewide Floodplain Mapping Program. The hydraulic model is prepared using this digital elevation data, without surveying bathymetric or structural data. Where bridge or culvert data are readily available, such as from the North Carolina Department of Transportation, these data have been reflected in the hydraulic model. If these structural data are not readily available, field measurements of these structures were made to approximate their geometry in the hydraulic models. In addition, this method does not include field surveys that determine specifics on channel and floodplain characteristics. A limited detailed study is a "buildable" product that can be upgraded to a fully detailed study at a later date by verifying stream channel characteristics, bridge and culvert opening geometry, and by analyzing multiple recurrence intervals.

The results of the HEC-RAS computations are tabulated for all cross sections (Table 17, "Limited Detailed Flood Hazard Data"). Flood Profiles have not been developed for streams studied by limited detailed methods. Water-surface elevation rasters were developed for steams studied by limited detailed methods. In addition, floodways for streams studied by limited detailed methods are not delineated on the FIRM. However, the 1% annual chance water-surface elevations, flood discharges, and non-encroachment widths from the limited detailed studies for every modeled cross section are given in Table 17. The non-encroachment widths given at modeled cross sections can be used by communities to enforce floodplain management ordinances that meet the requirement defined in 44 CFR 60.3(c)(10).

Between cross sections for streams studied by limited detailed methods, 1% annual chance water-surface elevations can be calculated by mathematical interpolation using the distance along the stream centerline. Non-encroachment widths and, therefore, the location of a non-encroachment area boundary between cross sections should be determined based on either 1) mathematical interpolation, or 2) the non-encroachment width at the upstream or downstream cross section, whichever is larger. If the width determined by this second method is wider than the Special Flood Hazard Area (SFHA) or the 1% annual chance floodplain delineated on the FIRM for this location along the stream, the non-encroachment area shall be considered to

Site:

## FEDERAL EMERGENCY MANAGEMENT AGENCY

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WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

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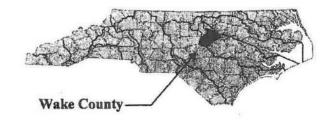
	Table 13 - Summ	ary of Dis	charges			
(square miles)   Chance   Ch	-	Ta	100/ 1		Ť	1 2 20/ 4 1
At Wade Avenue	Location					0.2% Annual Chance
At mouth	ith	1.20	*	*	1,450	*
At mouth	de Avenue	0.50	*	*	1,050	*
At Brooks Avenue	west Prong Beaverdam Creek (Basin 18, Stream 29)					
At Wade Avenue	ith	1.90	*	*	1,900	*
Spring Branch (Basin 6, Stream 6)   At mouth   1.00   1.120   360   5	oks Avenue	1.20	*	*	1,550	*
At mouth	de Avenue	0.50	*	*	1,050	*
At East Holding Ave	g Branch (Basin 6, Stream 6)					
Stirrup Iron Creek	ith	1.00	*	*	1,120	*
At mouth 14	t Holding Ave	0.30	*	*	360	*
Just upstream of Brier Creek (Basin 18, Stream 14)   14   12.30	p Iron Creek			_		
Just upstream of Basin 18, Stream 13	ith <sup>14</sup>	25.60	*	*	2,735	*
Straight Branch (Basin 20, Stream 23)   Straight Branch (Basin 20, Stream 23)   Straight Branch (Basin 20, Stream 23)   Swift Creek	ostream of Brier Creek (Basin 18, Stream 14) 14	12.30	*	*	2,235	*
Straight Branch (Basin 20, Stream 23)	ostream of Basin 18, Stream 13	9.40	*	*	1,150	*
Straight Branch (Basin 20, Stream 23)	ownstream of NRCS Dam No. 5A	8.70	*	*	165	*
At US Route 64/1	e/Durham County boundary	8.50	*	*	3,500	*
At US Route 64/1	ht Branch (Basin 20, Stream 23)					
Swift Creek	uth	1.10	*	*	1,150	*
At County boundary 79.10 * 11,900 * 11,900 * 11,900 * 10,800 * 10,	Route 64/1	0.50	*	*	750	*
At Lake Benson Dam	Creek					
At Cold Stage Road	nty boundary	79.10	*	*	11,900	*
At confluence of Yates Branch  Approximately 1.0 mile upstream of confluence of Yates Branch (Basin 20, Stream 39.06 * 4,560 * 4,560 * 4,560 * 4,560 * 4,580 * 4,610 * 4,580 * 4,610 *	e Benson Dam	66.20	*	*	10,800	*
Approximately 1.0 mile upstream of confluence of Yates Branch (Basin 20, Stream 39.06 * 4,560 * 4,560 * 4,580 * 4,610 * 4,580 * 4,610 * 4,580 * 4,610	Stage Road	55.20	*	*	9,600	*
Approximately 1.8 miles upstream of confluence of Yates Branch (Basin 20, Stream 38.45 * 4,580 * 4,580 * Approximately 250 feet upstream of Fayetteville Highway 36.77 * 4,580 * Approximately 1,060 feet downstream of Lake Wheeler Road 35.79 * 4,610 * Approximately 170 feet upstream of Lake Wheeler Road 35.73 * 4,610 * Approximately 500 feet downstream of confluence of Dutchmans Branch (Basin 20, Stream 17) * Approximately 0.5 mile upstream of confluence of Basin 20, Stream 20 24.63 * 4,580 * 9,270 *	luence of Yates Branch	41 66	*	*	4,550	*
Approximately 250 feet upstream of Fayetteville Highway 36.77 * * 4,580 *  Approximately 1,060 feet downstream of Lake Wheeler Road 35.79 * * 4,610 *  Approximately 170 feet upstream of Lake Wheeler Road 35.73 * * 8,480 *  Approximately 500 feet downstream of confluence of Dutchmans Branch (Basin 20, Stream 17) * 8,170 *  Approximately 0.5 mile upstream of confluence of Basin 20, Stream 20 24.63 * * 9,270 *	cimately 1.0 mile upstream of confluence of Yates Branch (Basin 20, Stream	39.06	*	*	4,560	*
Approximately 250 feet upstream of Fayetteville Highway       36.77       *       4,580       *         Approximately 1,060 feet downstream of Lake Wheeler Road       35.79       *       *       4,610       *         Approximately 170 feet upstream of Lake Wheeler Road       35.73       *       *       8,480       *         Approximately 500 feet downstream of confluence of Dutchmans Branch (Basin 20, Stream 17)       26.60       *       *       8,170       *         Approximately 0.5 mile upstream of confluence of Basin 20, Stream 20       24.63       *       *       9,270       *	imately 1.8 miles upstream of confluence of Yates Branch (Basin 20, Stream	38.45	*	*	4,580	*
Approximately 1,060 feet downstream of Lake Wheeler Road 35.79 * 4,610 *  Approximately 170 feet upstream of Lake Wheeler Road 35.73 * 8,480 *  Approximately 500 feet downstream of confluence of Dutchmans Branch (Basin 20, Stream 17) * 8,170 *  Approximately 0.5 mile upstream of confluence of Basin 20, Stream 20 24.63 * 9,270 *	rimately 250 feet unstream of Favetteville Highway	36.77	*	*	4 580	*
Approximately 170 feet upstream of Lake Wheeler Road 35.73 * * 8,480 *  Approximately 500 feet downstream of confluence of Dutchmans Branch (Basin 20, Stream 17) * * 8,170 *  Approximately 0.5 mile upstream of confluence of Basin 20, Stream 20 24.63 * * 9,270 *			*	*		*
Approximately 500 feet downstream of confluence of Dutchmans Branch (Basin 20, 26.60 * * 8,170 * Stream 17)  Approximately 0.5 mile upstream of confluence of Basin 20, Stream 20 24.63 * * 9,270 *			*	*		*
Stream 17)  Approximately 0.5 mile upstream of confluence of Basin 20, Stream 20  24.63  * 9,270  *	, ,		*	*		*
Approximately 0.8 mile upstream of confluence of Basin 20, Stream 20	cimately 0.5 mile upstream of confluence of Basin 20, Stream 20	24.63	*	*	9,270	*
	rimately 0.8 mile upstream of confluence of Basin 20, Stream 20	22.49	*	*	9,370	*
Approximately 0.5 mile downstream of Holly Springs Road 21.38 * * 9,420 *	imately 0.5 mile downstream of Holly Springs Road	21.38	*	*	9,420	*
At Holly Springs Road	y Springs Road	19.18	*	*	9,230	*
At confluence of Lens Branch         13.44         *         *         7,540         *	luence of Lens Branch	13.44	*	*	7,540	*
Approximately 225 feet upstream of Kildare Farm Road 12.80 * * 7,650 *	rimately 225 feet upstream of Kildare Farm Road	12.80	*	*	7,650	*
Approximately 1,580 feet downstream of confluence of Swift Creek Trib No. 7 (Basin 20, Stream 24)		10.39	*	*	6,800	*
At confluence of Swift Creek Tributary No. 7 (Basin 20, Stream 24) 5.44 * * 3,550 *	luence of Swift Creek Tributary No. 7 (Basin 20, Stream 24)	5.44	*	*	3,550	*
At US Highway 1 5.12 * 4,230 *	Highway 1	5.12	*	*	4,230	*
Approximately 530 feet upstream of US Highway 64 2.75 * 1,970 *		2.75	*	*		*
Swift Creek Tributary No. 7 (Basin 20, Stream 24)						
At mouth <sup>15</sup>   5.00   *   *   2,350   *		5.00	*	*	2.350	*

			Tal	ole 21 - Fl	<u>oodway D</u>	ata			
	y Source		Floodway				ter Surface Eleva		
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
175	17,540	50	212	0.8	292.2	*	292.2	293.0	0.8
180	18,030	41	216	0.8	292.3	*	292.3	293.1	0.8
Straight Bran	ch (Basin 20, S	Stream 23)	T	T	T			T	
020	1,950	174	1,331	0.9	366.5	*	366.5	366.5	0.0
034	3,395	375	5,172	0.1	391.6	*	391.6	391.6	0.0
Swift Creek	T	T	I	I	T			T	
1445	144,485	1,090	9,478	1.3	202.1	*	202.1	202.7	0.6
1581	158,130	305	3,678	3.2	220.0	*	220.0	220.9	0.9
1651	165,050	335	3,992	2.7	224.9	*	224.9	225.9	1.0
1658	165,760	370 <sup>10</sup>	16,395	0.7	238.0	*	238.0	238.0	0.0
1828	182,775	1,240	10,913	0.9	245.6	*	245.6	245.8	0.2
1901	190,090	1,240	11,576	0.8	245.6	246.0	245.6	245.8	0.2
1915	191,516	1,320	10,623	0.4	246.0	246.4	246.0	246.2	0.2
1920	192,042	1,420	10,823	0.4	246.0	246.4	246.0	246.2	0.2
1928	192,778	1,325	9,780	0.5	246.1	246.5	246.1	246.3	0.2
1934	193,389	1,230	8,569	0.5	246.2	246.5	246.2	246.4	0.2
1938	193,832	1,220	7,720	0.6	246.2	246.6	246.2	246.5	0.2
1948	194,763	1,250	7,763	0.6	246.4	246.7	246.4	246.6	0.2
1955	195,550	1,240	6,527	0.7	246.5	246.9	246.5	246.8	0.3
1970	197,039	1,100	4,810	0.9	247.3	247.7	247.3	247.7	0.4
1976	197,649	1,220	4,332	1.0	247.5	248.0	247.5	248.0	0.4
	,	<i>'</i>	,		248.0		248.0		0.4
1986	198,554	1,050	4,149	1.1		248.4		248.6	
1997	199,666	765	3,699	1.2	248.6	248.9	248.6	249.5	0.9
Site 34	200,615	825	3,523	1.3	249.1	249.4	249.1	250.1	1.0
2013	201,300	620	3,780	1.2	249.5	249.8	249.5	250.5	1.0
2019	201,907	550	2,605	1.8	249.7	250.0	249.7	250.7	1.0
2030	203,040	490	1,811	2.5	250.4	250.6	250.4	251.3	0.9
2048	204,835	530	2,114	2.2	252.3	252.7	252.3	252.9	0.6
2058	205,790	740	2,393	1.9	253.2	253.6	253.2	253.7	0.5
2067	206,702	570	1,503	3.0	254.3	254.6	254.3	254.6	0.4
2075	207,523	710	1,655	2.8	255.7	255.9	255.7	256.1	0.4
2091	209,116	650	2,052	2.2	258.9	259.1	258.9	259.1	0.3
2111	211,103	575	2,690	1.7	262.4	262.6	262.4	263.2	0.8
2116	211,570	430	2,467	1.9	263.3	263.6	263.3	263.8	0.5
2121	212,081	340	1,994	2.3	263.7	264.0	263.7	264.2	0.5
2136	213,608	1,545	24,733	0.3	289.4	289.8	289.4	289.4	0.0
2151	215,087	1,931	31,285	0.3	289.4	289.8	289.4	289.4	0.0
2179	217,930	1,697	28,088	0.3	289.4	289.8	289.4	289.4	0.0
2204	220,417	1,490	25,038	0.3	289.4	289.8	289.4	289.4	0.0
2227	222,727	1,717	29,347	0.3	289.7	290.2	289.7	289.7	0.0
2235	223,518	1,935	15,367	0.5	289.7	290.2	289.7	289.7	0.0
2251	225,128	1,625	13,321	0.6	289.8	290.2	289.8	289.8	0.0
2258	225,815	1,175	8,021	1.2	289.8	290.2	289.8	289.8	0.0
2265	226,458	900	5,607	1.6	289.9	290.4	289.9	289.9	0.0
	,	1	-,						

A Report of Flood Hazards in

## WAKE COUNTY, NORTH CAROLINA

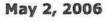
AND INCORPORATED AREAS



### **VOLUME 2 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse



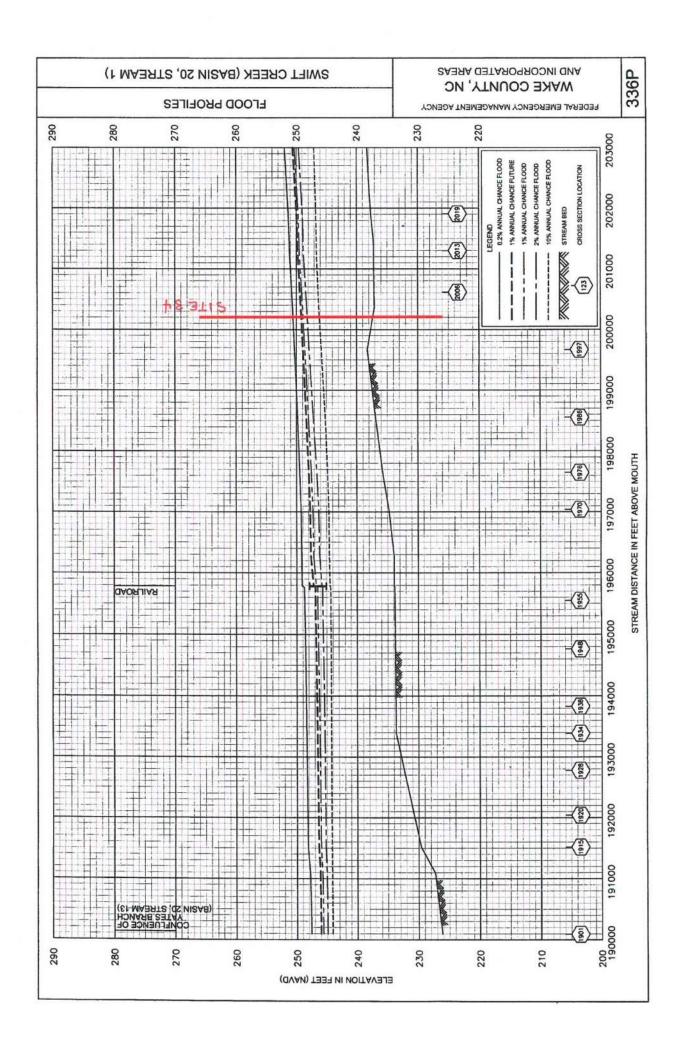


Federal Emergency Management Agency State of North Carolina

> Flood Insurance Study Number 37183CV002A







## PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake

PROJECT NUMBER R-2721, R-2828, & R-2829

STREAM Swift Creek

ROUTE New Location

(Site 34)

ASSESSMENT PREPARED BY Mulkey, INC. DATE 1/8/2014 (MLH)

HYDROLOGIC EVALUATION
NEAREST GAGING STATION ON THIS STREAM 1.5 miles upstream of Site 34 (NONE)
ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: Yes
FLOOD DATA: Q <sub>10</sub> 10,000 CFS EST. BKWTR. N/A FT. Q <sub>25</sub> 12,000 CFS EST. BKWTR. N/A FT. Q <sub>50</sub> 13,000 CFS EST. BKWTR. N/A FT. Q <sub>100</sub> 13,000 CFS EST. BKWTR. N/A FT. Q <sub>500</sub> 37,000 CFS EST. BKWTR. N/A FT.
DRAINAGE AREA 38.75 Sq.Mi. METHOD USED TO COMPUTE Q: USGS Urban
Regression PROPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: LOW MODERATE X HIGH
COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: YES NO X
EXPLANTION: A floodway modification may be required at this site.
LIST BUILDINGS IN FLOOD PLAIN: None LOCATION:
UPSTREAM LAND USE <u>Residential</u> ANTICIPATE ANY CHANGE? <u>No</u>
ANY FLOOD ZONING? (FIA STUDIES, ETC.) YES $\underline{X}$ NO
TYPE OF STUDY: FEMA - Special Flood Hazard Zone AE
REGULATORY FLOODWAY WIDTH 825 ft. Section 2006 (AS NOTED IN FIS)
COMMENTS:

## TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 20,000 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 55,200 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? $\underline{\text{N/A}}$
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS
NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Wehadkee TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service
ENVIRONMENTAL CONSIDERATIONS
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN:
MISCELLANEOUS COMMENTS
IS THERE UNUSUAL SCOUR POTENTIAL? YES NO $\underline{X}$ PROTECTION NEEDED

ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? $\underline{\text{No}}$
COMMENTS:
ALTERNATIVES
RECOMMENDED DESIGN Proposed Dual 1105' Bridges
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING 92,963 Sq. Ft.
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YESNO $\underline{X}$ DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:

Page 65 of 170

## 2012 North Carolina 303(d) List-Category 5

Veuse	Neuse River Basin	in		10-digit Watershed		0302020110			Swift Creek	reek
> AU Number	ımber	Name		Description			Length or Area U	Units	Classification	Category
	Category	Rating	Use	Reason	Reason for Rating	Parameter			Year	
> 27-43-(1)d	-(1)q	Swift Creek		From Lake Wheeler Dam 1006	to a point 0.6 mi	From Lake Wheeler Dam to a point 0.6 mile upstream of Wake County SR 1006	2.4 FW I	FW Miles	WS-III;NSW	w
**************************************	5	Impaired	Aquatic Life	Poor Biod	Poor Bioclassification	Ecological/biological Integrity Benthos	egrity Benthos		2008	_
> 27-43	27-43-(5.5)a	Swift Creek (Lake Benson)	(Lake	From a point 0.6 mile ups Lake Benson	tream of Wake C	mile upstream of Wake County SR 1006 to backwaters of	6.0	FW Miles	WS-III;NSW,CA	N Cu
	5	Impaired	Aquatic Life	Poor Biod	Poor Bioclassification	Ecological/biological Integrity Benthos	egrity Benthos		2008	_
				12-digit Subwatershed	rshed	030202011005			Little	Little Creek
> 27-43-12	1-12	Little Creek		From source to Swift Creek	ye.		11.4 FW	FW Miles	C;NSW	N.
	5	Impaired	Aquatic Life	Fair Biocl	Fair Bioclassification	Ecological/biological Integrity Benthos	regrity Benthos		1998	_
				12-digit Subwatershed	rshed	030202011003			Whiteoak Creek	k Creek
> 27-43-(8)a	-(8)a	Swift Creek		From dam at Lake Benson to Little Creek	n to Little Creek		20.6 FW	FW Miles	C;NSW	w
	5	Impaired	Aquatic Life	Fair Bioc	Fair Bioclassification	Ecological/biological Integrity Benthos	tegrity Benthos		2012	_
Neuse	Neuse River Basin	sin		10-digit Watershed		0302020111		Waln	Walnut Creek-Neuse River	River
				12-digit Subwatershed	rshed	030202011104			Mill Creek-Neuse Rive	ise Rive
> 27-(38.5)	18.5)	NEUSE RIVER	8	From a point 0.2 mile downstream of Johnston Co 1.4 mile downstream of Johnston County SR 1908	wnstream of Joh Johnston County	From a point 0.2 mile downstream of Johnston County SR 1700 to point 1.4 mile downstream of Johnston County SR 1908	9.7 FW	FW Miles	WS-IV;NSW	ru.
	r.	Impaired	Aquatic Life	Standard	Standard Violation	Copper			2012	_
				12-digit Subwatershed	ershed	030202011103			Poplar Creek-Neuse Rive	se Rive
> 27-(2	27-(22.5)c	NEUSE RIVER	EB	From Crabtree Creek to Auburn Knightdale Road	Auburn Knightda	le Road	3.9 FW	FW Miles	C;NSW	rv.
	2	Impaired	Aquatic Life	Standaro	Standard Violation	Copper			2008	
	2	Impaired	Aquatic Life	Standaro	Standard Violation	Turbidity			2010	
	u	pozicami	Fish Consumption		Standard Violation	PCB			2010	

Name	Index Number	Classification	Neuse River Basir Class Date
Description		Spe	ecial Designation
Strouds Creek	27-2-9	C;NSW	12/01/83
From source to Eno River			
Stump Bay	27-148-1-6	SA;HQW,NSW	05/01/88
From source to Long Bay			
Swan Creek	27-144	SA;HQW,NSW	05/01/88
From source to Neuse River			
Swan Pond	27-52-7	C;NSW	05/01/88
Entire pond and connecting stream to Mill Creek			
Swift Creek	27-97-(6)	SC;Sw,NSW	05/01/88
From mouth of Bear Branch to Neuse River			
Swift Creek	27-97-(0.5)	C;Sw,NSW	05/01/88
From source to mouth of Bear Branch			
Swift Creek	27-43-(8)	C;NSW	05/01/88
From dam at Lake Benson to Neuse River			
Swift Creek (Lake Benson)	27-43-(5.5)	WS-III;NSW,CA	08/03/92
From a point 0.6 mile upstream of Wake County SR 1	006 to dam at Lake Benson		
Swift Creek (Lake Wheeler)	27-43-(1)	WS-III;NSW	08/03/92
From source to a point 0.6 mile upstream of Wake Co	ounty SR 1006		
Swindell Bay	27-150-8-(2)	SC;Sw,NSW	05/01/88
From the narrows to Bay River			
Swindell Bay	27-150-8-(1)	SC;Sw,HQW,NS	W 08/01/90
From source to the narrows			
Sycamore Creek (Big Lake)	27-33-9	B;NSW	05/01/88
From source to Crabtree Creek			
Tar Creek	27-150-31-4	SA;HQW,NSW	05/01/88
From source to Gale Creek			
Tar Creek	27-141-4	SA;HQW,NSW	05/01/88
From source to Broad Creek			
Tar Kiln Branch	27-54-6	ws-IV;NSW	08/03/92
From source to Falling Creek			
Tar River	27-71-2-2	WS-IV;NSW	08/01/02
From source to Trotters Creek			

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			ME-ME =	27'
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BED MATERIAL	- FINE	SAND /	SILT	
DEBRIS POTENT				
RECENT DRIFT				

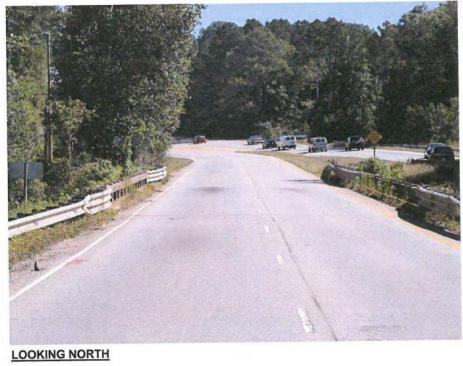


NC DEPARTMENT OF TRANSPORTATION **DIVISION OF HIGHWAYS** BRIDGE MANAGEMENT UNIT

ATTENTION

## BRIDGE INSPECTION REPORT

INSPECTION TYPE:	Routine inspection	
COUNTY WAKE	BRIDGE NUMBER 910089 INSPECTION CYCLE	2 YRS
US-401 (SOUTH BOUND LANE) ROUTE US401 SBL	ACROSS SWIFT CREEK	M.P. 0
0.3 OF A MILE NORTH OF JO	T. SR-1446 ( MANOR RIDGE ROAD )	
LOCATION 0.3 MI N JCT SR1446		
SUBSTRUCTURE EBTS:RC CAPS/TIM.P	ILES;IBTS:RCP&BEAM	
SPANS 3@40'		
LONGITUDE 78° 40' 51.54"	LATITUDE 35° 41' 15.24"	
INSPECTION DATE 09/17/2013	PRESENT CONDITION FAIR	
PRESENT POSTING N	NOT POSTED PROPOSED POSTING	
OTHER SIGNS PRESENT NONE		



No Fracture Critical Temporary Shoring No No Scour Critical Scour POA No

SIGN NOT		NUMBEREI REQUIRED
No	WEIGHT LIMIT	
No	DELINEATORS	
No	NARROW BRIDGE	
No	ONE LANE BRIDGE	
No	LOW CLEARANCE	1
-	-	

NUMBERED



NC DEPARTMENT OF TRANSPORTATION ATTENTION **DIVISION OF HIGHWAYS** 

## **BRIDGE INSPECTION REPORT**

INSPECTION TYPE:	: Routine Inspe	ction			
COUNTY WAKE	BRIDGE NUM	BER 910086	INSPECTION CYCLE	YR	S
US-401 (NORTH BOUND LANE		04.00450415051514 (MADD WILL)			
ROUTE US401 NBL	ACROSS SV	WIFT CREEK			P. <u>0</u>
0.3 OF A MILE NORTH OF	JCT. SR-1446 ( M	IANOR RIDGE RO	AD)		
OCATION 0.3 MI N JCT SR1446					
SUPERSTRUCTURE RC FLOOR ON I-BE	EAMS				
UPERSTRUCTURE RC FLOOR ON I-BL	ANIO	1			
SUBSTRUCTURE EBTS:RC CAPS ON	PPC PILES@7'9;	IBTS.RCP&BEAN	İ		
3 @ 40'					
3@40'					
ONGITUDE 78° 40' 51.24"		LATITUDE	35° 41' 14.76"		
NSPECTION DATE 09/17/2013		PRESENT C	ONDITION FAIR		
PRESENT POSTING N	NOT POSTED	PROPOSE	D POSTING		
OTHER SIGNS PRESENT NONE					

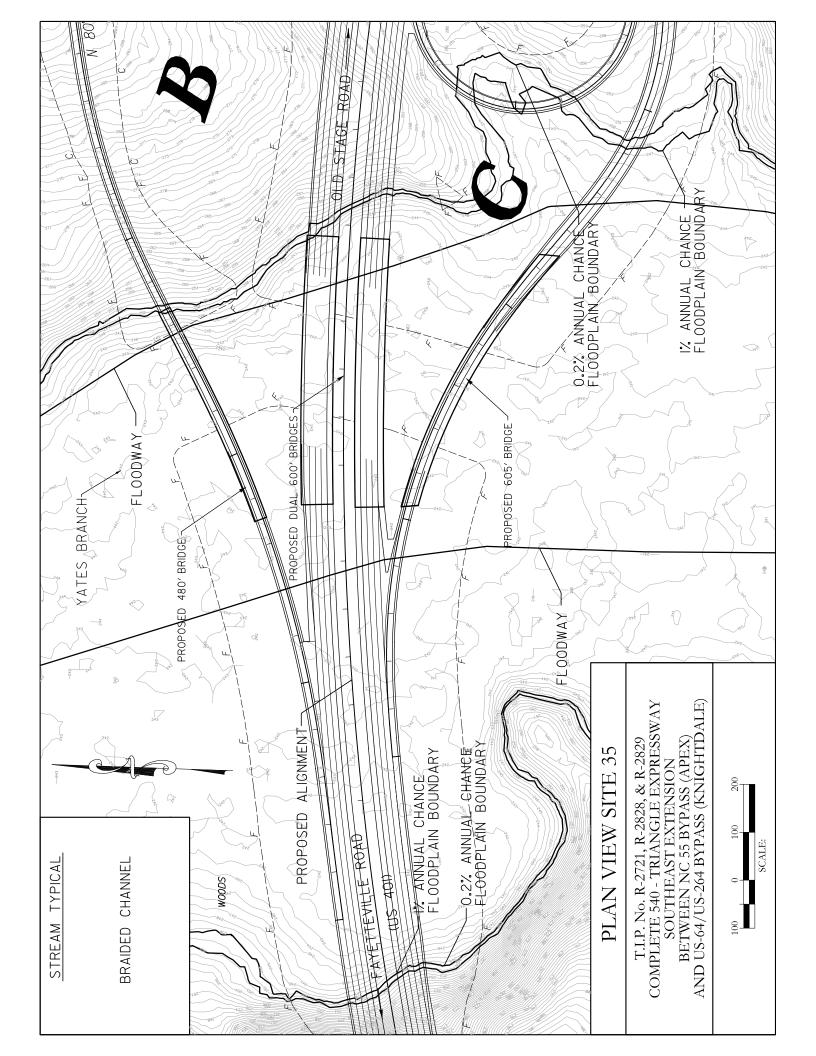
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LOOKING NORTH		

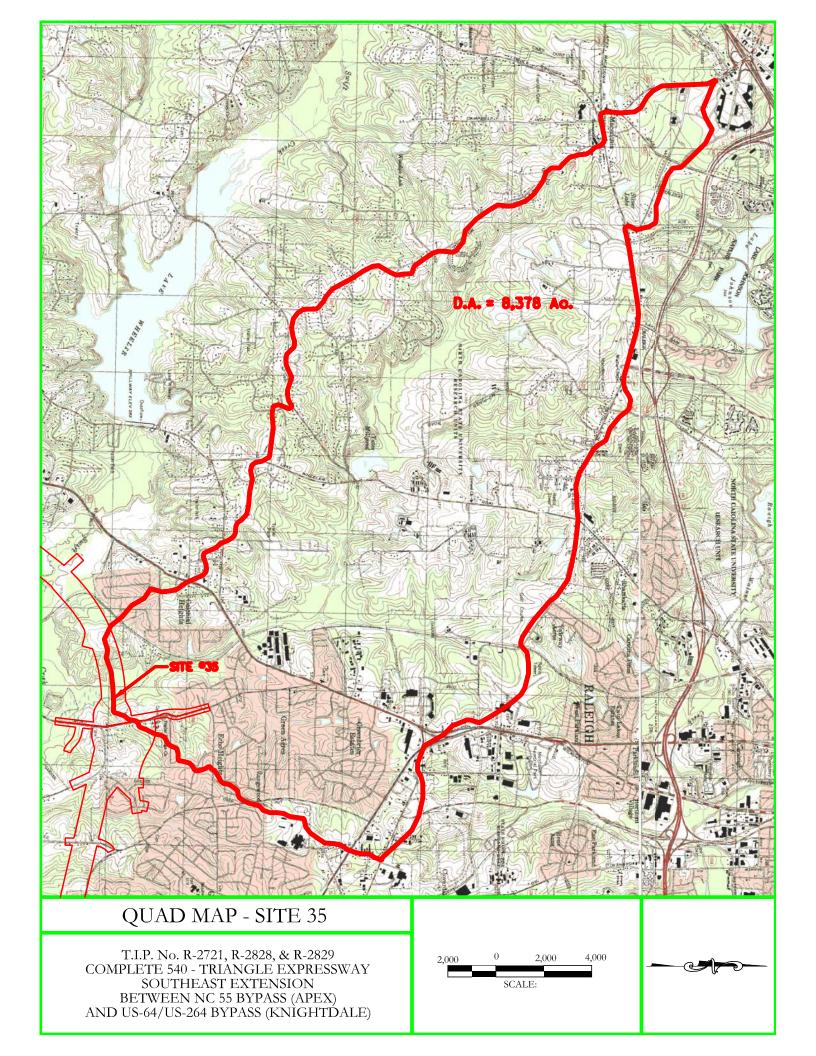
LOOKING NORTH

Fracture Critical	No
Temporary Shoring	No
Scour Critical	No
Scour POA	No

SIGN NOTIC		NUMBERED REQUIRED
No	WEIGHT LIMIT	
No	DELINEATORS	
No	NARROW BRIDGE	
No	ONE LANE BRIDGE	
No	LOW CLEARANCE	

NUMBERED





## **North Carolina**

PROJECT NAME: Triangle Expressway SE Ext. 4/22/2014

REGION: BLUE RIDGE METHOD USED: Fact Sheet: 007-00 **STREAM NAME: Yates Branch** sq. miles 13.09 Drainage Area = ENGLISH

RURAL EQUATIONS Report 01-4207	Soastal Plain Sand Hills	(cfs) (cfs)	365.26 209.08	660.46 336.72	914.27 437.76	1291.37 583.05	1626.95 709.56	2006.47 839.06	2436.03 992.36	3091.79 1219.57
<b>3AL EQUAT</b>	Blue Ridge (	(cfs)	821.16	1380.33	1832.99	2500.54	3082.15	3717.44	4427.11	5498.02
RUF	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR
ATIONS (OLD)										
SSION EQUA	Coastal Plain	(cfs)	352.59	665.65	947.44	1422.07	1837.82	2344.40	2961.07	3924.70
AL REGRES	Sand Hills	(cfs)	195.65	325.63	431.94	594.74	735.72	896.59	1105.79	1353.41
<b>USGS RURAL REGRESSION EQUA</b>	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR

# **USGS URBAN REGRESSION EQUATIONS**

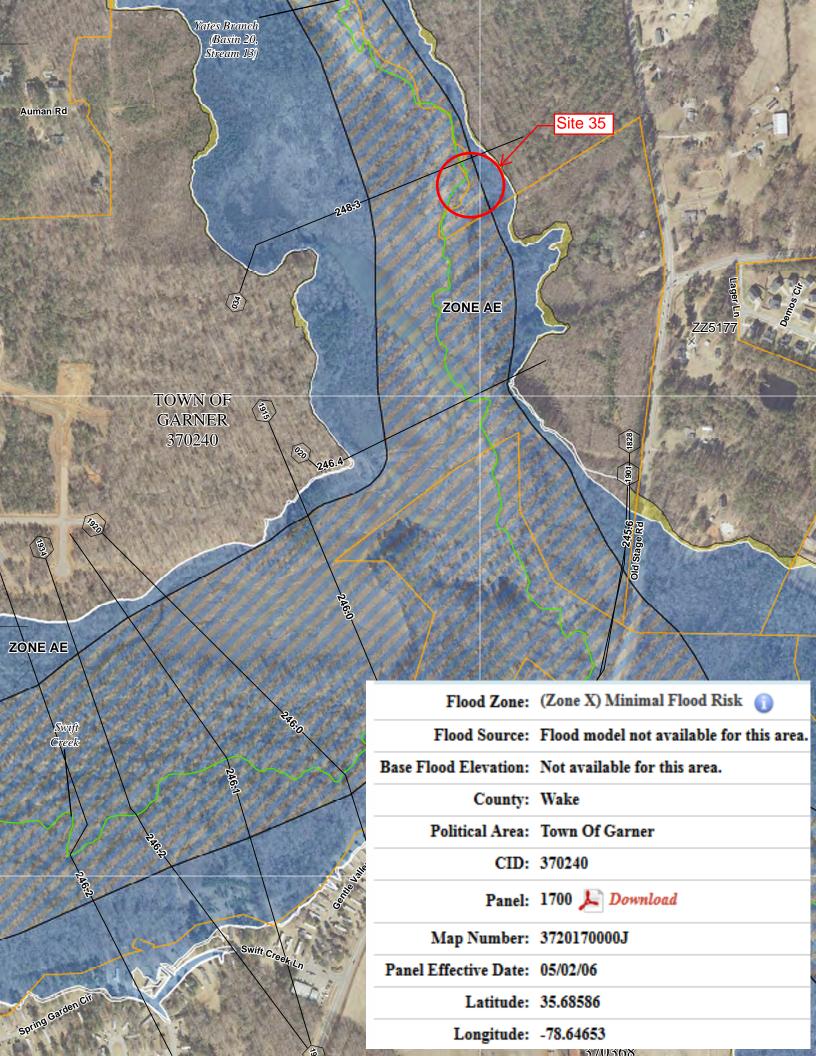
BDF=

(These Equations are used only for comparison)

								(Based on 2.80xQ10)	
	Blue Ridge	(cfs)	3541.35	4256.61	5302.01	6360.90	7747.07	11918.51	10860.41
of collipations	Coastal Plain	(cfs)	1994.87	2511.86	3357.74	4174.00	5261.73	7033.22	8102.96
These Equations are used only for comparison)	Sand Hills	(cfs)	1142.11	1350.53	1671.76	1988.40	2392.38	3781.47	3384.50
( IIICOC Eduation	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

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FREQUENCY	Sand Hills (cfs)	Coastal Plain (cfs)	Blue Ridge (cfs)	<u> </u>	FREQUENCY	Disharges
5YR	1665.44	2039.71	2522.91			
10YR	2017.07	2544.16	3076.00		10YR	
25YR	2476.10	3342.34	4051.67		50YR	4380
50YR	2865.15	3851.40	4559.29	4600	100YR	4920
100YR	3205.53	4331.53	5023.26		500YR	
200YR	5647.79	7123.64	8612.79	(Based on 2.80xQ10)		ı
500YR	7382.47	9311.62	11258.14	11258.14 (Based on 3.66xQ10)		



## FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000





Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	Affected Communities		
Source		Sources	Affected Communities
Southwest Prong Beaverdam Creek	From The confluence with Beaverdam Creek (Basin 18, Stream 28)	To Wade Avenue	City Of Raleigh
(Basin 18, Stream 29) Spring Branch (Basin 6, Stream 6)	The confluence with Dunn Creek (Basin 6, Stream 5)	Approximately 875 feet upstream of Franklin Street	Town Of Wake Forest
Stirrup Iron Creek	The confluence with Brier Creek (Basin 18, Stream 14)	The Wake/Durham County boundary	Rdu Town Of Cary Town Of Morrisville Wake County
Straight Branch (Basin 20, Stream 23)	The confluence with Lens Branch (Basin 20, Stream 22)	Approximately 1,000 feet upstream of US Route 164	Town Of Cary
Swift Creek	The confluence with the Neuse River	The confluence of Yates Branch (Basin 20, Stream 13)	Rdu Town Of Garner Wake County
Swift Creek Tributary No. 7 (Basin 20, Stream 24)	The confluence with Swift Creek (Basin 20, Stream 1)	Maynard Road	Town Of Cary
Swift Creek Tributary No. 7A (Basin 20, Stream 25)	The confluence with Swift Creek Tributary No. 7 (Basin 20, Stream 24)	Approximately 0.5 mile upstream of confluence with Swift Creek Tributary No. 7 (Basin 20, Stream 24)	Town Of Cary
Sycamore Creek (Basin 18, Stream 6)	Approximately 0.9 mile downstream of Basin 18, Stream 8	Approximately 0.5 mile upstream of A.C.C. Boulevard	City Of Raleigh Rdu Wake County
Terrible Creek (Basin 22, Stream 19)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 1.0 mile upstream of Sunset Lake Road	Rdu Town Of Fuquay-Varina Wake County
Toms Creek (Basin 7, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 0.9 mile upstream of Forestville Road	Rdu Town Of Rolesville Town Of Wake Forest Wake County
Tributary to Big Branch Tributary No. 1 (Basin 30, Stream 8)	The confluence with Big Branch Tributary No. 1 (Basin 30, Stream 6)	Approximately 0.5 mile upstream of confluence with Big Branch Tributary No. 1 (Basin 30, Stream 6)	Town Of Garner
Turkey Creek (Basin 18, Stream 23)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Approximately 1,200 feet upstream of High House Road	Town Of Cary
Turkey Creek (Basin 18, Stream 5)	Approximately 1,160 feet upstream of Sendero Drive	Glenwood Avenue	City Of Raleigh
Unnamed Stream	The confluence with Basin 19, Stream 3	Railroad	Rdu Town Of Garner Wake County
Unnamed Tributary (#1) to Swift Creek	The confluence with Swift Creek	The Johnston/Wake County boundary	Rdu Wake County
Upper Barton Creek (Basin 16, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Victory Church Road	Rdu Wake County
West Fork Mine Creek (Basin 18, Stream 33)	The confluence with Mine Creek (Basin 18, Stream 31)	Approximately 0.4 mile upstream of confluence of Mine Creek (Basin 18, Stream 31)	City Of Raleigh
Wheelers Creek (Basin 10, Stream 25)	The confluence with Little River (Basin 10, Stream 1)	Worth Hinton Road	Town Of Zebulon
White Oak Creek	The confluence with Swift Creek	Approximately 0.4 mile upstream of Pergo Parkway	Rdu Town Of Clayton Town Of Garner Wake County
Wildcat Branch (Basin 30, Stream 4)	The confluence with Walnut Creek (Basin 30, Stream 1)	Approximately 1,000 feet upstream of Rush Street	City Of Raleigh
Yates Branch (Basin 20, Stream 13)	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 3.6 miles upstream of Lake Wheeler Road	City Of Raleigh Rdu Town Of Garner Wake County

Site 35 \_\_\_\_\_\_

Table 10, "Flooding Sources Studied by Detailed Methods: Limited Detailed", lists all flooding sources within the county that were studied by limited detailed methods for either this FIS or previous FISs.

Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed

Table 10 -1 looding oddices olddied by Detailed Methods. Ellinted Detailed						
Source	Riverine	Affected Communties				
	From	То				
Adams Branch (Basin 30, Stream 9)	Corwin Road	Approximately 0.2 mile upstream of Meadowbrook Drive	Town Of Garner			
Angier Creek (Basin 24, Stream 4)	Railroad	Approximately 0.7 mile upstream of Old Baron Drive	Town Of Fuquay-Varina			
Armory Tributary (Basin 18, Stream 38)	The confluence with Richland Creek (Basin 18, Stream 3)	Approximately 0.5 mile upstream of confluence with Richland Creek (Basin 18, Stream 3)	City Of Raleigh			
Bachelor Branch (Basin 28, Stream 6)	The confluence with White Oak Creek	Approximately 530 feet upstream of Highway 55	Rdu Town Of Cary Wake County			

ary of Dis	charges					
Flooding Source  Location Drainage Area			Discharges (cfs)			
(square miles)	Chance	Chance	Chance	0.2% Annual Chance		
7.00	*	*	2,150	*		
6.92	*	*	6,020	*		
5.35	*	*	4,230	*		
4.36	*	*	3,480	*		
3.55	*	*	2,800	*		
2.92	*	*	2,340	*		
2.01	*	*	2,210	*		
1.36	*	*	1,870	*		
1.12	*	*	1,780	*		
3.50	*	*	2,070	*		
1.70	*	*	1,430	*		
1.00	*	*	1,020	*		
0.10	*	*	310	*		
	•					
7.90	*	*	3,350	*		
3.80	*	*	2,220	*		
2.20	*	*	1,700	*		
•	•			•		
15.90	*	*	4,191	*		
	*	*	<i>'</i>	*		
	*	*		*		
	*	*		*		
	*	*		*		
12.70	*	*	3,652	*		
1.60	*	*	990	*		
1.40	*	*	924	*		
1.00	*	*	758	*		
1.00	*	*	728	*		
0.90	*	*	680	*		
0.80	*	*	638	*		
0.70	*	*	576	*		
0.50	*	*	472	*		
0.30	*	*	377	*		
•		•		•		
2.10	*	*	1,400	*		
1.90	*	*	1,300	*		
1.90	*	*	1,700	*		
1.40	*	*	1.550	*		
1		I	I	I		
13.40	*	*	4.920	*		
	7.00 6.92 5.35 4.36 3.55 2.92 2.01 1.36 1.12  3.50  1.70 1.00 0.10  7.90 3.80 2.20  15.90 15.50 15.40 14.70 13.30 12.70 1.60 1.00 0.90 0.80 0.70 0.50 0.30	(square miles)     Chance       7.00     *       6.92     *       5.35     *       4.36     *       3.55     *       2.92     *       2.01     *       1.36     *       1.12     *       3.50     *       1.70     *       1.00     *       0.10     *       7.90     *       3.80     *       2.20     *       15.90     *       15.40     *       14.70     *       13.30     *       12.70     *       1.60     *       1.40     *       1.00     *       0.80     *       0.70     *       0.50     *       0.30     *	Dischar   Chance   Chance	Drainage Area (square miles)		

Site 35

Table 21 - Floodway Data

			<u>ı aı</u>	ole 21 - Fi	oodway L				
	y Source		Floodway				ter Surface Eleva		
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
287	28,726	725	3,709	1.4	262.2	*	262.2	263.2	1.0
294	29,394	525	2,397	2.1	263.2	*	263.2	264.1	1.0
301	30,052	350	1,593	3.2	264.8	*	264.8	265.7	0.9
312	31,246	285	1,747	1.9	269.1	*	269.1	269.7	0.7
317	31,681	200	14	2.6	269.4	*	269.4	270.0	0.6
330	32,980	370	1,834	1.2	249.7	*	249.7	250.1	0.4
353	35,280	195	668	3.4	250.9	*	250.9	251.7	0.8
434	43,395	170	755	3.0	286.7	*	286.7	287.3	0.6
Wildcat Brand	ch (Basin 30, S	tream 4)							
026	2,600	242	466	2.8	237.1	*	237.1	237.1	0.0
031	3,060	422	3,323	0.5	242.5	*	242.5	242.5	0.0
055	5,480	150	971	1.6	249.1	*	249.1	249.1	0.0
067	6,660	120	465	3.3	251.4	*	251.4	252.3	0.9
Yates Branch	(Basin 20, Str	eam 13)			1	1	1		
020	2.000	702	2.517	2.0	246.4	*	246.4	246.4	0.0
034	3,400	575	2,660	1.8	248.3	*	248.3	248.3	0.0
055	5,450	300	1,625	3.0	251.4	*	251.4	251.6	0.2
5 —	6,900	185	1,245	4.0	254.9	*	254.9	255.7	0.8
087	8,710	190	1,288	2.7	258.1	*	258.1	258.8	0.7
098	9,750	210	1,105	3.9	260.9	*	260.9	261.3	0.4
197	19,666	63	504	6.7	284.8	*	284.8	285.4	0.6
311	31,115	350	557	4.3	343.3	*	343.3	343.3	0.0
386	38,570	120	595	4.0	408.4	*	408.4	409.0	0.6

<sup>&</sup>lt;sup>1</sup>Elevation includes backwater effects

<sup>&</sup>lt;sup>2</sup>ELEVATION INCLUDES FLOODING CONTROLLED BY MIDDLE CREEK (BASIN 22, STREAM 1)

<sup>&</sup>lt;sup>3</sup>ELEVATION INCLUDES FLOODING CONTROLLED BY HORSE CREEK (BASIN 4, STREAM 1)

<sup>&</sup>lt;sup>4</sup>Combined floodway width of Horse Creek (Basin 4, Stream 1) and Basin 4, Stream 3

<sup>&</sup>lt;sup>5</sup>ELEVATION INCLUDES FLOODING CONTROLLED BY CRABTREE CREEK (BASIN 18, STREAM 9)

<sup>&</sup>lt;sup>6</sup>Feet above county boundary

<sup>&</sup>lt;sup>7</sup>Upstream flood hazard information is studied by new detailed methods. These methods reflect more detailed and up-to-date stream channel configurations. As a result, the stream channel distances may not agree with the adjoining redelineated portion of the stream.

<sup>&</sup>lt;sup>8</sup>ELEVATION INCLUDES FLOODING CONTROLLED BY MARSH CREEK (BASIN 18, STREAM 17)

<sup>&</sup>lt;sup>9</sup>Combined floodway width of Marsh Creek (Basin 18, Stream 17) and Millbrook Tributary to Marsh Creek (Basin 18, Stream 19)

<sup>&</sup>lt;sup>10</sup>Value is inaccurate, as the floodway has been adjusted in this area to match topographic-based floodplain redelineation

<sup>&</sup>lt;sup>11</sup>Combined floodway width of Sanford Creek (Basin 6, Stream 7) and Reedy Creek (Basin 6, Stream 8)

<sup>12</sup> ELEVATION INCLUDES FLOODING CONTROLLED BY WALNUT CREEK (BASIN 30, STREAM 1)

<sup>13</sup>Combined floodway width of Smith Creek (Basin 6, Stream 1) and Dunn Creek (Basin 6, Stream 5)

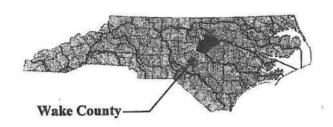
<sup>14</sup> ELEVATION INCLUDES FLOODING CONTROLLED BY DUNN CREEK (BASIN 6, STREAM 5)

<sup>&</sup>lt;sup>15</sup>Combined floodway width of Stirrup Iron Creek (Basin 18, Stream 12) and Brier Creek (Basin 18, Stream 14)

A Report of Flood Hazards in

WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



## **VOLUME 1 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuguay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





May 2, 2006

Federal Emergency Management Agency State of North Carolina

> Flood Insurance Study Number 37183CV001A



## Section 5.0 - Engineering Methods

Table 10-Roughness Coefficients

Stream	Channel "n"	Overbank "n"
Rocky Branch (Basin 22, Stream 8)	0.030 - 0.070	0.070 - 0.110
Rocky Branch (Basin 30, Stream 5) (upstream)	0.030 - 0.070	0.070 - 0.110
Rocky Ford Branch (Basin 24, Stream 5)	0.030 - 0.070	0.070 - 0.110
Sanford Creek (Basin 6, Stream 7)	0.030 - 0.070	0.070 - 0.110
Smith Creek (Basin 6, Stream 1)	0.030 - 0.070	0.070 - 0.110
Snipes Creek	0.042 - 0.045	0.120 - 0.130
Southeast Prong Beaverdam Creek (Basin 18, Stream 30)	0.030 - 0.070	0.070 - 0.110
Southwest Prong Beaverdam Creek (Basin 18, Stream 29)	0.030 - 0.060	0.050 - 0.090
Spring Branch (Basin 6, Stream 6)	0.030 - 0.070	0.070 - 0.110
Stirrup Iron Creek (Basin 18, Stream 12)	0.030 - 0.070	0.070 - 0.110
Straight Branch (Basin 20, Stream 23)	0.030 - 0.070	0.070 - 0.110
Swift Creek (Basin 20, Stream 1)	0.040 - 0.072	0.070 - 0.240
Swift Creek Tributary No. 7 (Basin 20, Stream 24)	0.030 - 0.070	0.070 - 0.110
Swift Creek Tributary No. 7A (Basin 20, Stream 25)	0.030 - 0.070	0.070 - 0.110
Sycamore Creek (Basin 18, Stream 6)	0.030 - 0.070	0.070 - 0.130
Terrible Creek (Basin 22, Stream 19)	0.030 - 0.070	0.070 - 0.110
Thomas Creek	0.050	0.145
Toms Creek (Basin 7, Stream 1)	0.030 - 0.070	0.070 - 0.110
Tributary to Big Branch Tributary No. 1 (Basin 30,	0.030 - 0.070	0.070 - 0.110
Stream 8)	0.030 - 0.070	0.070 - 0.110
Turkey Creek (Basin 18, Stream 5)	0.030 - 0.070	0.070 - 0.150
Turkey Creek (Basin 18, Stream 23)	0.030 - 0.070	0.070 - 0.110
Turkey Creek Tributary	0.046	0.100-0.150
Upper Barton Creek (Basin 16, Stream 1)	0.030 - 0.070	0.070 - 0.110
Unnamed Tributary to Swift Creek	0.040 - 0.043	0.105 - 0.133
Utley Creek	0.050	0.147
Walnut Creek (Basin 30, Stream 1)	0.038 - 0.050	0.100 - 0.200
West Fork Mine Creek (Basin 18, Stream 33)	0.030 - 0.070	0.070 - 0.110
Wheelers Creek (Basin 10, Stream 25)	0.030 - 0.070	0.070 - 0.110
White Oak Creek (Basin 19, Stream 1)	0.030 - 0.070	0.070 - 0.110
White Oak Creek (Basin 26, Stream 1)	0.050	0.150
White Oak Creek (Basin 28, Stream 1)	0.045 - 0.050	0.100 - 0.150
SITE 35 Wildcat Branch (Basin 30, Stream 4)	0.030 - 0.070	0.070 - 0.110
Yates Branch (Basin 20, Stream 13)	0.030 - 0.070	0.070 - 0.110

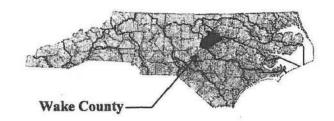
Does not include ineffective flow areas where n = 1.0 or 10.0

For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained

A Report of Flood Hazards in

## WAKE COUNTY, NORTH CAROLINA

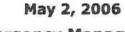
AND INCORPORATED AREAS



## **VOLUME 2 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse



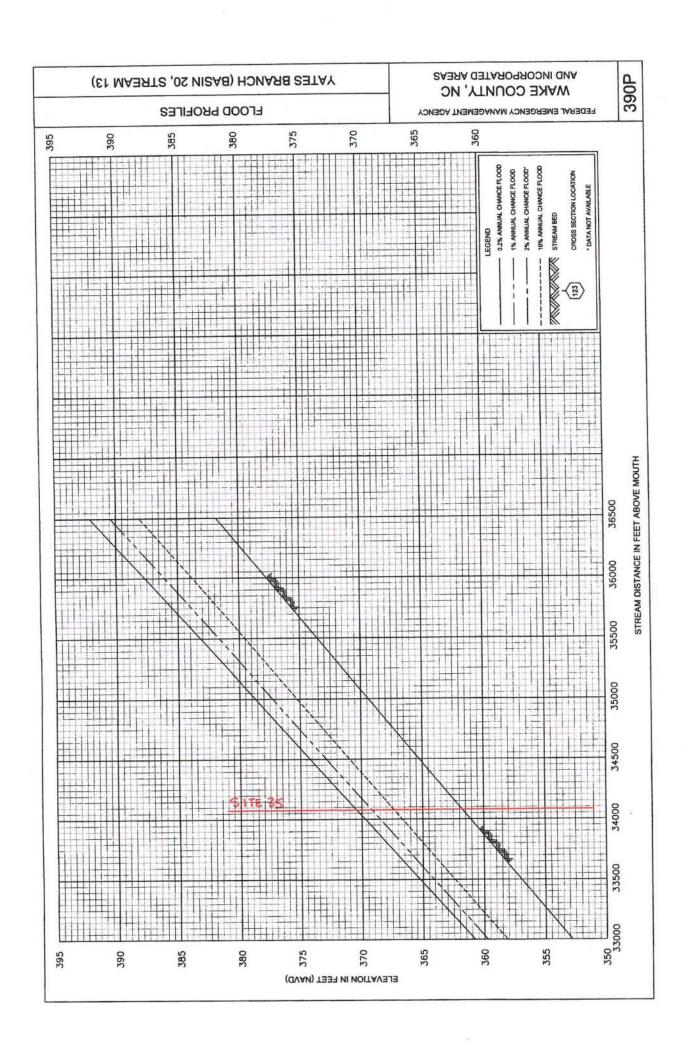


Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV002A







## PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake PROJECT NUMBER R-2721, R-2828, & R-2829
STREAM Yates Branch (Site 35) ROUTE New Location
ASSESSMENT PREPARED BY Mulkey, INC. DATE 1/8/2014 (MLH)
HYDROLOGIC EVALUATION
NEAREST GAGING STATION ON THIS STREAM (NONE $X$ )
ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: Yes
FLOOD DATA: $Q_{10} \ 3,100 \ \text{CFS}$ EST. BKWTR. $N/A \ \text{FT.}$ $Q_{25} \ 4,100 \ \text{CFS}$ EST. BKWTR. $N/A \ \text{FT.}$ $Q_{50} \ 4,600 \ \text{CFS}$ EST. BKWTR. $N/A \ \text{FT.}$ $Q_{100} \ 5,000 \ \text{CFS}$ EST. BKWTR. $N/A \ \text{FT.}$ EST. BKWTR. $N/A \ \text{FT.}$
DRAINAGE AREA 13.09 Sq.Mi. METHOD USED TO COMPUTE Q: USGS Urban Regression  PROPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: LOW MODERATE X HIGH
COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: YES NO $\underline{X}$
EXPLANTION: A floodway modification may be required at this site.
LIST BUILDINGS IN FLOOD PLAIN: None LOCATION:
UPSTREAM LAND USE <u>Residential</u> ANTICIPATE ANY CHANGE? <u>No</u>
ANY FLOOD ZONING? (FIA STUDIES, ETC.) YES $\underline{X}$ NO
TYPE OF STUDY: FEMA - Special Flood Hazard Zone AE
REGULATORY FLOODWAY WIDTH 575 ft. Section 34 (AS NOTED IN FIS

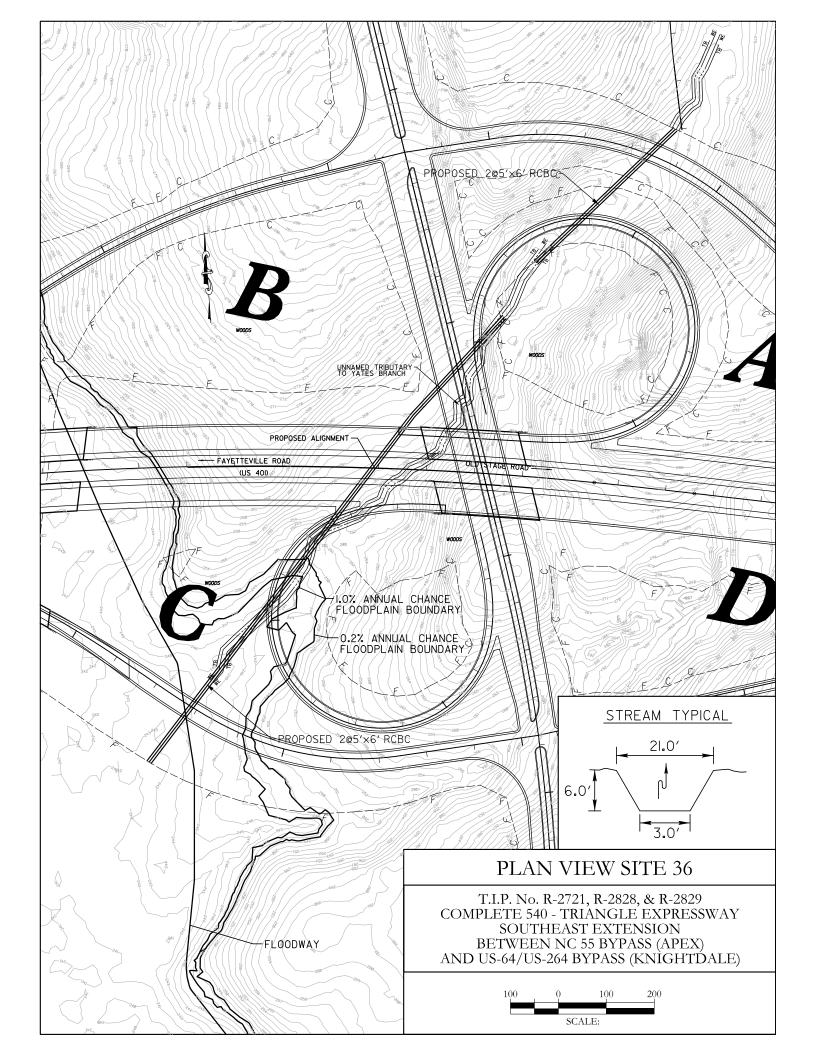
COMMENTS: \_\_\_\_\_

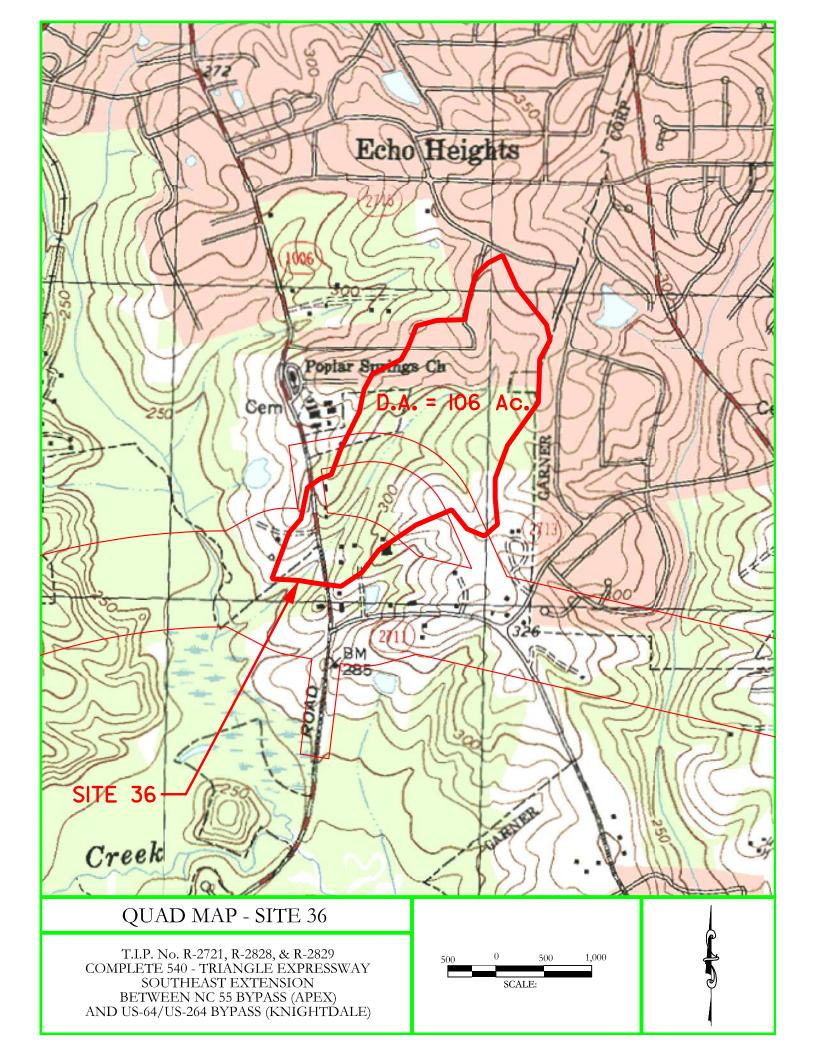
## TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 20,000 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 55,200 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? $N/A$
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS
NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICTNAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Chewacla TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service
ENVIRONMENTAL CONSIDERATIONS
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN:
MISCELLANEOUS COMMENTS
IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED

ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
ALTERNATIVES
RECOMMENDED DESIGN Bridge
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING 40,792 Sq. Ft. 480' Bridge - RPB-
BRIDGE WATERWAY OPENING 52,612 Sq. Ft. Dual 600' Bridges -L-
BRIDGE WATERWAY OPENING 53,090 Sq. Ft. 605' Bridge -RPC-
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YESNO $\underline{X}$ DISCUSSION: THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:

		Neus	se River Basir
Name	Index Number	Classification	Class Date
Description		Special D	esignation
trouds Creek	27-2-9	C;NSW	12/01/83
From source to Eno River			
	27-148-1-6	SA;HQW,NSW	05/01/88
tump Bay			
From source to Long Bay		SA;HQW,NSW	05/01/88
wan Creek	27-144	SA, HQVV, NSVV	05/02/00
From source to Neuse River			
iwan Pond	27-52-7	C;NSW	05/01/88
Entire pond and connecting stream to Mill Creek			
wift Creek	27-97-(6)	SC;Sw,NSW	05/01/88
From mouth of Bear Branch to Neuse River			10 1 90.01
Swift Creek	27-97-(0.5)	C;Sw,NSW	05/01/88
From source to mouth of Bear Branch			
Swift Creek	27-43-(8)	c;nsw	05/01/88
From dam at Lake Benson to Neuse River			
Swift Creek (Lake Benson)	27-43-(5.5)	WS-III;NSW,CA	08/03/92
From a point 0.6 mile upstream of Wake County S	R 1006 to dam at Lake Benson		
Swift Creek (Lake Wheeler)	27-43-(1)	WS-III;NSW	08/03/92
From source to a point 0.6 mile upstream of Wake	e County SR 1006		
Swindell Bay	27-150-8-(2)	sc;sw,NsW	05/01/88
From the narrows to Bay River			
Swindell Bay	27-150-8-(1)	SC;Sw,HQW,NSW	08/01/90
From source to the narrows			
Sycamore Creek (Big Lake)	27-33-9	B;NSW	05/01/88
From source to Crabtree Creek			
Tar Creek	27-150-31-4	SA;HQW,NSW	05/01/88
From source to Gale Creek			
Tar Creek	27-141-4	SA;HQW,NSW	05/01/88
From source to Broad Creek			
Tar Kiln Branch	27-54-6	WS-IV;NSW	08/03/92
From source to Falling Creek			
Tar River	27-71-2-2	WS-IV;NSW	08/01/02
From source to Trotters Creek			





	butary to Yates Branch REGION: BLUE RIDGE	METHOD USED: Fact Sheet: 007-00
	STREAM NAME: Unnamed Tri	sq. miles
	ly SE Ext.	0.17
14	NAME: Triangle Expresswa	Drainage Area =
3/18/201	PROJECT	ENGLISH

JSGS RUF	SGS RURAL REGRE	SSION EQU	ATIONS (OLD)	RUF	SAL EQUA	ATIONS Reg	oort 01-4207
REQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)
2YR	8.10	22.65	42.33	2YR	38.91	19.63	9.49
5YR	13.20	53.13	75.66	5YR	72.92	41.87	16.03
10YR	17.35	83.56	102.80	10YR	103.35	63.22	21.20
25YR	22.78	141.03	146.31	25YR	151.79	98.26	28.73
50YR	27.46	197.08	183.64	SOYR	195.40	131.55	35.27
100YR	32.60	270.67	230.10	100YR	246.14	171.66	42.26
200YR	40.03	363.31	280.40	200YR	304.82	219.57	50.41
500YR	46.10	522.97	374.67	500YR	397.08	297.43	62.50

## **USGS URBAN REGRESSION EQUATIONS**

חדום

 FREQUENCY
 Sand Hills
 Coastal Plain
 Blue Ridge

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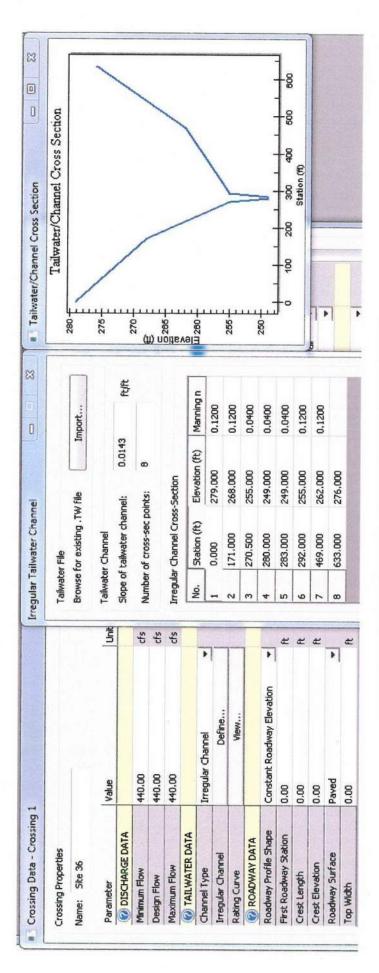
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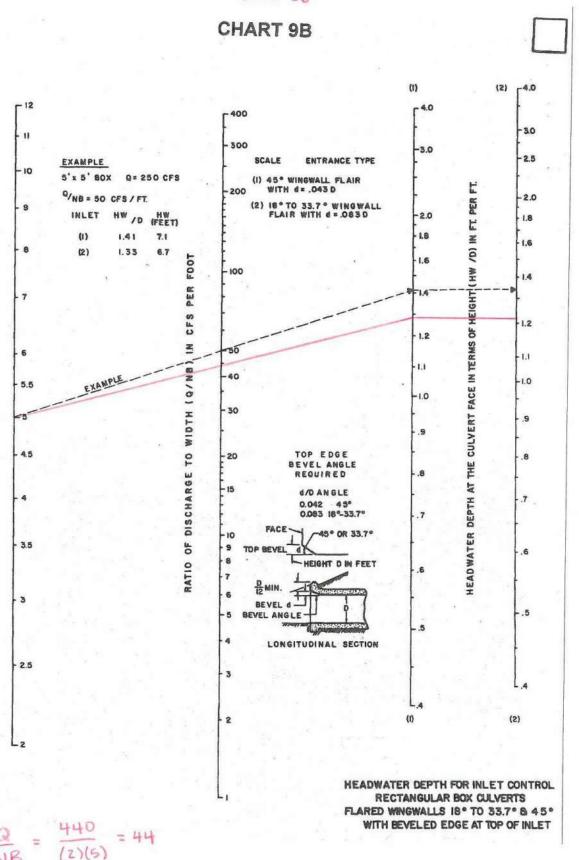
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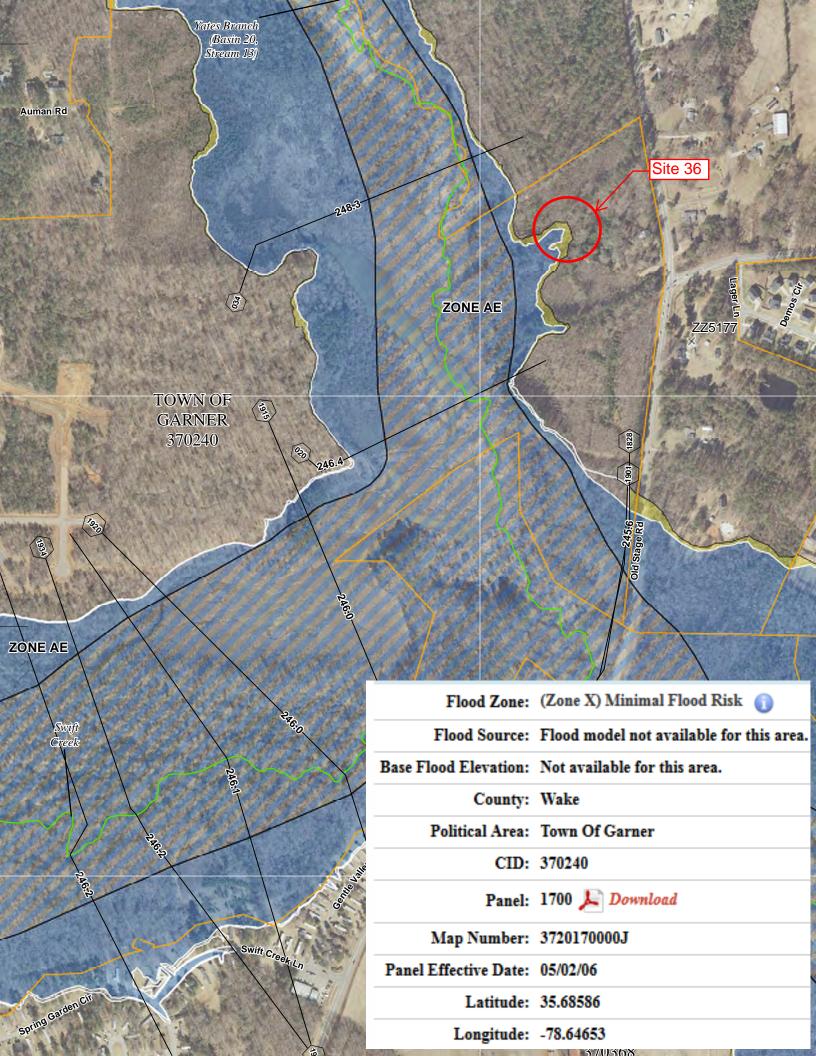
(Based on 2.80xQ10)

Impervious) USGS Fact Sheet 007-00	FEMA	Blue Ridge Discharge Used Disharges	(cfs)	194.71	10YR	385.69	438.97 440	489.85	715.36 (Based on 2.80xQ10)	
EQUATIONS (%		Coastal Plain	(cts)	176.24	240.72	380.19	448.92	515.82	674.02	
SION	40	Sand Hills	(cfs)	118.35	152.26	204.23	236.95	266.18	426.34	
NC REGRES	% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	



440.000         254.007         5.007         8.199         4.467           440.000         254.007         5.007         8.199         4.467           440.000         254.007         5.007         8.199         4.467           440.000         254.007         5.007         8.199         4.467           440.000         254.007         5.007         8.199         4.467           440.000         254.007         5.007         8.199         4.467           440.000         254.007         5.007         8.199         4.467           440.000         254.007         5.007         8.199         4.467           440.000         254.007         5.007         8.199         4.467           440.000         254.007         5.007         8.199         4.467           440.000         254.007         5.007         8.199         4.467	Flow (cfs)	Elevation (ft) Depth (ft)	Depth (ft)	Velocity (ft/s) Shear (psf)	Shear (psf.)
254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199	440.000	254,007	2.007	8.199	4.467
254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199	440.000	254.007	2.007	8.199	4.467
254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199	440.000	254.007	200'5	8,199	4,467
254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199	440,000	254.007	2,007	8.199	4.467
254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199	440,000	254,007	2.007	8.199	4.467
254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199	440.000	254.007	2,007	8.199	4.467
254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199	440.000	254,007	2,007	8,199	4.467
254.007       5.007       8.199         254.007       5.007       8.199         254.007       5.007       8.199	440,000	254,007	2.007	8,199	4,467
254.007 5.007 8.199 254.007 5.007 8.199	440.000	254.007	2,007	8,199	4,467
254.007 5.007 8.199	440,000	254,007	2,007	8.199	4,467
	440.000	254,007	5.007	8,199	4,467





### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000





Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	Riverine	Sources	Affected Communties
	From	То	
Southwest Prong Beaverdam Creek Basin 18, Stream 29)	The confluence with Beaverdam Creek (Basin 18, Stream 28)	Wade Avenue	City Of Raleigh
Spring Branch (Basin 6, Stream 6)	The confluence with Dunn Creek (Basin 6, Stream 5)	Approximately 875 feet upstream of Franklin Street	Town Of Wake Forest
Stirrup Iron Creek	The confluence with Brier Creek (Basin 18, Stream 14)	The Wake/Durham County boundary	Rdu Town Of Cary Town Of Morrisville Wake County
Straight Branch (Basin 20, Stream 23)	The confluence with Lens Branch (Basin 20, Stream 22)	Approximately 1,000 feet upstream of US Route 164	Town Of Cary
Swift Creek	The confluence with the Neuse River	The confluence of Yates Branch (Basin 20, Stream 13)	Rdu Town Of Garner Wake County
Swift Creek Tributary No. 7 (Basin 20, Stream 24)	The confluence with Swift Creek (Basin 20, Stream 1)	Maynard Road	Town Of Cary
Swift Creek Tributary No. 7A (Basin 20, Stream 25)	The confluence with Swift Creek Tributary No. 7 (Basin 20, Stream 24)	Approximately 0.5 mile upstream of confluence with Swift Creek Tributary No. 7 (Basin 20, Stream 24)	Town Of Cary
Sycamore Creek (Basin 18, Stream 6)	Approximately 0.9 mile downstream of Basin 18, Stream 8	Approximately 0.5 mile upstream of A.C.C. Boulevard	City Of Raleigh Rdu Wake County
Ferrible Creek (Basin 22, Stream 19)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 1.0 mile upstream of Sunset Lake Road	Rdu Town Of Fuquay-Varina Wake County
Foms Creek (Basin 7, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 0.9 mile upstream of Forestville Road	Rdu Town Of Rolesville Town Of Wake Forest Wake County
Fributary to Big Branch Tributary No. 1 Basin 30, Stream 8)	The confluence with Big Branch Tributary No. 1 (Basin 30, Stream 6)	Approximately 0.5 mile upstream of confluence with Big Branch Tributary No. 1 (Basin 30, Stream 6)	Town Of Garner
Furkey Creek (Basin 18, Stream 23)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Approximately 1,200 feet upstream of High House Road	Town Of Cary
Furkey Creek (Basin 18, Stream 5)	Approximately 1,160 feet upstream of Sendero Drive	Glenwood Avenue	City Of Raleigh
Jnnamed Stream	The confluence with Basin 19, Stream 3	Railroad	Rdu Town Of Garner Wake County
Jnnamed Tributary (#1) to Swift Creek	The confluence with Swift Creek	The Johnston/Wake County boundary	Rdu Wake County
Jpper Barton Creek (Basin 16, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Victory Church Road	Rdu Wake County
Vest Fork Mine Creek (Basin 18, Stream 3)	The confluence with Mine Creek (Basin 18, Stream 31)	Approximately 0.4 mile upstream of confluence of Mine Creek (Basin 18, Stream 31)	City Of Raleigh
Wheelers Creek (Basin 10, Stream 25)	The confluence with Little River (Basin 10, Stream 1)	Worth Hinton Road	Town Of Zebulon
White Oak Creek	The confluence with Swift Creek	Approximately 0.4 mile upstream of Pergo Parkway	Rdu Town Of Clayton Town Of Garner Wake County
Vildcat Branch (Basin 30, Stream 4)	The confluence with Walnut Creek (Basin 30, Stream 1)	Approximately 1,000 feet upstream of Rush Street	City Of Raleigh
Yates Branch (Basin 20, Stream 13)	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 3.6 miles upstream of Lake Wheeler Road	City Of Raleigh Rdu Town Of Garner Wake County

Site 36

Table 10, "Flooding Sources Studied by Detailed Methods: Limited Detailed", lists all flooding sources within the county that were studied by limited detailed methods for either this FIS or previous FISs.

Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed

14510 10 - 110	oding obdices ofdaled	by Detailed Methods. En	inted Detailed
Source	Riverine	Sources	Affected Communties
	From	То	
Adams Branch (Basin 30, Stream 9)	Corwin Road	Approximately 0.2 mile upstream of Meadowbrook Drive	Town Of Garner
Angier Creek (Basin 24, Stream 4)	Railroad	Approximately 0.7 mile upstream of Old Baron Drive	Town Of Fuquay-Varina
Armory Tributary (Basin 18, Stream 38)	The confluence with Richland Creek (Basin 18, Stream 3)	Approximately 0.5 mile upstream of confluence with Richland Creek (Basin 18, Stream 3)	City Of Raleigh
Bachelor Branch (Basin 28, Stream 6)	The confluence with White Oak Creek	Approximately 530 feet upstream of Highway 55	Rdu Town Of Cary Wake County

Table 13 - Summary of Discharges

Table 13 - Summ	ary of Dis	charges	<b>-</b>		
Flooding Source Location	Drainage Area	10% Annual	Dischar 2% Annual	rges (cfs) 1% Annual	0.2% Annual
Location	(square miles)	Chance	Chance	Chance	Chance
Approximately 530 feet downstream of Lake Dam Road	7.00	*	*	2,150	*
At Lake Johnson Dam	6.92	*	*	6,020	*
Approximately 1.3 miles upstream of Lake Johnson Dam	5.35	*	*	4,230	*
Approximately 1.6 miles upstream of Lake Johnson Dam	4.36	*	*	3,480	*
Approximately 2.0 miles upstream of Lake Johnson Dam	3.55	*	*	2,800	*
At Interstate 40	2.92	*	*	2,340	*
Approximately 0.4 mile downstream of Cary Towne Boulevard	2.01	*	*	2,210	*
Approximately 530 feet upstream of Cary Towne Boulevard	1.36	*	*	1,870	*
Approximately 1,580 feet downstream of York Street	1.12	*	*	1,780	*
West Fork Mine Creek (Basin 18, Stream 33)					
At mouth	3.50	*	*	2,070	*
Wheelers Creek (Basin 10, Stream 25)					
At mouth	1.70	*	*	1,430	*
Approximately 0.6 mile upstream of State Road 97	1.00	*	*	1,020	*
At pond	0.10	*	*	310	*
White Oak Creek	[0.10			1010	
	7.00	*		2.250	*
At County boundary	7.90		*	3,350	
Just upstream of Basin 19, Stream 3	3.80		*	2,220	
Approximately 0.7 mile upstream of Raynor Road just upstream of tributary	2.20	^		1,700	<u> </u>
White Oak Creek (Basin 26, Stream 1)					T
At the confluence with Utley Creek	15.90	*	*	4,191	*
Approximately 0.6 mile upstream of the confluence with Utley Creek	15.50	*	*	4,136	*
Approximately 0.4 mile downstream of Holly Springs New Hill Road	15.40	*	*	4,122	*
Approximately 220 feet downstream of Holly Springs New Hill Road	14.70	*	*	4,004	*
Approximately 0.7 mile upstream of Holly Springs New Hill Road	13.30	*	*	3,756	*
Approximately 1,580 feet downstream of confluence with Big Branch (Basin 26, Stream 5)	12.70	*	*	3,652	*
Approximately 1,060 feet upstream of confluence with Big Branch (Basin 26, Stream 5)	1.60	*	*	990	*
Approximately 0.5 mile upstream of confluence with Big Branch (Basin 26, Stream 5)	1.40	*	*	924	*
Approximately 1,580 feet downstream of Woods Creek Road	1.00	*	*	758	*
Approximately 200 feet downstream of Woods Creek Road	1.00	*	*	728	*
Approximately 740 feet upstream of Woods Creek Road	0.90	*	*	680	*
Approximately 0.4 mile upstream of Woods Creek Road	0.80	*	*	638	*
Approximately 1,580 feet downstream of Highway 1	0.70	*	*	576	*
Approximately 810 feet downstream of Highway 1	0.50	*	*	472	*
Approximately 1,060 feet upstream of Highway 1	0.30	*	*	377	*
Wildcat Branch (Basin 30, Stream 4)					
At mouth	2.10	*	*	1,400	*
Just downstream of Railroad	1.90	*	*	1,300	*
Just upstream of Railroad	1.90	*	*	1,700	*
Just downstream of fork near Montlawn Cemetery	1.40	*	*	1.550	*
Yates Branch (Basin 20, Stream 13)					
, ,	13.40	*	*	4.920	*
At mouth		*	*		*
At Raif bad	10.40	l		4,315	1

Table 21 - Floodway Data

Floodwa	y Source		Floodway			Wa	ter Surface Eleva	ation	
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
287	28,726	725	3,709	1.4	262.2	*	262.2	263.2	1.0
294	29,394	525	2,397	2.1	263.2	*	263.2	264.1	1.0
301	30,052	350	1,593	3.2	264.8	*	264.8	265.7	0.9
312	31,246	285	1,747	1.9	269.1	*	269.1	269.7	0.7
317	31,681	200	14	2.6	269.4	*	269.4	270.0	0.6
330	32,980	370	1,834	1.2	249.7	*	249.7	250.1	0.4
353	35,280	195	668	3.4	250.9	*	250.9	251.7	0.8
434	43,395	170	755	3.0	286.7	*	286.7	287.3	0.6
Wildcat Brand	ch (Basin 30, S	tream 4)							,
026	2,600	242	466	2.8	237.1	*	237.1	237.1	0.0
031	3,060	422	3,323	0.5	242.5	*	242.5	242.5	0.0
055	5,480	150	971	1.6	249.1	*	249.1	249.1	0.0
067	6,660	120	465	3.3	251.4	*	251.4	252.3	0.9
Yates Branch	(Basin 20, Str	eam 13)							
020	2,000	702	2,517	2.0	246.4	*	246.4	246.4	0.0
034	3,400	575	2,660	1.8	248.3	*	248.3	248.3	0.0
055	5,450	300	1,625	3.0	251.4	*	251.4	251.6	0.2
Site 36	6,900	185	1,245	4.0	254.9	*	254.9	255.7	0.8
087	8,710	190	1,288	2.7	258.1	*	258.1	258.8	0.7
098	9,750	210	1,105	3.9	260.9	*	260.9	261.3	0.4
197	19,666	63	504	6.7	284.8	*	284.8	285.4	0.6
311	31,115	350	557	4.3	343.3	*	343.3	343.3	0.0
386	38,570	120	595	4.0	408.4	*	408.4	409.0	0.6

<sup>&</sup>lt;sup>1</sup>Elevation includes backwater effects

<sup>&</sup>lt;sup>2</sup>ELEVATION INCLUDES FLOODING CONTROLLED BY MIDDLE CREEK (BASIN 22, STREAM 1)

<sup>&</sup>lt;sup>3</sup>ELEVATION INCLUDES FLOODING CONTROLLED BY HORSE CREEK (BASIN 4, STREAM 1)

<sup>&</sup>lt;sup>4</sup>Combined floodway width of Horse Creek (Basin 4, Stream 1) and Basin 4, Stream 3

<sup>&</sup>lt;sup>5</sup>ELEVATION INCLUDES FLOODING CONTROLLED BY CRABTREE CREEK (BASIN 18, STREAM 9)

<sup>&</sup>lt;sup>6</sup>Feet above county boundary

<sup>&</sup>lt;sup>7</sup>Upstream flood hazard information is studied by new detailed methods. These methods reflect more detailed and up-to-date stream channel configurations. As a result, the stream channel distances may not agree with the adjoining redelineated portion of the stream.

<sup>&</sup>lt;sup>8</sup>ELEVATION INCLUDES FLOODING CONTROLLED BY MARSH CREEK (BASIN 18, STREAM 17)

<sup>&</sup>lt;sup>9</sup>Combined floodway width of Marsh Creek (Basin 18, Stream 17) and Millbrook Tributary to Marsh Creek (Basin 18, Stream 19)

<sup>&</sup>lt;sup>10</sup>Value is inaccurate, as the floodway has been adjusted in this area to match topographic-based floodplain redelineation

<sup>&</sup>lt;sup>11</sup>Combined floodway width of Sanford Creek (Basin 6, Stream 7) and Reedy Creek (Basin 6, Stream 8)

<sup>12</sup> ELEVATION INCLUDES FLOODING CONTROLLED BY WALNUT CREEK (BASIN 30, STREAM 1)

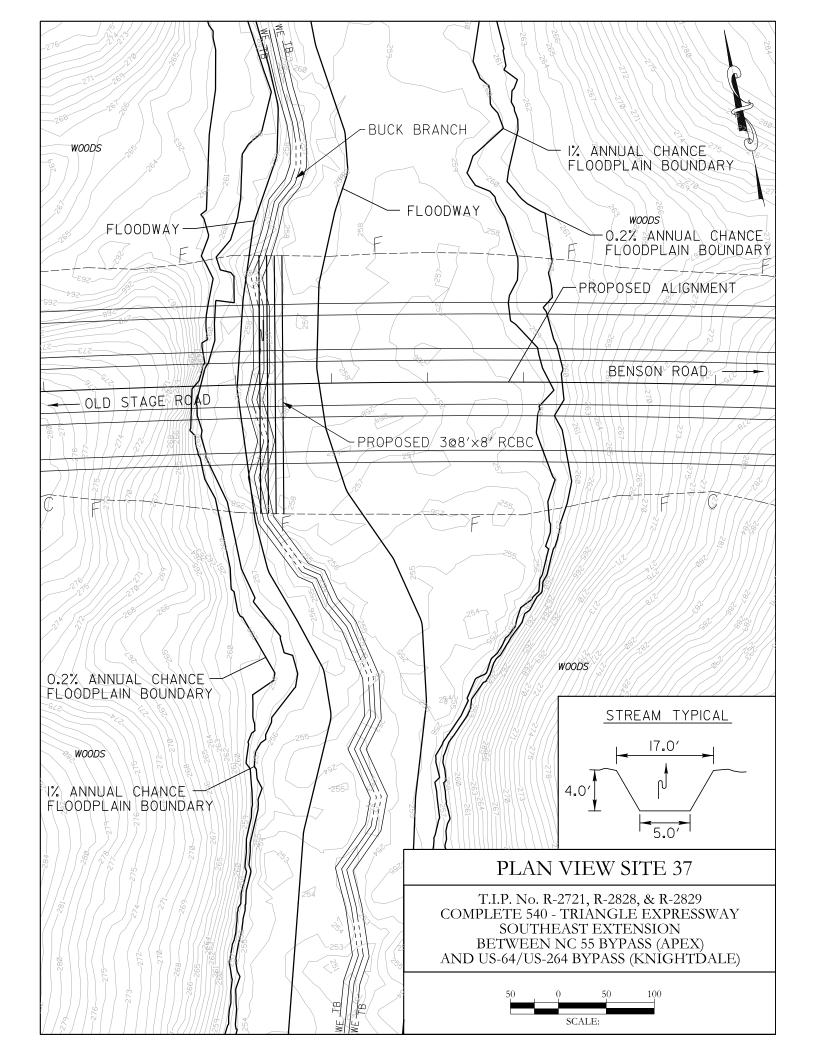
<sup>13</sup>Combined floodway width of Smith Creek (Basin 6, Stream 1) and Dunn Creek (Basin 6, Stream 5)

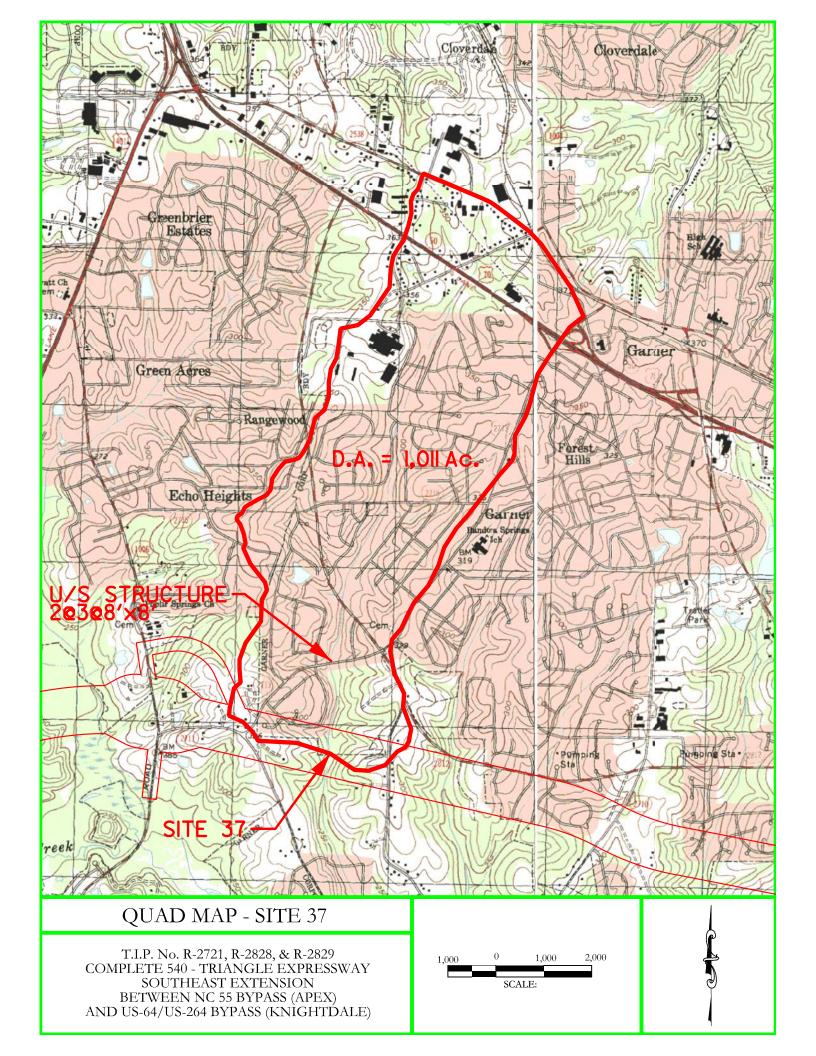
<sup>14</sup> ELEVATION INCLUDES FLOODING CONTROLLED BY DUNN CREEK (BASIN 6, STREAM 5)

<sup>&</sup>lt;sup>15</sup>Combined floodway width of Stirrup Iron Creek (Basin 18, Stream 12) and Brier Creek (Basin 18, Stream 14)

Name	Index Number	Ne Classification	euse River Basir Class Date
Description		Specia	al Designation
Strouds Creek	27-2-9	C;NSW	12/01/83
From source to Eno River			
Stump Bay	27-148-1-6	SA;HQW,NSW	05/01/88
From source to Long Bay			
Swan Creek	27-144	SA;HQW,NSW	05/01/88
From source to Neuse River			
Swan Pond	27-52-7	C;NSW	05/01/88
Entire pond and connecting stream to Mill Creek			
Swift Creek	27-97-(6)	SC;Sw,NSW	05/01/88
From mouth of Bear Branch to Neuse River			
Swift Creek	27-97-(0.5)	C;Sw,NSW	05/01/88
From source to mouth of Bear Branch			
Swift Creek	27-43-(8)	C;NSW	05/01/88
From dam at Lake Benson to Neuse River			
Swift Creek (Lake Benson)	27-43-(5.5)	WS-III;NSW,CA	08/03/92
From a point 0.6 mile upstream of Wake County SR 10	006 to dam at Lake Benson		
Swift Creek (Lake Wheeler)	27-43-(1)	WS-III;NSW	08/03/92
From source to a point 0.6 mile upstream of Wake Co	unty SR 1006		
Swindell Bay	27-150-8-(2)	SC;Sw,NSW	05/01/88
From the narrows to Bay River			
Swindell Bay	27-150-8-(1)	SC;Sw,HQW,NSW	08/01/90
From source to the narrows			
Sycamore Creek (Big Lake)	27-33-9	B;NSW	05/01/88
From source to Crabtree Creek			
Tar Creek	27-150-31-4	SA;HQW,NSW	05/01/88
From source to Gale Creek			
Tar Creek	27-141-4	SA;HQW,NSW	05/01/88
From source to Broad Creek			
Tar Kiln Branch	27-54-6	WS-IV;NSW	08/03/92
From source to Falling Creek			
Tar River	27-71-2-2	WS-IV;NSW	08/01/02
From source to Trotters Creek			

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### **North Carolina**

4/22/2014 PROJECT NAME: Triangle Expressway SE Ext.

ENGLISH

REGION: BLUE RIDGE METHOD USED: Fact Sheet: 007-00 STREAM NAME: Buck Branch sd. miles 1.58 Drainage Area =

RURAL EQUATIONS Report 01-4207	Soastal Plain Sand Hills	(cfs) (cfs)	88.02 46.40	172.48 76.48	249.08 100.27	368.56 134.69	478.29 164.61	606.30 195.89	755.01 232.66	989.14 287.14
<b>SAL EQUAT</b>	Blue Ridge (	(cfs)	186.12	329.84	452.12	639.35	804.90	991.56	1203.53	1529.84
RUF	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR
ATIONS (OLD)	Blue Ridge	(cfs)	197.53	336.94	452.74	630.14	782.17	964.86	1165.36	1502.59
SSION EQUA	Coastal Plain	(cfs)	92.66	194.45	290.56	461.74	619.88	819.68	1066.39	1471.38
<b>USGS RURAL REGRESSION EQUA</b>	Sand Hills	(cfs)	41.53	68.40	90.34	121.53	148.45	178.63	219.84	261.22
3UR	NCY		~	~	Œ	Œ	Œ	Æ	200YR	Æ

## **USGS URBAN REGRESSION EQUATIONS**

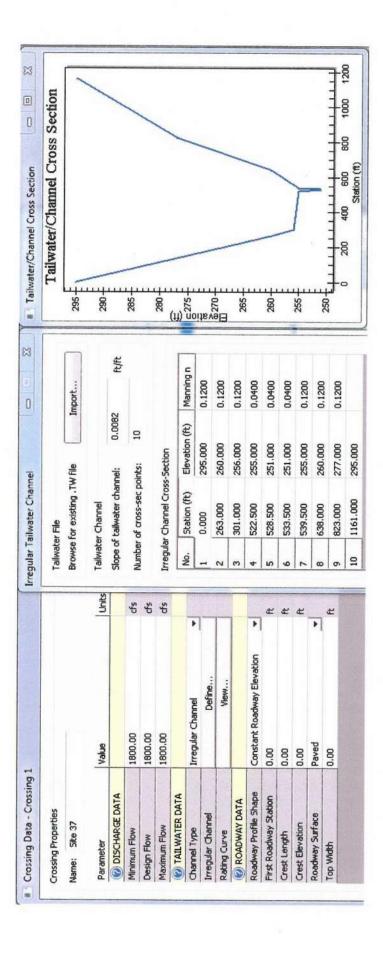
BDF= 11

(These Equations are used only for comparison)

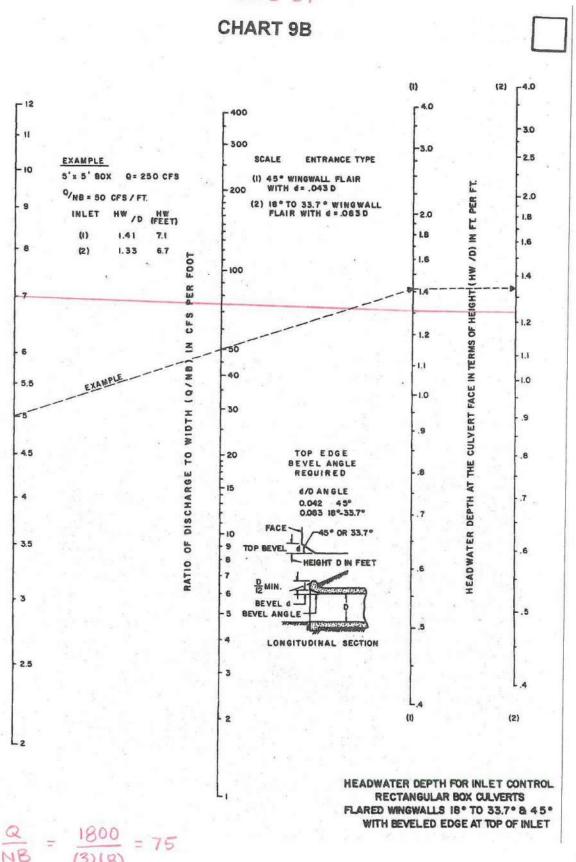
								(Based on 2.80xQ10)	
	Blue Ridge	(cfs)	818.78	989.35	1275.02	1521.60	1850.21	2798.19	2629.10
of company	Coastal Plain	(cfs)	533.27	703.96	994.22	1260.35	1618.64	1971.09	2584.22
(coc Edamento aro accedente)	Sand Hills	(cts)	236.05	279.74	341.76	396.00	464.04	783.26	626.24
יייים בלממנים	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

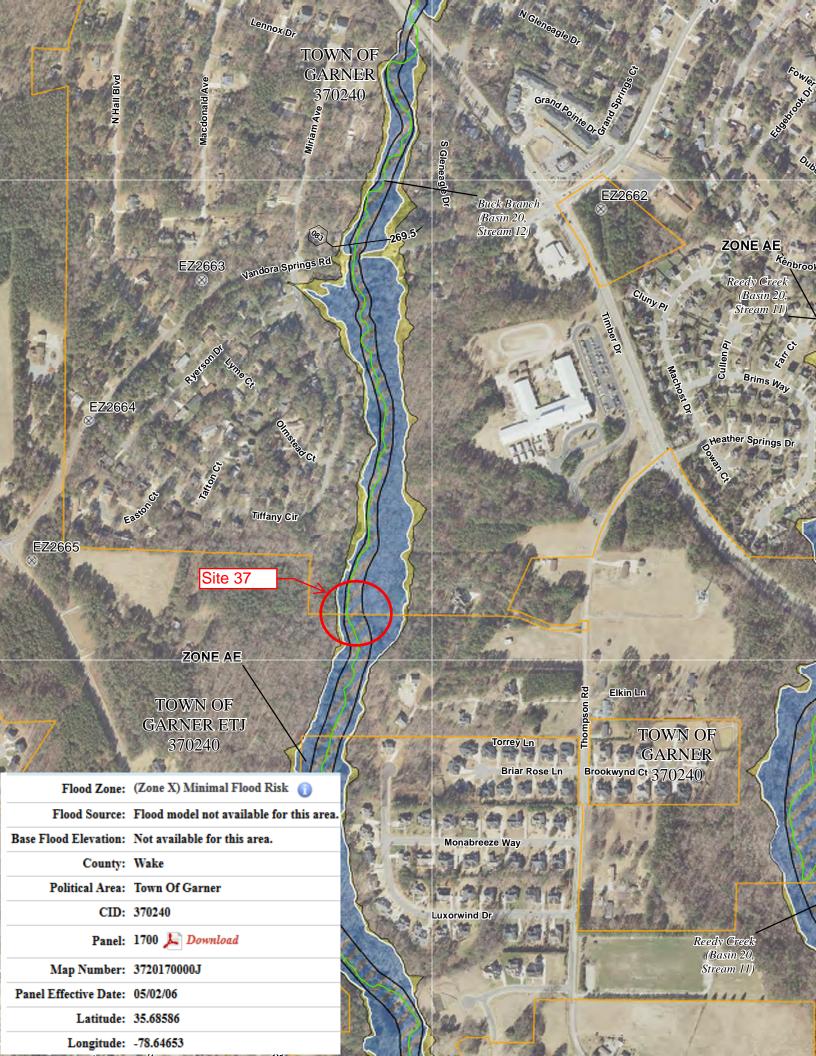
# NC REGRESSION EQUATIONS (% Impervious) USGS Fact Sheet 007-00

FEMA	Disharges			1120	1520			
핃	FREQUENCY		10YR	50YR	100YR	500YR		
	Blue Ridge Discharge Used				1800		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	Blue Ridge	950.60	1169.19	1585.31	1760.17	1916.57	3273.73	4279.23
	Coastal Plain	811.97	1030.37	1426.20	1631.85	1821.47	2885.03	3771.14
45	Sand Hills	602.81	731.84	903.54	1027.23	1131.00	2049.16	2678.54
% Impervious =	FREQUENCY	5YR	10YR	25YR	50YR	100YR	200YR	500YR



Flow (cfs)	Elevation (ft) Depth (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
1800,000	257.642	6,642	2.792	3,398
1800.000	257.642	6,642	2.792	3,398
1800.000	257,642	6.642	2.792	3,398
1800,000	257,642	6,642	2,792	3,398
1800,000	257.642	6.642	2.792	3,398
1800.000	257,642	6.642	2.792	3,398
1800.000	257,642	6.642	2.792	3.398
1800.000	257.642	6.642	2.792	3.398
1800.000	257.642	6.642	2.792	3,398
1800.000	257.642	6.642	2.792	3.398
1800,000	257,642	6,642	2.792	3.398





### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000





Source	ooding Sources Studied	Sources Sources	Affected Communities
Source	From	To	Affected Communities
Basin 22, Stream 6	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.5 mile upstream of Optimist Farm Road	Rdu Wake County
Basin 22, Stream 9	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.7 mile upstream of Optimist Farm Road	Rdu Town Of Holly Springs Wake County
Basin 27, Stream 4	The confluence with Beaver Creek (Basin 27, Stream 2)	Approximately 0.3 mile upstream of confluence with Beaver Creek (Basin 27, Stream 2)	Town Of Apex
Basin 3, Stream 6	The confluence with Newlight Creek (Basin 3, Stream 1)	Approximately 1.3 miles upstream of confluence with Newlight Creek (Basin 3, Stream 1)	Rdu Wake County
Basin 3, Stream 8	The confluence with Newlight Creek (Basin 3, Stream 1)	Approximately 1.2 miles upstream of Bold Run Hill Road	Rdu Wake County
Basin 30, Stream 3	The confluence with Big Branch (Basin 30, Stream 2)	Approximately 1.1 miles upstream of Auburn Church Road	City Of Raleigh
Basin 4, Stream 13	The confluence with Lowery Creek (Basin 4, Stream 10)	Approximately 1.1 miles upstream of confluence with Lowery Creek	Rdu Wake County
Basin 4, Stream 3	The confluence with Horse Creek (Basin 4, Stream 1)	Purnell Road	Rdu Town Of Wake Forest Wake County
Basin 6, Stream 9	The confluence with Sanford Creek (Basin 6, Stream 7)	Rogers Road	Town Of Rolesville Town Of Wake Forest
Beaver Creek Tributary (Basin 27, Stream 3)	The confluence with Beaver Creek (Basin 27, Stream 2)	Approximately 0.3 mile downstream of Holland Road	Town Of Apex
Beaverdam Creek	Entire shoreline in Wake County	Entire shoreline in Wake County	Rdu Wake County
Beaverdam Creek	The confluence of Moccasin Creek (Basin 11, Stream 1)	Approximately 0.7 mile upstream of Pearces Road	Rdu Town Of Zebulon Wake County
Beaverdam Creek (Basin 12, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Old Crews Road	City Of Raleigh Town Of Knightdale
Beaverdam Creek (Basin 15, Stream 21)	The confluence with Neuse River (Basin 15, Stream 1)	Kyle Drive	City Of Raleigh
Big Branch (Basin 10, Stream 8)	The confluence with Little River (Basin 10, Stream 1)	Highway 96/Zebulon Road	Rdu Wake County
Big Branch (Basin 30, Stream 2)	The confluence with Walnut Creek (Basin 30, Stream 1)	Auburn Church Road	City Of Raleigh Town Of Garner
Big Branch Tributary No.1 (Basin 30, Stream 6)	Approximately 0.5 mile upstream of Interstate 40	The confluence of Adams Branch (Basin 30, Stream 9)	Town Of Garner
Black Creek Tributary A (Basin 18, Stream 11)	The confluence with Crabtree Creek (Basin 18, Stream 9)	North Harrison Avenue	Town Of Cary
Bradley Creek (Basin 24, Stream 3)	The confluence with Kenneth Creek (Basin 24. Stream 2)	South Main Street (U.S. Route 401)	Town Of Fuquay-Varina
Buck Branch (Basin 20, Stream 12)	The confluence with Reedy Creek (Basin 20, Stream 11)	Approximately 0.7 mile upstream of Vandora Springs Road	Rdu Town Of Garner Wake County
Buckhow Branch (Basin 3, Stream 9)	The confluence with Newlight Creek (Basin 3, Stream 1)	Approximately 1.4 miles upstream of the confluence with Newlight Creek (Basin 3, Stream 1)	Rdu Wake County
Branch (Basin 10, Stream 22)	The confluence with Little River (Basin 10, Stream 1)	Morphus Bridge Road	Rdu Town Of Wendell Wake County
Buffalo Creek (Basin 9, Stream 1)	The Wake/Johnston County boundary	Robertsons Pond Dam	Rdu Town Of Wendell Wake County
Buffalo Creek West	The confluence with Middle Creek (South)	The Johnston/Wake County boundary	Rdu Wake County
Camp Branch (Basin 22, Stream 7)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 2.0 miles upstream of Optimist Farm Road	Rdu Town Of Cary Wake County
Cedar Creek (Basin 15, Stream 34)	The confluence with Falls Lake	Approximately 0.4 mile upstream of Coachmans Way	Rdu Wake County
Coles Branch (Basin 18, Stream 24)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Approximately 0.5 mile downstream of Maynard Road	Town Of Cary Town Of Morrisville
Crabtree Creek (Basin 18, Stream 9)	Approximately 3.4 miles upstream of Ebenezer Church Road	Approximately 1 mile upstream of Southwest Cary Parkway	City Of Durham City Of Raleigh Rdu Town Of Cary Town Of Morrisville Wake County
Crabtree Creek (Basin 18, Stream 9)	The confluence with Neuse River (Basin 15, Stream 1)	Ebenezer Church Road	City Of Raleigh
Dunn Creek (Basin 6, Stream 5)	The confluence with Smith Creek (Basin 6, Stream 1)	Approximately 1.0 mile upstream of Oak Grove Church Road	Town Of Wake Forest
Dutchmans Branch (Basin 20, Stream 17)	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 0.7 mile upstream of Dutchman Drive	Rdu Town Of Cary Wake County

**Table 13 - Summary of Discharges** 

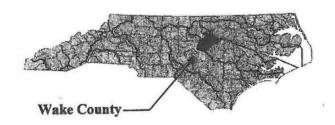
Flooding Source	D	400/ 4		rges (cfs)	0.00( 1
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annu Chance
Buck Branch (Basin 20, Stream 12)					_
Just upstream of lake	1.90	*	*	1,520	*
At State Route 2715	0.80	*	*	950	*
7 pckhorn Branch (Basin 3, Stream 9)					
At mouth	3.20	*	*	2,000	*
Buckhorn Creek	·				
Approximately 250 feet upstream of Cass Holt Road	11.40	*	*	3,395	*
Approximately 1,580 feet downstream of Sweet Springs Road	10.20	*	*	3,176	*
Just downstream of Sweet Springs Road	8.70	*	*	2,887	*
Approximately 0.6 mile upstream of Sweet Springs Road	8.50	*	*	2,842	*
Approximately 1.6 miles upstream of Sweet Springs Road	7.90	*	*	2,704	*
Approximately 1.2 miles downstream of Buckhorn Duncan Road	5.90	*	*	2,268	*
Approximately 0.8 mile downstream of Buckhorn Duncan Road	5.60	*	*	2,180	*
Approximately 0.4 mile downstream of Buckhorn Duncan Road	5.30	*	*	2,105	*
Approximately 180 feet downstream of Buckhorn Duncan Road	3.10	*	*	1,508	*
Approximately 1,060 feet upstream of Buckhorn Duncan Road	2.80	*	*	1,429	*
Approximately 0.4 mile upstream of Buckhorn Duncan Road	2.70	*	*	1,396	*
Approximately 1.1 miles downstream of Rouse Road	2.60	*	*	1,360	*
Approximately 0.9 mile downstream of Rouse Road	2.20	*	*	1,234	*
Approximately 0.7 mile downstream of Rouse Road	1.90	*	*	1,099	*
Approximately 0.4 mile downstream of Rouse Road	1.00	*	*	745	*
Approximately 0.6 mile downstream of Rouse Road	1.00	*	*	759	*
Approximately 1,060 feet downstream of Rouse Road	0.90	*	*	709	*
Just downstream of Rouse Road	0.90	*	*	682	*
Approximately 530 feet upstream of Rouse Road	0.80	*	*	625	*
Approximately 0.6 mile upstream of Rouse Road	0.60	*	*	528	*
Approximately 0.5 mile downstream of Honeycutt Road	0.40	*	*	414	*
Approximately 1,060 feet downstream of Honeycutt Road	0.30	*	*	339	*
Approximately 1,580 feet downstream of Honeycutt Road	0.30	*	*	360	*
Approximately 1,060 feet upstream of Honeycutt Road	0.20	*	*	233	*
Approximately 450 feet upstream of Honeycutt Road	0.20	*	*	255	*
Just downstream of Honeycutt Road	0.20	*	*	287	*
Approximately 0.4 mile upstream of Honeycutt Road	0.03	*	*	84	*
Buffalo Branch (Basin 10, Stream 22)					
Just downstream of Lake Johnson <sup>4</sup>	0.90	*	*	635	*
Just upstream of Lake Johnson	0.90	*	*	950	*
At Morphus Bridge Road	0.40	*	*	600	*
Buffalo Creek (Basin 9, Stream 1)					
At County boundary	18.40	*	*	5,300	*
Approximately 0.5 mile downstream of Railroad	14.00	*	*	4,600	*
At Robertsons Pond Dam	9.40	*	*	3,550	*
Approximately 0.4 mile upstream of Robertson Pond Road	9.35	*	*	3,010	*
Approximately 0.4 mile upstream of Riley Hill School Road	7.14	*	*	2,540	*
Approximately 1,580 feet downstream of Riley Hill School Road	6.25			2,340	1.

	Table 21 - Floodway Data								
	y Source		Floodway				ter Surface Eleva		
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
169	16,928	60	1,395	1.1	329.2	329.6	329.2	330.1	0.9
173	17,296	60	1,439	1.1	329.2	329.6	329.2	330.1	0.9
178	17,754	60	1,368	1.1	329.2	329.6	329.2	330.1	0.9
181	18,126	60	1,036	1.5	329.2	329.6	329.2	330.1	0.9
186	18,642	60	897	1.6	329.2	329.6	329.2	330.2	1.0
190	19,016	60	799	1.8	329.2	329.6	329.2	330.2	1.0
195	19,513	60	721	2.0	329.2	329.6	329.2	330.2	1.0
Buck Branch	(Basin 20, Stre	eam 12)	T		T	T		T	T
025	2,500	130	492	3.1	240.4	*	240.4	241.4	1.0
083	8,340	100	523	2.9	269.5	*	269.5	270.2	0.7
123	12,250	100	182	5.2	286.7	*	286.7	286.7	0.0
Site 37	nch (Basin 3,	Stream 9)			ı				
011	1,120	100	341	5.9	267.0	*	267.0	268.0	1.0
055	5,500	115	643	3.1	285.4	*	285.4	286.4	1.0
073	7,260	285	438	4.6	298.3	*	298.3	298.3	0.0
Buffalo Branc	h (Basin 10, S	tream 22)	I	l	I	I		I	l
024	2,425	40	163	3.7	227.8	*	227.8	228.5	0.7
038	3,830	130	205	4.3	241.6	*	241.6	241.6	0.0
041	4,090	140	867	1.0	255.7	*	255.7	256.0	0.3
045	4,475	170	690	1.3	255.7	*	255.7	256.0	0.3
056	5,550	130	314	2.3	257.2	*	257.2	257.8	0.6
070	7,000	60	146	4.1	269.0	*	269.0	269.0	0.0
Buffalo Creek	(Basin 9, Stre	am 1)	I		I	I		I	
039	3,9006	260	2,157	2.4	250.4	*	250.4	251.4	1.0
067	6,670 <sup>6</sup>	185	957	5.4	255.8	*	255.8	255.8	0.0
078	7,830 <sup>6</sup>	255	1,956	2.5	261.5	*	261.5	261.6	0.1
094	9,3606	140	1,378	3.6	263.0	*	263.0	263.4	0.4
128	12,750 <sup>6</sup>	430	4,519	1.1	266.2	*	266.2	266.8	0.6
161	16,140 <sup>6</sup>	540	3,309	1.4	266.8	*	266.8	267.4	0.6
202	20,2006	335	2,279	2.0	269.2	*	269.2	269.9	0.7
223	22,3006	315	1,760	2.6	273.1	*	273.1	274.1	1.0
253	25,330 <sup>6</sup>	270	1,825	2.5	279.4	*	279.4	280.2	0.8
271	27,1006	560	4,287	1.1	282.3	*	282.3	283.0	0.7
308	30,8306	545	4,294	1.1	284.5	*	284.5	284.5	0.0
326	32,630 <sup>6</sup>	55	358	9.9	284.5	*	284.5	285.2	0.7
Camp Branch	(Basin 22, Str	eam 7)				I			
019	1,885	230	830	2.7	291.7	*	291.7	292.5	0.8
025	2,490	210	829	2.7	293.9	*	293.9	294.7	0.8
030	3,045	245	749	3.0	296.3	*	296.3	296.8	0.5
056	5,550	75	356	5.8	310.2	*	310.2	310.9	0.7
063	6,260	135	593	2.8	314.3	*	314.3	314.9	0.6
069	6,860	115	446	3.6	316.3	*	316.3	316.9	0.6
079	7,880	140	514	3.2	321.0	*	321.0	321.8	0.8
092	9,200	160	572	2.8	326.7	*	326.7	327.1	0.4
096	9,580	150	757	2.0	330.5	*	330.5	331.1	0.6

A Report of Flood Hazards in

WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 1 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuguay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV001A



Table 10-Roughness Coefficients

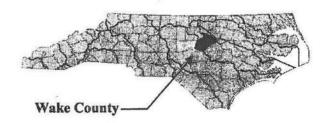
Stream	Channel "n"	Overbank "n"
Basin 22, Stream 6	0.030 - 0.070	0.070 - 0.110
Basin 22, Stream 9	0.030 - 0.070	0.070 - 0.110
Basin 22, Stream 20	0.030 - 0.070	0.070 - 0.110
Basin 23, Stream 2	0.050	0.140
Basin 23, Stream 2 Tributary	0.050	0.150
Basin 23, Stream 3	0.048	0.140
Basin 23, Stream 4	0.050	0.150
Basin 23, Stream 5	0.050	0.150
Basin 27, Stream 4	0.030 - 0.070	0.070 - 0.110
Basin 28, Stream 7	0.050 - 0.055	0.150 - 0.155
Basin 28, Stream 8	0.047 - 0.050	0.100 - 0.200
Basin 30, Stream 3	0.030 - 0.070	0.070 - 0.110
Beaver Creek (Basin 27, Stream 2)	0.043 - 0.050	0.100 - 0.200
Beaverdam Creek (Basin 11, Stream 3)	0.030 - 0.070	0.070 - 0.130
Beaverdam Creek (Basin 12, Stream 1)	0.024 - 0.070	0.070 - 0.130
Beaverdam Creek (Basin 15, Stream 21)	0.018 - 0.070	0.070 - 0.130
Beaverdam Creek (Basin 18, Stream 28)	0.040 - 0.055	0.090 - 0.200
Beaver Creek Tributary (Basin 27, Stream 3)	0.030 - 0.070	0.070 - 0.110
Big Branch	0.050	0.140
Big Branch (Basin 10, Stream 8)	0.030 - 0.070	0.070 - 0.130
Big Branch (Basin 18, Stream 21)	0.035 - 0.055	0.090 - 0.200
Big Branch (Basin 26, Stream 5)	0.050	0.140
Big Branch (Basin 30, Stream 2)	0.030 - 0.070	0.070 - 0.110
Big Branch Tributary No. 1 (Basin 30, Stream 6)	0.030 - 0.070	0.070 - 0.120
Adams Branch (Basin 30, Stream 9)	0.030 - 0.070	0.070 - 0.110
Black Creek (Basin 23, Stream 1)	0.045	0.150
Black Creek Tributary A (Basin 18, Stream 11)	0.030 - 0.070	0.070 - 0.110
Bradley Creek (Basin 24, Stream 3)	0.030 - 0.070	0.070 - 0.110
Bridges Branch	0.050	0.130
Brier Creek (Basin 18, Stream 14)	0.024 - 0.040	0.100 - 0.200
Buck Branch (Basin 20, Stream 12)	0.030 - 0.070	0.070 - 0.011
Buckhorn Branch (Basin 3, Stream 9)	0.030 - 0.070	0.070 - 0.011
Buckhorn Creek	0.040 - 0.048	0.145
Buffalo Branch (Basin 10, Stream 22)	0.030 - 0.070	0.070 - 0.110
Buffalo Creek (Basin 9, Stream 1)	0.030 - 0.070	0.070 - 0.130
Camp Branch (Basin 22, Stream 7)	0.030 - 0.070	0.070 - 0.110
Cary Branch	0.040	0.140
Cedar Creek (Basin 15, Stream 34)	0.030 - 0.070	0.070 - 0.110
Cedar Fork (Basin 10, Stream 15)	0.042	0.130
Clark Branch (Basin 28, Stream 3)	0.050	0.150
Coles Branch (Basin 18, Stream 24)	0.030 - 0.070	0.070 - 0.200

SITE 37

A Report of Flood Hazards in

### WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 4 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse



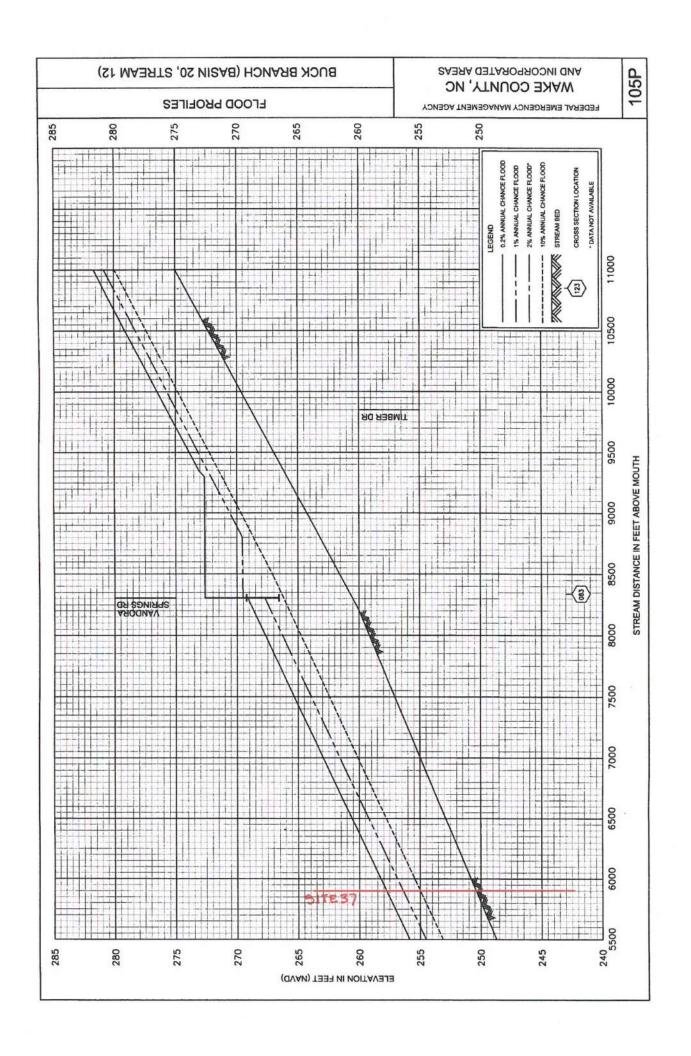


May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV004A





### PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake	PROJECT NUMBER <u>R-2721, R-2828, &amp; R-2829</u>
STREAM Yates Branch (Site 37)	ROUTE New Location
	BY Mulkey, INC. DATE 1/8/2014 (MLH)
	HYDROLOGIC EVALUATION
NEAREST GAGING STAT	ION ON THIS STREAM (NONE X_)
ARE FLOOD STUDIES AV	AILABLE ON THIS STREAM: Yes
FLOOD DATA: Q <sub>10</sub> 1,200 CFS EST. BKV Q <sub>50</sub> 1,800 CFS EST. BKV Q <sub>500</sub> 4,300 CFS EST. BKV	VTR. $\underline{N/A}$ FT. $Q_{25}$ $\underline{1,600}$ CFS EST. BKWTR. $\underline{N/A}$ FT. VTR. $\underline{N/A}$ FT. $Q_{100}$ 1,900 CFS EST. BKWTR. $\underline{N/A}$ FT. VTR. $\underline{N/A}$ FT.
	Mi. METHOD USED TO COMPUTE Q: <u>USGS Urban Regression</u> ROPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: LO	OW MODERATE X HIGH
COULD THIS BE SI	GNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT:	YES NO <u>X</u>
EXPLANTION: A flo	podway modification may be required at this site.
LIST BUILDINGS IN	N FLOOD PLAIN: None LOCATION:
UPSTREAM LAND ANTICIPATE ANY	
ANY FLOOD ZONII	NG? (FIA STUDIES, ETC.) YES $\underline{X}$ NO
TYPE OF STUDY: 1	FEMA – Special Flood Hazard Zone AE
REGULATORY FLO	OODWAY WIDTH 115 ft. Section 6320 (AS NOTED IN FIS)
COMMENTS:	

### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 20,000 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 55,200 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? $\underline{\text{N/A}}$
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS  NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR
FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Chewacla TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service
ENVIRONMENTAL CONSIDERATIONS
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: Buried culverts 1 foot to allow for fish passage.
MISCELLANEOUS COMMENTS
IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED

ARE BANKS STABLE? Yes PROTECTION NEEDED No							
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No							
COMMENTS:							
ALTERNATIVES							
RECOMMENDED DESIGN <u>3@8'x8' RCBC</u>							
DETOUR STRUCTURE N/A							
BRIDGE WATERWAY OPENING 168 Sq. Ft.							
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO $\underline{X}$ DISCUSSION:							
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:							
(1)NORMAL PROCESS							
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation							
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:							

		Neu	ise River Basin
Name	Index Number	Classification	Class Date
Description		Special	Designation
Brown Creek	27-141-3	SA;HQW,NSW	05/01/88
From source to Broad Creek			
Bryan Creek	27-150-26-1-4	SA;HQW,NSW	05/01/88
From source to Spring Creek			
Buck Branch	27-77-2-0.5	C;Sw,NSW	05/01/88
From source to Mosely Creek			
Buck Branch	27-101-4-4	C;Sw,NSW	05/01/88
From source to Joshua Creek			
Buck Branch	27-43-6-(1)	WS-III;NSW	08/03/92
From source to a point 0.6 mile upstream of mouth			
Buck Branch	27-43-6-(2)	WS-III;NSW,CA	08/03/92
From a point 0.6 mile upstream of mouth to Lake Be	nson, Swift Creek		
Buck Branch	27-86-11-6	C;Sw,NSW	05/01/88
From source to Toisnot Swamp			
Buck Branch	27-86-11-7-2	C;Sw,NSW	05/01/88
From source to Whiteoak Swamp			
Buck Creek	27-135-7	SA;HQW,NSW	05/01/88
From source to South River			
Buck Meadow Branch	27-86-14-0.6	C;Sw,NSW	05/01/88
From source to Nahunta Swamp			
Buck Swamp	27-57-20.7-1	WS-IV;NSW	08/03/92
From source to Mill Creek			
Buckhorn Branch	27-86-4	C;NSW	08/03/92
From source to Contentnea Creek			
Buckhorn Creek	27-13-1-(2)	WS-IV;NSW,CA	08/01/98
From a point 0.7 mile downstream of Granville-Wake	County Line to New Light Creek		
Buckhorn Creek	27-13-1-(1)	WS-IV;NSW	08/01/98
From source to point 0.7 mile downstream of Granvi	lle-Wake County Line		
Buckwater Creek	27-2-12	WS-IV;NSW	08/03/92
From source to Eno River			
Buffalo Branch	27-43-15-11	C;NSW	05/01/88
From source to Middle Creek			

37			
		WOOD	n=0.1
1///			
WOODS			
N=0-12	Te	5-TB =	17
	W	E-WE	- 5
		D	4
	+	120	0.2
		HW	1.5
n=0.040			
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((1			
RECENT DRIFT 4.	0		
DEBRIS POTENTIAL	MODERAT	E	
BED MATERIAL	SAND / @		



NC DEPARTMENT OF TRANSPORTATION **DIVISION OF HIGHWAYS BRIDGE MANAGEMENT UNIT** 

**ATTENTION** 

### **BRIDGE INSPECTION REPORT**

ROUTE SR-2713 (VANDORA SPRINGS)  ROUTE SR2713 ACROSS CREEK M.P. 0  0.3 OF A MILES NORTH OF SR-2711 (BUFFALO ROAD)  LOCATION DOUBLE 10' X 7' RCBC; 48' ALONG CENTERLINE CULVERT  SUPERSTRUCTURE DOUBLE 10'X7' RCBC; 48'ALONG CENTERLINE CULVERT  SUBSTRUCTURE  SPANS  LONGITUDE 78° 38' 21.56" LATITUDE 35° 41' 32.58"  INSPECTION DATE 10/01/2013 PRESENT CONDITION GOOD  PRESENT POSTING Not Posted NOT POSTED PROPOSED POSTING		INSPECTION TYPE:	Routine Inspection	_
ROUTE SR2713 ACROSS CREEK M.P. 0  0.3 OF A MILES NORTH OF SR-2711 (BUFFALO ROAD)  LOCATION 0.3 MI.N. OF SR2711  DOUBLE 10' X 7' RCBC; 48' ALONG CENTERLINE CULVERT  SUPERSTRUCTURE DOUBLE 10'X7' RCBC;48'ALONG CENTERLINE CULVERT  SUBSTRUCTURE  SPANS  LONGITUDE 78° 38' 21.56"  LATITUDE 35° 41' 32.58"  INSPECTION DATE 10/01/2013 PRESENT CONDITION GOOD	COUNTY			2 YRS
0.3 OF A MILES NORTH OF SR-2711 (BUFFALO ROAD )  LOCATION 0.3 MI.N. OF SR2711  DOUBLE 10' X 7' RCBC; 48' ALONG CENTERLINE CULVERT  SUPERSTRUCTURE DOUBLE 10'X7' RCBC;48'ALONG CENTERLINE CULVERT  SUBSTRUCTURE  SPANS  LONGITUDE 78° 38' 21.56"  LATITUDE 35° 41' 32.58"  INSPECTION DATE 10/01/2013 PRESENT CONDITION GOOD		SR-2713 (VANDORA SPRINGS)		
DOUBLE 10' X 7' RCBC; 48' ALONG CENTERLINE CULVERT  SUPERSTRUCTURE  SUBSTRUCTURE  SPANS  LONGITUDE 78° 38' 21.56"  LATITUDE 35° 41' 32.58"  INSPECTION DATE 10/01/2013  PRESENT CONDITION GOOD	ROUTE	SR2713	ACROSS CREEK	M.P. 0
DOUBLE 10' X 7' RCBC; 48' ALONG CENTERLINE CULVERT  SUPERSTRUCTURE  SPANS LONGITUDE 78° 38' 21.56"  LATITUDE 35° 41' 32.58"  INSPECTION DATE 10/01/2013  PRESENT CONDITION GOOD		0.3 OF A MILES NORTH OF	SR-2711 ( BUFFALO ROAD )	
SUPERSTRUCTURE  SUBSTRUCTURE  SPANS  LONGITUDE 78° 38' 21.56"  LATITUDE 35° 41' 32.58"  INSPECTION DATE 10/01/2013  PRESENT CONDITION GOOD	LOCATIO	0.3 MI.N. OF SR2711		
SPANS  LONGITUDE 78° 38' 21.56"  LATITUDE 35° 41' 32.58"  INSPECTION DATE 10/01/2013  PRESENT CONDITION GOOD		DOUBLE 10' X 7' RC	BC; 48' ALONG CENTERLINE CULVERT	
SPANS  LONGITUDE 78° 38' 21.56"  LATITUDE 35° 41' 32.58"  INSPECTION DATE 10/01/2013  PRESENT CONDITION GOOD	SUPERST	RUCTURE DOUBLE 10'X7' RCB	C;48'ALONG CENTERLINE CULVERT	
SPANS  LONGITUDE 78° 38' 21.56"  LATITUDE 35° 41' 32.58"  INSPECTION DATE 10/01/2013  PRESENT CONDITION GOOD				
SPANS  LONGITUDE 78° 38' 21.56"  LATITUDE 35° 41' 32.58"  INSPECTION DATE 10/01/2013  PRESENT CONDITION GOOD	CLIDETDI	ICTURE		
LONGITUDE 78° 38' 21.56"  LATITUDE 35° 41' 32.58"  INSPECTION DATE 10/01/2013  PRESENT CONDITION GOOD	SODSTRU			
LONGITUDE 78° 38' 21.56"  LATITUDE 35° 41' 32.58"  INSPECTION DATE 10/01/2013  PRESENT CONDITION GOOD				
INSPECTION DATE 10/01/2013 PRESENT CONDITION GOOD				
	SPANS			
PRESENT POSTING Not Posted NOT POSTED PROPOSED POSTING	-	DE 78° 38' 21.56"	LATITUDE 35° 41' 32.58"	
	LONGITU			
A DELINIE A POPULATION OF THE CALL VI	LONGITU	ON DATE 10/01/2013	PRESENT CONDITION GOOD	
	LONGITU INSPECTI PRESENT	ON DATE 10/01/2013	PRESENT CONDITION GOOD  NOT POSTED PROPOSED POSTING	



**Temporary Shoring** No Scour Critical No Scour POA No

No

Fracture Critical

SIGN NOTICE NUMBERED ISSUED FOR REQUIRED No WEIGHT LIMIT No **DELINEATORS** No NARROW BRIDGE No ONE LANE BRIDGE No LOW CLEARANCE

**LOOKING EAST** 



Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.



Looking at Upstream Channel of Upstream Structure.



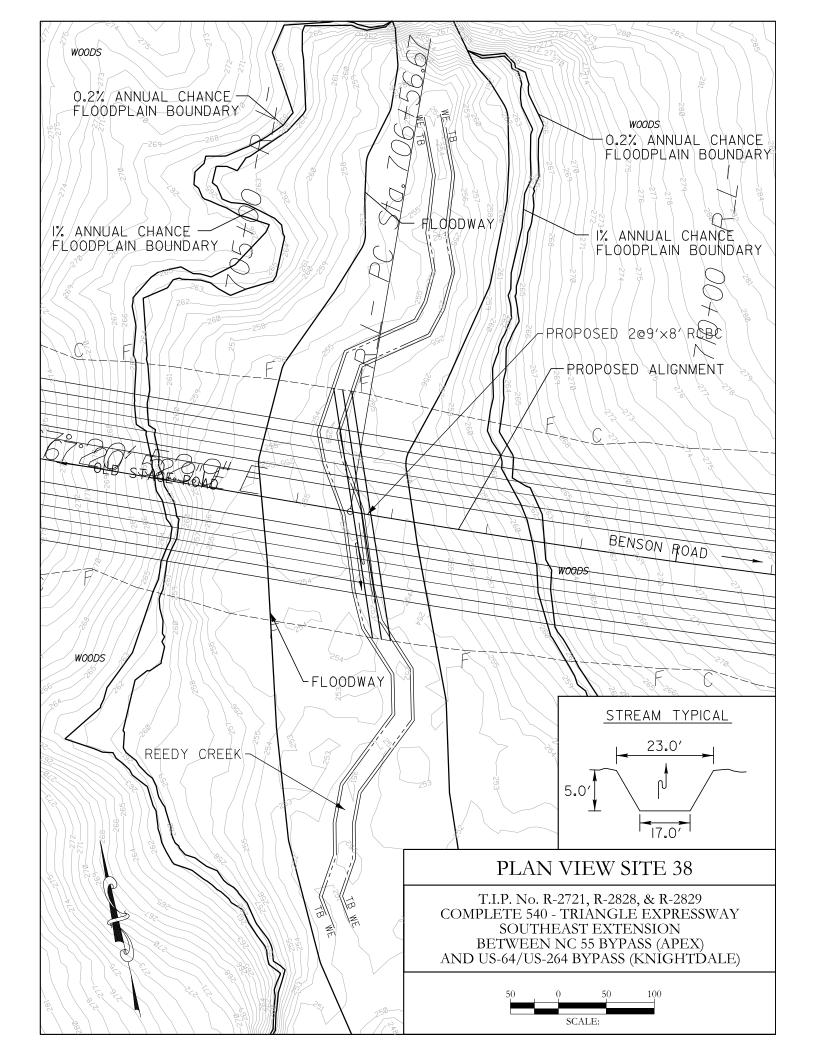
Looking at Upstream Face of Upstream Structure

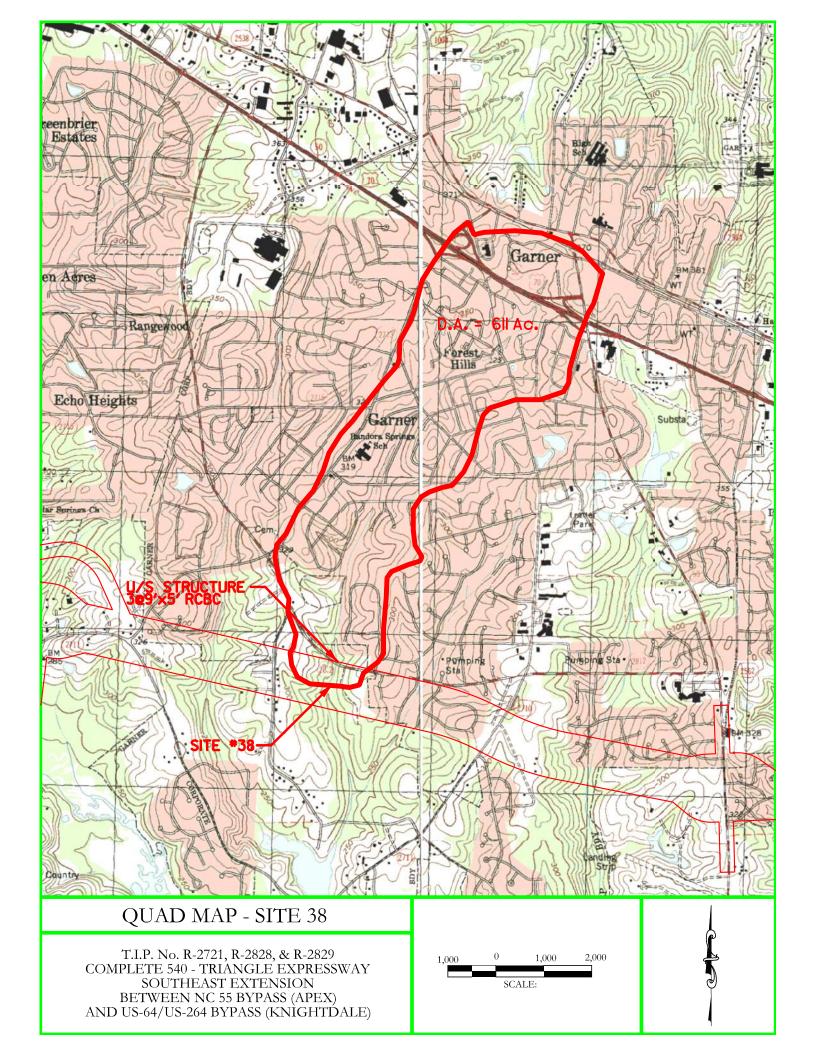


Looking at Downstream Channel of Upstream Structure.



Looking at Downstream Face of Upstream Structure.





4/22/2014

REGION: BLUE RIDGE	METHOD USED: Fact Sheet: 007-00
STREAM NAME: Reedy Creek	
	sq. mile
way SE Ext.	0.95
NAME: Triangle Express	Drainage Area =
PROJECT	ENGLISH

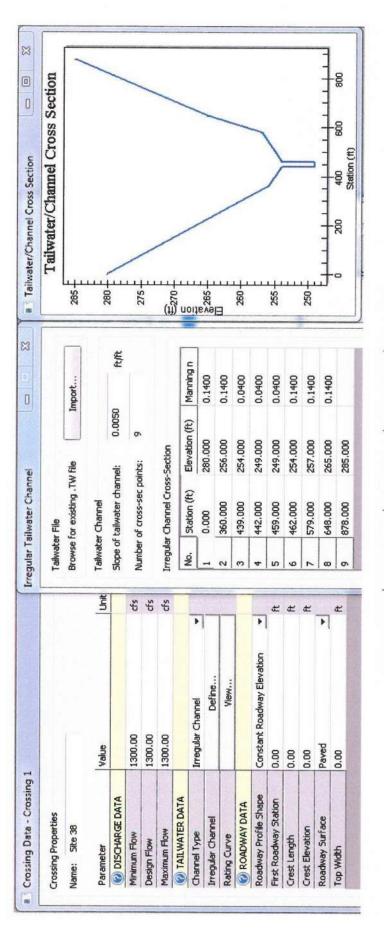
<b>USGS RUR</b>	AL REGRE	<b>ISGS RURAL REGRESSION EQUA</b>	ATIONS (OLD)	RUF	SAL EQUA	TIONS Rep	RURAL EQUATIONS Report 01-4207	
REQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills	
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)	
2YR	28.60	67.19	138.99	2YR	130.23	62.50	32.30	
5YR	46.99	144.62	239.62	5YR	233.74	124.87	53.54	
10YR	62.00	218.64	322.80	10YR	322.85	182.16	70.34	
25YR	82.94	352.26	451.57	25YR	460.51	272.58	94.67	
50YR	101.00	477.25	561.95	50YR	582.71	356.26	115.82	
100YR	121.16	636.56	695.67	100YR	721.50	454.61	138.04	
200YR	149.04	834.08	841.95	200YR	879.76	569.58	164.12	
500YR	175.84	1162.01	1094.46	500YR	1124.56	751.92	202.76	

# USGS URBAN REGRESSION EQUATIONS BDF= 11 (These Equations are used only for comparison)

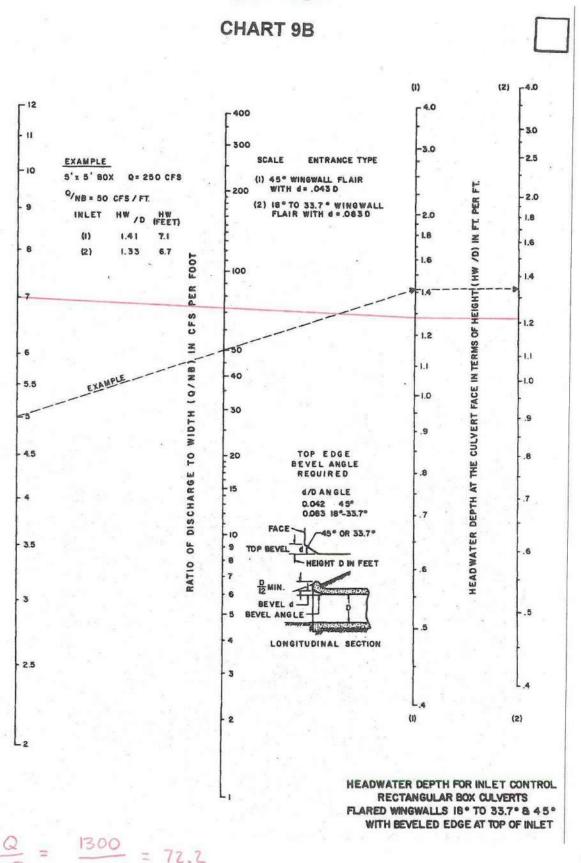
							(Based on 2.80xQ10)	
								1868.92
Coastal Plain	(cfs)	388.23	518.36	741.85	944.86	1218.91	1451.41	1963.00
Sand Hills	(cfs)	161.53	191.53	233.27	268.59	312.74	536.29	417.30
FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR
	Sand Hills Coastal Plain	Sand Hills Coastal Plain (cfs) (cfs)	Sand Hills   Coastal Plain   Cfs   (cfs   161.53   388.23	Sand Hills         Coastal Plain           (cfs)         (cfs)           161.53         388.23           191.53         518.36	Sand Hills         Coastal Plain           (cfs)         (cfs)           161.53         388.23           191.53         518.36           233.27         741.85	Sand Hills         Coastal Plain           (cfs)         (cfs)           161.53         388.23           191.53         518.36           233.27         741.85           268.59         944.86	Sand Hills         Coastal Plain         L           (cfs)         (cfs)           161.53         388.23           191.53         518.36           233.27         741.85           268.59         944.86           312.74         1218.91	Sand Hills         Coastal Plain         Blue Ridge           (cfs)         (cfs)         (cfs)           161.53         388.23         575.64           191.53         518.36         705.18           233.27         741.85         904.92           268.59         944.86         1078.55           312.74         1218.91         1310.97           536.29         1451.41         1974.51

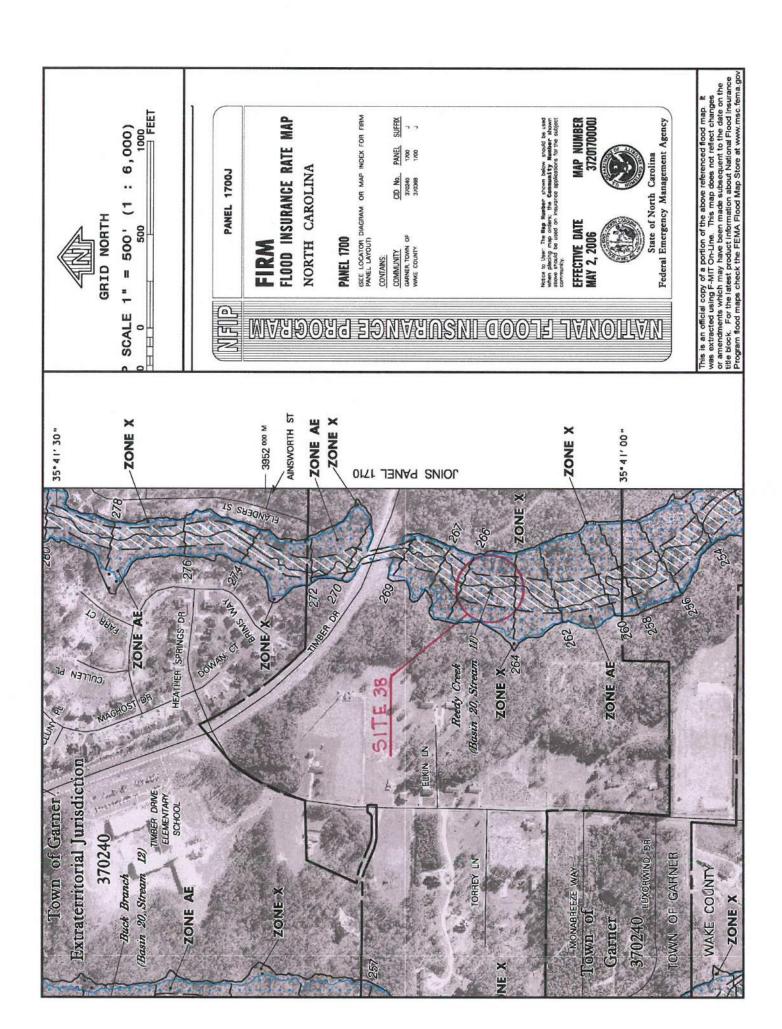
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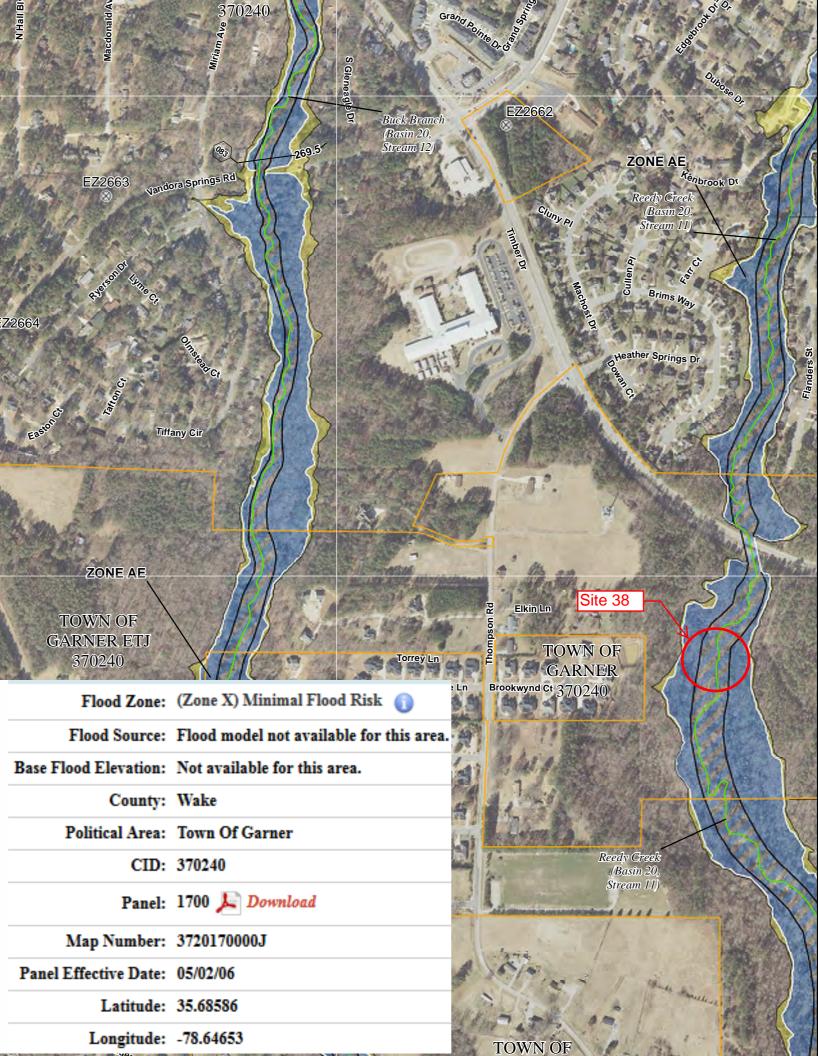
% Impervious =	45				FEMA	<b>ĕ</b>
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Blue Ridge Discharge Used	FREQUENCY	Disharges
	(cfs)	(cfs)	(cfs)			
5YR	422.21	581.88	672.27			
10YR	518.62	749.74	837.86		10YR	
25YR	651.13	1067.21	1161.78		50YR	800
50YR	742.90	1228.57	1295.85	1300	100YR	1100
100YR	820.87	1379.02	1417.46		500YR	
200YR	1452.12	2099.26	2346.02	(Based on 2.80xQ10)		ı
500YR	1898.13	2744.03	3066.58	(Based on 3.66xQ10)		



Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
1300,000	256.098	7.098	4.050	2.215
1300,000	256.098	7.098	4.050	2.215
1300.000	256.098	7,098	4.050	2.215
1300.000	256.098	7.098	4.050	2.215
1300,000	256,098	7.098	4.050	2.215
1300,000	256.098	7.098	4.050	2.215
1300,000	256.098	7.098	4.050	2.215
1300,000	256.098	7.098	4.050	2.215
1300,000	256.098	7.098	4.050	2.215
1300,000	256.098	7.098	4.050	2.215
1300,000	256.098	7.098	4.050	2.215







### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000





		by Detailed Methods: R		
Source		Sources	Affected Communties	
Middle Creek	From The confluence with Swift Creek	To Approximately 0.7 mile upstream of confluence of Middle Creek Tributary	Rdu Town Of Apex Town Of Cary Town Of Fuquay-Varina Town Of Holly Springs Wake County	
Millbrook Tributary to Marsh Creek (Basin 18, Stream 19)	The confluence with Marsh Creek (Basin 18, Stream 17)	East Millbrook Road	City Of Raleigh	
Mills Branch (Basin 22, Stream 5)	The confluence with Middle Creek (Basin 22, Stream 1)	Railroad	Rdu Town Of Fuquay-Varina Wake County	
Mine Creek (Basin 18, Stream 31)	The confluence with Crabtree Creek (Basin 18, Stream 9)	The confluences of East Fork Mine Creek (Basin 18, Stream 34) and West Fork Mine Creek (Basin 12, Stream 33)	City Of Raleigh	
Morrisville Tributary (Basin 18, Stream 26)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Approximately 0.3 mile upstream of Railroad	Town Of Morrisville	
Mud Branch (Basin 4, Stream 15)	The confluence with Horse Creek (Basin 4, Stream 1)	Approximately 3.0 miles upstream of confluence with Horse Creek (Basin 4, Stream 1)	Rdu Wake County	
Neil Branch (Basin 24, Stream 8)	The confluence with Neil Creek (Basin 24, Stream 7)	East Spring Avenue	Town Of Fuquay-Varina	
Neil Creek (Basin 24, Stream 7)	The confluence with Angier Creek (Basin 24, Stream 4)	Holland Road	Town Of Fuquay-Varina	
Neuse River	Entire shoreline in Wake County	Entire shoreline within Granville County	Rdu Wake County	
Neuse River	Wayne/Lenoir County boundary	Falls of the Neuse Road	City Of Raleigh Rdu Town Of Clayton Town Of Knightdale Town Of Wake Forest Wake County	
New Light Creek	The confluence with Neuse River (Basin 15, Stream 1)	The confluence of Basin 3, Stream 8	Rdu Wake County	
Panther Branch (Basin 22, Stream 2)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.5 mile upstream of Banks Road	Rdu Wake County	
Panther Creek	The Chatham/Wake County Boundary	Approximately 1.0 mile upstream of Green Level to Durham Road	Town Of Cary	
Perry Creek East Branch (Basin 15, Stream 27)	The confluence with Perry Creek (Basin 15, stream 26)	Approximately 0.3 mile upstream of Bivens Drive	City Of Raleigh	
Pigeon House Branch (Basin 18, Stream 27)	The confluence with Crabtree Creek (Basin 18, Stream 9)	West Peace Street	City Of Raleigh	
Poplar Branch (Basin 13, Stream 2)	The confluence with Poplar Creek (Basin 13, Stream 1)	Farm Road	Town Of Knightdale	
Poplar Creek (Basin 13, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 900 Feet upstream of Fayetteville Street	Rdu Town Of Knightdale Wake County	
Powell Creek (Basin 8, Stream 7)	The confluence with Hodges Creek (Basin 8, Stream 1)	Approximately 1.3 miles upstream of Peebles Road	City Of Raleigh Rdu Town Of Rolesville Wake County	
Reedy Creek (Basin 20, Stream 11)	The confluence with Swift Creek (Basin 20, Stream 1)	Seventh Avenue	Rdu Town Of Garner Wake County	
Reedy Creek (Basin 6, Stream 8)	The confluence with Sanford Creek (Basin 6, Stream 7)	Rogers Road	Town Of Rolesville Town Of Wake Forest	
dy Creek Tributary (Basin 20, Stream	The confluence with Reedy Creek (Basin 20, Stream 11)	Claymore Drive	Town Of Garner	
Richland Creek (Basin 18, Stream 3)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Trinity Road	City Of Raleigh	
Rocky Branch (Basin 22, Stream 8)	The confluence with Middle Creek (Basin 22, Stream 1)	Holly Springs Road	Rdu Town Of Holly Springs Wake County	
Rocky Branch (Basin 30, Stream 5)	Approximately 60 feet downstream of Western Boulevard (upstream crossing)	Approximately 900 feet upstream of Pullen Road	City Of Raleigh	
Rocky Branch (Basin 30, Stream 5)	The confluence with Walnut Creek (Basin 30, Stream 1)	Approximately 215 feet upstream of Fayetteville Road	City Of Raleigh	
Rocky Ford Branch (Basin 24, Stream 5)	The confluence with Kenneth Creek (Basin 24, Stream 2)	Approximately 0.9 mile upstream of confluence with Kenneth Creek (Basin 24, Stream 2)	Rdu Town Of Fuquay-Varina Wake County	
Sanford Creek (Basin 6, Stream 7)	The confluence with Smith Creek (Basin 6, Stream 1)	Approximately 300 feet upstream of the confluence of Basin 6, Stream 9	Rdu Town Of Rolesville Town Of Wake Forest Wake County	
Smith Creek	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 0.9 mile upstream of Oak Grove Church Road	Rdu Town Of Wake Forest Wake County	
Southeast Prong Beaverdam Creek (Basin 18, Stream 30)	The confluence with Beaverdam Creek (Basin 18, Stream 28)	Wade Avenue	City Of Raleigh	

**Table 13 - Summary of Discharges** 

Table 13 - Summ Flooding Source			Discha	rges (cfs)	
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Just upstream of Atlantic Avenue	2.70	*	*	2,740	*
At intersection of Fairview Road and Downtown Boulevard	2.10	*	*	2,590	*
Approximately 1,175 downstream of W Peace Street	0.90	*	*	1,700	*
Poplar Branch (Basin 13, Stream 2)			•		
At mouth	0.90	*	*	995	*
Approximately 700 feet upstream of Old Ferrell Road	0.40	*	*	690	*
Poplar Creek (Basin 13, Stream 1)	14.14	1			
At mouth	9.00	*	*	3,600	*
Just upstream of tributary just upstream of Grasshopper Road	6.60	*	*	3,000	*
Approximately 0.5 mile downstream of Grasshopper Road	2.90	*	*	2,000	*
Just upstream of Poplar Branch (Basin 13, Stream 2)	1.50	*	*	1,300	*
Approximately 500 feet upstream of Fayettville Street	0.90	*	*	900	*
Approximately 500 feet upstream of Fayettville Street	0.50	*	*	720	*
Powell Creek (Basin 8, Stream 7)	1 *****		<u> </u>	1.=-	1
At mouth	10.00	*	*	3,500	*
Approximately 0.6 mile upstream of Mitchell Mill Road	6.30	*	*	2,780	*
Approximately 1.3 miles upstream of Peebles Road	2.40	*	*	1,650	*
Approximately 1.5 miles upstream of Peebles Road  Approximately 1.4 miles upstream of Peebles Road	1.30	*	*	1,300	*
	1.50			1,300	
Reedy Branch (Basin 27, Stream 5)		4.500	0.550	0.000	1, 400
At confluence with Beaver Creek	4.10	1,520	2,550	3,020	4,430
Approximately 1,580 feet upstream of Olive Chapel Road	3.00	1,450	2,430	2,880	4,180
Just upstream of confluence with Reedy Branch Tributary (Basin 27, Stream 6)	1.00	656	1,120	1,350	1,970
Reedy Branch Tributary (Basin 27, Stream 6)		I	T	1	
At confluence with Reedy Branch (Basin 27, Stream 5)	1.50	864	1,430	1,690	2,380
Approximately 0.5 mile downstream of Kelly Road	1.10	819	1,320	1,540	2,140
Reedy Creek (Basin 20, Stream 11)			1		
Just upstream of tributary near lake	1.10	*	*	1,100	*
First street upstream of Vandora Springs School	0.50	*	*	880	*
Reedy Creek (Basin 6, Stream 8)					
Just downstream of Rogers Road	1.40	*	*	750	*
Just upstream of Rogers Road	1.40	*	*	1,300	*
Reedy Creek Tributary (Basin 20, Stream 9)					
At mouth	0.91	*	*	1,140	*
At street extending from Claymore Drive	0.60	*	*	925	*
38 land Creek					
At confluence with Neuse River (Basin 15, Stream 1)	14.00	*	*	5,040	*
Approximately 0.7 mile upstream of confluence with Neuse River (Basin 15, Stream	13.18	*	*	4,900	*
1)					
Approximately 1.5 miles upstream of confluence with Neuse River (Basin 15, Stream 1)	12.21	*	*	4,850	*
At confluence of Richland Creek Tributary	10.47	*	*	4,760	*
Approximately 0.4 mile upstream of US 1	9.57	*	*	4,750	*
Approximately 0.8 mile upstream of US 1	8.72	*	*	4,730	*
Approximately 530 feet upstream of West South Avenue	8.15	*	*	4,700	*
Approximately 0.6 mile downstream of confluence of Basal Creek	7.28	*	*	4,560	*

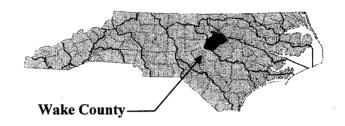
Table 21 - Floodway Data

Floodwa	y Source		Floodway	JIE ZI - II	oodway D 		ter Surface Eleva	ntion	
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
103	10,280	470	1,066	3.3	215.4	*	215.4	215.4	0.0
140	13,980	350	3,848	0.7	227.3	*	227.3	227.9	0.6
191	19,140	165	360	7.2	229.5	*	229.5	229.5	0.0
204	20,380	145	845	3.0	237.6	*	237.6	238.4	0.8
218	21,820	385	2,305	1.1	239.0	*	239.0	239.5	0.5
239	23,890	120	299	6.4	248.7	*	248.7	248.7	0.0
272	27,200	110	777	2.1	259.9	*	259.9	260.6	0.7
	n (Basin 27, St		1		1-44.4		1	1-4414	
010	1,017	605	3,079	1.0	238.7	*	238.7	239.7	1.0
017	1,666	250	910	3.3	239.4	*	239.4	240.3	0.9
034	3,393	240	1,591	1.9	246.4	*	246.4	247.4	1.0
048	4,763	405	2,302	1.2	249.1	*	249.1	249.8	0.7
064	6,403	370	2,158	1.3	254.5	*	254.5	255.4	0.9
069	6,929	170	935	3.1	255.1	*	255.1	256.1	1.0
072	7,243	130	754	3.8	256.5	*	256.5	257.3	0.8
080	7,966	190	1,184	2.4	259.3	*	259.3	260.3	1.0
085	8,517	250	1,557	1.8	260.6	*	260.6	261.6	1.0
090	8,990	250	1,158	2.5	261.6	*	261.6	262.4	0.8
090	9,685	215	880	3.3	264.1	*	264.1	265.0	0.9
	,								
102	10,193	305	1,752	1.6	266.0		266.0	267.0	1.0
107	10,679	240	1,221	2.4	267.3		267.3	268.1	0.8
111	11,132	70	259	5.2	269.2		269.2	269.7	0.5
119 Peedy Branch	11,924	100 Isin 27, Stream	466	2.9	273.5	*	273.5	274.5	1.0
009	864	127	549	3.1	268.0	*	268.0	269.0	1.0
012	1,197	90	463	3.6	270.3	*	270.3	271.2	0.9
				2.7		*			
018	1,811	92	624		273.3	*	273.3	274.1	0.8
027	2,666	124	701	2.4	276.1		276.1	277.1	1.0
031	3,137	92	555	3.0	277.9		277.9	278.9	1.0
039	3,850	120	640	2.6	281.4		281.4	282.4	0.9
045	4,488	90	626	2.7	284.1		284.1	285.1	0.9
050	4,980	85	405	3.8	286.6		286.6	287.5	0.9
056	5,596	65	383	4.0	292.4	*	292.4	293.2	0.9
061	6,069	90	597	2.6	295.1		295.1	296.1	1.0
065	6,541	80	408	3.8	297.1		297.1	298.0	0.9
071	7,080	95	379	4.1	301.3		301.3	302.2	0.9
078	7,789	130	923	1.7	309.4		309.4	310.4	1.0
083 Reedy Creek	8,257 (Basin 20 Stra	105	557	2.8	310.2	*	310.2	311.2	1.0
	(Basin 20, Stre		249	4.4	238.01	*	222.0	222.0	0.0
020	1,950	140	248	4.4		*	233.0	233.8	0.8
036	3,610	220	573	1.9	238.8		238.8	239.5	0.7
Site 38	10,960	150	168	6.5	286.9	_	286.9	286.9	0.0
117	11,720	190	1,284	0.9	293.2	*	293.2	293.5	0.3
136	13,600	240	530	1.7	306.0	*	306.0	306.1	0.1
142	14,220	60	267	3.3	309.1	*	309.1	309.4	0.3

A Report of Flood Hazards in

### WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 1 OF 7**

Community Name	<b>Community Number</b>	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV001A





**Table 10—Roughness Coefficients** 

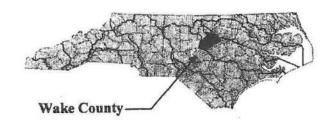
Stream	Channel "n"	Overbank "n"
Lower Barton Creek (Basin 17, Stream 1)	0.030 - 0.070	0.070 - 0.110
Lowery Creek (Basin 4, Stream 10)	0.030 - 0.070	0.070 - 0.110
Lynn Road Tributary (Basin 18, Stream 32)	0.030 - 0.070	0.070 - 0.110
Mahlers Creek (Basin 20, Stream 6)	0.030 - 0.070	0.070 - 0.110
Mango Creek (Basin 15, Stream 11)	0.030 - 0.070	0.070 - 0.110
Marks Creek (Basin 14, Stream 1)	0.030 - 0.070	0.070 - 0.130
Marsh Creek (Basin 18, Stream 17)	0.038 - 0.060	0.090 - 0.200
Medfield Tributary to Richland Creek (Basin 18, Stream 39)	0.030 - 0.070	0.070 - 0.110
Middle Creek (Basin 22, Stream 1)	0.030 - 0.070	0.070 - 0.110
Millbrook Tributary to Marsh Creek (Basin 18, Stream 19)	0.030 - 0.070	0.070 - 0.110
Mills Branch (Basin 22, Stream 5)	0.030 - 0.070	0.070 - 0.130
Mine Creek (Basin 18, Stream 31)	0.030 - 0.070	0.070 - 0.110
Mingo Creek (Basin 12, Stream 2)	0.041 - 0.044	0.100 - 0.200
Moccasin Creek (Basin 11, Stream 1)	0.030 - 0.070	0.070 - 0.110
Morris Branch (Basin 29, Stream 5)	0.030 - 0.050	0.100 - 0.200
Morrisville Tributary (Basin 18, Stream 26)	0.030 - 0.070	0.070 - 0.110
Mud Branch (Basin 4, Stream 15)	0.030 - 0.070	0.070 - 0.110
Neil Branch (Basin 24, Stream 8)	0.030 - 0.070	0.070 - 0.130
Neil Creek (Basin 24, Stream 7)	0.030 - 0.070	0.070 - 0.110
Neills Creek	0.035 - 0.048	0.100 - 0.150
Neuse River (Basin 15, Stream 1)	0.030 - 0.070	0.070 - 0.110
New Hope Tributary to Marsh Creek (Basin 18, Stream 18)	0.040 - 0.065	0.110 - 0.200
Newlight Creek (Basin 3, Stream 1)	0.040 - 0.070	0.070 - 0.150
Norris Branch	0.048	0.145
Panther Branch (Basin 22, Stream 2)	0.030 - 0.070	0.070 - 0.110
Panther Creek (Basin 29, Stream 1)	0.03-0.070	0.070 - 0.110
Perry Creek (Basin 10, Stream 19)	0.042	0.130
Perry Creek (Basin 15, Stream 26)	0.032 - 0.052	0.100 - 0.200
Perry Creek East Branch (Basin 15, Stream 27)	0.030 - 0.070	0.070 - 0.110
Pigeon House Branch (Basin 18, Stream 27)	0.030 - 0.070	0.070 - 0.110
Poplar Branch (Basin 13, Stream 2)	0.030 - 0.070	0.070 - 0.110
Poplar Creek (Basin 13, Stream 1)	0.030 - 0.070	0.070 - 0.110
Powell Creek (Basin 8, Stream 7)	0.030 - 0.070	0.070 - 0.110
Reedy Creek (Basin 20, Stream 11)	0.030 - 0.070	0.070 - 0.110
Reedy Branch (Basin 27, Stream 5)	0.045 - 0.050	0.100 - 0.200
Reedy Branch Tributary (Basin 20, Stream 9)	0.030 - 0.070	0.070 - 0.110
Reedy Branch Tributary (Basin 27, Stream 6)	0.045 - 0.050	0.100 - 0.200
Reedy Creek (Basin 6, Stream 8)	0.030 - 0.070	0.070 - 0.110
Richland Creek (Basin 5, Stream 1)	0.038 - 0.070	0.100 - 0.200
Richland Creek (Basin 18, Stream 3)	0.030 - 0.070	0.070 - 0.110
Richland Creek Tributary	0.040	0.100 - 0.200

Site 38

A Report of Flood Hazards in

### WAKE COUNTY, NORTH CAROLINA

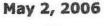
AND INCORPORATED AREAS



### **VOLUME 2 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuguay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse



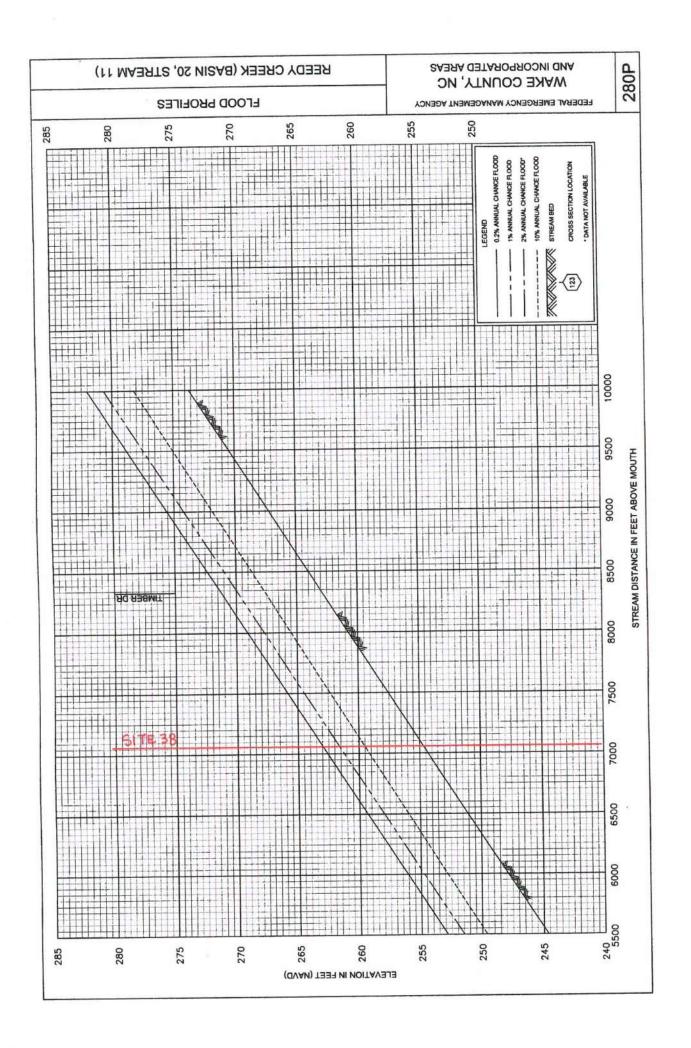


### Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV002A







		Neu	ise River Basi
Name	Index Number	Classification	Class Date
Description		Special	Designation
Rattlesnake Branch	27-101-5-2	C;Sw,NSW	05/01/88
From source to Tuckahoe Creek			
Rattlesnake Branch	27-150-6-4	SC;Sw,NSW	05/01/88
From source to Trent Creek			
Rattlesnake Branch	27-101-15-2	C;Sw,NSW	05/01/88
From source to Beaver Creek			
Rays Creek	27-2-21-2-1	WS-II;HQW,NSW	08/03/92
From source to South Fork Little River			
Reeds Gut	27-115-8	SC;Sw,NSW	05/01/88
From source to Hancock Creek			
Reedy Branch	27-101-7	C;Sw,NSW	05/01/88
From source to Trent River			
Reedy Branch	27-12-0.5	WS-IV;NSW	08/01/98
From source to Beaverdam Creek			
Reedy Branch	27-101-36	C;Sw,NSW	05/01/88
From source to Trent River			
Reedy Branch	27-43-7-(1)	WS-III;NSW	08/03/92
From source to a point 0.5 mile upstream of mouth	h		
Reedy Branch	27-43-7-(2)	WS-III;NSW,CA	08/03/92
From a point 0.5 mile upstream of mouth to Lake 8	Benson, Swift Creek		
Reedy Branch	27-62-2	C;NSW	05/01/88
From source to Stoney Creek			
Reedy Branch (Little Branch)	27-43-14	C;NSW	05/01/88
From source to Swift Creek			
Reedy Branch (Reeders Fork)	27-86-17-2	C;Sw,NSW	05/01/88
From source to Tyson Marsh			
Reedy Creek	27-45-10	C;NSW	05/01/88
From source to Black Creek			
Reedy Prong	27-52-3	C;NSW	05/01/88
From source to Mill Creek			
Reedys Creek (Reedy Creek Lake)	27-33-8	B;NSW	05/01/88
From source to Crabtree Creek			

WOODS N=0.14	<i>)</i> )))		
		TB-TB	23.0
1/1.0		WEWE	
(%)			5.0
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	N W	10005 N= 1	1.14
	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	040	
Dega. W	OTENTIAL M	0.D5 D 0.T5	



NC DEPARTMENT OF TRANSPORTATION **DIVISION OF HIGHWAYS BRIDGE MANAGEMENT UNIT** 

ATTENTION

### BRIDGE INSPECTION REPORT

INSPECTION TYPE:	Routine inspection	<u> </u>
COUNTY WAKE	BRIDGE NUMBER 910670 INSPECTION CYCL	E 2 YRS
ROUTE SR2812	ACROSS REEDY BRANCH	M.P. 0
LOCATION 0.6MI.N.W.JCT.SR2710		
SUPERSTRUCTURE TRIPLE 9'X5' RCBC;	186'9 ALONG C/L OF CULVERT	
SUBSTRUCTURE		
SPANS	<u> </u>	
LONGITUDE 78° 37' 50.82"	LATITUDE 35° 41' 12.95"	
INSPECTION DATE 07/03/2013	PRESENT CONDITION GOOD	
PRESENT POSTING N	NOT POSTED PROPOSED POSTING	
OTHER SIGNS PRESENT		



No Fracture Critical **Temporary Shoring** No No Scour Critical Scour POA No

1	SSUED FOR		REQUIRED
	No	WEIGHT LIMIT	
	No	DELINEATORS	
	No	NARROW BRIDGE	
	No	ONE LANE BRIDGE	
	No	LOW CLEARANCE	
			_

SIGN NOTICE

NUMBERED

LOOKING NORTH



Looking Upstream from Proposed Crossing.

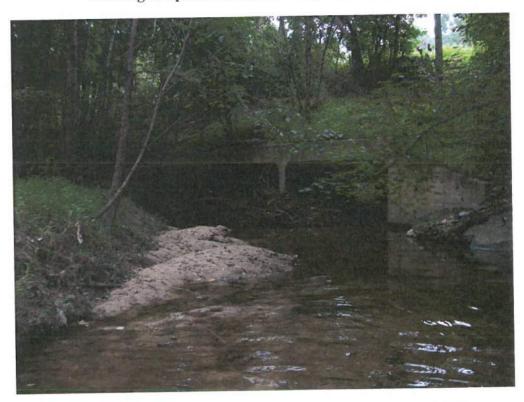


Looking Downstream from Proposed Crossing.

Page 1 of 3



Looking at Upstream Channel of Upstream Structure.



Looking at Upstream Face of Upstream Structure 3@9'x5' RCBC



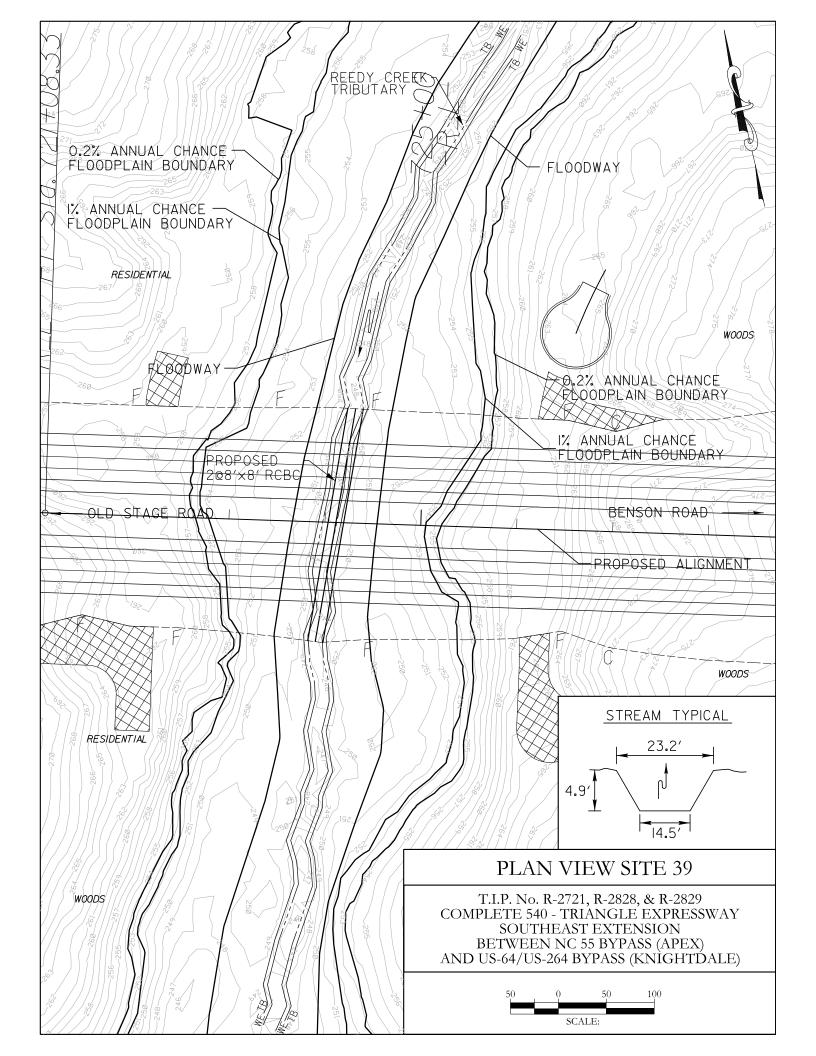
Looking at Downstream Face of Upstream Structure 3@9'x5' RCBC

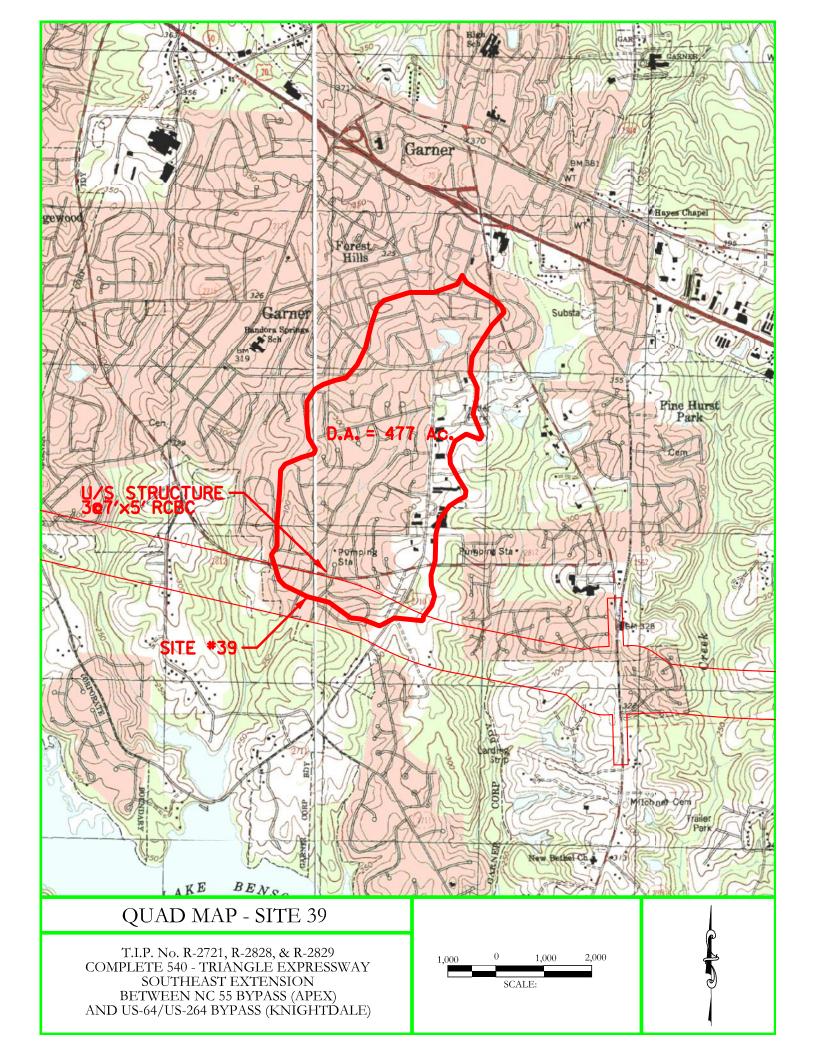


Looking at Downstream Channel of Upstream Structure.

Page 3 of 3

### Site 39





### **North Carolina**

PROJECT NAME: Triangle Expressway SE Ext. 4/22/2014

REGION: BLUE RIDGE METHOD USED: Fact Sheet: 007-00 STREAM NAME: Reedy Creek Tributary sd. miles Drainage Area = ENGLISH

<b>USGS RUR</b>	AL REGRE	<b>USGS RURAL REGRESSION EQUA</b>	ATIONS (OLD)	RUF	SAL EQUA	<b>ITIONS Rep</b>	RURAL EQUATIONS Report 01-4207
FREQUENCY	Sand Hills	Coastal Plain	ш	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)
2YR	24.05	57.86		2YR	110.31	53.31	27.30
5YR	39.47	126.03		5YR	199.17	107.46	45.36
10YR	52.05	191.58		10YR	276.08	157.51	29.62
25YR	69.45	310.63		25YR	395.39	236.93	80.37
50YR	84.45	422.65		50YR	501.49	310.69	98.37
100YR	101.17	566.00		100YR	622.40	397.68	117.32
200YR	124.42	744.08		200YR	760.54	499.67	139.55
500YR	146.30	1041.30	944.59	500YR	974.70	661.97	172.49

## **USGS URBAN REGRESSION EQUATIONS**

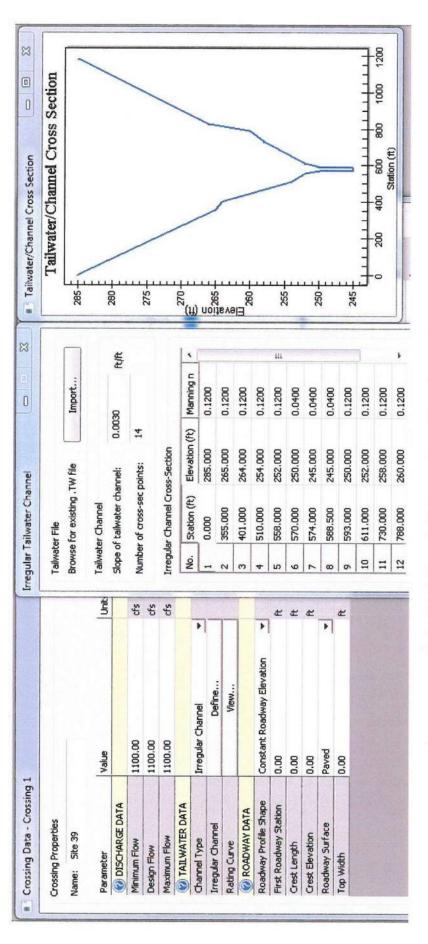
BDF=

(These Equations are used only for comparison)

								(Based on 2.80xQ10)	
		(cfs)							
or companioniy	Sand Hills Coastal Plain	(cfs)	334.99	449.64	647.47	826.47	1068.39	1259.01	1727.56
HIS ALE USEU OIIIY	Sand Hills	(cfs)	135.43	160.62	195.33	224.25	260.35	449.74	345.56
( Hiese Eduations	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

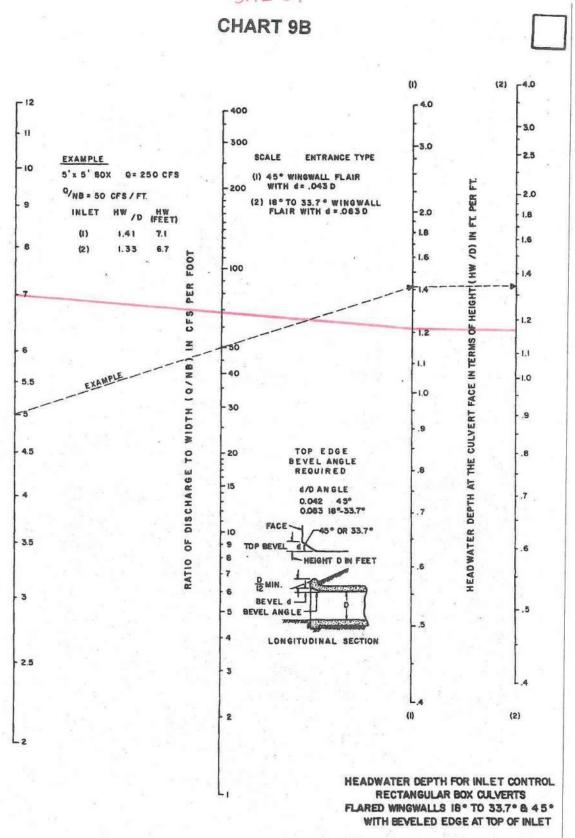
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<b>USGS Fact Sheet 007-00</b>
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ΨÞ	Disharges				940	1140			
FEMA	FREQUENCY			10YR	50YR	100YR	500YR		
	<b>Discharge Used</b>					1100		(Based on 2.80xQ10	(Based on 3.66xQ10)
	Blue Ridge	(cts)	572.31	717.68	1005.54	1123.96	1232.06	2009.50	2626.70
	Coastal Plain	(cfs)	498.41	646.76	932.68	1076.75	1211.76	1810.93	2367.15
45	Sand Hills	(cfs)	357.82	441.92	559.18	639.05	707.29	1237.37	1617.42
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

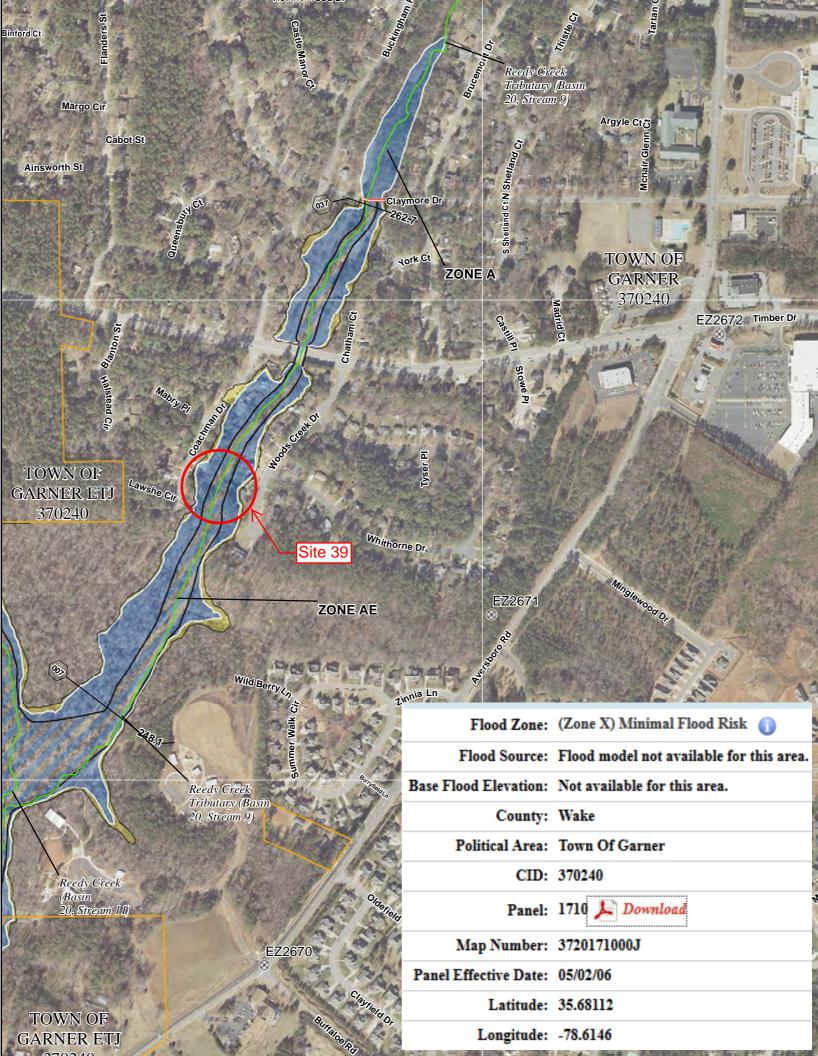


Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
1100.000	252.874	7.874	4.725	1.474
1100.000	252.874	7.874	4.725	1.474
1100.000	252.874	7.874	4.725	1.474
1100.000	252.874	7.874	4.725	1.474
1100,000	252.874	7.874	4.725	1.474
1100.000	252,874	7.874	4.725	1.474
1100.000	252,874	7.874	4.725	1.474
1100.000	252.874	7.874	4.725	1.474
1100.000	252.874	7.874	4.725	1.474
1100.000	252,874	7.874	4.725	1.474
1100.000	252.874	7.874	4.725	1.474

SITE 39



 $\frac{Q}{NB} = \frac{1100}{(2)(8)} = 68.75$ 



### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000





Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Table 9 - Flo	poding Sources Studied	by Detailed Methods: R	edelineated
Source		Sources	Affected Communities
	From	То	
Middle Creek	The confluence with Swift Creek	Approximately 0.7 mile upstream of confluence of Middle Creek Tributary	Rdu Town Of Apex Town Of Cary Town Of Fuquay-Varina Town Of Holly Springs Wake County
Millbrook Tributary to Marsh Creek (Basin 18, Stream 19)	The confluence with Marsh Creek (Basin 18, Stream 17)	East Millbrook Road	City Of Raleigh
Mills Branch (Basin 22, Stream 5)	The confluence with Middle Creek (Basin 22, Stream 1)	Railroad	Rdu Town Of Fuquay-Varina Wake County
Mine Creek (Basin 18, Stream 31)	The confluence with Crabtree Creek (Basin 18, Stream 9)	The confluences of East Fork Mine Creek (Basin 18, Stream 34) and West Fork Mine Creek (Basin 12, Stream 33)	City Of Raleigh
Morrisville Tributary (Basin 18, Stream 26)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Approximately 0.3 mile upstream of Railroad	Town Of Morrisville
Mud Branch (Basin 4, Stream 15)	The confluence with Horse Creek (Basin 4, Stream 1)	Approximately 3.0 miles upstream of confluence with Horse Creek (Basin 4, Stream 1)	Rdu Wake County
Neil Branch (Basin 24, Stream 8)	The confluence with Neil Creek (Basin 24, Stream 7)	East Spring Avenue	Town Of Fuquay-Varina
Neil Creek (Basin 24, Stream 7)	The confluence with Angier Creek (Basin 24, Stream 4)	Holland Road	Town Of Fuquay-Varina
Neuse River	Entire shoreline in Wake County	Entire shoreline within Granville County	Rdu Wake County
Neuse River	Wayne/Lenoir County boundary	Falls of the Neuse Road	City Of Raleigh Rdu Town Of Clayton Town Of Knightdale Town Of Wake Forest Wake County
New Light Creek	The confluence with Neuse River (Basin 15, Stream 1)	The confluence of Basin 3, Stream 8	Rdu Wake County
Panther Branch (Basin 22, Stream 2)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.5 mile upstream of Banks Road	Rdu Wake County
Panther Creek	The Chatham/Wake County Boundary	Approximately 1.0 mile upstream of Green Level to Durham Road	Town Of Cary
Perry Creek East Branch (Basin 15, Stream 27)	The confluence with Perry Creek (Basin 15, stream 26)	Approximately 0.3 mile upstream of Bivens Drive	City Of Raleigh
Pigeon House Branch (Basin 18, Stream 27)	The confluence with Crabtree Creek (Basin 18, Stream 9)	West Peace Street	City Of Raleigh
Poplar Branch (Basin 13, Stream 2)	The confluence with Poplar Creek (Basin 13, Stream 1)	Farm Road	Town Of Knightdale
Poplar Creek (Basin 13, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 900 Feet upstream of Fayetteville Street	Rdu Town Of Knightdale Wake County
Powell Creek (Basin 8, Stream 7)	The confluence with Hodges Creek (Basin 8, Stream 1)	Approximately 1.3 miles upstream of Peebles Road	City Of Raleigh Rdu Town Of Rolesville Wake County
Reedy Creek (Basin 20, Stream 11)	The confluence with Swift Creek (Basin 20, Stream 1)	Seventh Avenue	Rdu Town Of Garner Wake County
Reedy Creek (Basin 6, Stream 8)	The confluence with Sanford Creek (Basin 6, Stream 7)	Rogers Road	Town Of Rolesville Town Of Wake Forest
Reedy Creek Tributary (Basin 20, Stream 9)	The confluence with Reedy Creek (Basin 20, Stream 11)	Claymore Drive	Town Of Garner
Richland Creek (Basin 18, Stream 3)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Trinity Road	City Of Raleigh
9 cky Branch (Basin 22, Stream 8)	The confluence with Middle Creek (Basin 22, Stream 1)	Holly Springs Road	Rdu Town Of Holly Springs Wake County
Rocky Branch (Basin 30, Stream 5)	Approximately 60 feet downstream of Western Boulevard (upstream crossing)	Approximately 900 feet upstream of Pullen Road	City Of Raleigh
Rocky Branch (Basin 30, Stream 5)	The confluence with Walnut Creek (Basin 30, Stream 1)	Approximately 215 feet upstream of Fayetteville Road	City Of Raleigh
Rocky Ford Branch (Basin 24, Stream 5)	The confluence with Kenneth Creek (Basin 24, Stream 2)	Approximately 0.9 mile upstream of confluence with Kenneth Creek (Basin 24, Stream 2)	Rdu Town Of Fuquay-Varina Wake County
Sanford Creek (Basin 6, Stream 7)	The confluence with Smith Creek (Basin 6, Stream 1)	Approximately 300 feet upstream of the confluence of Basin 6, Stream 9	Rdu Town Of Rolesville Town Of Wake Forest Wake County
Smith Creek	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 0.9 mile upstream of Oak Grove Church Road	Rdu Town Of Wake Forest Wake County
Southeast Prong Beaverdam Creek (Basin 18, Stream 30)	The confluence with Beaverdam Creek (Basin 18, Stream 28)	Wade Avenue	City Of Raleigh

**Table 13 - Summary of Discharges** 

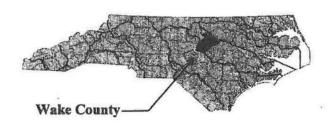
Table 13 - Summ Flooding Source			Discha	rges (cfs)	es (cfs)	
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance	
Just upstream of Atlantic Avenue	2.70	*	*	2,740	*	
At intersection of Fairview Road and Downtown Boulevard	2.10	*	*	2,590	*	
Approximately 1,175 downstream of W Peace Street	0.90	*	*	1,700	*	
Poplar Branch (Basin 13, Stream 2)						
At mouth	0.90	*	*	995	*	
Approximately 700 feet upstream of Old Ferrell Road	0.40	*	*	690	*	
Poplar Creek (Basin 13, Stream 1)		•	•			
At mouth	9.00	*	*	3,600	*	
Just upstream of tributary just upstream of Grasshopper Road	6.60	*	*	3,000	*	
Approximately 0.5 mile downstream of Grasshopper Road	2.90	*	*	2,000	*	
Just upstream of Poplar Branch (Basin 13, Stream 2)	1.50	*	*	1,300	*	
Approximately 500 feet upstream of Fayettville Street	0.90	*	*	900	*	
Approximately 500 feet upstream of Fayettville Street	0.50	*	*	720	*	
Powell Creek (Basin 8, Stream 7)						
At mouth	10.00	*	*	3,500	*	
Approximately 0.6 mile upstream of Mitchell Mill Road	6.30	*	*	2,780	*	
Approximately 1.3 miles upstream of Peebles Road	2.40	*	*	1,650	*	
Approximately 1.5 miles upstream of Peebles Road	1.30	*	*	1,300	*	
	1.50			1,500		
Reedy Branch (Basin 27, Stream 5)	4.40	1 500	2.550	2.020	4 420	
At confluence with Beaver Creek	4.10	1,520	2,550	3,020	4,430	
Approximately 1,580 feet upstream of Olive Chapel Road	3.00	1,450	2,430	2,880	4,180	
Just upstream of confluence with Reedy Branch Tributary (Basin 27, Stream 6)	1.00	656	1,120	1,350	1,970	
Reedy Branch Tributary (Basin 27, Stream 6)				1	1	
At confluence with Reedy Branch (Basin 27, Stream 5)	1.50	864	1,430	1,690	2,380	
Approximately 0.5 mile downstream of Kelly Road	1.10	819	1,320	1,540	2,140	
Reedy Creek (Basin 20, Stream 11)		I				
Just upstream of tributary near lake	1.10	*	*	1,100	*	
First street upstream of Vandora Springs School	0.50	*	*	880	*	
Reedy Creek (Basin 6, Stream 8)		1		1	T	
Just downstream of Rogers Road	1.40	*	*	750	*	
Just upstream of Rogers Road	1.40	*	*	1,300	*	
Reedy Creek Tributary (Basin 20, Stream 9)		1		1		
At mouth	0.91	*	*	1.140	*	
At street extending from Claymore Drive	0.60	*	*	925	*	
and Creek						
At confluence with Neuse River (Basin 15, Stream 1)	14.00	*	*	5,040	*	
Approximately 0.7 mile upstream of confluence with Neuse River (Basin 15, Stream 1)	13.18	*	*	4,900	*	
Approximately 1.5 miles upstream of confluence with Neuse River (Basin 15, Stream 1)	12.21	*	*	4,850	*	
At confluence of Richland Creek Tributary	10.47	*	*	4,760	*	
Approximately 0.4 mile upstream of US 1	9.57	*	*	4,750	*	
Approximately 0.8 mile upstream of US 1	8.72	*	*	4,730	*	
Approximately 530 feet upstream of West South Avenue	8.15	*	*	4,700	*	
Approximately 0.6 mile downstream of confluence of Basal Creek	7.28	*	*	4,560	*	

	Table 21 - Floodway Data								
Floodwa	y Source		Floodway			Wa	ter Surface Eleva		
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
156	15,575	180	186	4.7	317.3	*	317.3	317.4	0.1
Reedy Creek	(Basin 6, Strea	ım 8)		1	•		•		
001	80	500 <sup>11</sup>	1,203	2.0	235.8	*	235.8	236.6	0.8
009	860	110	247	5.3	237.9	*	237.9	237.9	0.0
030	3,040	50	136	5.5	252.7	*	252.7	253.7	1.0
Reedy Creek	Tributary (Bas	in 20, Stream 9	9)		l	ı	l	ı	
007	700	90	249	4.1	248.1	*	248.1	249.1	1.0
037	3,690	70	244	3.0	262.7	*	262.7	263.6	0.9
Richland Cree Site 39	ek 					İ		İ	
Oile 00	1,230	427	2,310	2.2	203.61	197.3	196.7	197.7	1.0
019	1,945	500	2,913	1.7	203.61	198.8	198.1	198.9	0.8
025	2,491	545	2,956	1.7	203.61	199.4	198.7	199.7	1.0
031	3,112	480	2,049	2.5	203.61	200.6	199.8	200.8	1.0
035	3,500	425	1,879	2.7	203.61	202.3	201.6	201.9	0.3
040	4,021	400	2,017	2.4	203.61	203.9	203.1	203.7	0.5
047	4,666	470	2,369	2.1	204.4	205.2	204.4	205.3	0.8
050	5,009	530	2,247	2.2	205.0	205.8	205.0	206.0	1.0
055	5,533	600	2,648	1.8	206.2	206.9	206.2	207.2	1.0
071	7,078	380	1,744	2.8	211.3	212.4	211.3	211.6	0.3
074	7,430	400	1,632	3.0	212.0	213.0	212.0	212.4	0.4
079	7,941	400	1,428	3.4	213.2	214.1	213.2	214.2	1.0
085	8,528	305	1,330	3.6	216.1	216.5	216.1	216.6	0.4
091	9,131	200	989	4.9	217.3	217.9	217.3	218.3	1.0
097	9,720	170	942	5.2	218.7	219.4	218.7	219.7	1.0
105	10,482	145	883	5.5	221.2	222.1	221.2	221.5	0.3
111	11,134	105	869	5.6	222.3	223.1	222.3	223.2	0.9
115	11,543	95	644	7.5	222.8	223.4	222.8	223.7	0.9
132	13,154	175	1,116	5.4	229.5	229.9	229.5	230.5	1.0
134	13,411	183	1,200	5.0	231.4	234.2	231.4	232.1	0.7
140	14,004	235	1,615	2.9	232.8	235.2	232.8	233.3	0.5
146	14,591	160	942	5.1	233.2	235.3	233.2	233.6	0.4
150	14,981	179	823	5.8	234.1	235.8	234.1	234.6	0.5
153	15,342	179	1,141	4.2	236.6	236.0	236.6	237.1	0.5
160	15,993	160	1,110	4.3	238.1	237.8	238.1	238.8	0.7
166	16,555	263	1,583	3.0	239.4	239.4	239.4	240.2	0.8
173	17,312	200	1,249	3.8	240.9	240.9	240.9	241.8	0.9
181	18,056	180	1,100	4.3	242.5	242.5	242.5	243.4	0.9
186	18,621	180	854	5.5	244.3	244.3	244.3	244.8	0.5
191	19,058	120	700	6.8	245.5	245.5	245.5	246.5	1.0
196	19,592	90	722	6.6	248.3	248.4	248.3	249.1	0.8
202	20,245	90	802	5.9	250.5	250.5	250.5	251.1	0.6
209	20,939	160	1,266	3.7	251.9	251.9	251.9	252.9	1.0
214	21,418	120	830	5.7	253.4	253.4	253.4	254.4	1.0
220	22,026	208	1,401	3.4	256.5	256.6	256.5	257.0	0.5
234	23,416	200	1,557	3.0	260.8	260.8	260.8	261.1	0.3
L207	20,710	1200	1,001	10.0	200.0	200.0	200.0	1201.1	10.0

A Report of Flood Hazards in

WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 1 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV001A



**Table 10—Roughness Coefficients** 

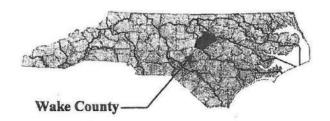
Stream	Channel "n"	Overbank "n"
Lower Barton Creek (Basin 17, Stream 1)	0.030 - 0.070	0.070 - 0.110
Lowery Creek (Basin 4, Stream 10)	0.030 - 0.070	0.070 - 0.110
Lynn Road Tributary (Basin 18, Stream 32)		
	0.030 - 0.070	0.070 - 0.110
Mahlers Creek (Basin 20, Stream 6)	0.030 - 0.070	0.070 - 0.110
Mango Creek (Basin 15, Stream 11)	0.030 - 0.070	0.070 - 0.110
Marks Creek (Basin 14, Stream 1)	0.030 - 0.070	0.070 - 0.130
Marsh Creek (Basin 18, Stream 17)	0.038 - 0.060	0.090 - 0.200
Medfield Tributary to Richland Creek (Basin 18, Stream 39)	0.030 - 0.070	0.070 - 0.110
Middle Creek (Basin 22, Stream 1)	0.030 - 0.070	0.070 - 0.110
Millbrook Tributary to Marsh Creek (Basin 18, Stream 19)	0.030 - 0.070	0.070 - 0.110
Mills Branch (Basin 22, Stream 5)	0.030 - 0.070	0.070 - 0.130
Mine Creek (Basin 18, Stream 31)	0.030 - 0.070	0.070 - 0.110
Mingo Creek (Basin 12, Stream 2)	0.041 - 0.044	0.100 - 0.200
Moccasin Creek (Basin 11, Stream 1)	0.030 - 0.070	0.070 - 0.110
Morris Branch (Basin 29, Stream 5)	0.030 - 0.050	0.100 - 0.200
Morrisville Tributary (Basin 18, Stream 26)	0.030 - 0.070	0.070 - 0.110
Mud Branch (Basin 4, Stream 15)	0.030 - 0.070	0.070 - 0.110
Neil Branch (Basin 24, Stream 8)	0.030 - 0.070	0.070 - 0.130
Neil Creek (Basin 24, Stream 7)	0.030 - 0.070	0.070 - 0.110
Neills Creek	0.035 - 0.048	0.100 - 0.150
Neuse River (Basin 15, Stream 1)	0.030 - 0.070	0.070 - 0.110
New Hope Tributary to Marsh Creek (Basin 18, Stream 18)	0.040 - 0.065	0.110 - 0.200
Newlight Creek (Basin 3, Stream 1)	0.040 - 0.070	0.070 - 0.150
Norris Branch	0.048	0.145
Panther Branch (Basin 22, Stream 2)	0.030 - 0.070	0.070 - 0.110
Panther Creek (Basin 29, Stream 1)	0.03-0.070	0.070 - 0.110
Perry Creek (Basin 10, Stream 19)	0.042	0.130
Perry Creek (Basin 15, Stream 26)	0.032 - 0.052	0.100 - 0.200
Perry Creek East Branch (Basin 15, Stream 27)	0.030 - 0.070	0.070 - 0.110
Pigeon House Branch (Basin 18, Stream 27)	0.030 - 0.070	0.070 - 0.110
Poplar Branch (Basin 13, Stream 2)	0.030 - 0.070	0.070 - 0.110
Poplar Creek (Basin 13, Stream 1)	0.030 - 0.070	0.070 - 0.110
Powell Creek (Basin 8, Stream 7)	0.030 - 0.070	0.070 - 0.110
Reedy Creek (Basin 20, Stream 11)	0.030 - 0.070	0.070 - 0.110
Reedy Branch (Basin 27, Stream 5)	0.045 - 0.050	0.100 - 0.200
Reedy Branch Tributary (Basin 20, Stream 9)	0.030 - 0.070	0.070 - 0.110
Reedy Branch Tributary (Basin 27, Stream 6)	0.045 - 0.050	0.100 - 0.200
Reedy Creek (Basin 6, Stream 8)	0.030 - 0.070	0.070 - 0.110
Richland Creek (Basin 5, Stream 1)	0.038 - 0.070	0.100 - 0.200
Richland Creek (Basin 18, Stream 3)	0.030 - 0.070	0.070 - 0.110
Richland Creek Tributary	0.040	0.100 - 0.200

SITE 39

A Report of Flood Hazards in

### WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 2 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse



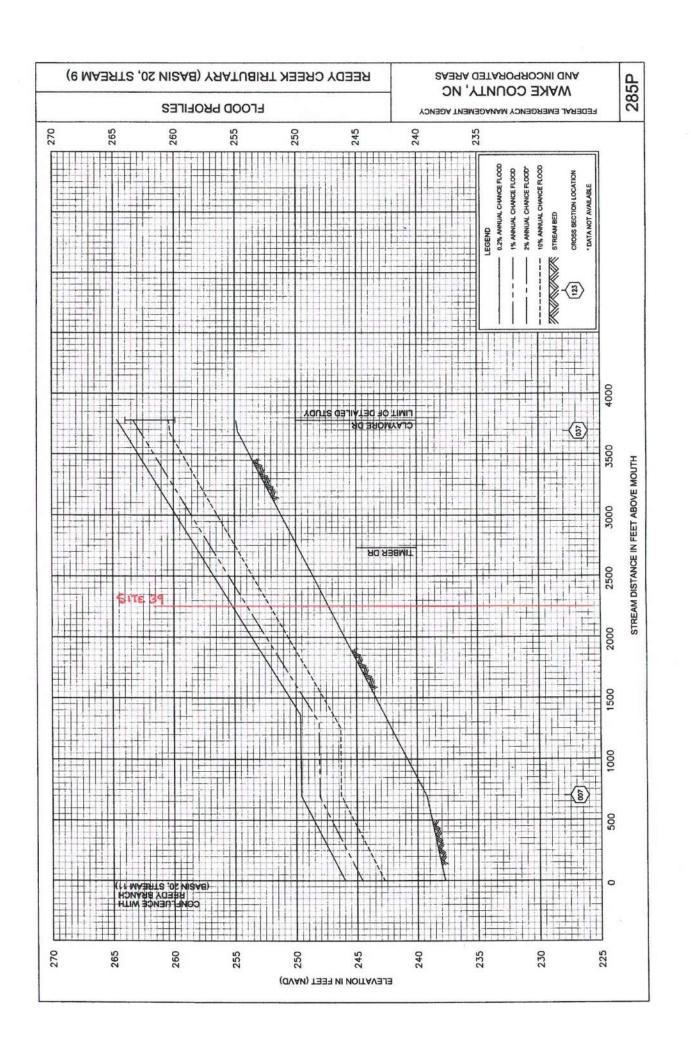


May 2, 2006

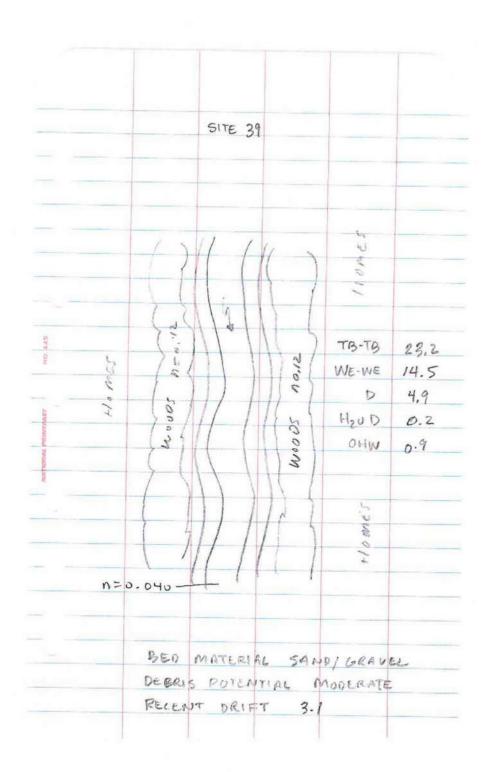
Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV002A





		Ne	use River Basir
Name	Index Number	Classification	Class Date
Description		Specia	l Designation
Rattlesnake Branch	27-101-5-2	C;Sw,NSW	05/01/88
From source to Tuckahoe Creek			
Rattlesnake Branch	27-150-6-4	SC;Sw,NSW	05/01/88
From source to Trent Creek			
Rattlesnake Branch	27-101-15-2	C;Sw,NSW	05/01/88
From source to Beaver Creek			
Rays Creek	27-2-21-2-1	WS-II;HQW,NSW	08/03/92
From source to South Fork Little River			
Reeds Gut	27-115-8	SC;Sw,NSW	05/01/88
From source to Hancock Creek			
Reedy Branch	27-101-7	C;Sw,NSW	05/01/88
From source to Trent River			
Reedy Branch	27-12-0.5	WS-IV;NSW	08/01/98
From source to Beaverdam Creek			
Reedy Branch	27-101-36	C;Sw,NSW	05/01/88
From source to Trent River			
Reedy Branch	27-43-7-(1)	WS-III;NSW	08/03/92
From source to a point 0.5 mile upstream of mouth	h		
Reedy Branch	27-43-7-(2)	WS-III;NSW,CA	08/03/92
From a point 0.5 mile upstream of mouth to Lake B	Benson, Swift Creek		
Reedy Branch	27-62-2	C;NSW	05/01/88
From source to Stoney Creek			
Reedy Branch (Little Branch)	27-43-14	C;NSW	05/01/88
From source to Swift Creek			
Reedy Branch (Reeders Fork)	27-86-17-2	C;Sw,NSW	05/01/88
From source to Tyson Marsh			
Reedy Creek	27-45-10	C;NSW	05/01/88
From source to Black Creek			
Reedy Prong	27-52-3	C;NSW	05/01/88
From source to Mill Creek			
Reedys Creek (Reedy Creek Lake)	27-33-8	B;NSW	05/01/88
From source to Crabtree Creek			





NC DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS BRIDGE MANAGEMENT UNIT

**ATTENTION** 

# **BRIDGE INSPECTION REPORT**

INSPECTION TIPE:	Routine inspection		
COUNTY WAKE	BRIDGE NUMBER 910683	INSPECTION CYCLE 2	YRS
ROUTE SR2812	ACROSS CREEK		M.P. 0
LOCATION 1.0 MI.W.JCT.NC50		*	
SUPERSTRUCTURE TRIPLE 7'X 5' RCBC;	20.3' ALONG C/L OF CULVE	RT	
SUBSTRUCTURE			
SPANS			
LONGITUDE 78° 37' 27.57"	LATITU	DE 35° 41' 86.43"	
INSPECTION DATE 07/03/2013	PRESENT	CONDITION GOOD	
PRESENT POSTING N	PROPOS	SED POSTING	
OTHER SIGNS PRESENT			-



 Fracture Critical
 No

 Temporary Shoring
 No

 Scour Critical
 No

 Scour POA
 No

SIGN NOTICE ISSUED FOR REQUIRED

No WEIGHT LIMIT

No DELINEATORS

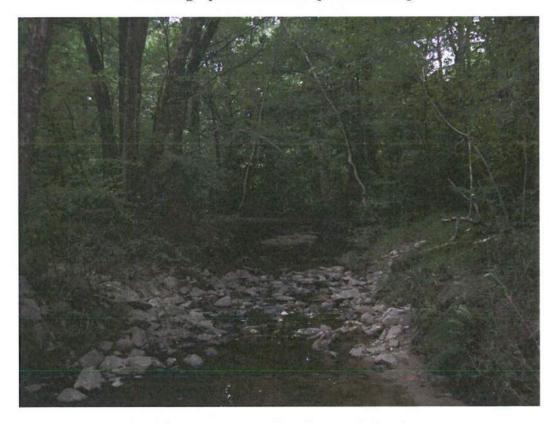
No NARROW BRIDGE

No ONE LANE BRIDGE

No LOW CLEARANCE



Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

Page 1 of 3



Looking at Upstream Channel of Upstream Structure.



Looking at Upstream Face of Upstream Structure (3@7'x5' RCBC)

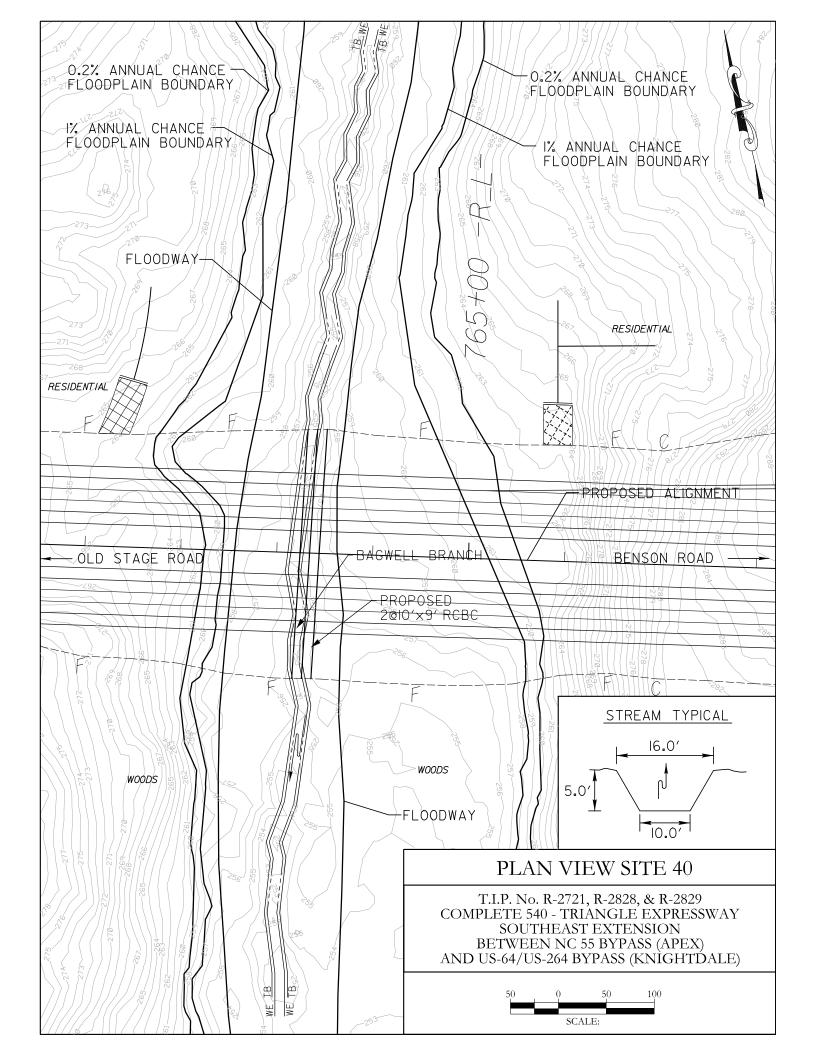


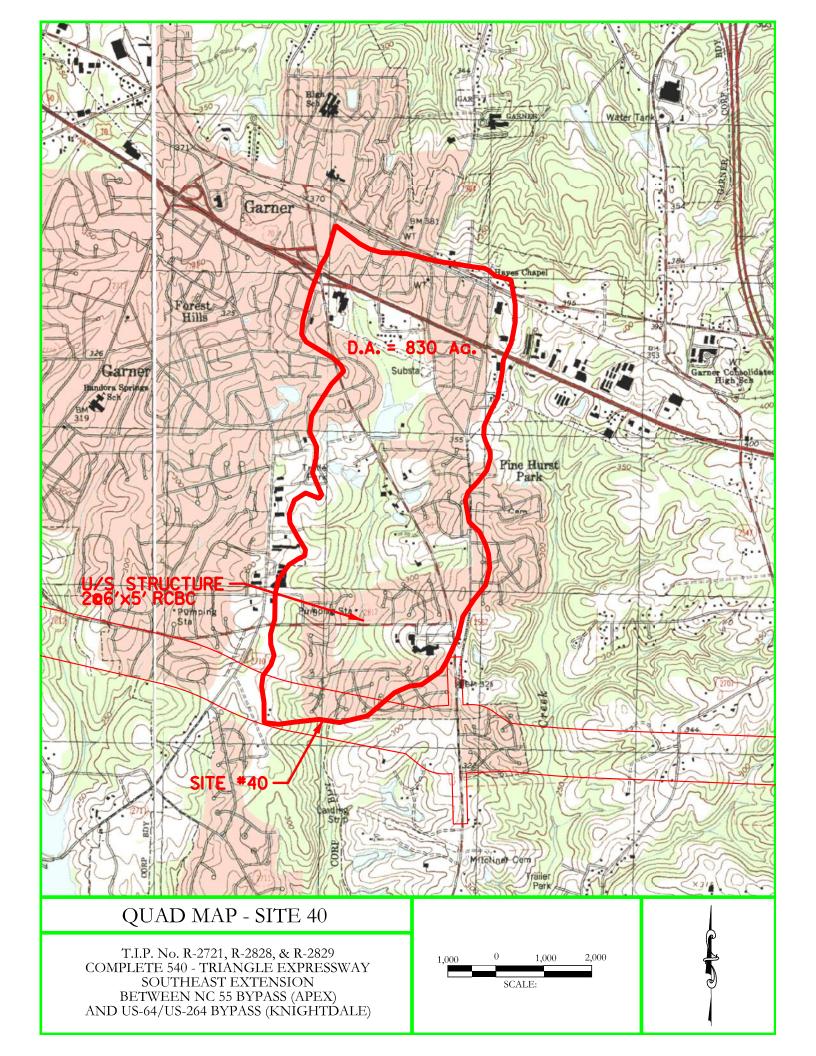
Looking at Downstream Face of Upstream Structure. (3@7'x5' RCBC)



Looking at Downstream Channel of Upstream Structure.

## Site 40





REGION: BLUE RIDGE METHOD USED: Fact Sheet: 007-00 STREAM NAME: Bagwell Branch sq. miles 1.30 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = 3/18/2014 ENGLISH

SGS RUR	AL REGRE	SSION EQU	ATIONS (OLD)	RUR	SAL EQUA	TIONS Rep	oort 01-4207	
REQUENCY	REQUENCY Sand Hills Coastal Plair	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	QUENCY Blue Ridge Coastal Plain Sand Hills	
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)	
2YR	36.00	81.92	172.62	2YR	162.30	77.19	40.38	
5YR	59.23	173.58	295.66	5YR	289.04	152.39	66.71	
10YR	78.20	260.54	397.67	10YR	397.35	220.92	87.53	
25YR	104.97	416.22	554.56	25YR	563.77	328.30	117.66	
50YR	128.07	560.74	689.03	50YR	711.13	427.21	143.85	
100YR	153.93	743.95	851.13	100YR	877.75	542.92	171.29	
200YR	189.40	970.51	1028.80	200YR	1067.27	677.68	203.52	
500YR	224.44	1344.05	1330.65	500YR	1359.55	890.42	251.28	

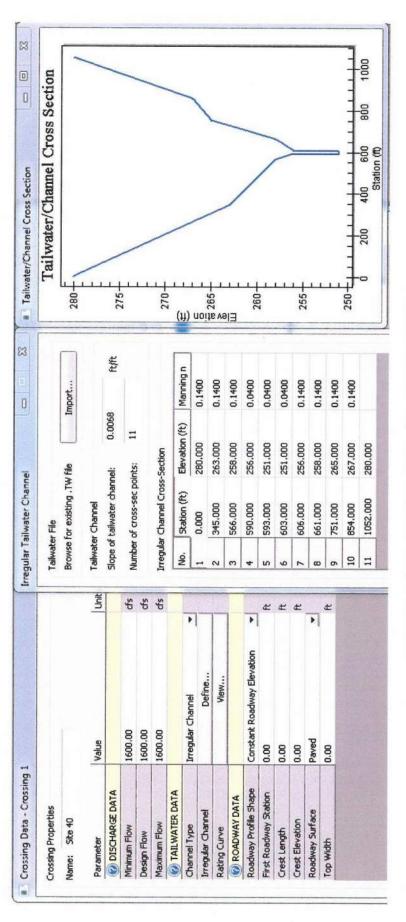
# **USGS URBAN REGRESSION EQUATIONS**

BDF=

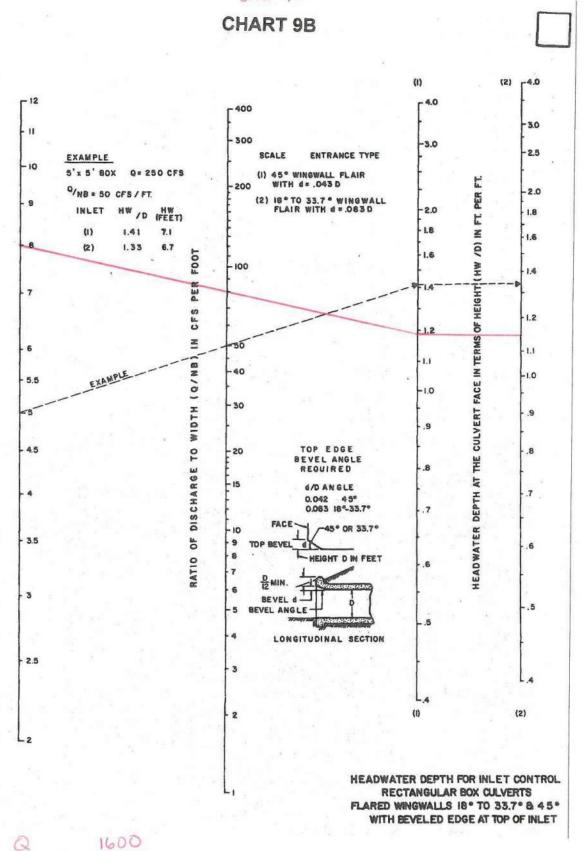
Ridge	(s)	.31	.30	7.95	3.50	1.24	2448.04 (Based on 2.80xQ10)	2306.62
ш	(cfs)						117000	W. Co. Sec.
Sand Hills Coastal Plain	(cfs)	472.16	626.01	888.63	1128.54	1451.84	1752.84	2325.65
Sand Hills	(cfs)	204.09	241.92	295.21	341.23	398.88	677.38	535.97
FREQUENCY					50YR			

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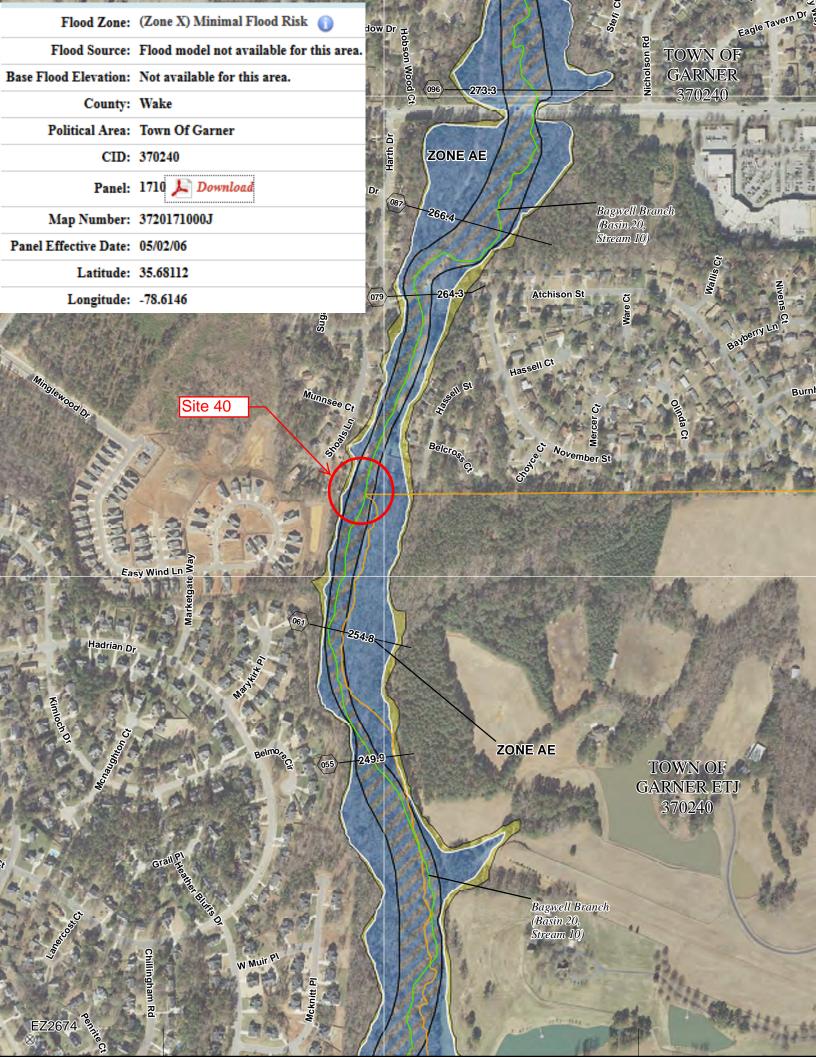
% Impervious =	20				FEMA	MA
FREQUENCY	Sand Hills (cfs)	Coastal Plain	Blue Ridge (cfs)	Discharge Used	FREQUENCY	Disharges
5YR	558.54	758.98	884.06			
10YR	677.07	962.97	1086.33		10YR	
25YR	834.33	1336.12	1473.35		50YR	
50YR	945.85	1525.92	1631.84	1600	100YR	
100YR	1038.66	1700.06	1772.85		500YR	
200YR	1895.78	2696.30	3041.73	(Based on 2.80xQ10)		1
500YR	2478.06	3524.45	3975.97	(Based on 3 66xO10)		



Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s) Shear (psf)	Shear (ps
1600,000	259.704	8.704	3.804	3.693
1600,000	259.704	8,704	3,804	3,693
1600,000	259.704	8,704	3,804	3.693
1600.000	259.704	8,704	3,804	3.693
1600,000	259.704	8.704	3,804	3.693
1600.000	259,704	8.704	3,804	3.693
1600,000	259,704	8.704	3.804	3,693
1600.000	259,704	8.704	3.804	3,693
1600.000	259.704	8.704	3.804	3.693
1600,000	259.704	8.704	3.804	3.693
1600,000	259.704	8,704	3.804	3,693



VB = (2)(10)



## **FLOOD INSURANCE STUDY**

### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 9, "Flooding Sources Studied by Detailed Methods: Redelineated", lists all flooding sources that were studied by detailed methods for the prestatewide FIS and redelineated for previous FISs. These flooding sources were not part of this revision and their effective analyses remain valid.

Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	Riverine	Sources	Affected Communities
Course	From	To	7 mosted Communities
Adams Branch (Basin 30, Stream 9)	The confluence with Big Branch Tributary No. 1 (Basin 30, Stream 6)	Corwin Road	Town Of Garner
Angier Creek (Basin 24, Stream 4)	The confluence with Kenneth Creek (Basin 24, Stream 2)	Railroad	Town Of Fuquay-Varina
Armory Tributary (Basin 18, Stream 38)	The confluence with Richland Creek (Basin 18, Stream 3)	Approximately 0.5 mile upstream of confluence with Richland Creek (Basin 18, Stream 3)	City Of Raleigh
Austin Creek (Basin 6, Stream 10)	The confluence with Smith Creek (Basin 6, Stream 1)	Approximately 350 feet upstream of Averette Road	Rdu Town Of Wake Forest Wake County
Bagwell Branch (Basin 20, Stream 10)	The confluence with Swift Creek (Basin 20, Stream 1)	NC Route 50	Town Of Garner
Basal Cheek (Basin 22, Stream 16)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.8 mile upstream of State Road 55	Rdu Town Of Fuquay-Varina Town Of Holly Springs
Basin 10, Stream 10	The confluence with Little River (Basin 10,	Highway 96/Zebulon Road	Wake County Rdu
Basin 10, Stream 2	Stream 1) The confluence with Little River (Basin 10,	<u> </u>	Wake County Rdu
basin 10, Stream 2	Stream 1)	Approximately 0.9 mile upstream of confluence with Little River (Basin 10, Stream 1)	Wake County
Basin 10, Stream 3	The confluence with Little River (Basin 10, Stream 1)	Moss Road	Rdu Wake County
Basin 10, Stream 5	The confluence with Little River (Basin 10, Stream 1)	Lizard Lick Rd	Rdu Wake County
Basin 10, Stream 6	The confluence with Little River (Basin 10, Stream 1)	Lizard Lick Rd	Rdu Wake County
Basin 10, Stream 9	The confluence with Little River (Basin 10, Stream 1)	Zebulon Road	Rdu Wake County
Basin 12, Stream 3	The confluence with Beaverdam Creek (Basin 12, Stream 1)	Old Crews Road	Town Of Knightdale
Basin 15, Stream 22	The confluence with Neuse River (Basin 15, Stream 1)	Forestville Road	City Of Raleigh
Basin 15, Stream 25	The confluence with Neuse River (Basin 15, Stream 1)	The intersection between Forestville Rd and Mitchell Mill Road	City Of Raleigh
Basin 15, Stream 28	The confluence with Perry Creek (Basin 15, stream 26)	Approximately 0.7 mile upstream of Berkshire Downs Drive	City Of Raleigh
Basin 15, Stream 32	The confluence with Falls Lake	Just upstream of Raven Ridge Road	Rdu Wake County
Basin 15, Stream 33	The confluence with Honeycutt Creek (Basin 15, Stream 31)	Approximately 0.3 mile upstream of Honeycutt Road	Rdu Wake County
Basin 15, Stream 7	The confluence with Neuse River (Basin 15, Stream 1)	Clifton Road	Rdu Town Of Knightdale Wake County
Basin 15, Stream 8	The confluence with Basin 15, Stream 7	Grasshopper Road	Rdu Wake County
Basin 15, Stream 9	The confluence with Neuse River (Basin 15, Stream 1)	Battle Ridge Road	Rdu Wake County
Basin 16, Stream 2	The confluence with Upper Barton Creek (Basin 16, Stream 1)	State Route 50	Rdu Wake County
Basin 16, Stream 5	The confluence with Upper Barton Creek (Basin 16, Stream 1)	Approximately 0.2 mile upstream of State Route 50	Rdu Wake County
Basin 17, Stream 4	The confluence with Lower Barton Creek (Basin 17, Stream 1)	Old Creedmoor Road	Rdu Wake County
Basin 18, Stream 13	The confluence with Stirrup Iron Creek (Basin 18, Stream 12)	Sorrell Grove Church Road	Town Of Morrisville
Basin 18, Stream 4	The confluence with Turkey Creek (Basin 18, Stream 5)	Approximately 0.3 mile upstream of Lynn Road	City Of Raleigh
Basin 18, Stream 8	The confluence with Sycamore Creek (Basin 18, Stream 6)	Approximately 0.6 mile upstream of West Gate Road	City Of Raleigh
Basin 19, Stream 3	The confluence with White Oak Creek (Basin 19, Stream 1)	Railroad	Rdu Town Of Garner Wake County
Basin 20, Stream 20	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 0.8 mile upstream of confluence with Swift Creek (Basin 20, Stream 1)	Rdu Wake County
Basin 20, Stream 7	The confluence with Mahlers Creek (Basin 20, Stream 6)	Bryan Road	Town Of Garner
Basin 20, Stream 8	The confluence with Basin 20, Stream 7	Bryan Road	Town Of Garner
Basin 22, Stream 20	The confluence with Terrible Creek (Basin 22, Stream 19)	Approximately 1.0 mile upstream of confluence with Terrible Creek (Basin 22, Stream 19)	Town Of Fuquay-Varina

### 5.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for floods of the selected recurrence intervals for each flooding source studied. Hydrologic analyses are typically performed at the watershed level. Depending on factors such as watershed size and shape, land use and urbanization, and natural or man-made storage, various models or methodologies may be applied. For details on the county's hydrologic analyses, the hydrologic report is available by request.

A summary of the drainage area-peak discharge relationships for the flooding sources studied by detailed methods is shown in Table 13, "Summary of Discharges".

**Table 13 - Summary of Discharges** 

Flooding Source				ges (cfs)	
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Adams Branch (Basin 30, Stream 9)					
At mouth	0.90	*	*	1,075	*
Just upstream of Corwin Road	0.70	*	*	1,093	*
Angier Creek (Basin 24, Stream 4)					
At mouth	5.10	530	1,600	2,300	4,300
Just downstream of Neil Creek	3.40	360	950	1,300	2,400
Just upstream of Neil Creek	1.00	100	190	230	330
Just downstream of tributary	0.60	65	100	110	150
At old railroad crossing	0.40	10	50	50	60
Approximately 675 feet upstream of railroad	0.30	*	*	494	*
Just upstream of railroad	0.30	*	*	607	*
Approximately 1,900 feet upstream of railroad	0.10	*	*	404	*
Armory Tributary (Basin 18, Stream 38)					
At mouth	0.90	*	*	1,150	*
Approximately 1,400 feet upstream of Edwards Mill Road	0.60	*	*	554	*
Austin Creek (Basin 6, Stream 10)					
At mouth	4.00	*	*	2,325	*
At State Road 98/Wait Avenue	2.00	*	*	1,590	*
At Mitchell Pond	0.80	*	*	960	*
Bachelor Branch (Basin 28, Stream 6)					
At confluence with White Oak Creek	2.80	*	*	2,583	*
Approximately 0.6 mile upstream of Green Level West Road	2.00	*	*	2,366	*
Approximately 0.5 mile downstream of Glenmore Road	1.20	*	*	1,839	*
Approximately 1,580 feet upstream of Glenmore Road	0.80	*	*	1,547	*
Bagwell Branch (Basin 20, Stream 10)					
Just upstream of lake	2.00	*	*	1,450	*
At State Royte 50	0.60	*	*	950	*
al Creek					
At confluence with Richland Creek (Basin 5, Stream 1)	0.21	*	*	149	*
Approximately 0.1 mile upstream of confluence with Richland Creek (Basin 5, Stream 1)	0.20	*	*	249	*
Approximately 1,060 feet upstream of confluence with Richland Creek (Basin 5, Stream 1)	0.11	*	*	161	*
Basal Creek (Basin 22, Stream 16)					
Dam at Ross Lake	8.90	*	*	2,900	*
At State Road 55	4.80	*	*	2,100	*

Table 21 - Floodway Data

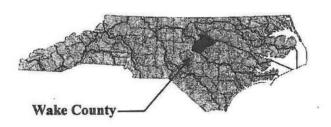
Flood	v Course			ole 21 - Fi	oodway D		tor Curfoss Flavo	tion	
Cross Section	y Source Distance (Feet	Width (Feet)	Floodway Section Area	Mean Velocity	Regulatory	1% Annual	ter Surface Eleva Without	With Floodway	Increase
0.000 000.001	Above Mouth)	main (r sor)	(Square Feet)	(Feet Per Second)	riogulatory	Chance Future Water-Surface Elevation	Floodway	· · · · · · · · · · · · · · · · · · ·	iiioi dada
067	6,700	140	567	3.0	275.3	*	275.3	275.9	0.6
076	7,615	100	395	4.0	280.2	*	280.2	280.3	0.1
080	8,000	90	452	3.5	282.4	*	282.4	282.7	0.3
082	8,200	110	458	2.9	283.1	*	283.1	283.7	0.6
088	8,800	130	705	1.9	287.0	*	287.0	287.4	0.4
092	9,200	130	562	2.2	287.3	*	287.3	287.9	0.6
095	9,500	90	422	2.9	290.6	*	290.6	291.1	0.5
099	9,850	135	603	2.0	291.5	*	291.5	292.0	0.5
104	10,400	120	298	3.8	293.4	*	293.4	293.8	0.4
110	11,000	120	341	3.3	299.4	*	299.4	299.6	0.2
121	12,100	80	307	3.3	308.8	*	308.8	309.4	0.6
124	12,350	31	107	9.2	313.9	*	313.9	314.0	0.1
128	12,770	75	526	1.9	331.4	*	331.4	331.4	0.0
Bagwell Bran	ch (Basin 20, S	Stream 10)	T		T	1		T	T
033	3,300	95	401	3.6	238.1	*	238.1	238.2	0.1
055	5,450	125	408	3.6	249.9	*	249.9	250.0	0.1
061	6,050	95	332	4.4	254.8	*	254.8	254.8	0.0
079	7,940	140	548	2.6	264.3	*	264.3	264.3	0.0
Site 40	8,740	250	644	2.3	266.4	*	266.4	266.5	0.1
096	9,590	250	1,523	0.8	273.3	*	273.3	273.6	0.3
103	10,270	175	450	2.8	273.3	*	273.3	273.9	0.6
114	11,420	125	421	3.0	278.8	*	278.8	279.5	0.7
131	13,100	100	223	4.2	291.7	*	291.7	291.7	0.0
Basal Creek		T	T		T			T	T
002	158	11	38	4.0	272.81	272.1	271.6	272.6	1.0
004	430	11	26	5.7	274.3	274.8	274.3	274.2	0.0
006	637	295	3,594	0.1	297.3	297.5	297.3	297.5	0.2
009	944	148	1,417	0.2	297.3	297.5	297.3	297.5	0.2
013	1,349	45	169	1.0	297.3	297.5	297.3	297.5	0.2
016	1,568	12	23	6.9	302.4	302.8	302.4	302.6	0.2
019	1,923	12	64	2.5	308.6	308.9	308.6	309.0	0.5
Basal Creek (	Basin 22, Strea	am 16)	I	T	I	T	T	I	I
052	5,225	728	10,078	0.3	327.4	*	327.4	327.4	0.0
092	9,240	355	903	3.2	328.2	*	328.2	328.3	0.1
158	15,765	215	934	2.2	356.3	*	356.3	356.6	0.3
165	16,500	90	329	4.0	358.3	*	358.3	358.6	0.3
169	16,900	120	389	3.4	361.4	*	361.4	361.4	0.0
173	17,300	100	439	3.0	362.9	*	362.9	363.4	0.5
196	19,640	90	215	6.2	380.3	*	380.3	380.4	0.1
Basin 10, Stre	eam 10								
005	541	95	185	5.8	257.2 <sup>1</sup>	*	256.9	256.9	0.0
021	2,050	160	550	1.8	265.2	*	265.2	265.6	0.4
021	2,100	185	577	1.7	265.3	*	265.3	265.7	0.4
023	2,340	155	602	1.7	270.2	*	270.2	270.9	0.7
Basin 10, Stre	am 2								

### FLOOD INSURANCE STUDY

A Report of Flood Hazards in

WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 1 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





May 2, 2006

Federal Emergency Management Agency State of North Carolina

> Flood Insurance Study Number 37183CV001A

www.fema.gov and www.ncfloodmaps.com



Roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment based on field inspection and aerial photographs.

Starting water-surface elevations for Southwest Prong Beaverdam Creek are based on normal depth calculations.

### **Revised Analyses for Countywide FIS**

For the streams studied by detailed methods, water-surface elevations of floods of the selected recurrence intervals were computed through use of the Army Corps of Engineers' HEC-RAS step-backwater computer program version 3.0 (U.S. Army Corps of Engineers, 2001). The hydraulic analyses were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail. The computer models were calibrated using historic high water data collected during field investigations.

Peak flood discharges with 10%, 2%, 1%, and 0.2% annual chance of exceedance have been modeled for this study. The cross section geometries were obtained from a combination of digital elevation data obtained by Light Detection and Ranging (LIDAR) and field surveys. All bridges, dams, and culverts were field surveyed to obtain elevation data and structural geometry. Natural floodplain cross sections were surveyed approximately every 4000' along the detail study reaches to obtain the channel geometry between bridges and culverts. Overbank cross section data for the backwater analyses were obtained from recently flown LIDAR data. Topographic data for the floodplain models was developed using recently flown LIDAR land data, field measured of verified structure information, and updated hydrologic data. The model was developed using HEC-RAS 3.0, run for the 1% annual chance and 0.2% annual chance frequency storms, and calibrated to known historic flood marks. Approximate 1% annual chance floodway models were also developed using method 4 in HEC-RAS 3.0.

Starting conditions for the hydraulic models were set to normal depth using starting slopes calculated from channel invert values taken from the LIDAR data, or, where applicable, derived from the water surface elevations of existing effective Flood Insurance Study water surface elevations.

Channel roughness factors (Manning's "n") used in the hydraulic computations were made in the field by an engineer where stream access was possible, with orthophotos used to supplement areas that could not be accessed. The channel and overbank "n" values for all of the streams studied by detailed methods are shown in Table 10, "Roughness Coefficients."

Table 10—Roughness Coefficients

	Stream	Channel "n"	Overbank "n"
	Angier Creek (Basin 24, Stream 4)	0.030 - 0.070	0.070 - 0.150
	Armory Tributary (Basin 18, Stream 38)	0.030 - 0.070	0.070 - 0.120
	Austin Creek (Basin 6, Stream 10)	0.030 - 0.070	0.070 - 0.110
_	Bachelor Branch (Basin 28, Stream6)	0.050	0.14 - 0.155
	Bagwell Branch (Basin 20, Stream 10)	0.030 - 0.070	0.070 - 0.110
	Basal Creek	0.042	0.090 - 0.200
	Basal Creek (Basin 22, Stream 16)	0.030 - 0.070	0.070 - 0.200

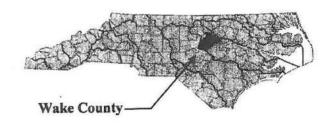
Site 40

# FLOOD INSURANCE STUDY

A Report of Flood Hazards in

### WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 3 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuguay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





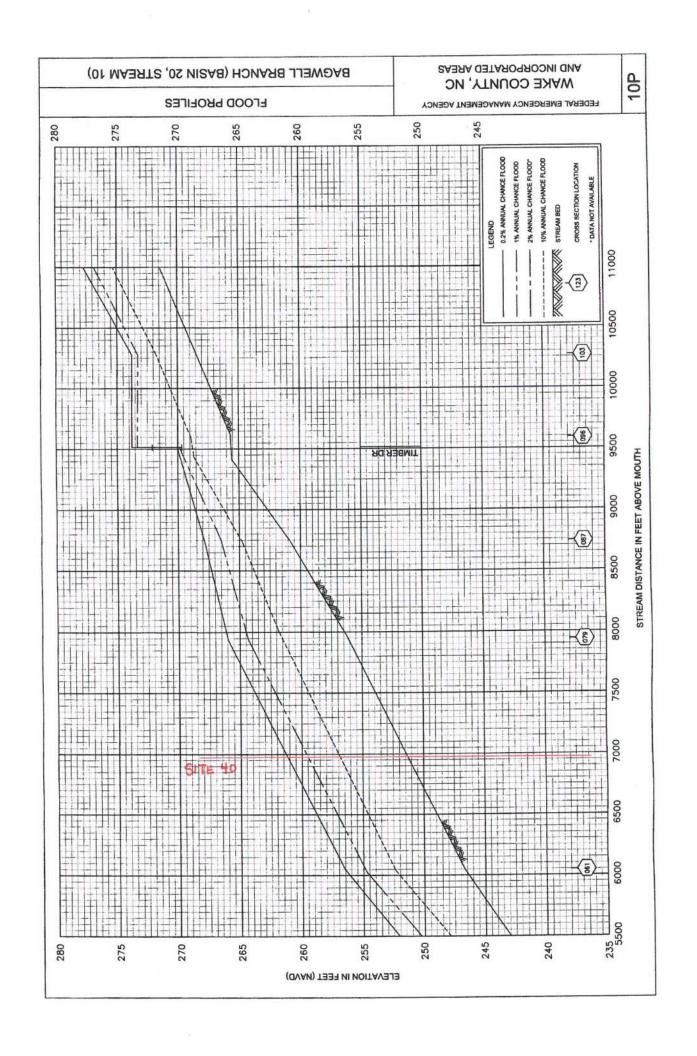
May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV003A

www.fema.gov and www.ncfloodmaps.com





Name	Index Number	Neu: Classification	se River Basir Class Date
Description		Special D	esignation
Strouds Creek	27-2-9	C;NSW	12/01/83
From source to Eno River			
tump Bay	27-148-1-6	SA;HQW,NSW	05/01/88
From source to Long Bay			
wan Creek	27-144	SA;HQW,NSW	05/01/88
From source to Neuse River			
wan Pond	27-52-7	C;NSW	05/01/88
Entire pond and connecting stream to Mill Creek			
Swift Creek	27-97-(6)	SC;Sw,NSW	05/01/88
From mouth of Bear Branch to Neuse River			
Swift Creek	27-97-(0.5)	C;Sw,NSW	05/01/88
From source to mouth of Bear Branch			
Swift Creek	27-43-(8)	C;NSW	05/01/88
From dam at Lake Benson to Neuse River			
Swift Creek (Lake Benson)	27-43-(5.5)	WS-III;NSW,CA	08/03/92
From a point 0.6 mile upstream of Wake County SR	1006 to dam at Lake Benson		
Swift Creek (Lake Wheeler)	27-43-(1)	WS-III;NSW	08/03/92
From source to a point 0.6 mile upstream of Wake 0	County SR 1006		
Swindell Bay	27-150-8-(2)	SC;Sw,NSW	05/01/88
From the narrows to Bay River			
Swindell Bay	27-150-8-(1)	SC;Sw,HQW,NSW	08/01/90
From source to the narrows			
Sycamore Creek (Big Lake)	27-33-9	B;NSW	05/01/88
From source to Crabtree Creek			
Tar Creek	27-150-31-4	SA;HQW,NSW	05/01/88
From source to Gale Creek			
Tar Creek	27-141-4	SA;HQW,NSW	05/01/88
From source to Broad Creek			
Tar Kiln Branch	27-54-6	WS-IV;NSW	08/03/92
From source to Falling Creek			
Tar River	27-71-2-2	WS-IV;NSW	08/01/02
From source to Trotters Creek			

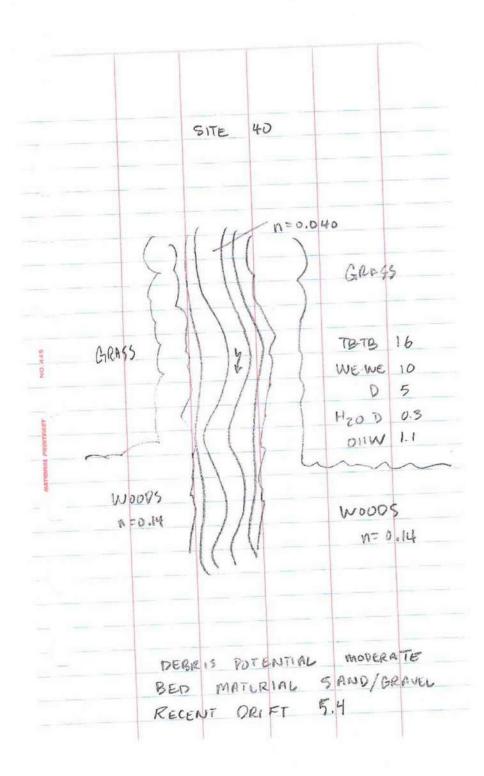
# PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake	PROJECT NUMBER <u>R-2721</u> , <u>R-2828</u> , & <u>R-2829</u>
STREAM Bagwell Branch	ROUTE New Location
(Site 40) ASSESSMENT PREPARED	OBY <u>Mulkey, INC.</u> DATE <u>1/8/2014</u> (MLH)
	HYDROLOGIC EVALUATION
NEAREST GAGING STAT	ION ON THIS STREAM (NONE <u>X</u> )
ARE FLOOD STUDIES AV	AILABLE ON THIS STREAM: Yes
FLOOD DATA:  Q <sub>10</sub> 1,100 CFS EST. BKV Q <sub>50</sub> 1,600 CFS EST. BKV Q <sub>500</sub> 4,000 CFS EST. BKV	WTR. <u>N/A</u> FT. Q <sub>25</sub> <u>1,500</u> CFS EST. BKWTR. <u>N/A</u> FT. WTR. <u>N/A</u> FT. Q <sub>100</sub> <u>1,800</u> CFS EST. BKWTR. <u>N/A</u> FT. WTR. <u>N/A</u> FT.
DRAINAGE AREA <u>1.30 Sq</u>	.Mi. METHOD USED TO COMPUTE Q: <u>USGS Urban Regression</u> ROPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: L	OW MODERATE X HIGH
COULD THIS BE S	IGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT	: YES NO <u>X</u>
EXPLANTION: A f	loodway modification may be required at this site.
LIST BUILDINGS I	N FLOOD PLAIN: None LOCATION:
UPSTREAM LAND ANTICIPATE ANY	
ANY FLOOD ZON	ING? (FIA STUDIES, ETC.) YES $\underline{X}$ NO
TYPE OF STUDY:	FEMA – Special Flood Hazard Zone AE
REGULATORY FL	OODWAY WIDTH 122 ft. Section 6780 (AS NOTED IN FIS)
COMMENTS:	

### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 20,000 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 55,200 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? $N/A$
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS
NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Chewacla TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service
ENVIRONMENTAL CONSIDERATIONS
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: Buried culverts 1 foot to allow for fish passage.
MISCELLANEOUS COMMENTS
IS THERE UNUSUAL SCOUR POTENTIAL? YES NO $\underline{\mathrm{X}}$ PROTECTION NEEDED

ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
ALTERNATIVES
RECOMMENDED DESIGN <u>2@10'x9' RCBC</u>
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING 160 Sq. Ft.
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YESNO $\underline{X}$ DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC



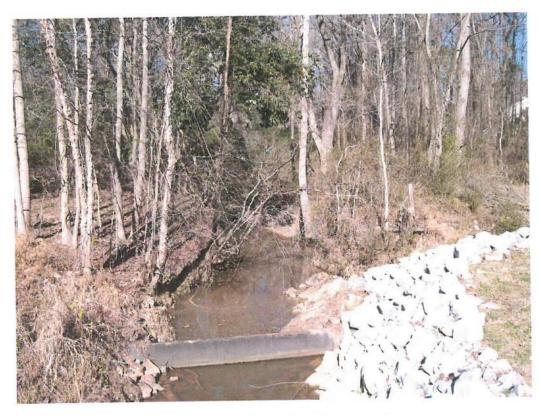


Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

Page 1 of 3

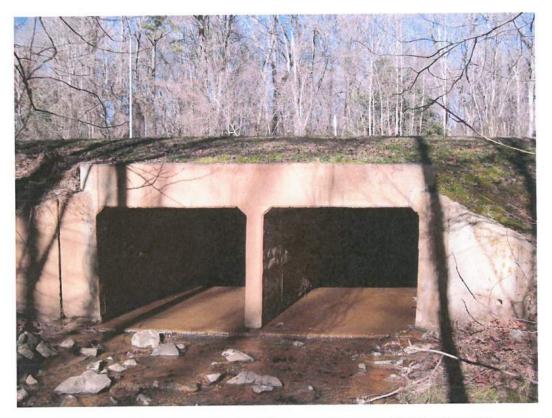


Looking at Upstream Channel of Upstream Structure.



Looking at Upstream Face of Upstream Structure (2@6'x5' RCBC).

Page 2 of 3



Looking at Downstream Face of Upstream Structure (2@6'x5' RCBC).



Looking at Downstream Face of Upstream Structure.

Page 3 of 3

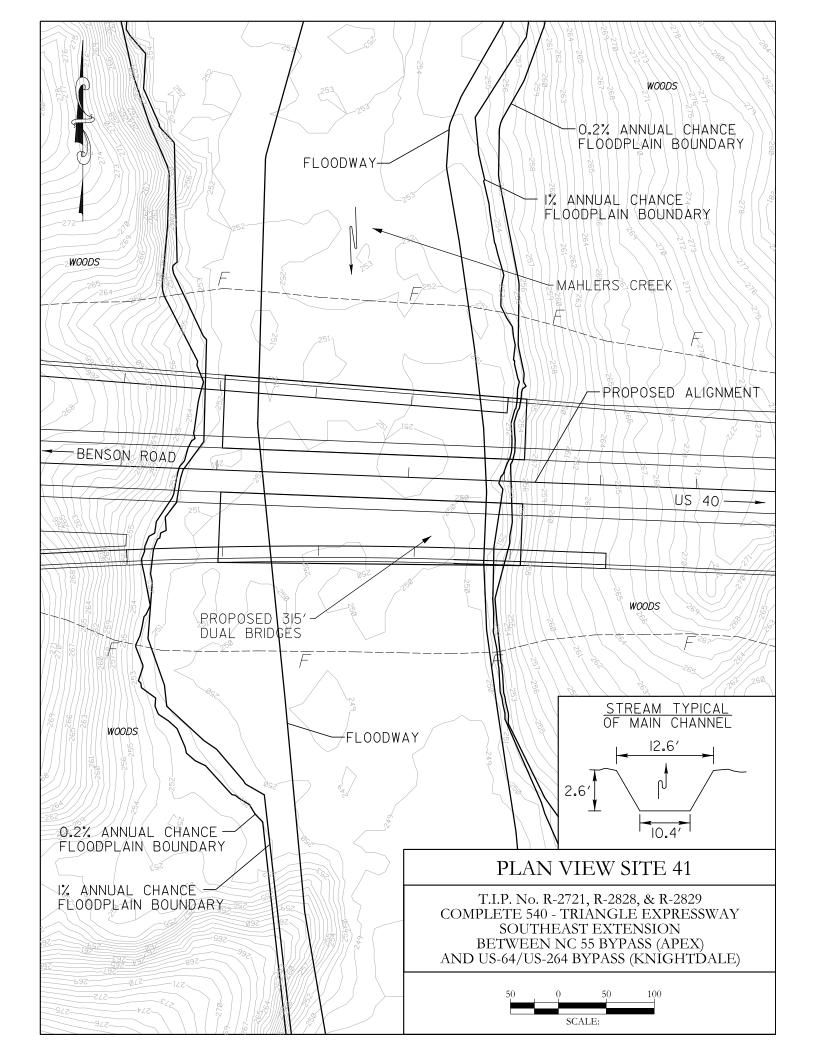
# PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

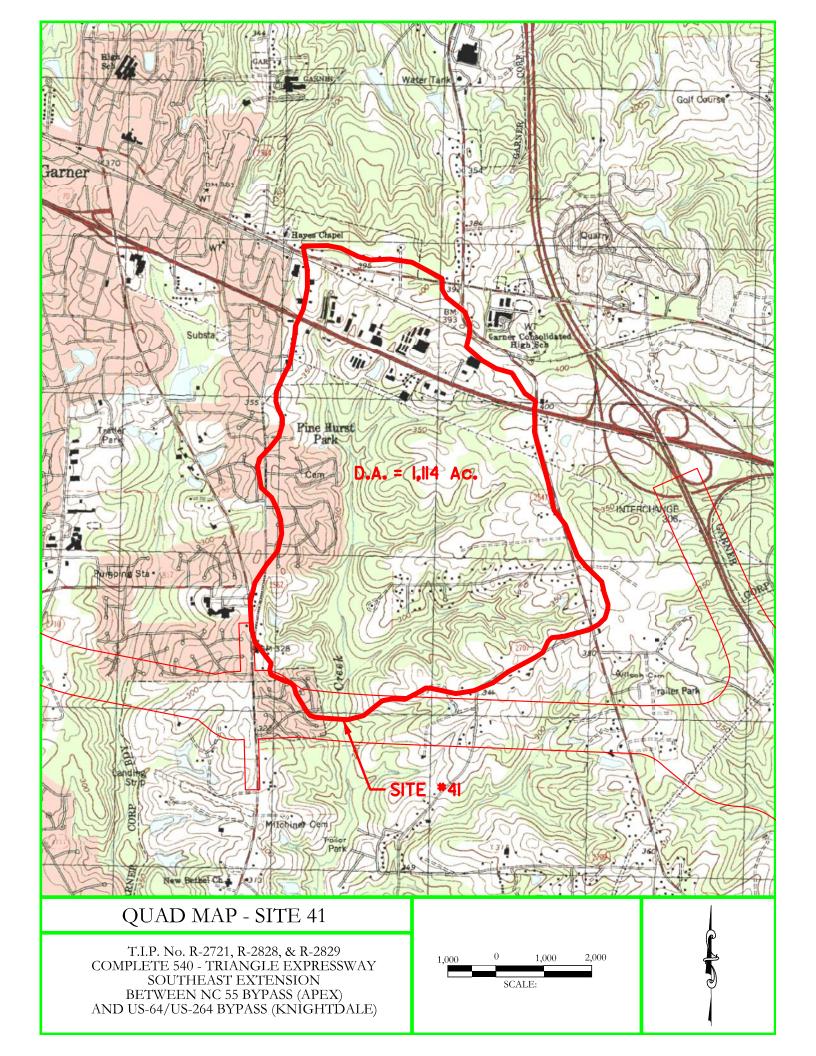
STREAM CROSSINGS AND ENCROPERING
COUNTY Wake PROJECT NUMBER R-2721, R-2828, & R-2829
STREAM Bagwell Branch ROUTE New Location
(Site 40) ASSESSMENT PREPARED BY Mulkey, INC. DATE 1/8/2014 (MLH)
HYDROLOGIC EVALUATION
NEAREST GAGING STATION ON THIS STREAM (NONE $X$ _)
ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: Yes
$\begin{array}{llllllllllllllllllllllllllllllllllll$
DRAINAGE AREA <u>1.30 Sq.Mi.</u> METHOD USED TO COMPUTE Q: <u>USGS Urban Regression</u> <u>PROPERTY RELATED EVALUATIONS</u>
DAMAGE POTENTIAL: LOW MODERATE X HIGH
COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: YES NO $\underline{X}$
EXPLANTION: A floodway modification may be required at this site.
LIST BUILDINGS IN FLOOD PLAIN: None LOCATION:
UPSTREAM LAND USE <u>Residential</u> ANTICIPATE ANY CHANGE? <u>No</u>
ANY FLOOD ZONING? (FIA STUDIES, ETC.) YES $\underline{X}$ NO
TYPE OF STUDY: FEMA - Special Flood Hazard Zone AE

REGULATORY FLOODWAY WIDTH 122 ft. Section 6780 (AS NOTED IN FIS)

COMMENTS: \_\_\_\_\_

# Site 41





Site # 41

4/22/2014

REGION: BLUE RIDGE METHOD USED: Fact Sheet: 007-00 STREAM NAME: Mahlers Creek sq. miles PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = ENGLISH

<b>USGS RURAL REGRESSION EQUA</b> .	AL REGRE	SSION EQUA	ATIONS (OLD)	RUF	SAL EQUA	TIONS Rep	ort 01-4207
FREQUENCY	Sand Hills	Coastal Plain	ш	FREQUENCY	Blue Ridge	Coastal Plain	NUENCY Blue Ridge Coastal Plain Sand Hills
	(cfs)	(cfs)			(cfs)	(cfs)	(cfs)
2YR	44.57	98.49		2YR	199.16	93.93	49.70
5YR	73.44	205.68		5YR	352.10	183.37	81.83
10YR	97.03	306.65	482.74	10YR	481.94	264.30	107.25
25YR	130.67	486.05		25YR	680.40	390.26	144.00
50YR	159.69	651.39		50YR	855.75	505.76	175.95
100YR	192.27	859.94		100YR	1053.17	640.32	209.33
200YR	236.65	1117.25	1239.45	200YR	1277.22	796.46	248.58
500YR	281.58	1538.73	1595.66	500YR	1621.77	1041.92	306.73

# **USGS URBAN REGRESSION EQUATIONS**

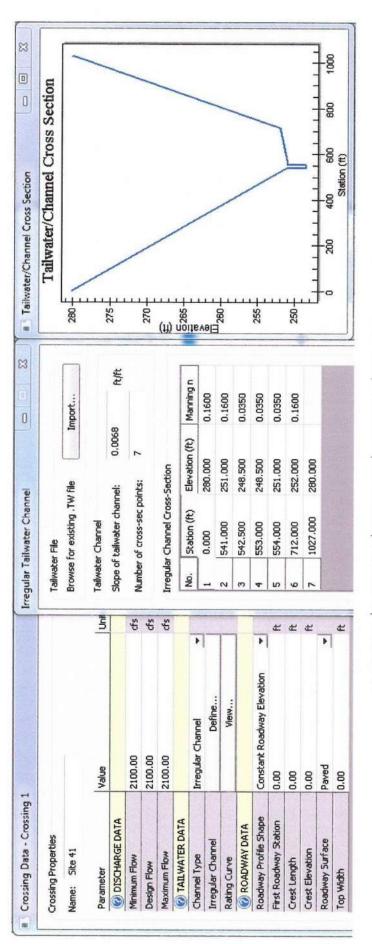
BDF= 11

(These Equations are used only for comparison)

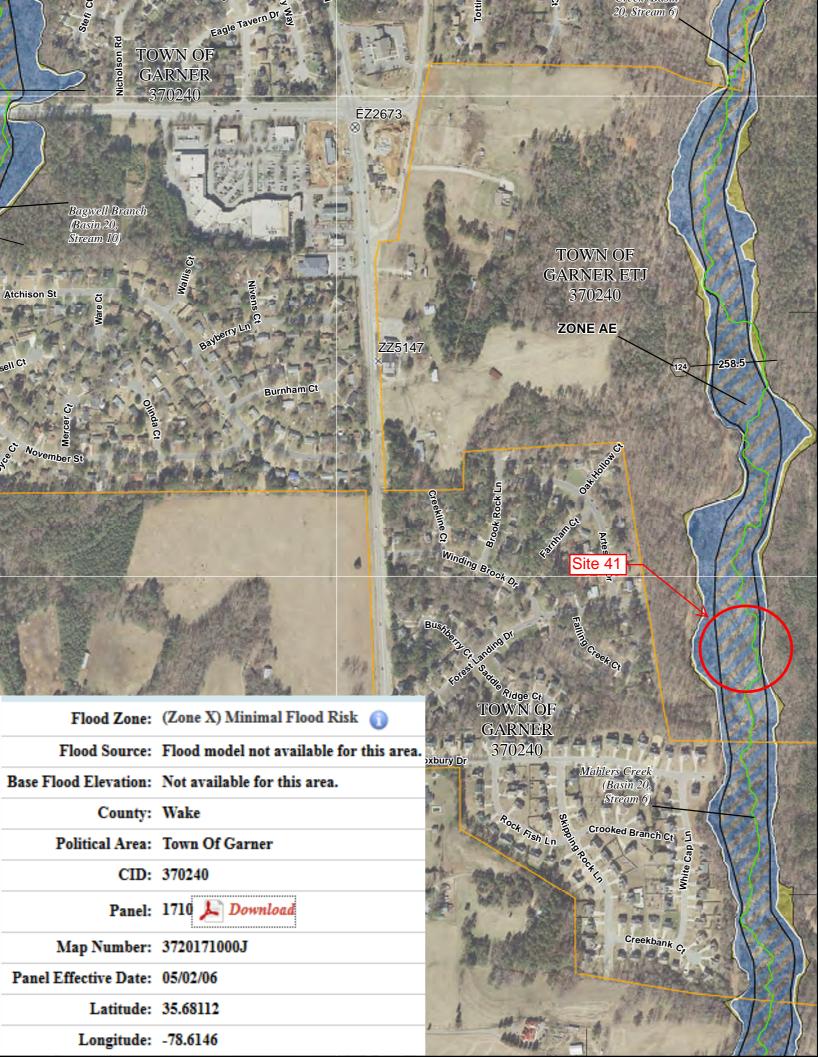
								(Based on 2.80xQ10)	
	ш	(cfs)							2804.86
or companisori)	Coastal Plain	(cfs)	566.35	746.02	1050.99	1331.12	1708.07	2088.86	2722.53
s are used orlly	Sand Hills	(cfs)	253.65	300.57	367.43	426.26	500.09	841.59	676.35
( These Eduation	FREQUENCY	(cfs) (cfs)	5YR	10YR	25YR	50YR	100YR	200YR	500YR

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<b>IC REGRESSION EQUATIONS (% In</b>

FEMA	Coastal Plain Blue Ridge Discharge Used FREQUENCY Disharges		1019.64 1196.72	1269.16 1444.33 10YR	1906.27 50YR	1929.89 2090.50 2100 100YR 1230	2128.46 2249.55 500YR	3553.66 4044.13 (Based on 2.80xQ10)	464E 14 E 196 DE (Boood on 9 66,010)
	-		•	_				Ì	
09	Sand Hills	(cts)	760.27	905.99	1089.93	1224.13	1332.24	2536.76	2215 01
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	G/00/2



2100.000         253.410         4.910         4.908         2.083           2100.000         253.410         4.910         4.908         2.083           2100.000         253.410         4.910         4.908         2.083           2100.000         253.410         4.910         4.908         2.083           2100.000         253.410         4.910         4.908         2.083           2100.000         253.410         4.910         4.908         2.083           2100.000         253.410         4.910         4.908         2.083           2100.000         253.410         4.910         4.908         2.083           2100.000         253.410         4.910         4.908         2.083           2100.000         253.410         4.910         4.908         2.083           2100.000         253.410         4.910         4.908         2.083           2100.000         253.410         4.910         4.908         2.083	Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908	2100,000	253,410	4.910	4,908	2.083
253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908	2100,000	253,410	4.910	4.908	2.083
253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908	2100,000	253,410	4.910	4.908	2.083
253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908         253.410       4.910       4.908	2100,000	253.410	4.910	4.908	2.083
253.410       4,910       4,908         253.410       4,910       4,908         253.410       4,910       4,908         253.410       4,910       4,908         253.410       4,910       4,908	2100,000	253,410	4.910	4.908	2.083
253.410       4,910       4,908         253.410       4,910       4,908         253.410       4,910       4,908         253.410       4,910       4,908	2100,000	253,410	4.910	4,908	2.083
253.410     4.910     4.908       253.410     4.910     4.908       253.410     4.910     4.908       253.410     4.910     4.908	2100.000	253.410	4,910	4.908	2.083
253.410 4.910 4.908 253.410 4.910 4.908 253.410 4.910 4.908	2100,000	253,410	4.910	4.908	2.083
253.410 4.910 4.908 253.410 4.910 4.908	2100,000	253.410	4.910	4.908	2.083
253.410 4.910 4.908	2100,000	253,410	4.910	4,908	2.083
	2100,000	253,410	4.910	4.908	2.083



### **FLOOD INSURANCE STUDY**

### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	Riverine	Sources	Affected Communties
	From	То	
East Fork Mine Creek (Basin 18, Stream 34)	The confluence with Mine Creek (Basin 18, Stream 31)	Approximately 0.6 mile upstream of Newton Road	City Of Raleigh
East Fork Mine Creek Tributary (Basin 18, Stream 35)	The confluence with East Fork Mine Creek (Basin 18, Stream 34)	Approximately 0.4 mile upstream of Woodbend Drive	City Of Raleigh
Echo Creek (Basin 20, Stream 14)	The confluence with Yates Branch (Basin 20, Stream 13)	Vesta Drive	Rdu Town Of Garner Wake County
Gill Creek (Basin 10, Stream 24)	The confluence with Little River (Basin 10, Stream 1)	Mack Todd Road	Town Of Zebulon
Haleys Branch (Basin 18, Stream 10)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Approximately 0.7 mile upstream of Interstate 40	Rdu Wake County
Hare Snipe Creek (Basin 18, Stream 1)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Approximately 100 feet upstream of Lynn Road	City Of Raleigh
Hillard Creek (Basin 30, Stream 7)	The confluence with Big Branch Tributary No. 1 (Basin 30, Stream 6)	Approximately 0.7 mile upstream of confluence with Big Branch Tributary No. 1 (Basin 30, Stream 6)	Town Of Garner
Hodges Creek (Basin 8, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 1,060 feet upstream of Old Crews Road	City Of Raleigh Rdu Wake County
Hominy Branch (Basin 10, Stream 4)	The confluence with Little River (Basin 10, Stream 1)	Marshburn Road	Rdu Town Of Wendell Wake County
Hominy Creek (Basin 10, Stream 7)	The confluence with Little River (Basin 10, Stream 1)	Lizard Lick Rd	Rdu Wake County
Honeycutt Creek (Basin 15, Stream 31)	The confluence with Falls Lake	Honeycutt Road	Rdu Wake County
Horse Creek	State Route 98	Approximately 0.5 mile upstream of Purnell Road	Rdu Town Of Wake Forest Wake County
House Creek (Basin 18, Stream 36)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Interstate 440	City Of Raleigh
Kenneth Branch (Basin 24, Stream 6)	The confluence with Kenneth Creek (Basin 24, Stream 2)	Approximately 390 feet upstream of Phelps West Road	Town Of Fuquay-Varina
Kenneth Creek	Approximately 0.4 miles upstream of Harnett/Wake County Boundary	West Academy Street	Town Of Fuquay-Varina
Kit Creek	The Chatham/Wake County Boundary	Approximately 475 feet upstream of Railroad	Rdu Town Of Cary Wake County
Kit Creek Tributary 2 (Basin 29, Stream 8)	The confluence with Kit Creek (Basin 29, Stream 7)	Approximately 1.0 mile upstream of confluence from Kit Creek (Basin 29, Stream 7)	City Of Raleigh Rdu Wake County
Lens Branch (Basin 20, Stream 22)	The confluence with Swift Creek (Basin 20, Stream 1)	Seabrook Avenue	Town Of Cary
Little Beaverdam Creek (Basin 2, Stream 2)	Approximately 0.7 mile downstream of Wake/Granville County boundary	The Wake/Granville County boundary	Rdu Wake County
Little Brier Creek (Basin 18, Stream 15)	The confluence with Brier Creek (Basin 18, Stream 14)	The Wake/Durham County boundary	City Of Raleigh Rdu Town Of Cary Wake County
Little Brier Creek East (Basin 18, Stream 16)	The confluence with Little Brier Creek (Basin 18, Stream 15)	Glenwood Avenue	City Of Raleigh
Little Creek (Basin 11, Stream 2)	The Wake/Johnston County boundary	Cemetery Road	Rdu Town Of Zebulon Wake County
Lizard Lick Creek (Basin 10, Stream 23)	The confluence with Little River (Basin 10, Stream 1)	County Road	Town Of Wendell
Lower Barton Creek (Basin 17, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Ray Road	City Of Raleigh Rdu Wake County
Lowery Creek (Basin 4, Stream 10)	The confluence with Falls Lake	Purnell Road	Rdu Wake County
Lynn Road Tributary (Basin 18, Stream 32)	The confluence with Mine Creek (Basin 18, Stream 31)	Approximately 0.3 mile upstream of Lead Mine Road	City Of Raleigh
Mahlers Creek (Basin 20, Stream 6)	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 2.2 miles upstream of confluence of Basin 20, Stream 7	Town Of Garner
Mango Ofeek (Basin 15, Stream 11)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 2.4 miles upstream of Hodge Road	Town Of Knightdale
1 ks.dreek	Approximately 0.8 mile downstream of Knightdale Eagle Rock Road	Marks Creek Road	Rdu Town Of Knightdale Town Of Wendell Wake County
Medfield Tributary (Basin 18, Stream 39)	The confluence with Richland Creek (Basin 18, Stream 3)	Approximately 0.4 mile upstream of Old Trinity Road	City Of Raleigh

**Table 13 - Summary of Discharges** 

Table 13 - Summary of Dis		Discharges (cfs)			
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
At county road	0.70	*	*	750	*
Lower Barton Creek (Basin 17, Stream 1)	10.70			1700	
Approximately 0.7 mile downstream of Norwood Road just upstream of tributary	10.40	*	*	3,900	*
Just downstream of tributary just downstream of Mount Vernon Church Road	9.00	*	*	3,590	*
Just upstream of tributary just downstream of Mount Vernon Church Road	7.60	*	*	3,300	*
Just upstream of tributary approximately 1,800 feet upstream of Mount Vernon	4.90	*	*	2,550	*
Church Road					
Just downstream of tributary at Old Creedmoor Road	3.90	*	*	2,250	*
Just upstream of tributary at Old Creedmoor Road	3.20	*	*	2,000	*
Just downstream of tributary at State Route 1833	2.60	*	*	1,790	*
Just upstream of tributary at State Route 1833	2.00	*	*	1,550	*
Lowery Creek (Basin 4, Stream 10)		1	,		
At mouth	3.00	*	*	1,950	*
Just downstream of confluence of Basin 4, Stream 13	2.30	*	*	1,700	*
Just upstream of confluence of Basin 4, Stream 13	1.20	*	*	1,200	*
Lynn Road Tributary (Basin 18, Stream 32)					
At mouth	1.10	*	*	1,120	*
Mahlers Creek (Basin 20, Stream 6)					
At mouth	4.40	*	*	2 400	*
Approximately 1,200 feet upstream of New Bethel Church Road	2.30	*	*	1,690	*
Approximate 0.4 mile upstream of New Bethel Church Road	1.30	*	*	1,230	*
Mango Creek (Basin 15, Stream 11)	1.101			1.,	
nouth	4.30	*	*	2,410	*
Approximately 1.0 mile above Hodge Road	2.00	*	*	1,600	*
At State Route 2233	0.30	*	*	520	*
Marks Creek	10.00			1020	
Approximately 0.5 mile upstream of Wake/Johnston County boundary	19.52	*	*	4,770	*
Approximately 530 feet upstream of Turnipseed Road	13.81	*	*	3.840	*
Approximately 0.5 mile upstream of confluence of Basin 14, Stream 2	13.15	*	*	3,730	*
Approximately 530 feet upstream of Poole Road	12.44	*	*	3,600	*
Approximately 0.5 mile downstream of confluence of Basin 14, Stream 3	10.38	*	*	3,220	*
Approximately 530 feet upstream of confluence from Basin 14, Stream 3	9.72	*	*	3,090	*
Approximately 0.7 mile downstream of Knightdale Eagle Rock Road	7.90	*	*	3,300	*
Approximately 0.4 mile upstream of Knightdale Eagle Rock Road, just downstream of		*	*	2,500	*
tributary	3.30			2,300	
Approximately 0.4 mile upstream of Knightdale Eagle Rock Road, just upstream of tributary	3.00	*	*	1,900	*
At Marks Creek Road	1.70	*	*	1,300	*
Approximately 1,800 feet upstream of Marks Creek Road	0.50	*	*	750	*
Marsh Creek (Basin 18, Stream 17)					
At confluence with Crabtree Creek (Basin 18, Stream 9)	9.42	*	*	4,020	*
At upstream face of Interstate 440	8.54	*	*	3,990	*
Approximately 175 feet upstream of Timberlake Road	7.59	*	*	3,980	*
Approximately 145 feet downstream of Stoneybrook Drive	6.80	*	*	4,390	*
At confluence of New Hope Tributary to Marsh Creek (Basin 18, Stream 18)	4.56	*	*	3,530	*

Table 21 - Floodway Data

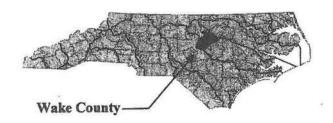
			Tal	ole 21 - Fl	oodway D	ata			
	y Source	ME 111 /E 0	Floodway		D 1.		ter Surface Eleva		
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
144	14,410	374	5,196	0.1	364.8	*	364.8	364.8	0.0
154	15,400	52	107	5.0	364.8	*	364.8	364.8	0.0
158	15,777	40	54	6.1	368.9	*	368.9	368.9	0.0
Lynn Road Tr	ibutary (Basin	18, Stream 32			T	T		1	ı
014	1,360	50	174	6.4	274.0 <sup>1</sup>	*	271.1	271.1	0.0
031	3,050	50	153	6.8	298.1	*	298.1	298.2	0.1
Mahlers Cree	k (Basin 20, St	ream 6)			T	T		1	T
008	760	260	1,045	2.3	223.81	*	215.3	216.3	1.0
037	3,690	300	2,097	1.1	227.9	*	227.9	228.7	0.8
041	4,085	385	2,528	1.0	228.1	*	228.1	228.8	0.7
124	12,420	210	210	5.9	258.5	*	258.5	258.5	0.0
167	16,660	80	424	2.9	286.9	*	286.9	287.6	0.7
	(Basin 15, Stre	eam 11)							
Site 41	1,520	135	601	4.0	175.1 <sup>1</sup>	*	166.7	167.7	1.0
043	4,330	195	986	2.4	175.1 <sup>1</sup>	*	174.4	175.4	1.0
054	5,350	110	668	3.6	180.7	*	180.7	181.1	0.4
064	6,445	315	914	2.6	185.6	*	185.6	185.6	0.0
087	8,650	250	505	4.8	189.5	*	189.5	189.7	0.2
156	15,580	170	666	2.4	229.1	*	229.1	229.9	0.8
Marks Creek									
376	37,590	300	1,177	2.8	207.8	*	207.8	208.8	1.0
376	37,590	300	1,175	2.8	207.8	*	207.8	208.8	1.0
416	41,600	360	1,439	2.2	220.3	*	220.3	220.3	0.0
469	46,900	175	556	3.4	234.0	*	234.0	235.0	1.0
511	51,130	95	367	3.5	254.6	*	254.6	255.4	0.8
-	(Basin 18, Stre				1=4.114		1=44	1-4411	
029	2,895	215	2,088	1.9	201.9 <sup>1</sup>	193.7	193.4	194.4	1.0
033	3,336	210	1,773	2.2	201.9 <sup>1</sup>	193.9	193.6	194.6	1.0
040	4,041	150	1,351	3.0	201.9 <sup>1</sup>	195.2	195.0	196.0	1.0
042	4,157	170	1,450	2.8	201.9 <sup>1</sup>	195.5	195.2	196.1	0.9
047	4,733	215	1,579	2.5	201.9 <sup>1</sup>	196.4	196.1	197.1	1.0
056	5,576	300	1,944	2.0	201.9 <sup>1</sup>	197.7	197.4	198.3	1.0
063	6,309	220	1,412	2.8	201.9	199.3	199.0	200.0	1.0
066	6,614	240	1,374	2.9	201.91	*	200.0	200.0	1.0
	7,054	210		3.1	201.9 <sup>1</sup>	202.1	200.0	201.0	2.6
071			1,277						
079	7,855	295	2,358	1.7	205.5	206.2	205.5	206.3	0.8
088	8,793	160	1,260	3.2	206.1	207.0	206.1	207.1	1.0
100	10,011	230	1,403	2.9	210.4	210.5	210.4	211.1	0.7
109	10,931	260	2,189	1.8	214.6	214.8	214.6	215.2	0.6
115	11,549	370	2,692	1.2	214.8	215.1	214.8	215.6	0.8
122	12,238	330	2,118	1.5	215.2	215.5	215.2	216.1	0.9
130	12,950	335	1,813	1.7	216.1	216.5	216.1	217.1	1.0
140	14,025	220	774	4.0	219.8	*	219.8	220.4	0.6
147	14,732	210	1,029	3.0	222.8	223.2	222.8	223.7	0.9
153	15,317	135	1,113	2.8	227.4	227.6	227.4	228.2	0.8

### FLOOD INSURANCE STUDY

A Report of Flood Hazards in

WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 1 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuguay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





May 2, 2006

Federal Emergency Management Agency State of North Carolina

> Flood Insurance Study Number 37183CV001A

www.fema.gov and www.ncfloodmaps.com



**Table 10—Roughness Coefficients** 

-	-	_	.11
2		E	41
100			

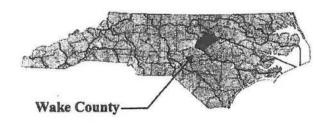
Stream	Channel "n"	Overbank "n"
Lower Barton Creek (Basin 17, Stream 1)	0.030 - 0.070	0.070 - 0.110
Lowery Creek (Basin 4, Stream 10)	0.030 - 0.070	0.070 - 0.110
Lynn Road Tributary (Basin 18, Stream 32)	0.030 - 0.070	0.070 - 0.110
Mahlers Creek (Basin 20, Stream 6)	0.030 - 0.070	0.070 - 0.110
Mango Creek (Basin 15, Stream 11)	0.030 - 0.070	0.070 - 0.110
Marks Creek (Basin 14, Stream 1)	0.030 - 0.070	0.070 - 0.130
Marsh Creek (Basin 18, Stream 17)	0.038 - 0.060	0.090 - 0.200
Medfield Tributary to Richland Creek (Basin 18, Stream 39)	0.030 - 0.070	0.070 - 0.110
Middle Creek (Basin 22, Stream 1)	0.030 - 0.070	0.070 - 0.110
Millbrook Tributary to Marsh Creek (Basin 18, Stream 19)	0.030 - 0.070	0.070 - 0.110
Mills Branch (Basin 22, Stream 5)	0.030 - 0.070	0.070 - 0.130
Mine Creek (Basin 18, Stream 31)	0.030 - 0.070	0.070 - 0.110
Mingo Creek (Basin 12, Stream 2)	0.041 - 0.044	0.100 - 0.200
Moccasin Creek (Basin 11, Stream 1)	0.030 - 0.070	0.070 - 0.110
Morris Branch (Basin 29, Stream 5)	0.030 - 0.050	0.100 - 0.200
Morrisville Tributary (Basin 18, Stream 26)	0.030 - 0.070	0.070 - 0.110
Mud Branch (Basin 4, Stream 15)	0.030 - 0.070	0.070 - 0.110
Neil Branch (Basin 24, Stream 8)	0.030 - 0.070	0.070 - 0.130
Neil Creek (Basin 24, Stream 7)	0.030 - 0.070	0.070 - 0.110
Neills Creek	0.035 - 0.048	0.100 - 0.150
Neuse River (Basin 15, Stream 1)	0.030 - 0.070	0.070 - 0.110
New Hope Tributary to Marsh Creek (Basin 18, Stream 18)	0.040 - 0.065	0.110 - 0.200
Newlight Creek (Basin 3, Stream 1)	0.040 - 0.070	0.070 - 0.150
Norris Branch	0.048	0.145
Panther Branch (Basin 22, Stream 2)	0.030 - 0.070	0.070 - 0.110
Panther Creek (Basin 29, Stream 1)	0.03-0.070	0.070 - 0.110
Perry Creek (Basin 10, Stream 19)	0.042	0.130
Perry Creek (Basin 15, Stream 26)	0.032 - 0.052	0.100 - 0.200
Perry Creek East Branch (Basin 15, Stream 27)	0.030 - 0.070	0.070 - 0.110
Pigeon House Branch (Basin 18, Stream 27)	0.030 - 0.070	0.070 - 0.110
Poplar Branch (Basin 13, Stream 2)	0.030 - 0.070	0.070 - 0.110
Poplar Creek (Basin 13, Stream 1)	0.030 - 0.070	0.070 - 0.110
Powell Creek (Basin 8, Stream 7)	0.030 - 0.070	0.070 - 0.110
Reedy Creek (Basin 20, Stream 11)	0.030 - 0.070	0.070 - 0.110
Reedy Branch (Basin 27, Stream 5)	0.045 - 0.050	0.100 - 0.200
Reedy Branch Tributary (Basin 20, Stream 9)	0.030 - 0.070	0.070 - 0.110
Reedy Branch Tributary (Basin 27, Stream 6)	0.045 - 0.050	0.100 - 0.200
Reedy Creek (Basin 6, Stream 8)	0.030 - 0.070	0.070 - 0.110
Richland Creek (Basin 5, Stream 1)	0.038 - 0.070	0.100 - 0.200
Richland Creek (Basin 18, Stream 3)	0.030 - 0.070	0.070 - 0.110
Richland Creek Tributary	0.040	0.100 - 0.200

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### **VOLUME 5 OF 7**

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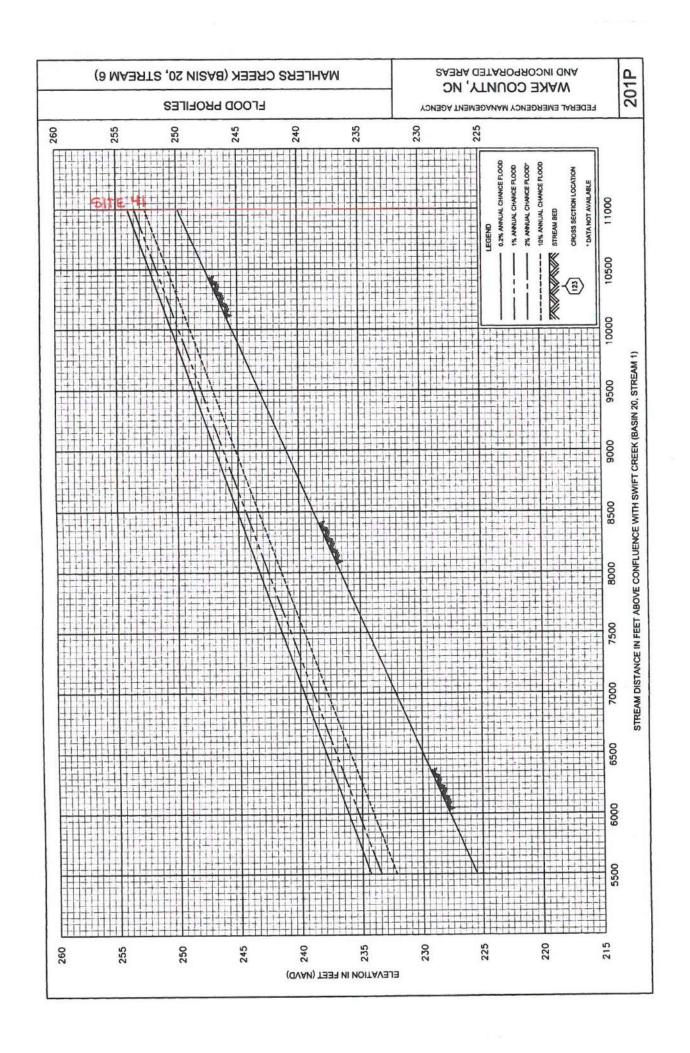
May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV005A

www.fema.gov and www.ncfloodmaps.com





### PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake	PROJECT NUMBER R	R-2721, R-2828, & R-2829
STREAM Mahlers Creek (Site 41)	ROUTE New Location	
ASSESSMENT PREPARED	BY Mulkey, INC. DA	ATE <u>1/8/2014</u>
	HYDROLOGIC EVA	LUATION
NEAREST GAGING STATE	ON ON THIS STREAM	(NONE <u>X</u> _)
ARE FLOOD STUDIES AV	AILABLE ON THIS STE	REAM: Yes
FLOOD DATA: Q <sub>10</sub> 1,400 CFS EST. BKV Q <sub>50</sub> 2,100 CFS EST. BKV Q <sub>500</sub> 5,300 CFS EST. BKV	/TR. <u>N/A</u> FT. Q <sub>100</sub> <u>2,20</u>	00 CFS EST. BKWTR. N/A FT. 00 CFS EST. BKWTR. N/A FT.
	<u>Mi. METHOD USED TO</u> ROPERTY RELATED E	O COMPUTE Q: <u>USGS Urban Regressio</u> VALUATIONS
DAMAGE POTENTIAL: LC	OWMODERA	ATE X HIGH
COULD THIS BE SI	GNIFICANTLY INCREA	ASED BY PROPOSED
ENCROACHMENT:	YES	NO <u>X</u>
EXPLANTION: A flo	oodway modification may	y be required at this site.
LIST BUILDINGS IN	N FLOOD PLAIN: None	LOCATION:
UPSTREAM LAND ANTICIPATE ANY		
ANY FLOOD ZONII	NG? (FIA STUDIES, ETC	C.) YES <u>X</u> NO
TYPE OF STUDY: 1	FEMA – Special Flood Ha	azard Zone AE
REGULATORY FLO	OODWAY WIDTH 230 f	t. Section 10965 (AS NOTED IN FIS)
COMMENTS		

### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 19,600 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 49,100 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? $\underline{\text{N/A}}$
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS
NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Wehadkee TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service
ENVIRONMENTAL CONSIDERATIONS
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: Buried culverts 1 foot to allow for fish passage.
MISCELLANEOUS COMMENTS
IS THERE UNUSUAL SCOUR POTENTIAL? YES NO $\underline{X}$ PROTECTION NEEDED

ARE BANKS STABLE? <u>Yes</u> PROTECTION NEEDED <u>No</u>
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? $\underline{\text{No}}$
COMMENTS:
ALTERNATIVES
RECOMMENDED DESIGN Proposed 315' Dual Bridges
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING 18,550 Sq. Ft.
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YESNO X DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1) NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:

Name	Index Number	Classification	use River Basi
Name	maex Number	Classification	Class Date
Description		Specia	l Designation
Mahlers Creek	27-43-9	C;NSW	05/01/88
From source to Swift Creek			
Mango Creek	27-32	C;NSW	05/01/88
From source to Neuse River			
Manley Branch	27-74	WS-IV;Sw,NSW	08/01/02
From source to Neuse River			
Marks Creek (Lake Myra)	27-38	C;NSW	05/01/88
From soruce to Neuse River			33,32,32
Marsh Creek	27-33-20	C;NSW	05/01/88
From source to Crabtree Creek			33,52,53
Marsh Swamp	27-86-5-(1)	C;NSW	08/03/92
From source to Wilson County SR 1149			
Marsh Swamp	27-86-5-(2)	WS-IV;NSW	08/03/92
From Wilson County SR 1149 to Contentnea Creek			00/00/02
Martin Creek	27-11-1	WS-IV;NSW	08/03/92
From source to Lick Creek			•
Mason Creek	27-150-9	SC;Sw,HQW,NSW	08/01/90
From source to Bay River			
Maul Run	27-150-26-1-2	SA;HQW,NSW	05/01/88
From source to Spring Creek			
Mauls Swamp	27-97-5.7	C;Sw,NSW	05/01/88
From source to Swift Creek			
Maw Bay	27-146	SA;HQW,NSW	05/01/88
From source to Neuse River			
Maw Point Creek	27-147	SA;HQW,NSW	05/01/88
From source to Neuse River			
McCoy Branch	27-91-1-1	C;Sw,NSW	05/01/88
From source to Mill Run			
McCullens Branch (McCullers Branch)	27-45-5	C;NSW	05/01/88
From source to Black Creek			
McGowan Creek	27-2-5-(2)	WS- II;HQW,NSW,CA	08/03/92

		SITE 41			
		11 11			
		11 11	n=0.03	5	
		111		T	77624 73
		1111		TB-TB	
		1/6/		WE-WE	
1.45.DC	0=0.11	16		D	2-6
WOODS	U=0'18	11/1	/	Les .	0.5
		1/1/		OHM	1.7
		1111	Mark		
			VV00V5	n=0.16	
		1111			
		VALUE IA	THE AUT O	DAAG	
		X	BEAVER	Dam	
				Dam	
			DHW	Dam	
				Dam	
				Dam	
BED M	MTERIAL	1211	DHW	Dam	
		SILT /	DHW	Dam	



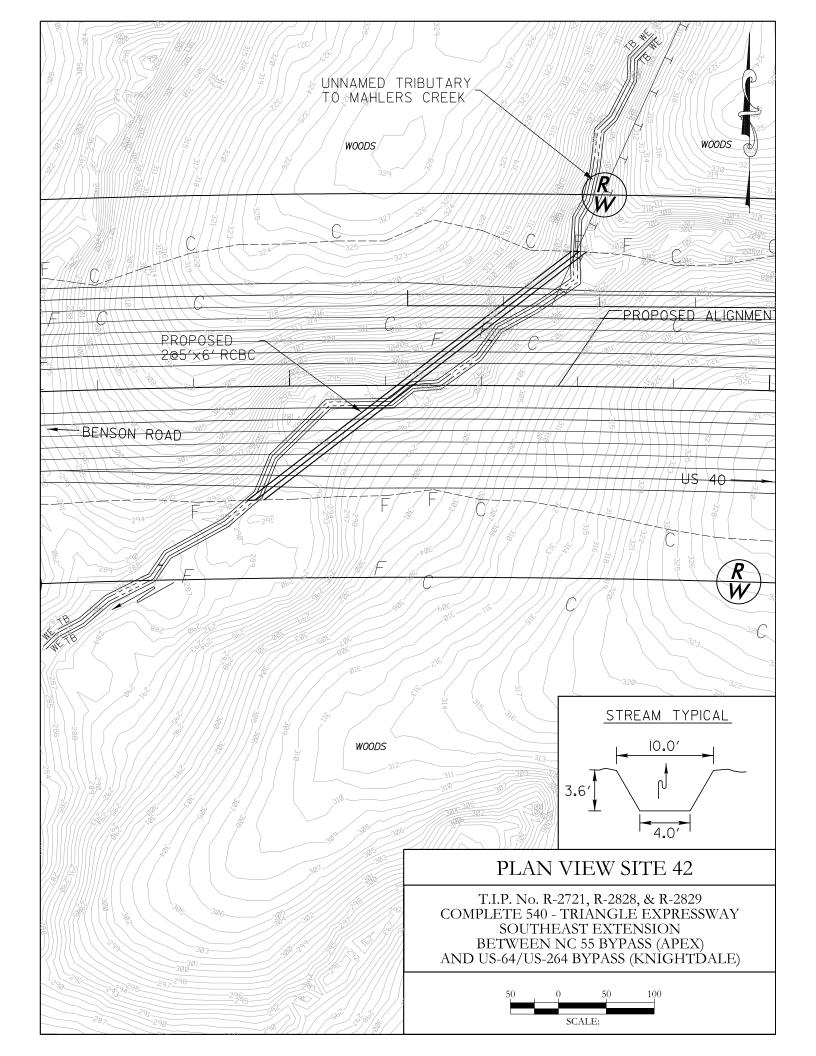
Looking Upstream from Proposed Crossing. (Above beaver dam)

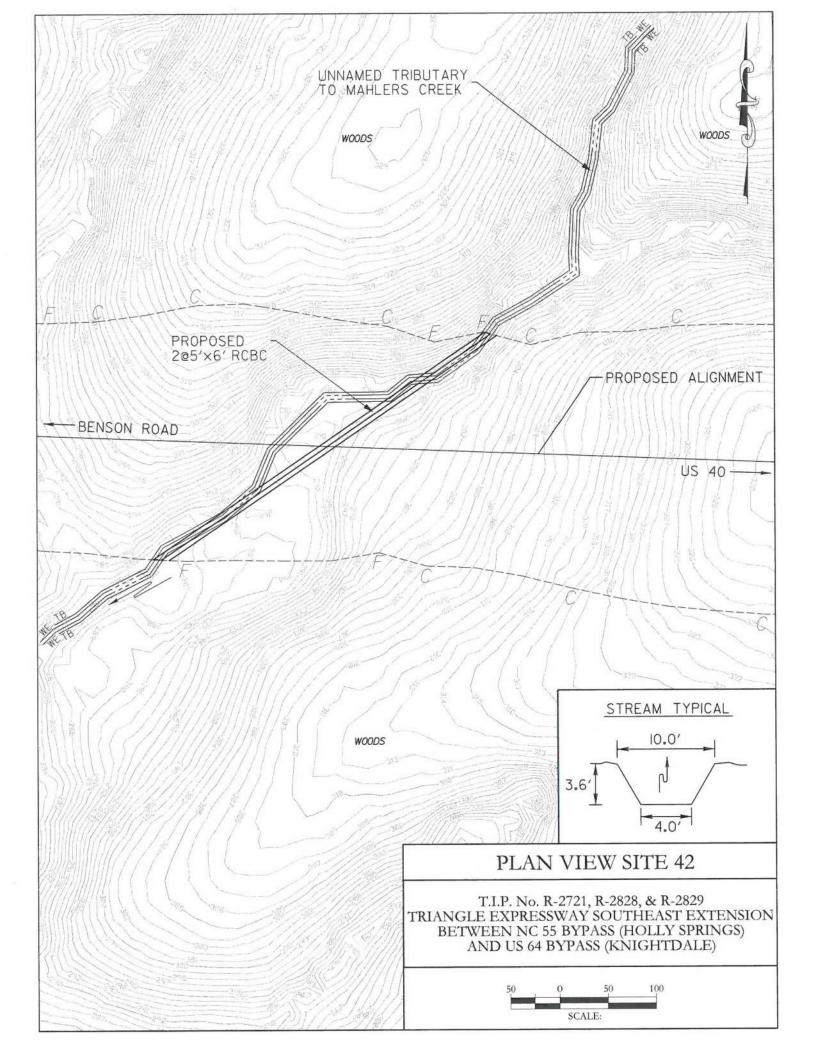


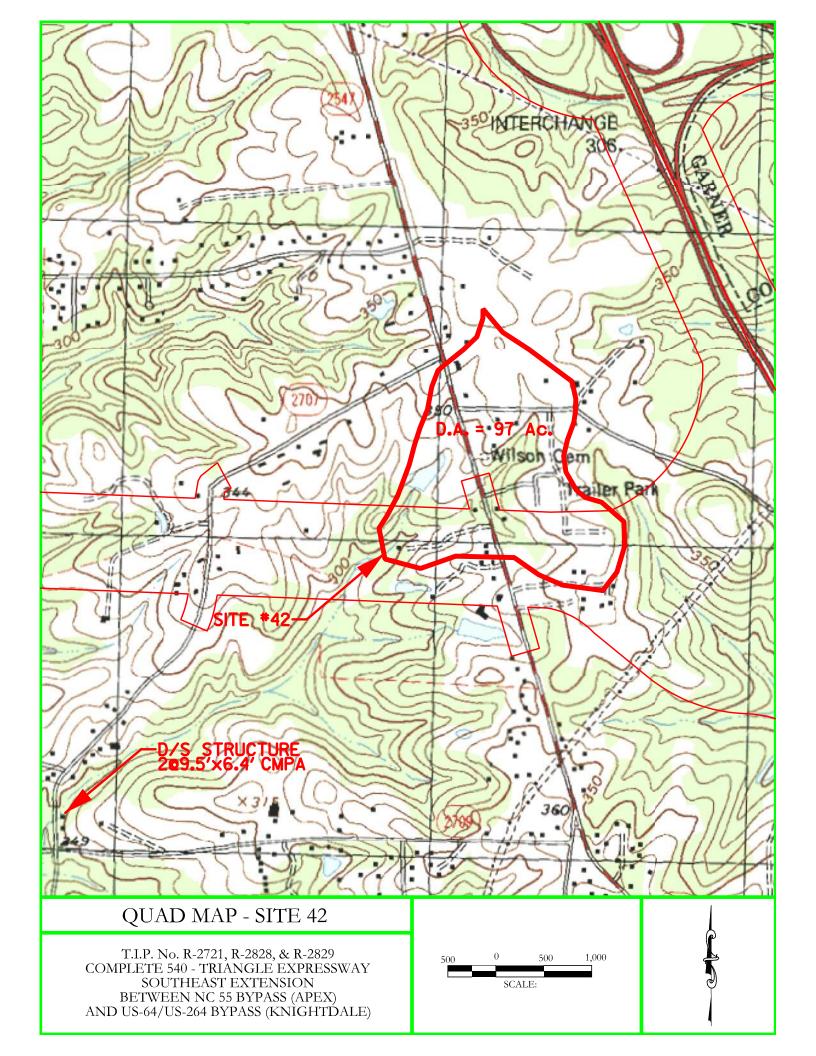
Looking Downstream from Proposed Crossing. (Below beaver dam)



Beaver dam at site.







3/18/2014

Site # 42

REGION: BLUE RIDGE METHOD USED: Fact Sheet: 007-00 STREAM NAME: Unnamed Tributary to Mahlers Creek sq. miles 0.15 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = ENGLISH

USGS PIIDAL PECE

ort 01-4207	Sand Hills	(cfs)	8.68	14.68	19.43	26.35	32.35	38.77	46.26	57.37
ATIONS Rep	Coastal Plain	(cfs)	18.05	38.67	58.54	91.23	122.36	159.92	204.86	278.03
SAL EQUA	Blue Ridge	(cts)	35.64	66.99	95.13	140.02	180.47	227.62	282.20	368.12
RUF	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR
- 0		38.82	69.57	94 59	134 70	169.20	212.23	258 85	346 56	00:010
REQUENCY Sand Hills Coastal Blain	(cfs)	20.92	49.39	77.91	131.94	184.80	254.35	341.99	493.46	) i
AL KEGRE Sand Hills	(cfs)	7.39	12.03	15.82	20.74	24.97	29.63	36.38	41.83	
FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR	

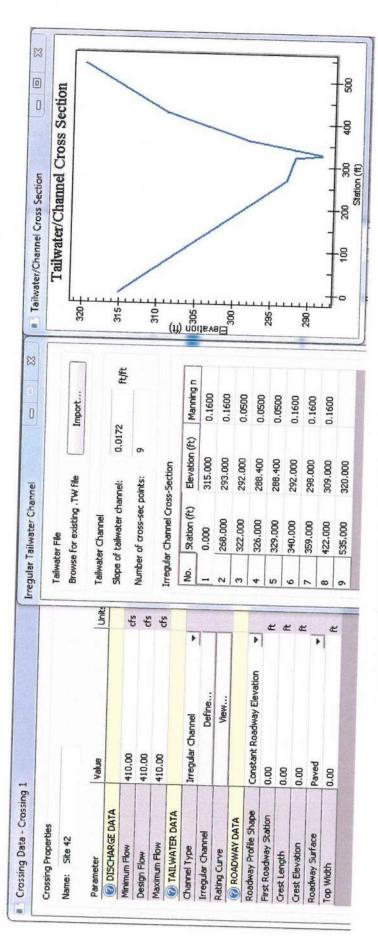
## **USGS URBAN REGRESSION EQUATIONS**

(These Equations are used only for comparison)

							-	(based on 2.80xQ10)
Blue Ridge	(ofe)	160 30	199.02	260.80	309.41	375 56	557.26	541.76
Sand Hills Coastal Plain	(cfs)	122.72	170.75	256.39	332.18	435.54	478.10	723.86
Sand Hills	(cts)	40.79	48.46	58.34	65.66	74.71	135.68	95.67
FREQUENCY	The state of the s	5YR	10YR	25YR	50YR	100YR	200YR	500YR

# NC REGRESSION EQUATIONS (% Impervious) USGS Fact Sheet 007-00

	FEMA	FREQUENCY			10YR	50YR	100YR	500YR	
	Discharge Head	ı				410		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	Blue Ridge	(cfs)	178.80	235.38	357.29	407.11	454.81	659.05	861.47
	Coastal Plain	(cfs)	162.37	222.61	354.01	418.63	481.69	623.31	014.73
40	Sand Hills	(cts)	108.42	139.89	188.41	218.79	246.00	391.70	0.710
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR 500YR	



Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)   Shear (nef)	Shear (nef)
410.000	292.844	4,444	5.590	4.770
410,000	292,844	4.444	5.590	4 770
410.000	292.844	4,444	5.590	4.770
410.000	292,844	4,444	5,590	4 770
410,000	292.844	4,444	5.590	4 770
410.000	292.844	4.444	5.590	4 770
410.000	292.844	4,444	5.590	4 770
410,000	292.844	4.444	5.590	4 770
410.000	292.844	4.444	5.590	4 770
410.000	292.844	4,444	5,590	4 770
410,000	292.844	4.444	5,590	4 770

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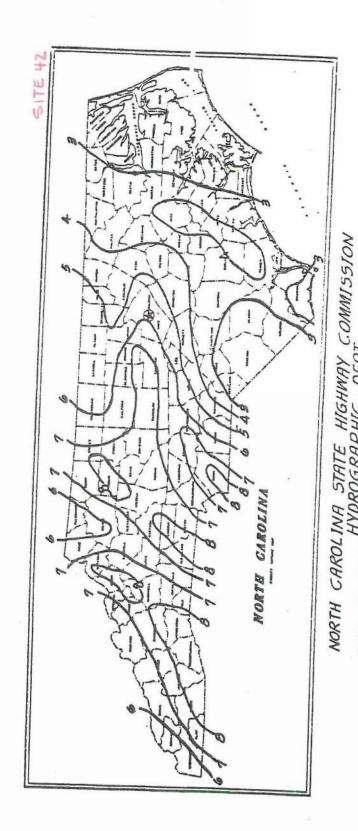
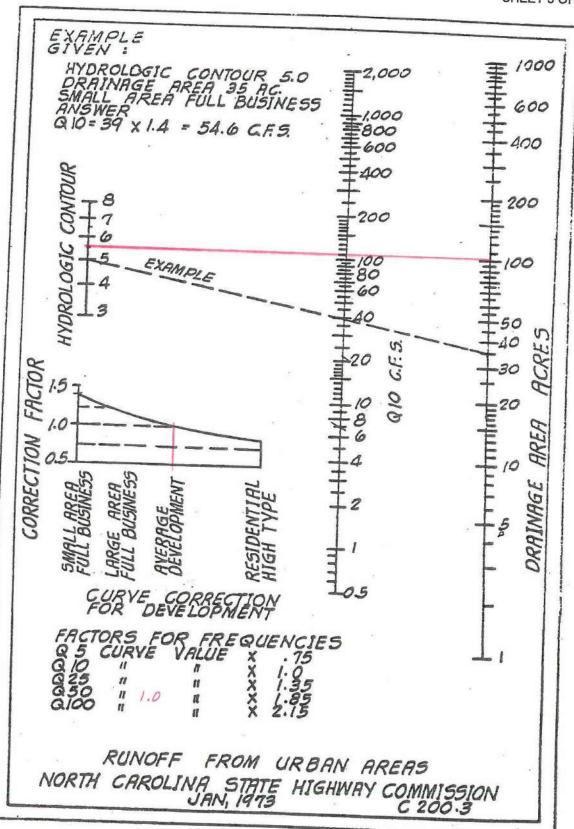
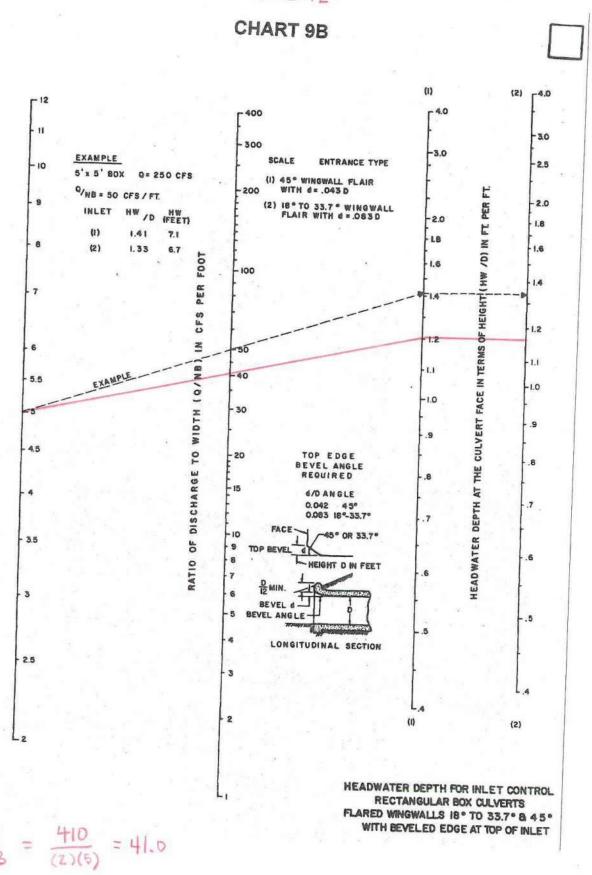
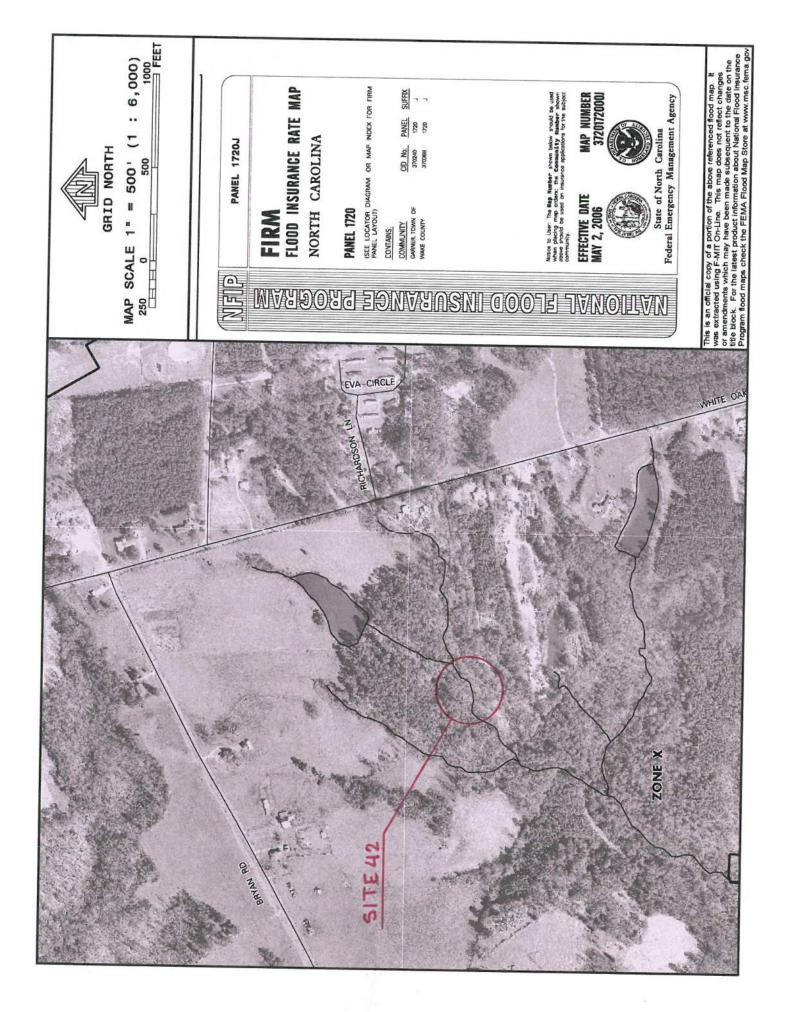


CHART C 200.1







Name	Index Number	N Classification	euse River Basir Class Date
Description			
Mahlers Creek	27-43-9	C;NSW	al Designation
From source to Swift Creek	100	C,14544	05/01/88
Mango Creek	27-32	C;NSW	05/01/88
From source to Neuse River			03/01/88
Manley Branch	27-74	WS-IV;Sw,NSW	08/01/02
From source to Neuse River			00/02/02
Marks Creek (Lake Myra)	27-38	C;NSW	05/01/88
From soruce to Neuse River		S), to to	03/01/88
Marsh Creek	27-33-20	C;NSW	05/01/88
From source to Crabtree Creek			33,32,00
Marsh Swamp	27-86-5-(1)	C;NSW	08/03/92
From source to Wilson County SR 1149			
Marsh Swamp	27-86-5-(2)	WS-IV;NSW	08/03/92
From Wilson County SR 1149 to Contentnea Creek			00/03/32
Martin Creek	27-11-1	WS-IV;NSW	08/03/92
From source to Lick Creek			00,00,52
Mason Creek	27-150-9	SC;Sw,HQW,NSW	08/01/90
From source to Bay River			
Maul Run	27-150-26-1-2	SA;HQW,NSW	05/01/88
From source to Spring Creek			
Mauls Swamp	27-97-5.7	C;Sw,NSW	05/01/88
From source to Swift Creek			
Maw Bay	27-146	SA;HQW,NSW	05/01/88
From source to Neuse River			-,,
Maw Point Creek	27-147	SA;HQW,NSW	05/01/88
From source to Neuse River			,,
McCoy Branch	27-91-1-1	C;Sw,NSW	05/01/88
From source to Mill Run			
AcCullens Branch (McCullers Branch)	27-45-5	C;NSW	05/01/88
From source to Black Creek			
AcGowan Creek	27-2-5-(2)	WS-	08/03/92
From a point 0.7 mile upstream of mouth to Corporation La	ke Eng River	II;HQW,NSW,CA	

	51TE 42		
	1/1/2/		
	Bank	TB-TB	10
60	1 3	WE WE	
18	20 10 W	- 20	3.6
R1P6;	1///	H20 D	
4-10	A 15.	OHW	
BEN	4/6/	Otiva	104
Woods	WOODS		
N=0.16	1 0:00		
	1/11		***************************************
	11 10=0	2.05	
· ·	1111		
PED MASS	Dro c		
BED MATERIAL	DED ROCK, BOUL	DERS, COAR	SE SA
DEBEIS POTENTIA			
RECENT DRIFT	4.0		



NC DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS BRIDGE MANAGEMENT UNIT

**ATTENTION** 

### **BRIDGE INSPECTION REPORT**

INSPECTION TYPE:	Routine Inspection	
COUNTY WAKE	BRIDGE NUMBER 910250 INSPECTION CYCLE	2 YRS
ROUTE SR2707	ACROSS CREEK	M.P. 0
LOCATION 0.2 MI.N.SR2709		
SUPERSTRUCTURE 2 LNS 117X79 CMP	3;60' ALONG CENTERLINE PIPE	
SUBSTRUCTURE		
SPANS		
LONGITUDE 78° 35' 36.84"	LATITUDE 35° 40' 16.31"	
PRESENT CONDITION FAIR	INVENTORY RATING	
INSPECTION DATE 10/10/2012	OPERATING RATING	
PRESENT POSTING Not Posted	PROPOSED POSTING	
COMPUTER UPDATE	ANALYSIS DATE	
POSTING LETTER DATE	SUFFICIENCY RATING	
OTHER SIGNS PRESENT DELINEATORS		
	SIGN NOTICE ISSUED FOR No WE	NUMBEREI REQUIRED

No

No

No

No

**DELINEATORS** 

NARROW BRIDGE

ONE LANE BRIDGE

LOW CLEARANCE



**NORTH VIEW** 



Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

Page 1 of 3



Looking at Upstream Channel of Downstream Structure.



Looking at Upstream Face of Downstream Structure (2@ 9.5'x6.4' CMPA)

Page 2 of 3

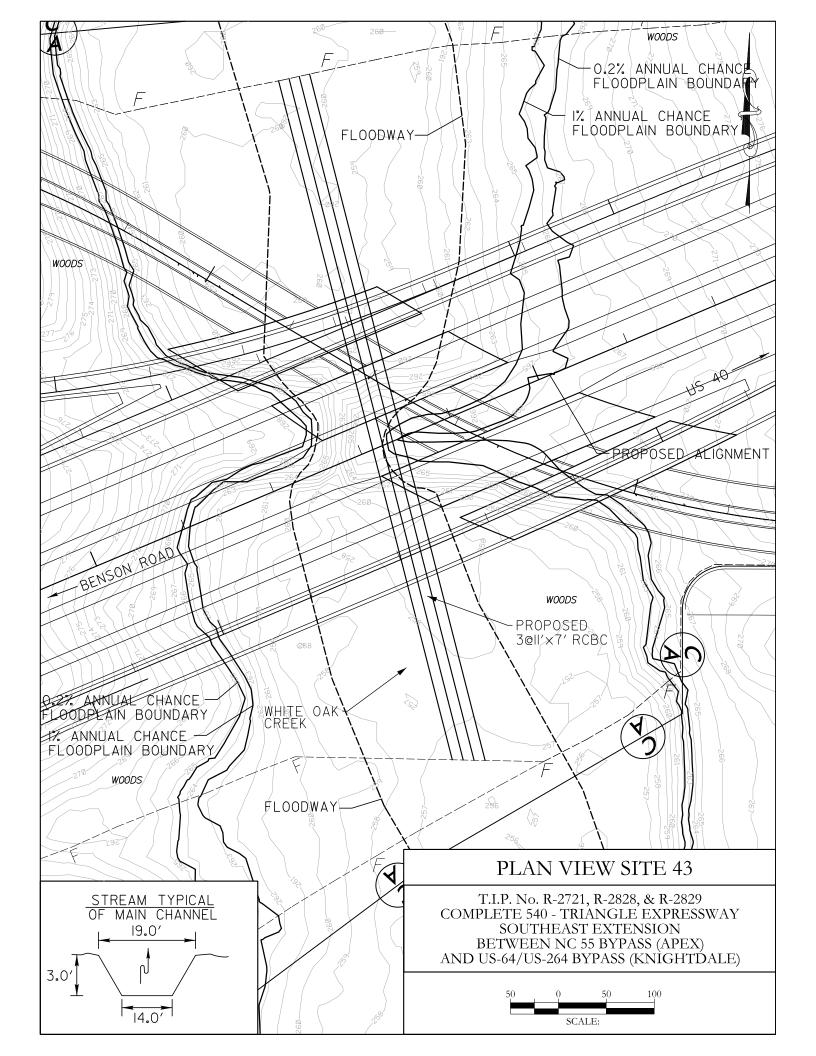


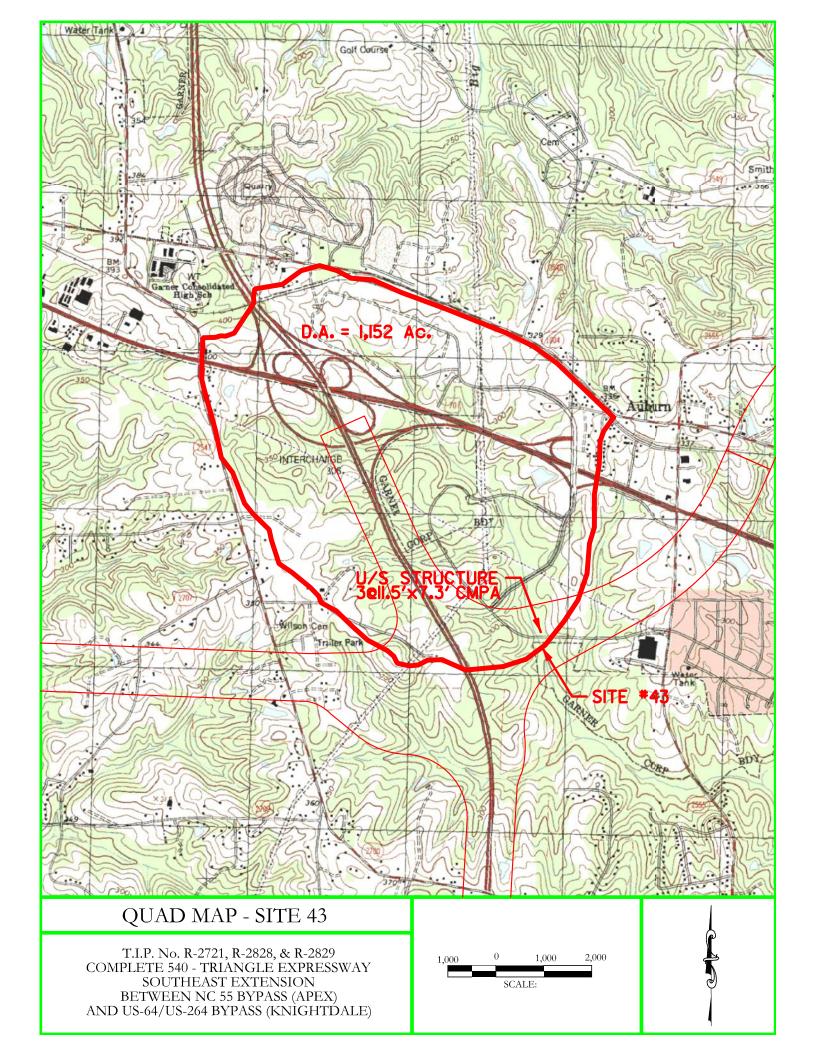
Looking at Downstream Face of Downstream Structure (2@ 9.5'x6.4' CMPA)



Looking at Downstream Channel of Downstream Structure.

Page 3 of 3





### **North Carolina**

4/22/2014

PROJECT NAME: Triangle Expressway SE Ext. ENGLISH

1.80 Drainage Area =

STREAM NAME: White Oak Creek sd. miles

REGION: BLUE RIDGE

METHOD USED: Fact Sheet: 007-00

<b>USGS RUI</b>	RAL REGRE	<b>USGS RURAL REGRESSION EQUA</b>	ATIONS (OLD)	RUF	<b>3AL EQUA</b>	<b>ITIONS Rep</b>	RURAL EQUATIONS Report 01-4207	
FREQUENCY	Sand Hills	Coastal Plain		FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills	
	(cfs)	(cfs)			(cfs)	(cfs)	(cfs)	
2YR	45.70	100.62		2YR	203.96	96.10	50.91	
5YR	75.30	209.78		5YR	360.28	187.36	83.80	
10YR	99.49	312.52		10YR	492.88	269.87	109.81	
25YR	134.03	494.90		25YR	695.44	398.18	147.43	
50YR	163.84	662.84		50YR	874.37	515.79	180.13	
100YR	197.31	874.55		100YR	1075.73	652.72	214.27	
200YR	242.86	1135.70		200YR	1304.17	811.56	254.43	
500YR	289.10	1563.12		500YR	1655.38	1061.14	313.92	

### **USGS URBAN REGRESSION EQUATIONS**

BDF=

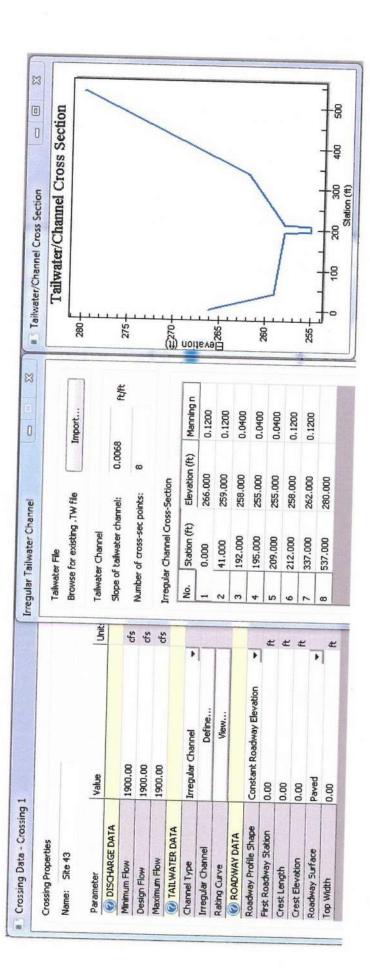
(These Equations are used only for comparison)

יייסט באממוט	(ccc Equations at cased city to compared to	of company	
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge
	(cfs)	(cfs)	(cfs)
5YR	260.14	578.45	896.14
10YR	308.25	761.39	1092.75
25YR	376.91	1071.70	1392.12
50YR	437.43	1356.93	1661.88
100YR	513.42	1740.66	2020.99
200YR	863.10	2131.90	3059.70
500YR	694.89	2772.87	2869.38

# NC REGRESSION EQUATIONS (% Impervious) USGS Fact Sheet 007-00

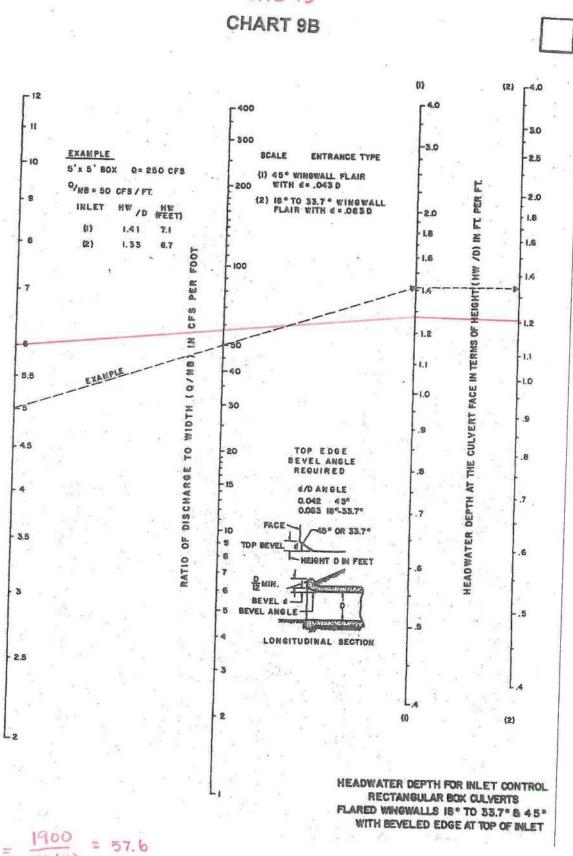
(Based on 2.80xQ10)

% Impervious –	45				FFMA	4
	2					
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	<u>Blue Ridge Discharge Used</u>	FREQUENCY	Disharges
	(cts)	(cts)	(cts)			
5YR	660.40	884.35	1038.86			
10YR	799.37	1117.83	1273.41		10YR	
25YR	982.67	1536.22	1716.75		50YR	1380
50YR	1116.17	1754.98	1903.87	1900	100YR	1700
100YR	1227.81	1956.10	2070.61		500YR	
200YR	2238.23	3129.93	3565.54	(Based on 2.80xQ10)		ı
500YR	2925.68	4091.26	4660.68	(Based on 3.66xQ10)		

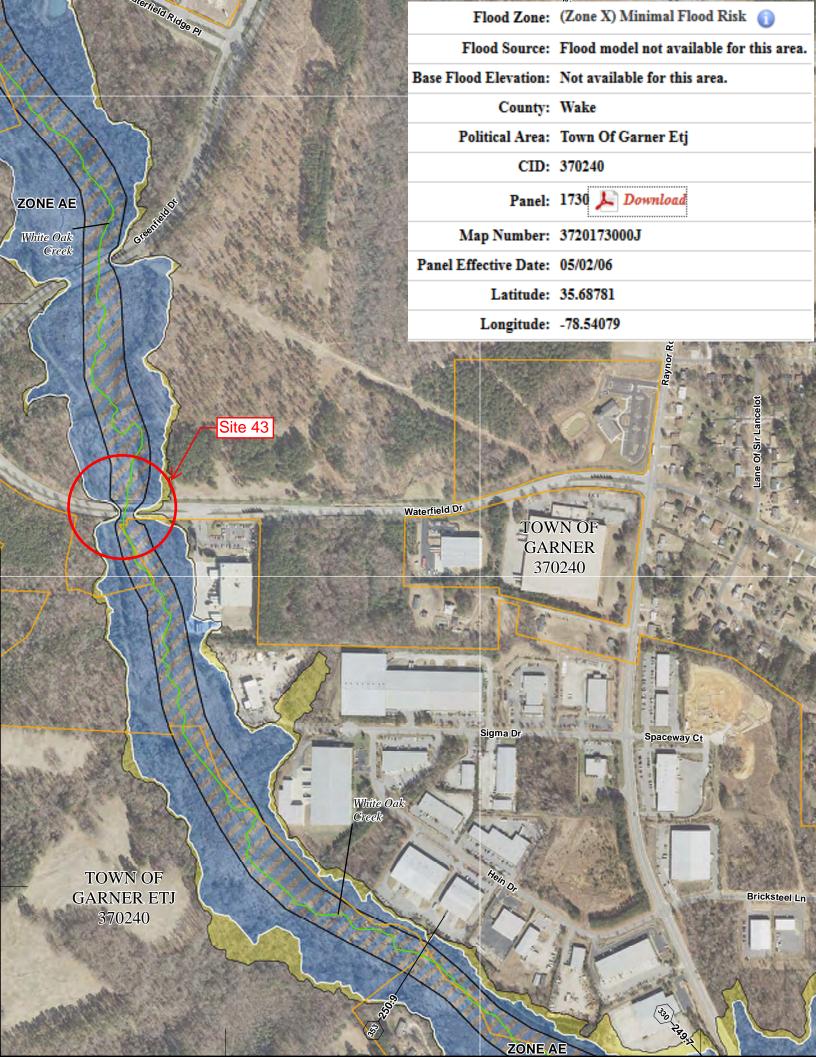


Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (nef)
1900,000	261.017	6.017	2.944	2.553
1900.000	261.017	6.017	2.944	2.553
1900.000	261.017	6.017	2.944	2.553
1900.000	261.017	6.017	2,944	2,553
1900.000	261,017	6.017	2,944	2,553
1900.000	261.017	6.017	2,944	2.553
1900,000	261.017	6.017	2.944	2.553
1900.000	261.017	6.017	2.944	2.553
1900.000	261.017	6.017	2.944	2,553
1900,000	261.017	6.017	2.944	2,553
1900,000	261.017	6.017	2.944	2,553

SITE 43



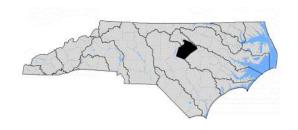
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# PRELIMINARY FLOOD INSURANCE STUDY

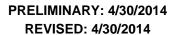
### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

State of North Carolina

Flood Insurance Study Number

37183CV000





Table 9, "Flooding Sources Studied by Detailed Methods: Redelineated", lists all flooding sources that were studied by detailed methods for the prestatewide FIS and redelineated for previous FISs. These flooding sources were not part of this revision and their effective analyses remain valid.

Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	Riverine	Sources	Affected Communities
	From	То	
Basin 10, Stream 2	The confluence with Little River (Basin 10, Stream 1)	Approximately 0.9 mile upstream of confluence with Little River (Basin 10, Stream 1)	Rdu Wake County
Basin 10, Stream 3	The confluence with Little River (Basin 10, Stream 1)	Moss Road	Rdu Wake County
Buffalo Branch (Basin 10, Stream 22)	The confluence with Little River (Basin 10, Stream 1)	Morphus Bridge Road	Rdu Town Of Wendell Wake County
Buffalo Creek (Basin 9, Stream 1)	The Wake/Johnston County boundary	Robertsons Pond Dam	Rdu Town Of Wendell Wake County
Kit Creek	The Chatham/Wake County Boundary	Approximately 475 feet upstream of Railroad	Rdu Town Of Cary Wake County
Little Creek (Basin 11, Stream 2)	The Wake/Johnston County boundary	Cemetery Road	Rdu Town Of Zebulon Wake County
Middle Creek	The confluence with Swift Creek	Approximately 0.7 mile upstream of confluence of Middle Creek Tributary	Rdu Town Of Apex Town Of Cary Town Of Fuquay-Varina Town Of Holly Springs Wake County
Panther Branch (Basin 22, Stream 2)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.5 mile upstream of Banks Road	Rdu Wake County
Panther Creek	The Chatham/Wake County Boundary	Approximately 1.0 mile upstream of Green Level to Durham Road	Town Of Cary
Poplar Creek (Basin 13, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 900 Feet upstream of Fayetteville Street	Rdu Town Of Knightdale Wake County
Swift Creek	The confluence with the Neuse River	The confluence of Yates Branch (Basin 20, Stream 13)	Rdu Town Of Garner Wake County
White Oak Creek	The confluence with Swift Creek	Approximately 0.4 mile upstream of Pergo Parkway	Rdu Town Of Clayton Town Of Garner Wake County

Site 43

Table 10, "Flooding Sources Studied by Detailed Methods: Limited Detailed", lists all flooding sources within the county that were studied by limited detailed methods for either this FIS or previous FISs.

Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed

Source	Riverine	Affected Communties	
	From	То	
Bachelor Branch (Basin 28, Stream 6)	The confluence with White Oak Creek	Approximately 530 feet upstream of Highway 55	Rdu Town Of Cary Wake County
Basin 11, Stream 7	The Wake/Johnston County boundary	Approximately 0.4 mile upstream of Wake/Johnston County boundary	Rdu Wake County
Basin 14, Stream 2	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.4 mile upstream of Lake Myra Road	Rdu Wake County
Basin 14, Stream 3	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.7 mile upstream of confluence with Marks Creek (Basin 14, Stream 1)	Rdu Town Of Knightdale Town Of Wendell Wake County
Basin 20, Stream 5	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 1.7 miles upstream of confluence with Swift Creek (Basin 20, Stream 1)	Rdu Wake County
Basin 28, Stream 7	The confluence with Basin 28, Stream 8	Approximately 0.4 mile upstream of confluence with Basin 28, Stream 8	Town Of Cary
Beddingfield Creek	Approximately 0.4 mile upstream of the confluence with Neuse River	Approximately 0.2 mile upstream of Shotwell Road	Rdu Town Of Clayton Wake County
Big Branch	The confluence with Harris Reservoir	Approximately 0.9 mile upstream of Highway 1	Rdu Town Of Apex Wake County
Black Creek	Approximately 260 feet upstream of State HWY 210	Approximately 1.0 mile upstream of dam along Black Creek (Basin 23, Stream 1)	Rdu Town Of Fuquay-Varina Wake County

**Table 16 - Roughness Coefficients** 

Stream	Channel "n"	Overbank "n"
Beaver Creek	0.043 to 0.050	0.100 to 0.200
Beddingfield Creek	0.050	0.130
Big Branch	0.050	0.140
Black Creek	0.025 to 0.060	0.030 to 0.150
Buckhorn Creek	0.040 to 0.048	0.145
Buffalo Creek (Basin 9, Stream 1)	0.030 to 0.070	0.035 to 0.140
Buffalo Creek West	0.045 to 0.052	0.030 to 0.140
Cary Branch	0.040	0.140
Guffy Branch (Basin 21, Stream 4)	0.047	0.130
Jim Branch	0.045	0.145
Juniper Branch (Basin 21, Stream 2)	0.045	0.110 to 0.130
Kit Creek	0.030 to 0.070	0.070 to 0.110
Little Beaver Creek	0.045 to 0.055	0.100 to 0.220
Little Black Creek	0.030 to 0.070	0.070 to 0.130
Little Creek (Basin 11, Stream 2)	0.030 to 0.080	0.070 to 0.150
Little Creek (Into Middle Creek)	0.033 to 0.047	0.095 to 0.140
Little River	0.040 to 0.066	0.070 to 0.240
Marks Creek	0.025 to 0.070	0.070 to 0.130
Middle Creek	0.042 to 0.050	0.030 to 0.140
Mill Branch	0.050	0.030 to 0.150
Mill Creek (South)	0.035 to 0.060	0.040 to 0.160
Moccasin Creek	0.030 to 0.070	0.070 to 0.220
Morris Branch	0.030 to 0.050	0.100 to 0.200
Nancy Branch	0.045 to 0.050	0.120 to 0.150
Neuse River	0.035 to 0.060	0.055 to 0.250
Norris Branch	0.048	0.145
Panther Creek	0.030 to 0.070	0.070 to 0.130
Reedy Branch (Basin 27, Stream 5)	0.045 to 0.050	0.100 to 0.200
Snipes Creek	0.042 to 0.045	0.120 to 0.130
Swift Creek	0.040 to 0.072	0.035 to 0.240
Thomas Creek	0.050	0.145
Unnamed Tributary (#1) to Swift Creek	0.045 to 0.060	0.050 to 0.150
White Oak Creek	0.035 to 0.050	0.035 to 0.150

Site 43

For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained using digital elevation data obtained with LIDAR technology developed as part of the North Carolina Statewide Floodplain Mapping Program. The hydraulic model is prepared using this digital elevation data, without surveying bathymetric or structural data. Where bridge or culvert data are readily available, such as from the North Carolina Department of Transportation, these data have been reflected in the hydraulic model. If these structural data are not readily available, field measurements of these structures were made to approximate their geometry in the hydraulic models. In addition, this method does not include field surveys that determine specifics on channel and floodplain characteristics. A limited detailed study is a "buildable" product that can be upgraded to a fully detailed study at a later date by verifying stream channel characteristics, bridge and culvert opening geometry, and by analyzing multiple recurrence intervals.

The results of the HEC-RAS computations are tabulated for all cross sections (Table 17, "Limited Detailed Flood Hazard Data"). Flood Profiles have not been developed for streams studied by limited detailed methods. Water-surface elevation rasters were developed for steams studied by limited detailed methods. In addition, floodways for streams studied by limited detailed methods are not delineated on the FIRM. However, the 1% annual chance water-surface elevations, flood discharges, and non-encroachment widths from the limited detailed studies for every modeled cross section are given in Table 17. The non-encroachment widths given at modeled cross sections can be used by communities to enforce floodplain management ordinances that meet the requirement defined in 44 CFR 60.3(c)(10).

Between cross sections for streams studied by limited detailed methods, 1% annual chance water-surface elevations can be calculated by mathematical interpolation using the distance along the stream centerline. Non-encroachment widths and, therefore, the location of a non-encroachment area boundary between cross sections should be determined based on either 1) mathematical interpolation, or 2) the non-encroachment width at the upstream or downstream cross section, whichever is larger. If the width determined by this second method is wider than the Special Flood Hazard Area (SFHA) or the 1% annual chance floodplain delineated on the FIRM for this location along the stream, the non-encroachment area shall be considered to

Table 21 - Floodway Data

Floodwa	y Source		Floodway	ole ZI - FI			ter Surface Eleva	ation	
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
036	3,560	150	762	2.8	243.1	*	243.1	243.9	0.8
049	4,930	90	445	4.5	247.9	*	247.9	248.8	0.9
057	5,730	130	651	3.1	251.7	*	251.7	252.4	0.7
063	6,315	140	964	1.9	255.8	*	255.8	256.5	0.7
077	7,710	120	598	3.0	257.8	*	257.8	258.7	0.9
084	8,375	90	435	4.1	260.5	*	260.5	261.2	0.7
093	9,320	100	478	3.8	264.8	*	264.8	265.5	0.7
101	10,130	70	330	4.8	268.9	*	268.9	269.6	0.7
109	10,890	90	406	3.9	273.1	*	273.1	274.1	1.0
120	12,030	140	472	3.3	279.6	*	279.6	280.1	0.5
132	13,210	140	461	3.4	286.4	*	286.4	287.0	0.6
136	13,565	140	952	1.5	291.2	*	291.2	291.6	0.4
143	14,300	110	374	3.5	291.9	*	291.9	292.7	0.8
161	16,085	100	351	3.1	303.9	*	303.9	304.6	0.7
Panther Creel	k								
126	12,614	142	807	2.8	245.5	*	245.5	246.3	0.8
127	12,660	190	1,175	2.0	251.5	*	251.5	251.5	0.0
144	14,400	180	1,044	1.9	252.3	*	252.3	252.5	0.2
156	15,620	420	4,111	0.4	261.2	*	261.2	261.3	0.1
Poplar Creek	(Basin 13, Stre	eam 1)							
015	1,530	200	791	4.5	165.4 <sup>1</sup>	*	154.9	155.9	1.0
Reedy Branch	n (Basin 27, St	ream 5)		T	T		T		1
010	1,017	605	3,079	1.0	238.7	*	238.7	239.7	1.0
017	1,666	250	910	3.3	239.4	*	239.4	240.3	0.9
Swift Creek	ı		İ	ı		i	ı		ı
1435	143,473	1,090	12,492	0.8	202.5	*	202.5	203.4	0.9
Jnnamed Trik	outary (#1) to S	Swift Creek		<u> </u>	I		<u> </u>		I
)98	9,769	118	420	3.6	214.7	*	214.7	215.7	1.0
100	10,035	48	259	5.9	216.4	*	216.4	217.4	1.0
White Oak Cro	eek 		1				l		ı
088	8,804	588	4,690	1.3	238.0 <sup>1</sup>	*	233.7	234.7	1.0
096	9,645	790	6,444	1.0	238.01	*	234.2	235.3	1.0
105	10,545	1,065	7,654	0.8	238.0 <sup>1</sup>	*	234.6	235.6	1.0
119	11,886	950	5,187	1.2	238.0 <sup>1</sup>	*	235.4	236.3	1.0
125	12,466	815	4,803	1.3	238.01	*	236.0	236.9	1.0
130	12,997	630	3,846	1.6	238.0 <sup>1</sup>	*	236.6	237.6	1.0
258	25,831	240	1,206	2.2	222.5	*	222.5	223.2	0.7
282	28,170	140	670	3.4	234.3	*	234.3	235.3	1.0
ite 43	32,980	370	1,834	1.2	249.7	*	249.7	250.1	0.4

<sup>&</sup>lt;sup>1</sup>Elevation includes backwater effects

<sup>&</sup>lt;sup>2</sup>Feet above county boundary

<sup>\*</sup> Future conditions not computed for this stream

### **FLOOD INSURANCE STUDY**

### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000





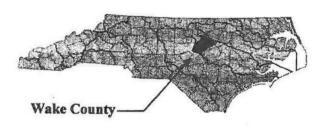
Table 13 - Summ	ary of Dis	charges			
Flooding Source	1			ges (cfs)	I
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Approximately 530 feet downstream of Lake Dam Road	7.00	*	*	2,150	*
At Lake Johnson Dam	6.92	*	*	6,020	*
Approximately 1.3 miles upstream of Lake Johnson Dam	5.35	*	*	4,230	*
Approximately 1.6 miles upstream of Lake Johnson Dam	4.36	*	*	3,480	*
Approximately 2.0 miles upstream of Lake Johnson Dam	3.55	*	*	2,800	*
At Interstate 40	2.92	*	*	2,340	*
Approximately 0.4 mile downstream of Cary Towne Boulevard	2.01	*	*	2,210	*
Approximately 530 feet upstream of Cary Towne Boulevard	1.36	*	*	1,870	*
Approximately 1,580 feet downstream of York Street	1.12	*	*	1,780	*
West Fork Mine Creek (Basin 18, Stream 33)					
At mouth	3.50	*	*	2,070	*
Wheelers Creek (Basin 10, Stream 25)					
At mouth	1.70	*	*	1,430	*
Approximately 0.6 mile upstream of State Road 97	1.00	*	*	1,020	*
At pond	0.10	*	*	310	*
White Oak Creek	•	•		•	
At County boundary	7.90	*	*	3,350	*
Just upstream of Basin 19, Stream 3	3.80	*	*	2,220	*
Approximately 0.7 mile upstream of Raynor Road just upstream of tributary	2.20	*	*	1,700	*
White Qak Creek (Basin 26, Stream 1)	12.20	1		1,,, 00	
	15.90	*	*	4,191	*
Approximately 0.6 mile upstream of the confluence with Utley Creek	15.50	*	*	4,136	*
Approximately 0.4 mile downstream of Holly Springs New Hill Road	15.40	*	*	4,122	*
Approximately 220 feet downstream of Holly Springs New Hill Road	14.70	*	*	4,004	*
Approximately 0.7 mile upstream of Holly Springs New Hill Road	13.30	*	*	3,756	*
Approximately 1,580 feet downstream of confluence with Big Branch (Basin 26, Stream 5)	12.70	*	*	3,652	*
Approximately 1,060 feet upstream of confluence with Big Branch (Basin 26, Stream 5)	1.60	*	*	990	*
Approximately 0.5 mile upstream of confluence with Big Branch (Basin 26, Stream 5)	1.40	*	*	924	*
Approximately 1,580 feet downstream of Woods Creek Road	1.00	*	*	758	*
Approximately 200 feet downstream of Woods Creek Road	1.00	*	*	728	*
Approximately 740 feet upstream of Woods Creek Road	0.90	*	*	680	*
Approximately 0.4 mile upstream of Woods Creek Road	0.80	*	*	638	*
Approximately 1,580 feet downstream of Highway 1	0.70	*	*	576	*
Approximately 810 feet downstream of Highway 1	0.50	*	*	472	*
Approximately 1,060 feet upstream of Highway 1	0.30	*	*	377	*
Wildcat Branch (Basin 30, Stream 4)					
At mouth	2.10	*	*	1,400	*
Just downstream of Railroad	1.90	*	*	1,300	*
Just upstream of Railroad	1.90	*	*	1,700	*
Just downstream of fork near Montlawn Cemetery	1.40	*	*	1,550	*
Yates Branch (Basin 20, Stream 13)	,	•	•		'
At mouth	13.40	*	*	4,920	*
At Railroad	10.40	*	*	4,315	*
	1 . 5. 10	I.	1	1 .,0 .0	1

### FLOOD INSURANCE STUDY

A Report of Flood Hazards in

### WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 7 OF 7**

Community Name	Community Number	River Basin	
Apex, Town of	370467	Cape Fear/Neuse	
Cary, Town of	370238	Cape Fear/Neuse	
Fuquay-Varina, Town of	370239	Cape Fear	
Garner, Town of	370240	Neuse	
Holly Springs, Town of	370403	Cape Fear/Neuse	
Knightdale, Town of	370241 Neuse		
Morrisville, Town of	370242	Cape Fear/Neuse	
Raleigh, City of	370243	Neuse	
Rolesville, Town of	370468 Neuse		
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse	
Wake Forest, Town of	370244	Neuse	
Wendell, Town of	370245	Neuse	
Zebulon, Town of	370246	Neuse	



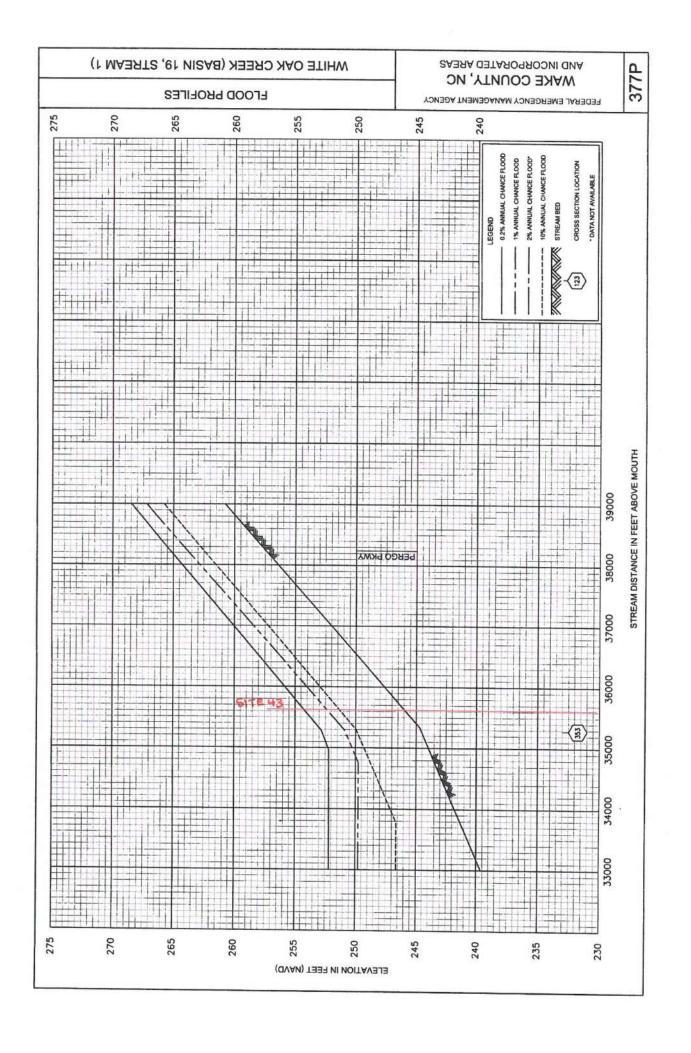


May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV007A





### PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake PROJECT NUMBER R-2721, R-2828, & R-2829 STREAM White Oak Creek ROUTE New Location (Site 43) ASSESSMENT PREPARED BY Mulkey, INC. DATE 1/9/2014 (MLH) HYDROLOGIC EVALUATION NEAREST GAGING STATION ON THIS STREAM \_\_\_\_ (NONE X) ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: Yes FLOOD DATA: Q<sub>10</sub> <u>1,300</u> CFS EST. BKWTR. <u>N/A</u> FT. Q<sub>25</sub> <u>1,700</u> CFS EST. BKWTR. <u>N/A</u> FT. Q<sub>50</sub> <u>1,900</u> CFS EST. BKWTR. <u>N/A</u> FT. Q<sub>100</sub> <u>2,100</u> CFS EST. BKWTR. <u>N/A</u> FT. Q<sub>500</sub> 4,700 CFS EST. BKWTR. N/A FT. DRAINAGE AREA 1.80 Sq.Mi. METHOD USED TO COMPUTE Q: USGS Urban Regression PROPERTY RELATED EVALUATIONS DAMAGE POTENTIAL: LOW MODERATE X HIGH COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED ENCROACHMENT: YES NO X EXPLANTION: A floodway modification may be required at this site. LIST BUILDINGS IN FLOOD PLAIN: None LOCATION: UPSTREAM LAND USE Residential

ANY FLOOD ZONING? (FIA STUDIES, ETC.) YES  $\underline{X}$  NO

REGULATORY FLOODWAY WIDTH 172 ft. Section 37980 (AS NOTED IN FIS)

TYPE OF STUDY: FEMA - Special Flood Hazard Zone AE

ANTICIPATE ANY CHANGE? No

COMMENTS:

### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 19,600 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 49,100 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? N/A
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS  NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE  EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Wehadkee TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service
ENVIRONMENTAL CONSIDERATIONS
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: Buried culverts 1 foot to allow for fish passage.
MISCELLANEOUS COMMENTS
IS THERE UNUSUAL SCOUR POTENTIAL? YES NO $\underline{\mathrm{X}}$ PROTECTION NEEDED

ARE B	SANKS STABLE? Yes PROTECTION NEEDED No
DOES	STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMN	MENTS:
	ALTERNATIVES
RECO	MMENDED DESIGN 3@11'x7' RCBC
DETO	UR STRUCTURE N/A
BRIDO	GE WATERWAY OPENING <u>198 Sq. Ft.</u>
	OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO X SSION:
THIS S	SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)	NORMAL PROCESS
(2) <u>X</u>	NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3)	SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:

Name	Index Number	Classification	Neuse River Basir Class Date
Description		Car	ecial Designation
Whealton Creek	27-150-31-3	SA;HQW,NSW	05/01/88
From source to Gale Creek			35/55/35
Wheat Swamp Creek	27-86-24	C;Sw,NSW	05/01/88
From source to Contentnea Creek			
Wheeler Gut	27-125-3	sc;nsw	05/01/88
From source to Dawson Creek			
Whitaker Branch	27-12-1-2	WS-IV;NSW	08/03/92
From source to Robertson Creek			
White Mash Run	27-77-2.5	C;Sw,NSW	05/01/88
From source to Falling Creek			
White Oak Branch	27-52-5-2	C;NSW	05/01/88
From source to Stone Creek			
White Oak Creek (Austin Pond)	27-43-11	C;NSW	05/01/88
From source to Swift Creek			
White Oak Swamp	27-86-9-3-1-2	C;Sw,NSW	05/01/88
From source to Juniper Swamp			
Whitehurst Creek	27-150-7-1	SC;Sw,HQW,NS	W 08/01/90
From source to Chapel Creek			
Whiteoak Swamp	27-86-11-2	WS-III;NSW	08/03/92
From source to Toisnot Swamp			
Whiteoak Swamp	27-86-11-7	C;Sw,NSW	05/01/88
From source to Toisnot Swamp			
Whitleys Creek (Whitelace Creek)	27-76	C;Sw,NSW	05/01/88
From source to Neuse River			
Whittaker Creek	27-130	SA;HQW,NSW	05/01/88
From source to Neuse River			
Wildcat Branch	27-34-7	C;NSW	05/01/88
From source to Walnut Creek			
Williams Creek	27-43-2	WS-III;NSW	08/03/92
From source to Swift Creek			
Williamson Branch	27-33-18-1	C;NSW	05/01/88
From source to Pigeon House Branch			

		SITE 43		
			-	
WATE	ERFIELD	DRIVE		
_	-	500	5:	
10.3×7.1	2 CMPA			
		)) //		
			0.035	
			TB-TB	19.0
			ME-ME	14.0
			D	3.0
			H20 D	
			OHW	1.8
		TAL - MODERATE		
BED MA				
RECENT	DRIFT	4.0		

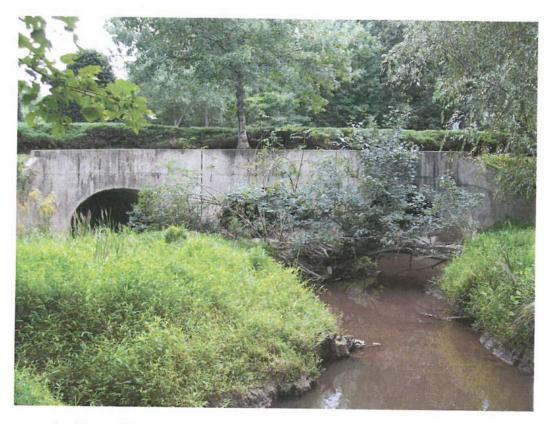


Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

Page 1 of 2



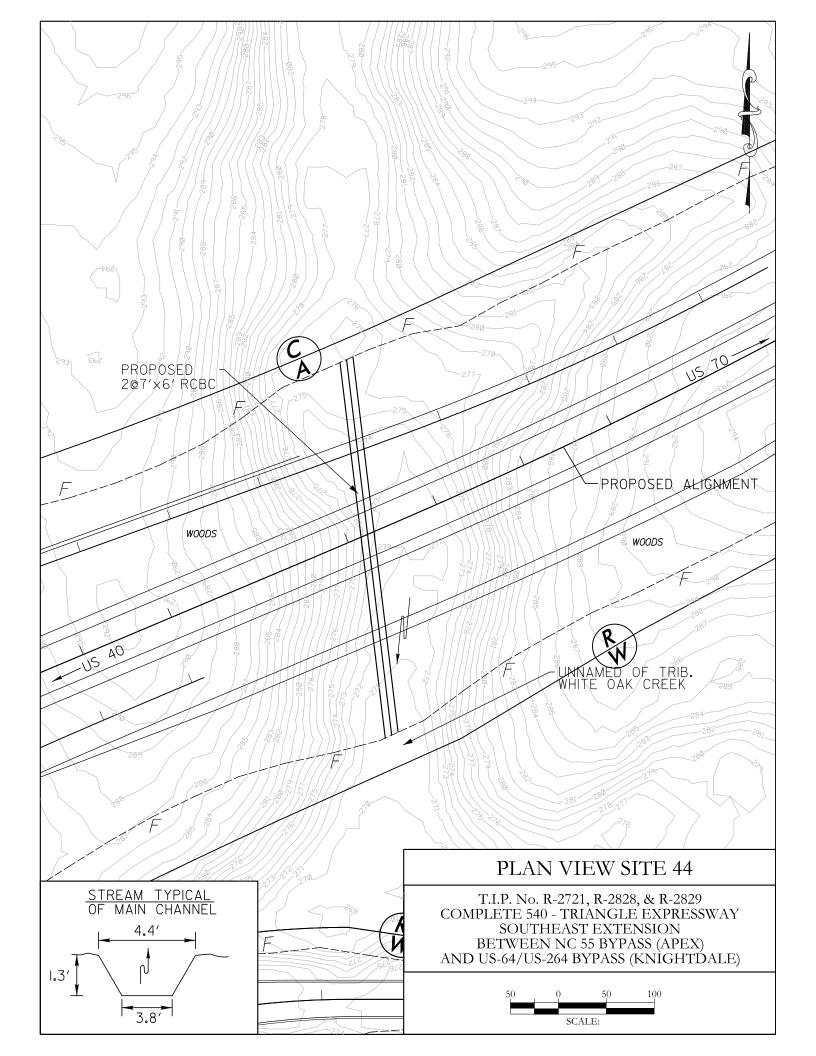
Looking at Upstream Face of Upstream Structure (3@11.5'x7.3' CMPA)

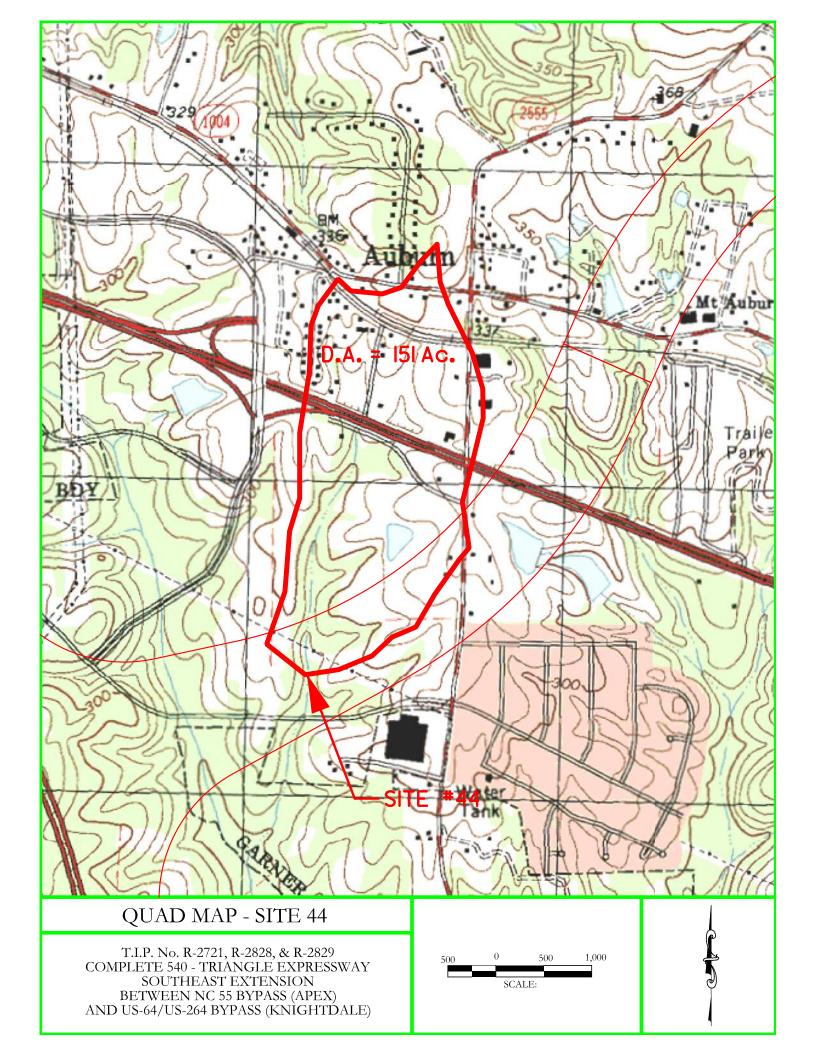


Looking at Downstream Face of Upstream Structure (3@11.5'x7.3' CMPA)

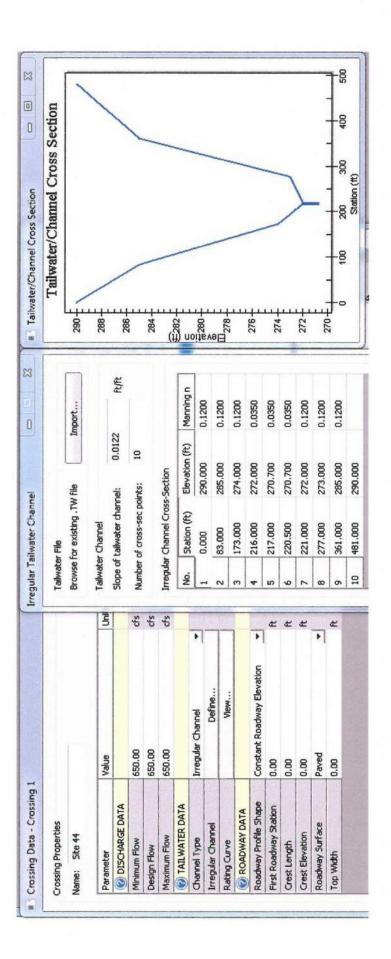
Page 2 of 2

### Site 44

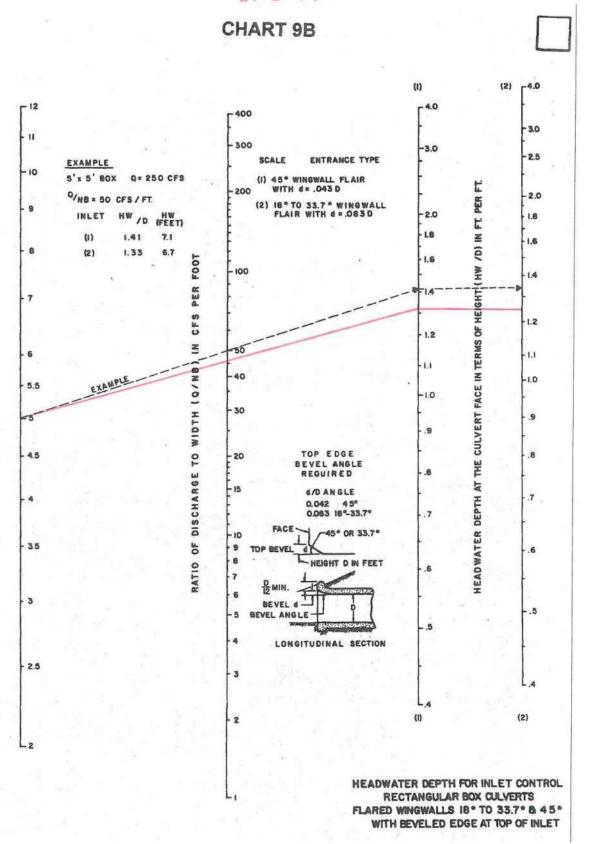




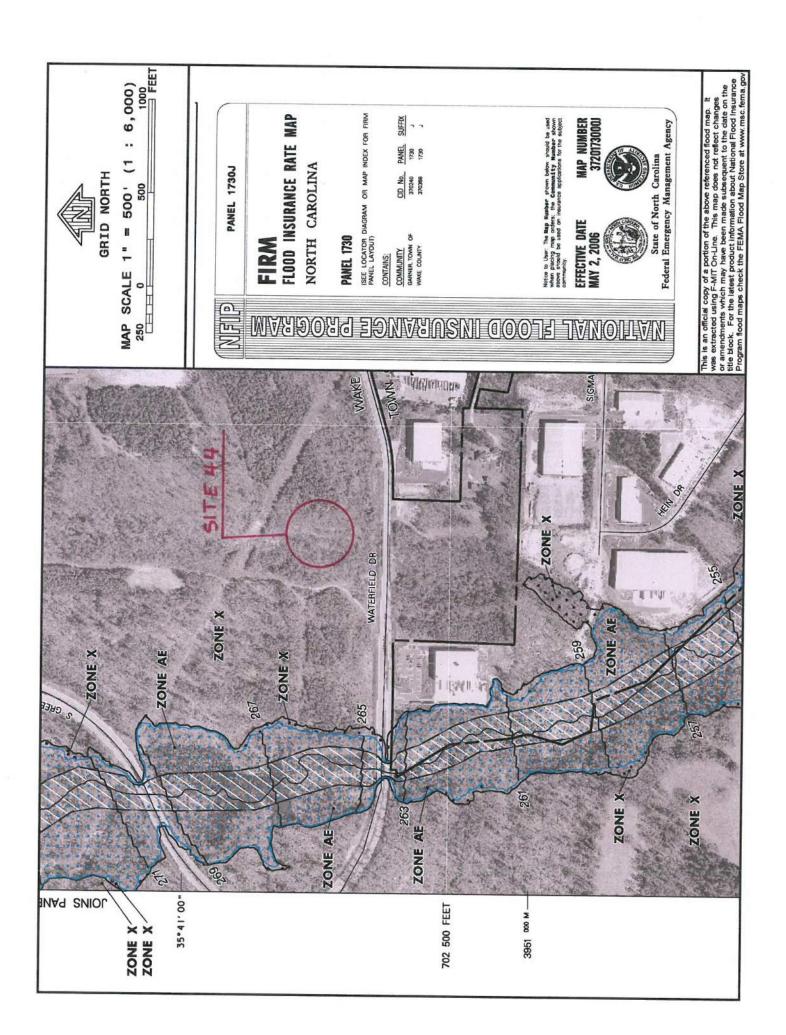
3/18/2014	€1							Site # 44
PROJECT NA	PROJECT NAME: Triangle Expressway SE Ext.	ssway SE Ext.	STREAM NAME: Unnamed of Trib. White Oak Creek	d of Trib. White O	ak Creek	REGION:	REGION: BLUE RIDGE	
ENGLISH	Drainage Area =	0.24	sq. miles		METHOD USED:	METHOD USED: Fact Sheet: 007-00		
<b>USGS RURAL</b>	JRAL REGRE	SSION EQU	REGRESSION EQUATIONS (OLD)	RURAL	AL EQUA	<b>EQUATIONS Report 01-4207</b>	ort 01-42	70
FREQUENCY	Sal	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills	
2YR	(crs) 10.43	(cfs) 28.16	(cfs) 53.71	2YR	(cfs) 49.57	(cfs) 24.76	(crs) 12.13	
5YR	17.02	64.93	95.32	5YR	92.09	52.12	20.41	
10YR	22.40	101.33	129.30	10YR	129.85	78.16	26.96	
25YR	29.52	169.43	183.38	25YR	189.60	120.55	36.49	
50YR	35.65	235.30	229.78	50YR	243.24	160.62	44.76	
100YR	42.41	321.28	287.21	100YR	305.34	208.66	53.57	
200YR 500YR	52.10	613.71	349.5 <i>z</i> 464.46	200YR 500YR	376.96 489.20	358.19	79.12	
USG	USGS URBAN REGRESSION	GRESSION	EQUATIONS					
BDF=	11							
Those East	Man boott org orgit	for comparison)						
EDECITENCY	These Equations are used only for companisorily	Coastal Plain	Blico Didge					
081		(cfs)	(cfs)					
5YR	57.91	164.54	221.98					
10YR	68.76	226.55	274.66					
25YR	83.03	336.04	358.00					
SOYR	93.99	433.49	425.23					
100YR	107.58	566.02						
200YR	192.53	634.34	769.05 (Based on 2.80xQ10)	(010)				
500YR	139.21	933.20	742.58					
NC REGE	NC REGRESSION EQUATIONS (%	WATIONS (%	Impervious) USGS Fact Sheet 007-00	act Sheet 0	00-20			
% Impervious =	3 = 65						FEMA	IA
FREQUENCY	Sal	Coastal Plain	Blue Ridge Discharge Used	וסד			FREQUENCY	Disharges
0.23	(cfs)	(cfs)	(CTS) 325 (18					
TOYR	246.93	383.45	411.20				10YR	
25YR	315.13	571.87	588.40				50YR	
50YR	357.73	659.52	654.78 650				100YR	
100YR	393.56	741.15		ı			500YR	
200YR	691.41	1073.66	1151.35 (Based on 2.80xQ10)	(010)				
500YR	903.77	1403.43	1504.98 (Based on 3.66x(210)	(010)				



Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
650,000	274.803	4,103	2.708	3.124
650,000	274.803	4,103	2.708	3.124
650,000	274.803	4,103	2,708	3.124
650.000	274.803	4.103	2.708	3,124
650,000	274.803	4.103	2.708	3.124
650,000	274.803	4,103	2.708	3.124
650.000	274.803	4.103	2.708	3.124
650,000	274.803	4.103	2.708	3,124
650,000	274.803	4.103	2.708	3.124
650,000	274.803	4,103	2,708	3.124
650,000	274.803	4.103	2.708	3.124



 $\frac{Q}{NB} = \frac{650}{(2)(7)}$ 



Name	Index Number	Ne Classification	use River Basin
Description		Special	Designation
Whealton Creek	27-150-31-3	SA;HQW,NSW	05/01/88
From source to Gale Creek			<i>395</i>
Wheat Swamp Creek	27-86-24	C;Sw,NSW	05/01/88
From source to Contentnea Creek			
Wheeler Gut	27-125-3	sc;nsw	05/01/88
From source to Dawson Creek			
Whitaker Branch	27-12-1-2	ws-iv;nsw	08/03/92
From source to Robertson Creek			
White Mash Run	27-77-2.5	C;Sw,NSW	05/01/88
From source to Falling Creek			
White Oak Branch	27-52-5-2	C;NSW	05/01/88
From source to Stone Creek			
White Oak Creek (Austin Pond)	27-43-11	C;NSW	05/01/88
From source to Swift Creek			
White Oak Swamp	27-86-9-3-1-2	C;Sw,NSW	05/01/88
From source to Juniper Swamp			
Whitehurst Creek	27-150-7-1	SC;Sw,HQW,NSW	08/01/90
From source to Chapel Creek			
Whiteoak Swamp	27-86-11-2	WS-III;NSW	08/03/92
From source to Toisnot Swamp			
Whiteoak Swamp	27-86-11-7	C;Sw,NSW	05/01/88
From source to Toisnot Swamp			
Whitleys Creek (Whitelace Creek)	27-76	C;Sw,NSW	05/01/88
From source to Neuse River			
Whittaker Creek	27-130	SA;HQW,NSW	05/01/88
From source to Neuse River			
Wildcat Branch	27-34-7	C;NSW	05/01/88
From source to Walnut Creek			
Williams Creek	27-43-2	WS-III;NSW	08/03/92
From source to Swift Creek			
Williamson Branch	27-33-18-1	C;NSW	05/01/88
From source to Pigeon House Branch			

	SITE 4L			
			-	
	11 11			
	11 11	WOODS	n=0.12	
WOODS	1/ //		TB-TB	4.4
N=0.1Z	11411		WE-WE	3.8
	(1)		D	1.3
			100	0.9
			OHW	1.0
	11/1			
	111			
	11			
		n=0.035		
				-
DEBRIS	POTENT	IAL N	LODERATE	
		MVCK		
BED M	ALERIAL	TIVCK		



Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.



Looking at Upstream Channel of Downstream Structure.



Looking at Upstream Face of Downstream Structure (2@60"RCP)

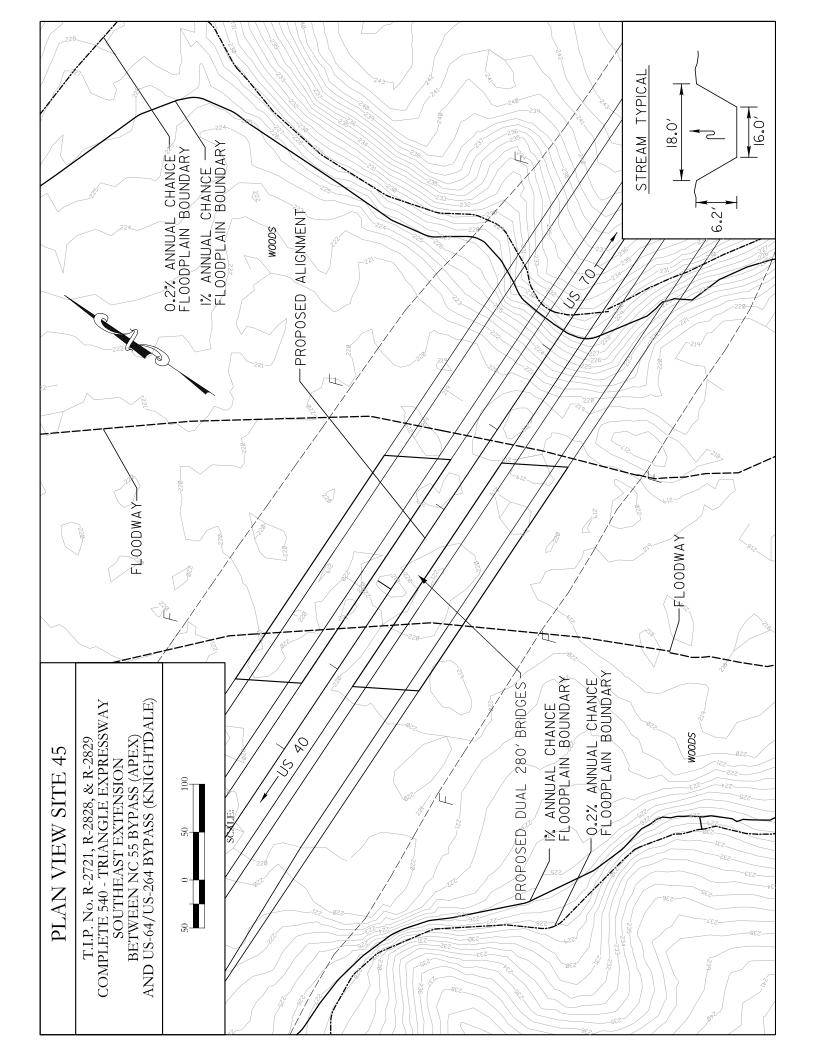


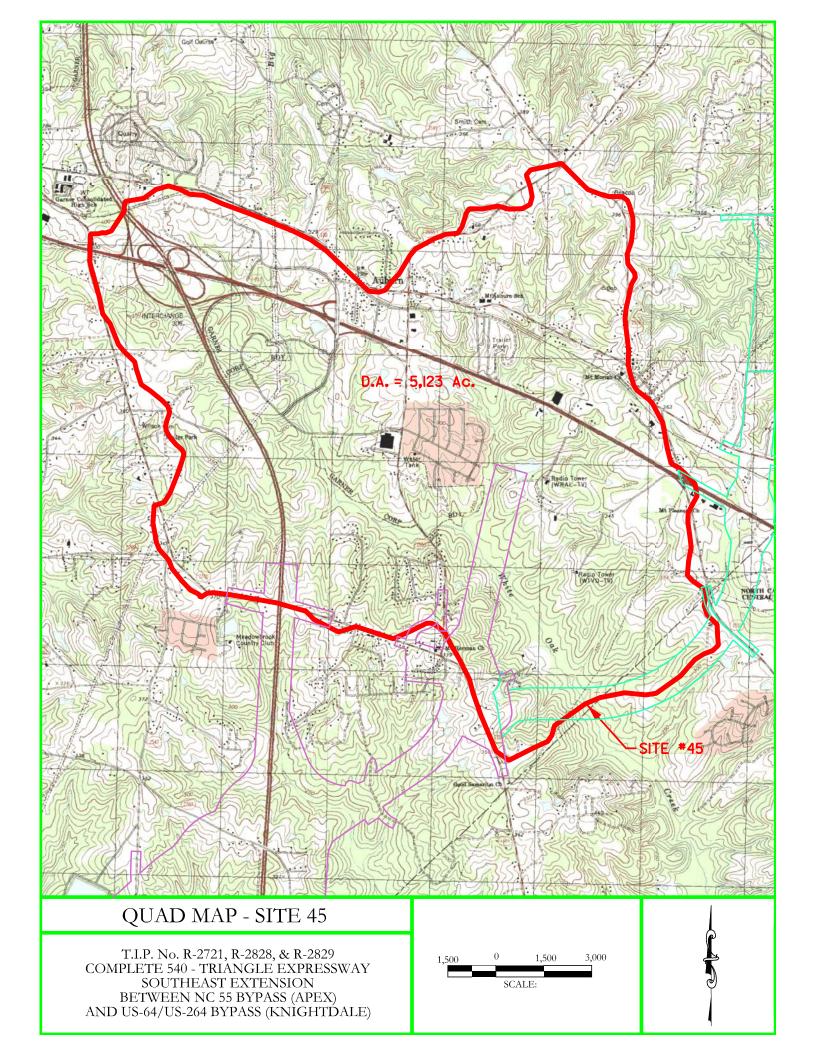
Looking at Downstream Channel of Downstream Structure.



Looking at Downstream Face of Downstream Structure. (2@60"RCP with 42"RCP from Roadway)

### Site 45





REGION: BLUE RIDGE

METHOD USED: Fact Sheet: 007-00

# **North Carolina**

STREAM NAME: White Oak Creek sq. miles 8.00 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = ENGLISH

4/22/2014

RURAL EQUATIONS Report 01-4207 Sand Hills 147.25 238.43 310.59 414.49 707.89 870.83 504.91 597.95 (cts) Coastal Plain 1223.36 1518.43 1854.43 2371.07 262.23 483.12 675.40 964.36 (cts) Blue Ridge 1323.10 1820.12 2254.54 2732.67 3268.81 4081.57 581.17 989.03 (cts) FREQUENCY 500YR 100YR 200YR 10YR 25YR 50YR **USGS RURAL REGRESSION EQUATIONS (OLD)** Blue Ridge 2737.89 3285.44 1331.38 605.90 998.90 1823.23 2244.84 4127.66 (cts) Coastal Plain 258.29 499.79 719.47 1094.34 1426.87 1835.48 2334.31 3123.06 (cts) Sand Hills 226.41 300.04 410.89 506.79 615.78 759.09 922.69 136.37 (cts) FREQUENCY 100YR 200YR 500YR 10YR 25YR 50YR 2YR 5YR

# **USGS URBAN REGRESSION EQUATIONS**

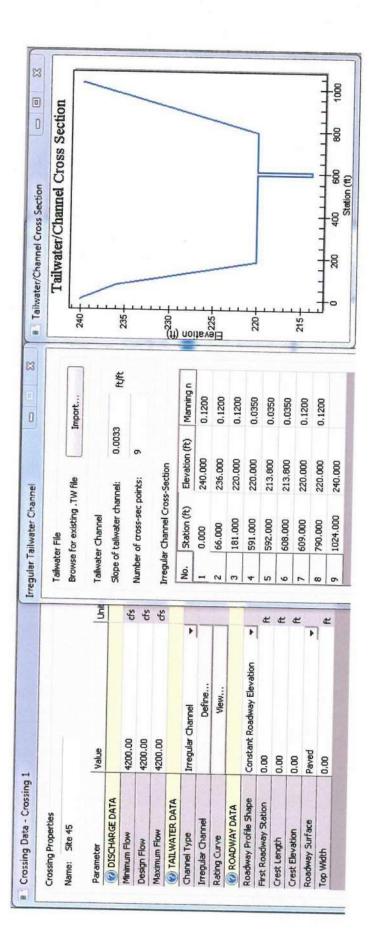
BDF= 11

(These Equations are used only for comparison)

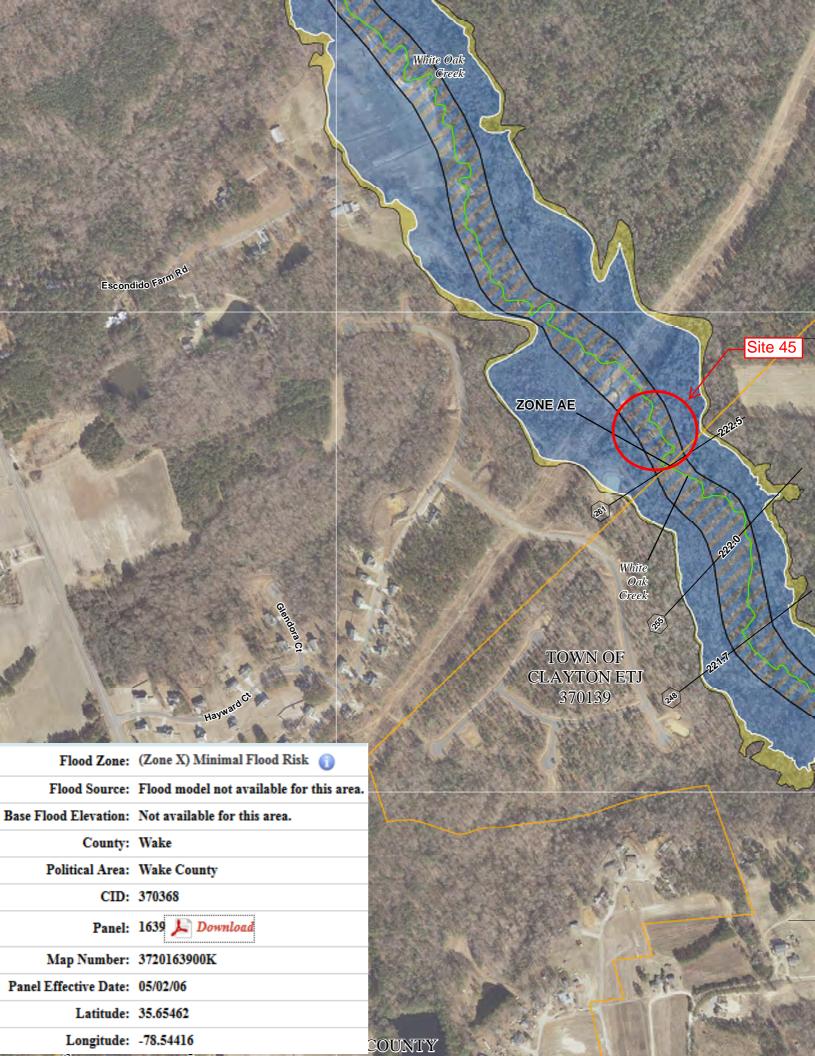
								(Based on 2.80xQ10)	
	Blue Ridge	(cfs)	2518.01	3037.40	3804.57	4558.79	5550.16	8504.72	7805.18
of colling in the	Coastal Plain	(cfs)	1467.17	1867.85	2529.04	3158.21	3998.51	5229.98	6209.58
These Equations are used only to comparison,	Sand Hills	(cfs)	791.14	935.99	1155.09	1365.53	1632.89	2620.77	2284.82
	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

# NC REGRESSION EQUATIONS (% Impervious) USGS Fact Sheet 007-00

% Impervious =	35				E	-EMA
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	lue Ridge Discharge Used	FREQUENCY	Disharges
	(cfs)	(cfs)	(cfs)			
5YR	1624.99	2034.77	2484.78			
10YR	1928.01	2494.90	2972.21		10YR	
25YR	2301.51	3221.97	3827.69		50YR	2970
50YR	2613.17	3652.02	4230.61	4200	100YR	3350
100YR	2871.99	4042.72	4583.32		500YR	
200YR	5398.42	6985.71	8322.18	(Based on 2.80xQ10)		
500YR	7056.51	9131.33	10878.27	0878.27 (Based on 3.66xQ10)		



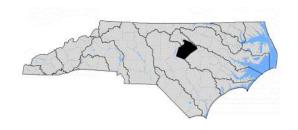
Flow (cfs)	Elevation (ft) Depth (ft)	Depth (ft)	Velocity (ft/s)   Shear (osf)	Shear (osf
4200.000	223.175	9.375	1.968	1.930
4200,000	223.175	9.375	1.968	1.930
4200.000	223.175	9.375	1.968	1.930
4200.000	223.175	9.375	1.968	1.930
4200,000	223.175	9.375	1.968	1.930
4200,000	223.175	9.375	1.968	1.930
4200,000	223.175	9.375	1.968	1.930
4200,000	223.175	9.375	1.968	1.930
4200.000	223,175	9.375	1.968	1,930
4200,000	223,175	9.375	1.968	1.930
4200.000	223.175	9.375	1.968	1.930



# PRELIMINARY FLOOD INSURANCE STUDY

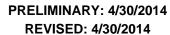
### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

State of North Carolina
Flood Insurance Study Number

37183CV000





Table 9, "Flooding Sources Studied by Detailed Methods: Redelineated", lists all flooding sources that were studied by detailed methods for the prestatewide FIS and redelineated for previous FISs. These flooding sources were not part of this revision and their effective analyses remain valid.

Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	Riverine	Sources	Affected Communities
	From	То	
Basin 10, Stream 2	The confluence with Little River (Basin 10, Stream 1)	Approximately 0.9 mile upstream of confluence with Little River (Basin 10, Stream 1)	Rdu Wake County
Basin 10, Stream 3	The confluence with Little River (Basin 10, Stream 1)	Moss Road	Rdu Wake County
Buffalo Branch (Basin 10, Stream 22)	The confluence with Little River (Basin 10, Stream 1)	Morphus Bridge Road	Rdu Town Of Wendell Wake County
Buffalo Creek (Basin 9, Stream 1)	The Wake/Johnston County boundary	Robertsons Pond Dam	Rdu Town Of Wendell Wake County
Kit Creek	The Chatham/Wake County Boundary	Approximately 475 feet upstream of Railroad	Rdu Town Of Cary Wake County
Little Creek (Basin 11, Stream 2)	The Wake/Johnston County boundary	Cemetery Road	Rdu Town Of Zebulon Wake County
Middle Creek	The confluence with Swift Creek	Approximately 0.7 mile upstream of confluence of Middle Creek Tributary	Rdu Town Of Apex Town Of Cary Town Of Fuquay-Varina Town Of Holly Springs Wake County
Panther Branch (Basin 22, Stream 2)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.5 mile upstream of Banks Road	Rdu Wake County
Panther Creek	The Chatham/Wake County Boundary	Approximately 1.0 mile upstream of Green Level to Durham Road	Town Of Cary
Poplar Creek (Basin 13, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 900 Feet upstream of Fayetteville Street	Rdu Town Of Knightdale Wake County
Swift Creek	The confluence with the Neuse River	The confluence of Yates Branch (Basin 20, Stream 13)	Rdu Town Of Garner Wake County
White Oak Creek	The confluence with Swift Creek	Approximately 0.4 mile upstream of Pergo Parkway	Rdu Town Of Clayton Town Of Garner Wake County

Site 45

Table 10, "Flooding Sources Studied by Detailed Methods: Limited Detailed", lists all flooding sources within the county that were studied by limited detailed methods for either this FIS or previous FISs.

Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed

Source	Riverine	Sources	Affected Communities	
	From	То		
Bachelor Branch (Basin 28, Stream 6)	The confluence with White Oak Creek	Approximately 530 feet upstream of Highway 55	Rdu Town Of Cary Wake County	
Basin 11, Stream 7	The Wake/Johnston County boundary	Approximately 0.4 mile upstream of Wake/Johnston County boundary	Rdu Wake County	
Basin 14, Stream 2	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.4 mile upstream of Lake Myra Road	Rdu Wake County	
Basin 14, Stream 3	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.7 mile upstream of confluence with Marks Creek (Basin 14, Stream 1)	Rdu Town Of Knightdale Town Of Wendell Wake County	
Basin 20, Stream 5	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 1.7 miles upstream of confluence with Swift Creek (Basin 20, Stream 1)	Rdu Wake County	
Basin 28, Stream 7	The confluence with Basin 28, Stream 8	Approximately 0.4 mile upstream of confluence with Basin 28, Stream 8	Town Of Cary	
Beddingfield Creek	Approximately 0.4 mile upstream of the confluence with Neuse River	Approximately 0.2 mile upstream of Shotwell Road	Rdu Town Of Clayton Wake County	
Big Branch	The confluence with Harris Reservoir	Approximately 0.9 mile upstream of Highway 1	Rdu Town Of Apex Wake County	
Black Creek	Approximately 260 feet upstream of State HWY 210	Approximately 1.0 mile upstream of dam along Black Creek (Basin 23, Stream 1)	Rdu Town Of Fuquay-Varina Wake County	

**Table 16 - Roughness Coefficients** 

Stream	Channel "n"	Overbank "n"
Beaver Creek	0.043 to 0.050	0.100 to 0.200
Beddingfield Creek	0.050	0.130
Big Branch	0.050	0.140
Black Creek	0.025 to 0.060	0.030 to 0.150
Buckhorn Creek	0.040 to 0.048	0.145
Buffalo Creek (Basin 9, Stream 1)	0.030 to 0.070	0.035 to 0.140
Buffalo Creek West	0.045 to 0.052	0.030 to 0.140
Cary Branch	0.040	0.140
Guffy Branch (Basin 21, Stream 4)	0.047	0.130
Jim Branch	0.045	0.145
Juniper Branch (Basin 21, Stream 2)	0.045	0.110 to 0.130
Kit Creek	0.030 to 0.070	0.070 to 0.110
Little Beaver Creek	0.045 to 0.055	0.100 to 0.220
Little Black Creek	0.030 to 0.070	0.070 to 0.130
Little Creek (Basin 11, Stream 2)	0.030 to 0.080	0.070 to 0.150
Little Creek (Into Middle Creek)	0.033 to 0.047	0.095 to 0.140
Little River	0.040 to 0.066	0.070 to 0.240
Marks Creek	0.025 to 0.070	0.070 to 0.130
Middle Creek	0.042 to 0.050	0.030 to 0.140
Mill Branch	0.050	0.030 to 0.150
Mill Creek (South)	0.035 to 0.060	0.040 to 0.160
Moccasin Creek	0.030 to 0.070	0.070 to 0.220
Morris Branch	0.030 to 0.050	0.100 to 0.200
Nancy Branch	0.045 to 0.050	0.120 to 0.150
Neuse River	0.035 to 0.060	0.055 to 0.250
Norris Branch	0.048	0.145
Panther Creek	0.030 to 0.070	0.070 to 0.130
Reedy Branch (Basin 27, Stream 5)	0.045 to 0.050	0.100 to 0.200
Snipes Creek	0.042 to 0.045	0.120 to 0.130
Swift Creek	0.040 to 0.072	0.035 to 0.240
Thomas Creek	0.050	0.145
Unnamed Tributary (#1) to Swift Creek	0.045 to 0.060	0.050 to 0.150
White Oak Creek	0.035 to 0.050	0.035 to 0.150

Site 45

For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained using digital elevation data obtained with LIDAR technology developed as part of the North Carolina Statewide Floodplain Mapping Program. The hydraulic model is prepared using this digital elevation data, without surveying bathymetric or structural data. Where bridge or culvert data are readily available, such as from the North Carolina Department of Transportation, these data have been reflected in the hydraulic model. If these structural data are not readily available, field measurements of these structures were made to approximate their geometry in the hydraulic models. In addition, this method does not include field surveys that determine specifics on channel and floodplain characteristics. A limited detailed study is a "buildable" product that can be upgraded to a fully detailed study at a later date by verifying stream channel characteristics, bridge and culvert opening geometry, and by analyzing multiple recurrence intervals.

The results of the HEC-RAS computations are tabulated for all cross sections (Table 17, "Limited Detailed Flood Hazard Data"). Flood Profiles have not been developed for streams studied by limited detailed methods. Water-surface elevation rasters were developed for steams studied by limited detailed methods. In addition, floodways for streams studied by limited detailed methods are not delineated on the FIRM. However, the 1% annual chance water-surface elevations, flood discharges, and non-encroachment widths from the limited detailed studies for every modeled cross section are given in Table 17. The non-encroachment widths given at modeled cross sections can be used by communities to enforce floodplain management ordinances that meet the requirement defined in 44 CFR 60.3(c)(10).

Between cross sections for streams studied by limited detailed methods, 1% annual chance water-surface elevations can be calculated by mathematical interpolation using the distance along the stream centerline. Non-encroachment widths and, therefore, the location of a non-encroachment area boundary between cross sections should be determined based on either 1) mathematical interpolation, or 2) the non-encroachment width at the upstream or downstream cross section, whichever is larger. If the width determined by this second method is wider than the Special Flood Hazard Area (SFHA) or the 1% annual chance floodplain delineated on the FIRM for this location along the stream, the non-encroachment area shall be considered to

Table 21 - Floodway Data

Floodwa	y Source		Floodway			Wa	ter Surface Eleva	ation	
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
036	3,560	150	762	2.8	243.1	*	243.1	243.9	0.8
049	4,930	90	445	4.5	247.9	*	247.9	248.8	0.9
057	5,730	130	651	3.1	251.7	*	251.7	252.4	0.7
063	6,315	140	964	1.9	255.8	*	255.8	256.5	0.7
077	7,710	120	598	3.0	257.8	*	257.8	258.7	0.9
084	8,375	90	435	4.1	260.5	*	260.5	261.2	0.7
093	9,320	100	478	3.8	264.8	*	264.8	265.5	0.7
101	10,130	70	330	4.8	268.9	*	268.9	269.6	0.7
109	10,890	90	406	3.9	273.1	*	273.1	274.1	1.0
120	12,030	140	472	3.3	279.6	*	279.6	280.1	0.5
132	13,210	140	461	3.4	286.4	*	286.4	287.0	0.6
136	13,565	140	952	1.5	291.2	*	291.2	291.6	0.4
143	14,300	110	374	3.5	291.9	*	291.9	292.7	0.8
161	16,085	100	351	3.1	303.9	*	303.9	304.6	0.7
Panther Creel	k				1				
126	12,614	142	807	2.8	245.5	*	245.5	246.3	0.8
127	12,660	190	1,175	2.0	251.5	*	251.5	251.5	0.0
144	14,400	180	1,044	1.9	252.3	*	252.3	252.5	0.2
156	15,620	420	4,111	0.4	261.2	*	261.2	261.3	0.1
Poplar Creek	(Basin 13, Stre	eam 1)		l					ı
015	1,530	200	791	4.5	165.4 <sup>1</sup>	*	154.9	155.9	1.0
Reedy Branch	n (Basin 27, St	ream 5)							
010	1,017	605	3,079	1.0	238.7	*	238.7	239.7	1.0
017	1,666	250	910	3.3	239.4	*	239.4	240.3	0.9
Swift Creek									
1435	143,473	1,090	12,492	0.8	202.5	*	202.5	203.4	0.9
	outary (#1) to S		420	2.6	214.7	*	214.7	215.7	1.0
098	9,769	118	420	3.6	214.7	*	214.7	215.7	1.0
100 White Oak Cr	10,035	48	259	5.9	216.4		216.4	217.4	1.0
088	8,804	588	4,690	1.3	238.01	*	233.7	234.7	1.0
096	9,645	790	6,444	1.0	238.0	*	234.2	235.3	1.0
105	10,545	1,065	7,654	0.8	238.0	*	234.6	235.6	1.0
119	11,886	950	5,187	1.2	238.0	*	235.4	236.3	1.0
125	12,466	815	4,803	1.3	238.0 1	*	236.0	236.9	1.0
					238.0 1	*		237.6	1.0
130	12,997	630	3,846	1.6		*	236.6		
258	25,831	240	1,206	2.2	222.5	*	222.5	223.2	0.7
282	28,170	140	670	3.4	234.3		234.3	235.3	1.0
ite 45	32,980	370	1,834	1.2	249.7	1-	249.7	250.1	0.4

'Elevation includes backwater effects

<sup>&</sup>lt;sup>2</sup>Feet above county boundary

<sup>\*</sup> Future conditions not computed for this stream

## **FLOOD INSURANCE STUDY**

## FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





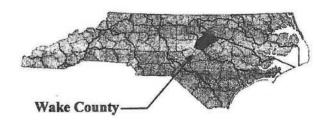
Table 13 - Summary of Discharges					
Flooding Source	400/ 4	Discharges (cfs)			
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Approximately 530 feet downstream of Lake Dam Road	7.00	*	*	2,150	*
At Lake Johnson Dam	6.92	*	*	6,020	*
Approximately 1.3 miles upstream of Lake Johnson Dam	5.35	*	*	4,230	*
Approximately 1.6 miles upstream of Lake Johnson Dam	4.36	*	*	3,480	*
Approximately 2.0 miles upstream of Lake Johnson Dam	3.55	*	*	2,800	*
At Interstate 40	2.92	*	*	2,340	*
Approximately 0.4 mile downstream of Cary Towne Boulevard	2.01	*	*	2,210	*
Approximately 530 feet upstream of Cary Towne Boulevard	1.36	*	*	1,870	*
Approximately 1,580 feet downstream of York Street	1.12	*	*	1,780	*
West Fork Mine Creek (Basin 18, Stream 33)		ı			
At mouth	3.50	*	*	2,070	*
Wheelers Creek (Basin 10, Stream 25)					
At mouth	1.70	*	*	1,430	*
Approximately 0.6 mile upstream of State Road 97	1.00	*	*	1,020	*
At pond	0.10	*	*	310	*
White Oak Creek					
At County boundary	7 90	*	*	3,350	*
Just upstream of Basin 19, Stream 3	3.80	*	*	2,220	*
oximately 0.7 mile upstream of Raynor Road just upstream of tributary	2.20	*	*	1,700	*
White Oak Creek (Basin 26, Stream 1)					
At the confluence with Utley Creek	15.90	*	*	4,191	*
Approximately 0.6 mile upstream of the confluence with Utley Creek	15.50	*	*	4,136	*
Approximately 0.4 mile downstream of Holly Springs New Hill Road	15.40	*	*	4,122	*
Approximately 220 feet downstream of Holly Springs New Hill Road	14.70	*	*	4,004	*
Approximately 0.7 mile upstream of Holly Springs New Hill Road	13.30	*	*	3,756	*
Approximately 1,580 feet downstream of confluence with Big Branch (Basin 26, Stream 5)	12.70	*	*	3,652	*
Approximately 1,060 feet upstream of confluence with Big Branch (Basin 26, Stream 5)	1.60	*	*	990	*
Approximately 0.5 mile upstream of confluence with Big Branch (Basin 26, Stream 5)	1.40	*	*	924	*
Approximately 1,580 feet downstream of Woods Creek Road	1.00	*	*	758	*
Approximately 200 feet downstream of Woods Creek Road	1.00	*	*	728	*
Approximately 740 feet upstream of Woods Creek Road	0.90	*	*	680	*
Approximately 0.4 mile upstream of Woods Creek Road	0.80	*	*	638	*
Approximately 1,580 feet downstream of Highway 1	0.70	*	*	576	*
Approximately 810 feet downstream of Highway 1	0.50	*	*	472	*
Approximately 1,060 feet upstream of Highway 1	0.30	*	*	377	*
Wildcat Branch (Basin 30, Stream 4)					
At mouth	2.10	*	*	1,400	*
Just downstream of Railroad	1.90	*	*	1,300	*
Just upstream of Railroad	1.90	*	*	1,700	*
Just downstream of fork near Montlawn Cemetery	1.40	*	*	1,550	*
Yates Branch (Basin 20, Stream 13)					
At mouth	13.40	*	*	4,920	*
At Railroad	10.40	*	*	4,315	*

## FLOOD INSURANCE STUDY

A Report of Flood Hazards in

## WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



## **VOLUME 7 OF 7**

Community Name	Community Number	River Basin	
Apex, Town of	370467	Cape Fear/Neuse	
Cary, Town of	370238	Cape Fear/Neuse	
Fuquay-Varina, Town of	370239	Cape Fear	
Garner, Town of	370240	Neuse	
Holly Springs, Town of	370403	Cape Fear/Neuse	
Knightdale, Town of	370241	Neuse	
Morrisville, Town of	370242	Cape Fear/Neuse	
Raleigh, City of	370243	Neuse	
Rolesville, Town of	370468	Neuse	
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse	
Wake Forest, Town of	370244	Neuse	
Wendell, Town of	370245	Neuse	
Zebulon, Town of	370246	Neuse	





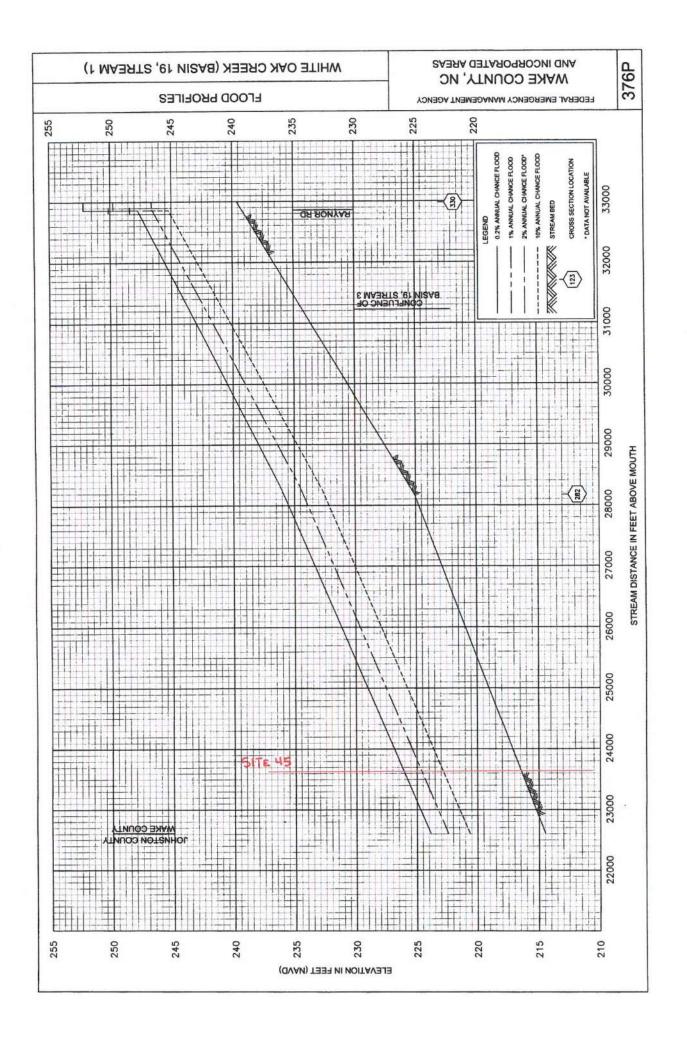
May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV007A

www.fema.gov and www.ncfloodmaps.com





## PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake PROJECT NUMBER R-2721, R-2828, & R-2829 STREAM White Oak Creek ROUTE New Location (Site 45) ASSESSMENT PREPARED BY Mulkey, INC. DATE 1/9/2014 (MLH) HYDROLOGIC EVALUATION NEAREST GAGING STATION ON THIS STREAM (NONE X) ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: Yes FLOOD DATA: Q<sub>10</sub> 3,000 CFS EST. BKWTR. N/A FT. Q<sub>25</sub> 3,800 CFS EST. BKWTR. N/A FT. Q<sub>50</sub> 4,200 CFS EST. BKWTR. N/A FT. Q<sub>100</sub> 4,600 CFS EST. BKWTR. N/A FT. Q<sub>500</sub> 11,000 CFS EST. BKWTR. N/A FT. DRAINAGE AREA 8.0 Sq.Mi. METHOD USED TO COMPUTE Q: USGS Urban Regression PROPERTY RELATED EVALUATIONS DAMAGE POTENTIAL: LOW \_\_\_\_\_ MODERATE X HIGH COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED ENCROACHMENT: YES NO X EXPLANTION: A floodway modification may be required at this site. LIST BUILDINGS IN FLOOD PLAIN: None LOCATION: \_\_\_\_\_ UPSTREAM LAND USE Residential & Agriculture ANTICIPATE ANY CHANGE? No ANY FLOOD ZONING? (FIA STUDIES, ETC.) YES X NO \_\_\_\_\_ TYPE OF STUDY: FEMA –Zone AE REGULATORY FLOODWAY WIDTH 200' Section 23,733 COMMENTS:

## TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 20,600 VPD % TRUCKS 9
DESIGN YEAR 2035 TRAFFIC COUNT 54,000 VPD % TRUCKS 9ii
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? <u>N/A New Location</u> LENGTH OF DETOUR <u>N/A</u> MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? N/A
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS  NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR
FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE <u>X</u> ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Wehadkee TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service
ENVIRONMENTAL CONSIDERATIONS
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN:
MISCELLANEOUS COMMENTS
IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED

ARE BANKS STABLE? Yes PROTECTION NEEDED No				
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No				
COMMENTS:				
<u>ALTERNATIVES</u>				
RECOMMENDED DESIGN <u>Dual 280' Bridges</u>				
DETOUR STRUCTURE N/A				
BRIDGE WATERWAY OPENING <u>13,050 Sq. Ft.</u>				
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO $\underline{X}$ DISCUSSION:				
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:				
(1)X NORMAL PROCESS				
(2)NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR				
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:				

		Neu	ise River Basir
Name	Index Number	Classification	Class Date
Description		Special	Designation
Whealton Creek	27-150-31-3	SA;HQW,NSW	05/01/88
From source to Gale Creek			
Wheat Swamp Creek	27-86-24	C;Sw,NSW	05/01/88
From source to Contentnea Creek			
Wheeler Gut	27-125-3	SC;NSW	05/01/88
From source to Dawson Creek			
Whitaker Branch	27-12-1-2	WS-IV;NSW	08/03/92
From source to Robertson Creek			
White Mash Run	27-77-2.5	C;Sw,NSW	05/01/88
From source to Falling Creek			
White Oak Branch	27-52-5-2	C;NSW	05/01/88
From source to Stone Creek			
White Oak Creek (Austin Pond)	27-43-11	C;NSW	05/01/88
From source to Swift Creek			
White Oak Swamp	27-86-9-3-1-2	C;Sw,NSW	05/01/88
From source to Juniper Swamp			
Whitehurst Creek	27-150-7-1	SC;Sw,HQW,NSW	08/01/90
From source to Chapel Creek			
Whiteoak Swamp	27-86-11-2	WS-III;NSW	08/03/92
From source to Toisnot Swamp			
Whiteoak Swamp	27-86-11-7	C;Sw,NSW	05/01/88
From source to Toisnot Swamp			
Whitleys Creek (Whitelace Creek)	27-76	C;Sw,NSW	05/01/88
From source to Neuse River			
Whittaker Creek	27-130	SA;HQW,NSW	05/01/88
From source to Neuse River			
Wildcat Branch	27-34-7	C;NSW	05/01/88
From source to Walnut Creek			
Williams Creek	27-43-2	WS-III;NSW	08/03/92
From source to Swift Creek			
Williamson Branch	27-33-18-1	C;NSW	05/01/88
From source to Pigeon House Branch			

	SITE 45			
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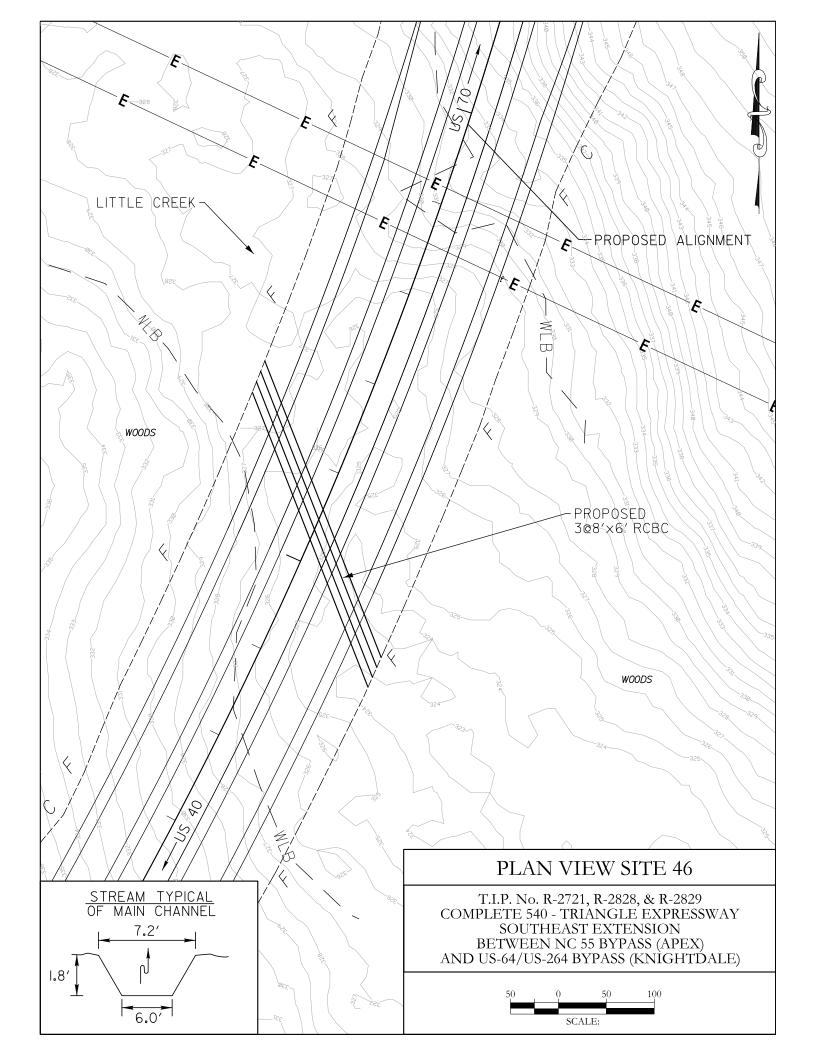
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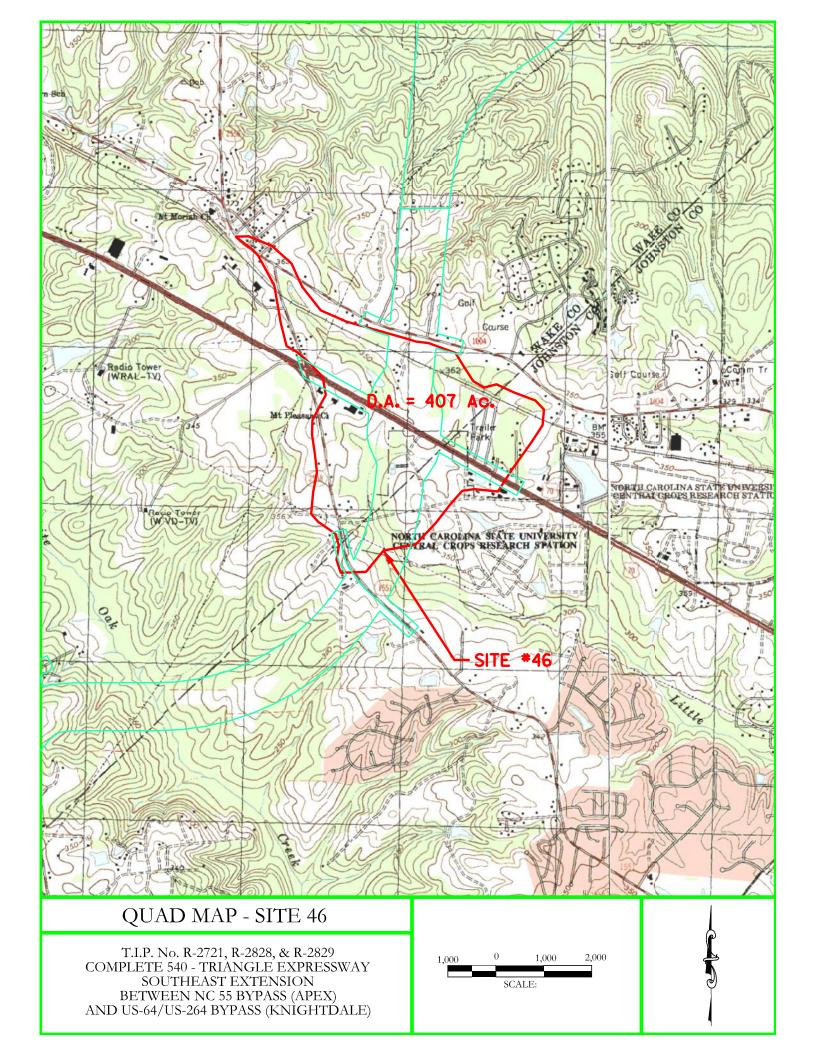
Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

## Site 46





3/18/2014

PROJECT NAME: Triangle Expressway SE Ext. ENGLISH

Drainage Area =

sq. miles 0.64

STREAM NAME: Little Creek

REGION: BLUE RIDGE

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EQUENCY	Sand Hills	Coactal Diain	Din Dida			100000000000000000000000000000000000000	1074-101101
	(cfs)	(cfs)	(cfs)	FREGUENCY	Blue Ridge	Coastal Plain	Sand Hills
2YR	21.41	52.34	105 79	CAN'C	(CTS)	(cfs)	(cts)
5YR	35.11	114.92	183.90	ZYR	98.69	47.91	24.38
10YR	46.29	175.32	248 23	ATC.	1/8.90	97.17	40.59
25YR	61.65	285.49	348 63	DIVE	248.56	142.88	53.41
50YR	74.90	389.56	434.70	ATC2	350.94	215.66	72.00
100YR	89.64	523.10	539.64	300K	453.44	283.43	88.16
200YR	110.22	689.21	654.14	1007R	563.66	363.53	105.19
500YR	129.32	967 42	855.71	ZUUTR	089.75	457.64	125.17

## USGS URBAN REGRESSION EQUATIONS

BDF=

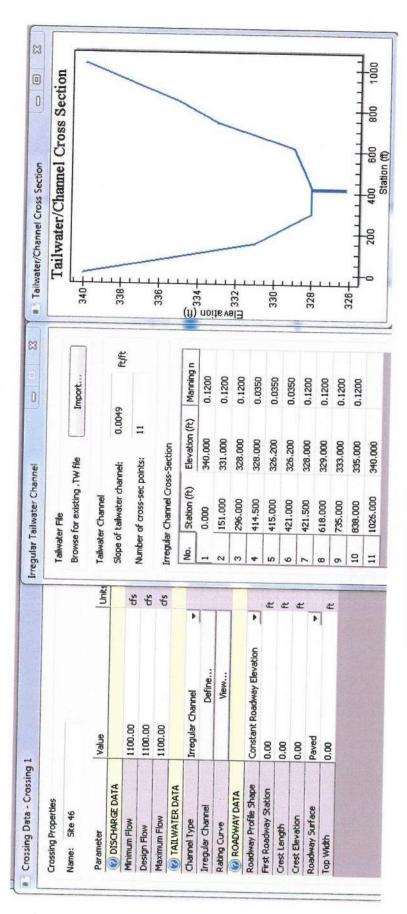
(These Equations are used only for comparison)

lidae	(8)	437.86	94	41	64	.26	24 (Based on 2 80×010)	
-								
Sand Hills Coastal Plain	(cfs)	303.43	408.72	590.98	755.47	977.97	1144.43	1585.64
Sand Hills	(cfs)	120.32	142.73	173.40	198.69	230.21	399.64	304.48
FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

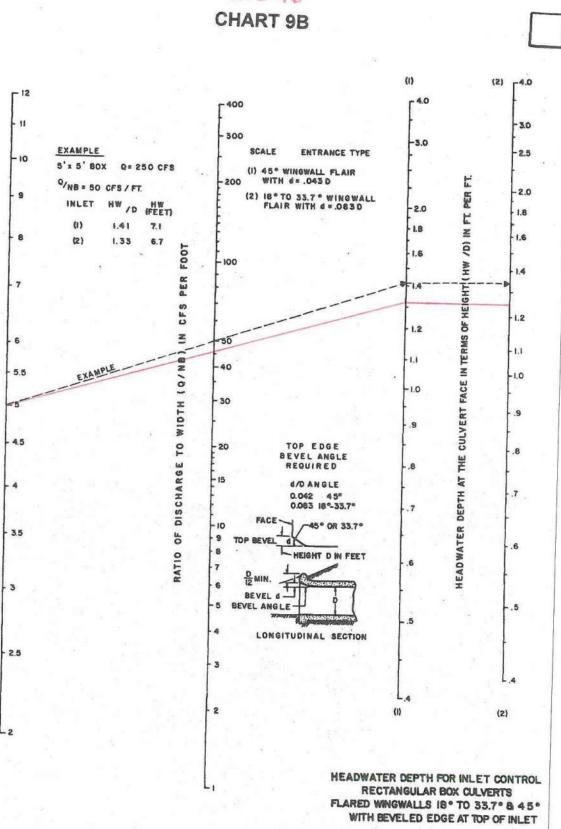
# NC REGRESSION EQUATIONS (% Impervious) USGS Fact Sheet 007-00

Commence of the commence of th					
% Impervious = REQUENCY	Sand Hills	Coastal Plain		<b>L</b>	FEMA
	(cfs)	(cfs)	(cfs)	FREQUENCY	Disharges
5YR	340.11	477.14	545.63		
10YR	419.06	618.38	682.93		
25YR	528.62	892.11	955.57	10YR	
50YR	602.25	1027.54	1065 13 1100	SOYR	
100YR	664.64	1153.77	1164 58	100YR	
200YR	1173.37	1731.48	1912.21 (Based on 2 80xO10)	500YR	
500YR	1533.76	2263.29			

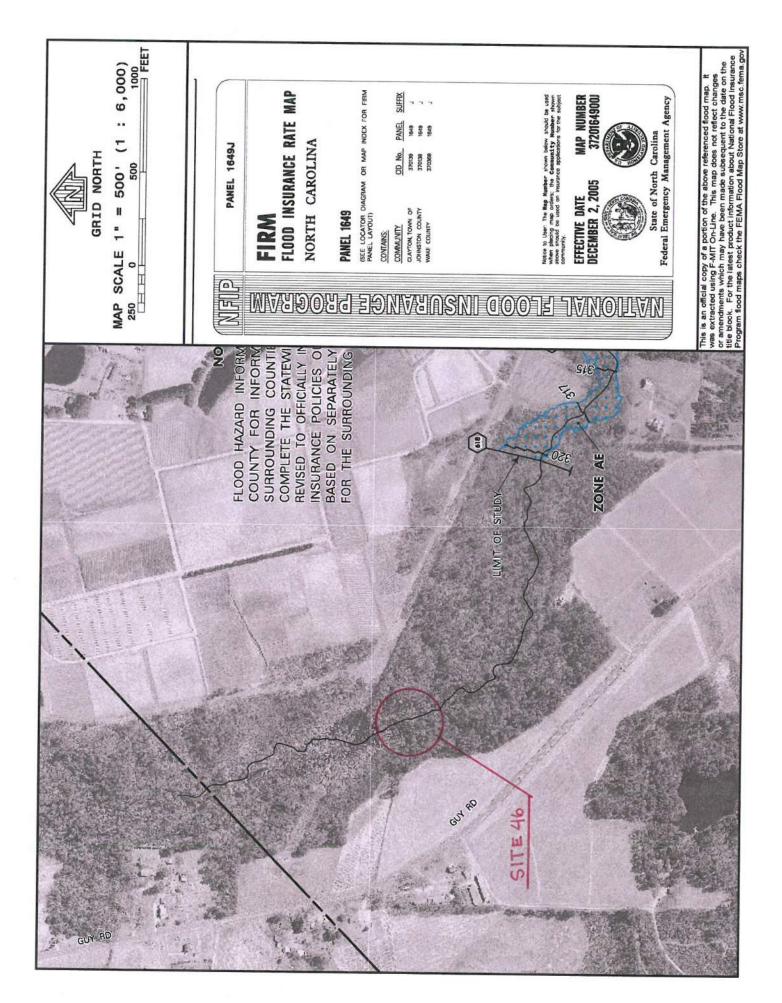
Disharges



330.278 4.078 330.278 4.078 330.278 4.078 330.278 4.078 330.278 4.078 330.278 4.078 330.278 4.078 330.278 4.078 330.278 4.078 330.278 4.078 330.278 4.078	Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)   Shear (psf)	Shear (ps
330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       1     1.382     1	1100.000	330.278	4.078	1.382	1.247
330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       1     380.278     4.078	1100,000	330,278	4.078	1.382	1.247
330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       1     1.382     1.382	1100,000	330.278	4.078	1.382	1.247
330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382	1100,000	330,278	4.078	1.382	1.247
330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382       330.278     4.078     1.382	1100.000	330.278	4.078	1.382	1.247
330,278     4,078     1,382       330,278     4,078     1,382       330,278     4,078     1,382       330,278     4,078     1,382       330,278     4,078     1,382	1100,000	330,278	4.078	1.382	1.247
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330,278 4,078 1,382	1100.000	330.278	4.078	1.382	1.247
	1100,000	330,278	4.078	1.382	1.247



$$\frac{Q}{NB} = \frac{1100}{(3)(8)} = 45.8$$



## 2012 North Carolina 303(d) List-Category 5

Nen	Neuse Kiver Basin	HISPA		TO-nigit watershed	OSOZOZOTIO			Swift Creek	reek
> AU	AU Number	Name		Description		Length or Area	Units	Classification	Category
	Category	y Rating	Use	Reason for Rating	Parameter			Year	
2 2	> 27-43-(1)d	Swift Creek	u u	From Lake Wheeler Dam to a point 0.6 mile upstream of Wake County SR 1006	nile upstream of Wake County SF	2.4	FW Miles	WS-III;NSW	in T
	2	Impaired	Aquatic Life	Poor Bioclassification	Ecological/biological Integrity Benthos	itegrity Benthos		2008	
× 27	27-43-(5.5)a	Swift Creek (Lake Benson)	r (Lake	From a point 0.6 mile upstream of Wake County SR 1006 to backwaters of Lake Benson	County SR 1006 to backwaters o	6:0	FW Miles	WS-III;NSW,CA	N
	2	Impaired	Aquatic Life	Poor Bioclassification	Ecological/biological Integrity Benthos	itegrity Benthos		2008	
	The state of			12-digit Subwatershed	030202011005			Little	Little Creek
> 27	27-43-12	Little Creek		From source to Swift Creek		11.4 FW	FW Miles	C;NSW	ın
1	ı,	Impaired	Aquatic Life	Fair Bioclassification	Ecological/biological Integrity Benthos	itegrity Benthos		1998	
				12-digit Subwatershed	030202011003			Whiteoak Creek	Creek
> 27	27-43-(8)a	Swift Creek		From dam at Lake Benson to Little Creek		20.6 FW	FW Miles	C;NSW	20
	r.	Impaired	Aquatic Life	Fair Bioclassification	Ecological/biological Integrity Benthos	itegrity Benthos		2012	
Veu	Neuse River Basin	asin		10-digit Watershed	0302020111		Waln	Walnut Creek-Neuse River	River
				12-digit Subwatershed	030202011104			Mill Creek-Neuse Rive	e Rive
> 27	27-(38.5)	NEUSE RIVER		From a point 0.2 mile downstream of Johnston Co 1.4 mile downstream of Johnston County SR 1908	mile downstream of Johnston County SR 1700 to point eam of Johnston County SR 1908	9.7 FW	FW Miles	WS-IV;NSW	ru.
	S	Impaired	Aquatic Life	Standard Violation	Copper			2012	
				12-digit Subwatershed	030202011103			Poplar Creek-Neuse Rive	e Rive
> 27	27-(22.5)c	NEUSE RIVER		From Crabtree Creek to Auburn Knightdale Road	sle Road	3.9 FW	FW Miles	C;NSW	r.
	2	Impaired	Aquatic Life	Standard Violation	Copper			2008	
	2	Impaired	Aquatic Life	Standard Violation	Turbidity			2010	
	2	Impaired	Cich Concumution	Ctandard Violation	808				

## PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake PROJECT NUMBER R-2721, R-2828, & R-2829
STREAM <u>Little Creek</u> ROUTE <u>New Location</u> (Site 46)
ASSESSMENT PREPARED BY Mulkey, INC. DATE 1/9/2014 (MLH)
HYDROLOGIC EVALUATION
NEAREST GAGING STATION ON THIS STREAM (NONE $X$ _)
ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: Yes
FLOOD DATA: Q <sub>10</sub> 700 CFS EST. BKWTR. N/A FT. Q <sub>25</sub> 950 CFS EST. BKWTR. N/A FT. Q <sub>50</sub> 1,100 CFS EST. BKWTR. N/A FT. Q <sub>100</sub> 1,200 CFS EST. BKWTR. N/A FT. Q <sub>500</sub> 4,700 CFS EST. BKWTR. N/A FT.
DRAINAGE AREA <u>0.64 Sq.Mi.</u> METHOD USED TO COMPUTE Q: <u>USGS Urban Regression</u>
PROPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: LOW MODERATE X HIGH
COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: YES NO $\underline{X}$
EXPLANTION: A floodway modification may be required at this site.
LIST BUILDINGS IN FLOOD PLAIN: None LOCATION:
UPSTREAM LAND USE <u>Residential &amp; Agriculture</u> ANTICIPATE ANY CHANGE? <u>No</u>
ANY FLOOD ZONING? (FIA STUDIES, ETC.) YES $\underline{X}$ NO
TYPE OF STUDY: FEMA –Zone X
REGULATORY FLOODWAY WIDTH NA

COMMENTS:

## TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 19,600 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 49,100 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? $\overline{\text{N/A}}$
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS
NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Wehadkee TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service
ENVIRONMENTAL CONSIDERATIONS
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: <u>Buried culverts 1 foot to allow for fish passage.</u>
MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES \_\_\_ NO X PROTECTION NEEDED \_\_\_

ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? $\underline{\text{No}}$
COMMENTS:
ALTERNATIVES
RECOMMENDED DESIGN <u>3@8'x6' RCBC</u>
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING 120 Sq. Ft.
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO $\underline{X}$ DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)X NORMAL PROCESS
(2)NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:

		Ne	use River Basin
Name	Index Number	Classification	Class Date
Description		Special	Designation
Little Buffalo Creek	27-57-17	C;NSW	05/01/88
From source to Little River			
Little Chinquapin Branch	27-101-11	C;Sw,NSW	05/01/88
From source to Trent River			
Little Contentnea Creek	27-86-26	C;Sw,NSW	05/01/88
From source to Contentnea Creek			
Little Creek	27-57-19	C;NSW	05/01/88
From source to Little River			
Little Creek	27-43-12	C;NSW	05/01/88
From source to Swift Creek			
Little Creek	27-135-11	SA;HQW,NSW	05/01/88
From source to South River			
Little Creek	27-139	SA;HQW,NSW	05/01/88
From source to Neuse River			
Little Creek	27-43-15-10	C;NSW	05/01/88
From source to Middle Creek			
Little Creek	27-86-3.7	C;NSW	08/03/92
From source to Buckhorn Reservoir, Contentnea Creek			
Little Creek	27-2-11	WS-IV;NSW	08/03/92
From source to Eno River			
Little Creek (East Side)	27-86-2-5	C;NSW	05/01/88
From source to Moccasin Creek			
Little Creek (West Side)	27-86-2-4	C;NSW	05/01/88
From source to Moccasin Creek			
Little Drum Creek	27-152-9	SA;HQW,NSW	05/01/88
From source to Jones Bay			
Little Eve Creek	27-152-8	SA;HQW,NSW	05/01/88
From source to Jones Bay			
Little Hell Creek	27-101-24	C;Sw,NSW	05/01/88
From source to Trent River			
Little John Creek	27-115-6	SC;Sw,NSW	05/01/88
From source to Hancock Creek			

		SITE	46		
	BRAIDE	D WI	ETLAND	NO M	AIN
	CHAM	JEL			
			Typ	TICAL CH	MUNEL
	)				
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TriEX



Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

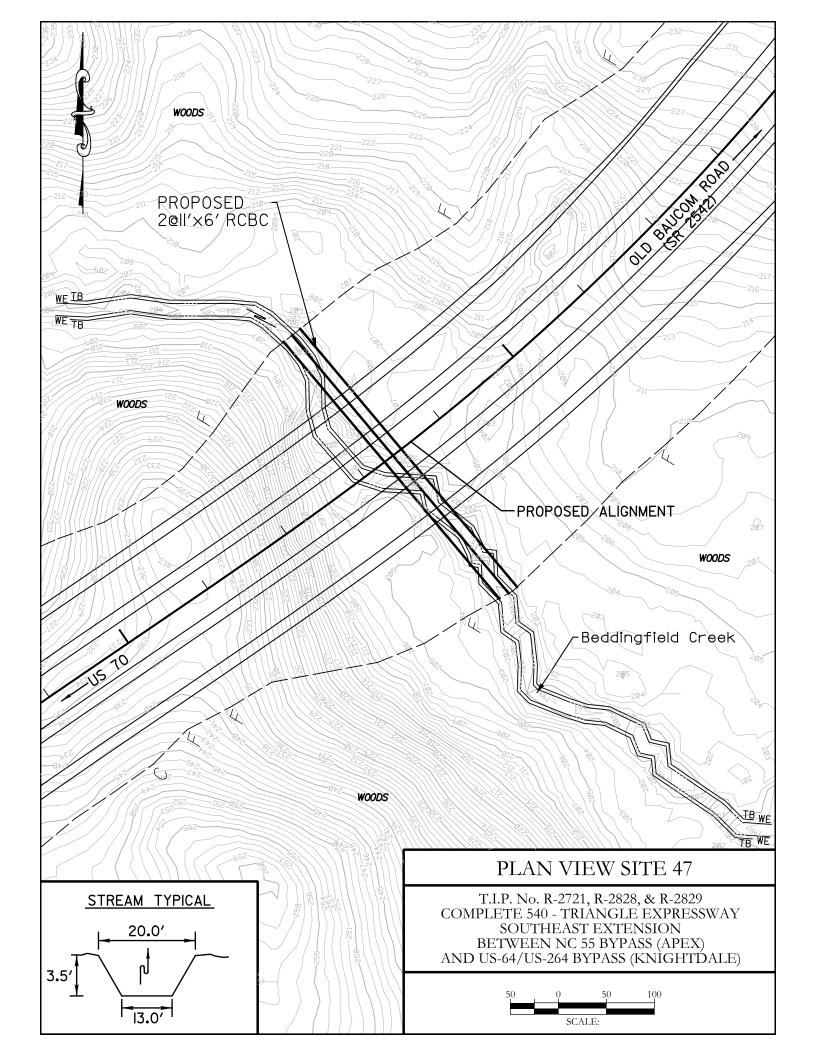
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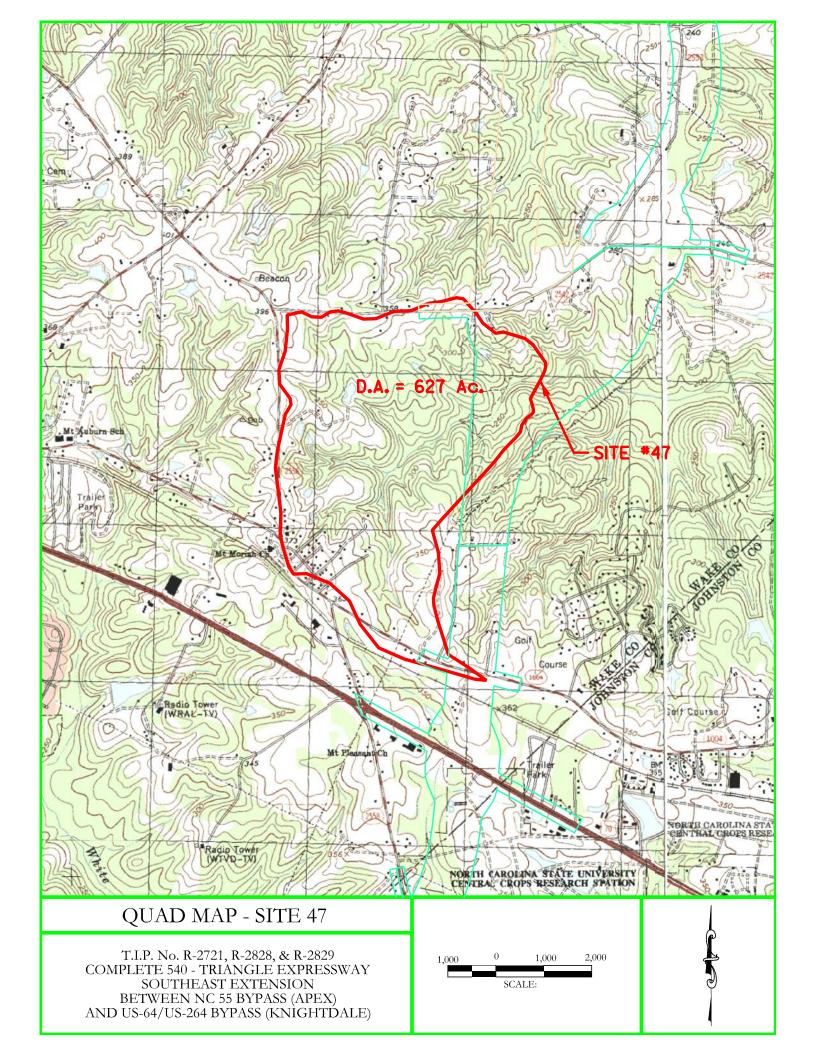


Looking at line back down project corridor.



Looking at line ahead down project corridor.





0113	2	
	REGION: BILLE PINGE	METHOD USED: Fact Sheet: 007-00
	STREAM NAME: Unnamed Tributary to Neuse River	sq. miles METHOD USED: F
3/18/2014	PROJECT NAME: Triangle Expressway SE Ext.	ENGLISH Drainage Area = 0.98

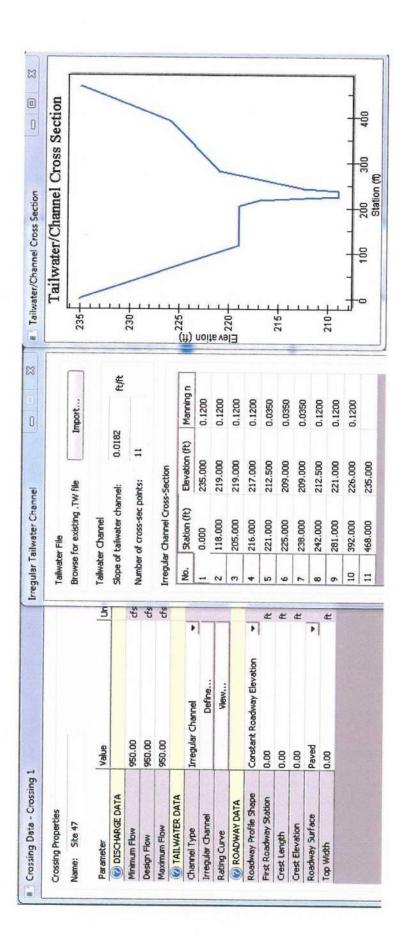
202 202	AL AEGRA	SOLON ELLO	TIONS (OLD)	TOX N	KAL EOUA	NONS Ren	ort 01-4207
REQUENCY Sa	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coactal Diain	Sand Lille
	(cfs)	(cfs)	(cfs)		(ofc)	(ofc)	Cofo)
2YR	29.26	68.52	142.00	2VR	133 10	(3.83	33.03
5YR	48.08	147.26	244.67	5VR	238 71	127.36	53.02
10YR	63.44	222.47	329.54	10VR	329.56	185.69	24.72
25YR	84.90	358.13	460.86	25VP	469.84	277.65	06.74
50YR	103.41	484.94	573.42	SOVR	504 33	362.73	110.74
100YR	124.07	646.48	709.72	100YR	735.65	462.68	144.03
200YR	152.63	846.70	858.84	200YR	896 77	579.48	167.66
500YR	180.15	1178.90	1115.87	SOOVE	1115 01	764.62	00.700

## USGS URBAN REGRESSION EQUATIONS BDF= 11 (These Equations are used only for comparison)

and a second of the second of	FREQUENCY Sand Hills Coastal Plain Blue Ridge					320.38 1240.22 1338.86		***
	FREQUENCY	5YR	10YR	25YR	50YR	100YR	200YR	FOOVE

֡

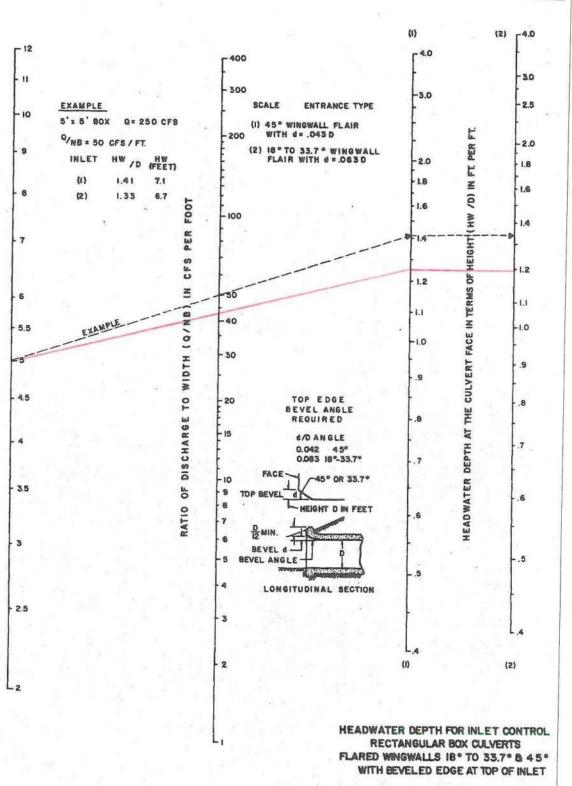
1	7	ON CHARTEN TO NOT THE PARTY OF	OIA IDOINI	impervious) oada radi aneet 007-00		
% Impervious =	20				Щ	-FMA
	Sand Hills	Coastal Plain	Blue Ridge	Discharge Used	FREDIENCY	Dieharasa
	(cts)	(cfs)	(cfs)			śl
	271.35	373.44	431.81			
	348.83	503.47	563.17		4000	80
	466.45	762.77	831.42		FOYE	UTO 10
	549.63	906.71	957.67	950	100VP	100
	626.18	1049.24	1080.03		ATOOL	550
	976.72	1409.71	1576.89	(Based on 2.80xQ10)	NI OOC	
	1276.71	1842.70	2061.22	(Based on 3.66xQ10)		



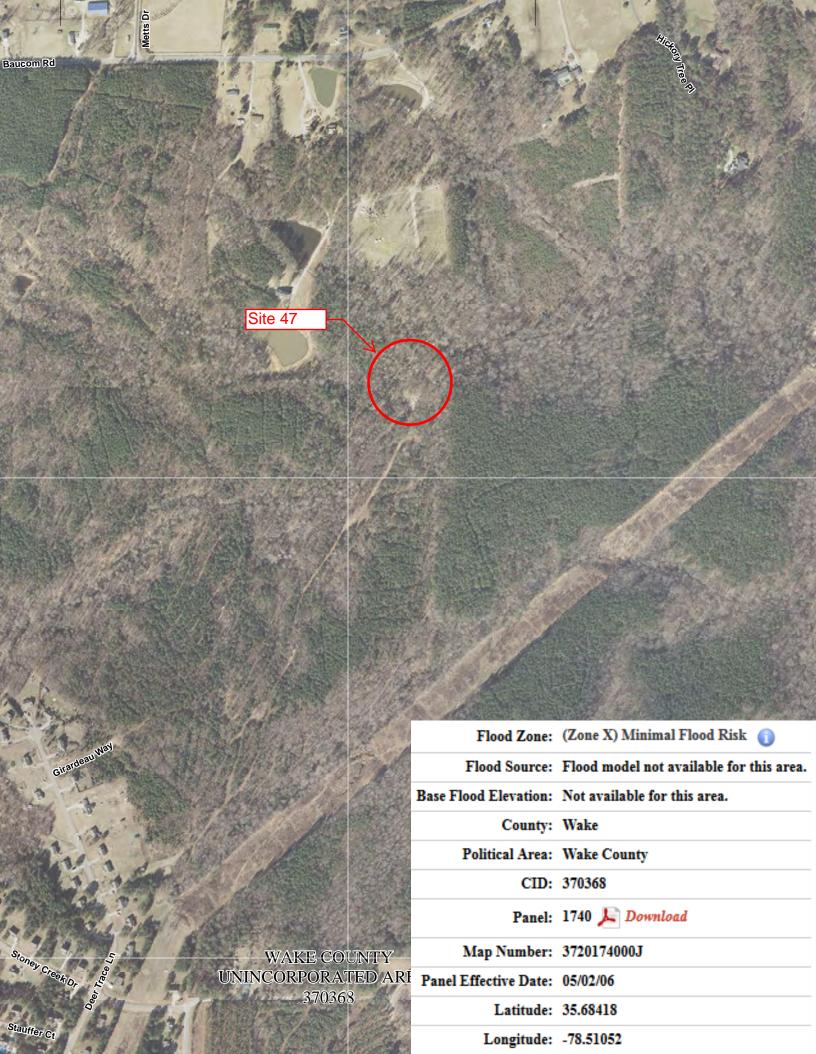
950.000         213.286         4.286         12.217         4.867           950.000         213.286         4.286         12.217         4.867           950.000         213.286         4.286         12.217         4.867           950.000         213.286         4.286         12.217         4.867           950.000         213.286         4.286         12.217         4.867           950.000         213.286         4.286         12.217         4.867           950.000         213.286         4.286         12.217         4.867           950.000         213.286         4.286         12.217         4.867           950.000         213.286         4.286         12.217         4.867           950.000         213.286         4.286         12.217         4.867           950.000         213.286         4.286         12.217         4.867           950.000         213.286         4.286         12.217         4.867	Flow (cfs)	Elevation (ft) Depth (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217	950,000	213,286	4.286	12.217	4.867
213.286       4.286       12.217         213.286       4.286       12.217         213.286       4.286       12.217         213.286       4.286       12.217         213.286       4.286       12.217         213.286       4.286       12.217         213.286       4.286       12.217         213.286       4.286       12.217         213.286       4.286       12.217	950,000	213.286	4.286	12.217	4.867
213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217	950,000	213,286	4.286	12.217	4.867
213,286     4,286     12,217       213,286     4,286     12,217       213,286     4,286     12,217       213,286     4,286     12,217       213,286     4,286     12,217       213,286     4,286     12,217       213,286     4,286     12,217	950,000	213.286	4.286	12.217	4.867
213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217	950,000	213,286	4,286	12.217	4.867
213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217	950,000	213,286	4.286	12.217	4.867
213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217       213.286     4.286     12.217	950.000	213,286	4.286	12.217	4.867
213.286 4.286 12.217 213.286 4.286 12.217 213.286 4.286 12.217	950.000	213,286	4.286	12.217	4.867
213.286 4.286 12.217 213.286 4.286 12.217	950.000	213.286	4.286	12.217	4.867
213,286 4,286 12,217	950.000	213,286	4.286	12.217	4.867
	950,000	213.286	4.286	12.217	4.867

SITE 47

## CHART 9B



$$\frac{Q}{NB} = \frac{950}{(12)(11)} = 43.2$$



## PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

STREAM CROSSINGS AND ENCROACHMENTS
COUNTY Wake PROJECT NUMBER R-2721, R-2828, & R-2829
STREAM <u>Unnamed Tributary to Neuse River</u> ROUTE <u>New Location</u> (Site 47)
ASSESSMENT PREPARED BY Mulkey, INC. DATE 1/9/2014 (MLH)
HYDROLOGIC EVALUATION
NEAREST GAGING STATION ON THIS STREAM (NONE _X_)
ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: Yes
FLOOD DATA: $ Q_{10} \ \underline{550} \ \text{CFS}  \text{EST. BKWTR. } \underline{N/A} \ \text{FT.}  Q_{25} \ \underline{850} \ \text{CFS}  \text{EST. BKWTR. } \underline{N/A} \ \text{FT.} \\ Q_{50} \ \underline{950} \ \text{CFS}  \text{EST. BKWTR. } \underline{N/A} \ \text{FT.}  Q_{100} \ \underline{1,100} \ \text{CFS}  \text{EST. BKWTR. } \underline{N/A} \ \text{FT.} \\ Q_{500} \ \underline{2,000} \ \text{CFS}  \text{EST. BKWTR. } \underline{N/A} \ \text{FT.} $
DRAINAGE AREA <u>0.98 Sq.Mi.</u> METHOD USED TO COMPUTE Q: <u>USGS Urban Regression</u>
PROPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: LOW MODERATE X HIGH
COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: YES NO X
EXPLANTION: A floodway modification may be required at this site.
LIST BUILDINGS IN FLOOD PLAIN: None LOCATION:
UPSTREAM LAND USE Woods & Residential ANTICIPATE ANY CHANGE? An increase in Residential
ANY FLOOD ZONING? (FIA STUDIES, ETC.) YES $\underline{X}$ NO
TYPE OF STUDY: FEMA –Zone X
REGULATORY FLOODWAY WIDTH NA

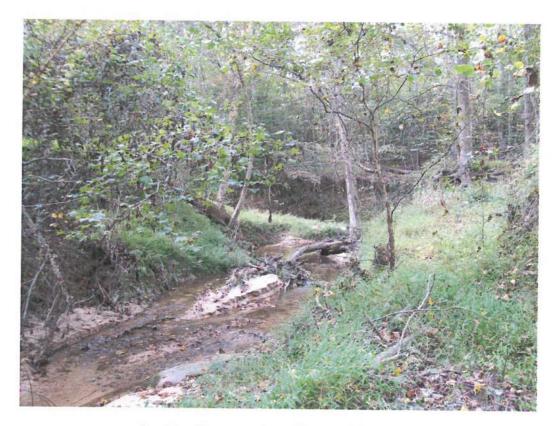
COMMENTS: \_\_\_\_\_

#### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 19,600 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 49,100 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? $\underline{\text{N/A}}$
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS  NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR
FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Wehadkee TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service
ENVIRONMENTAL CONSIDERATIONS
EN MONNENTAL CONSIDERATIONS
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: Buried culverts 1 foot to allow for fish passage.
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC

ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
ALTERNATIVES
RECOMMENDED DESIGN <u>2@11'x6' RCBC</u>
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING 110 Sq. Ft.
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YESNO X DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1) X NORMAL PROCESS
(2)NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:

SITE 47		
	WOOD	s n=0.17
	TE-TB	20
W0005	WE. WE	13
N-0-12	Low D	3.5
	HIGH D	10.0
//2//	1500	0.35
(.) (.)	OHW	1-6
	n = 0.045	
1		
\		
DEBRIS POTENTIAL	MODERATE	ξ
BEO MATERIAL S	GNA	
RECENT DRIFT 4.1		



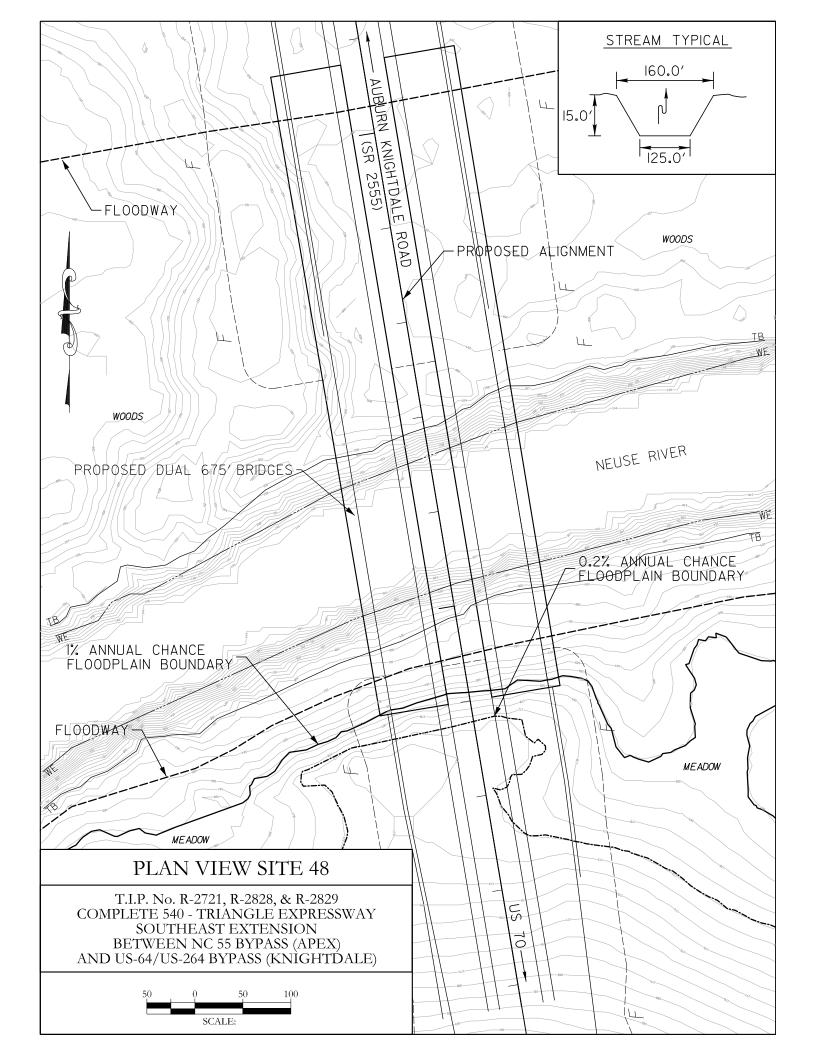
Looking Upstream from Proposed Crossing.

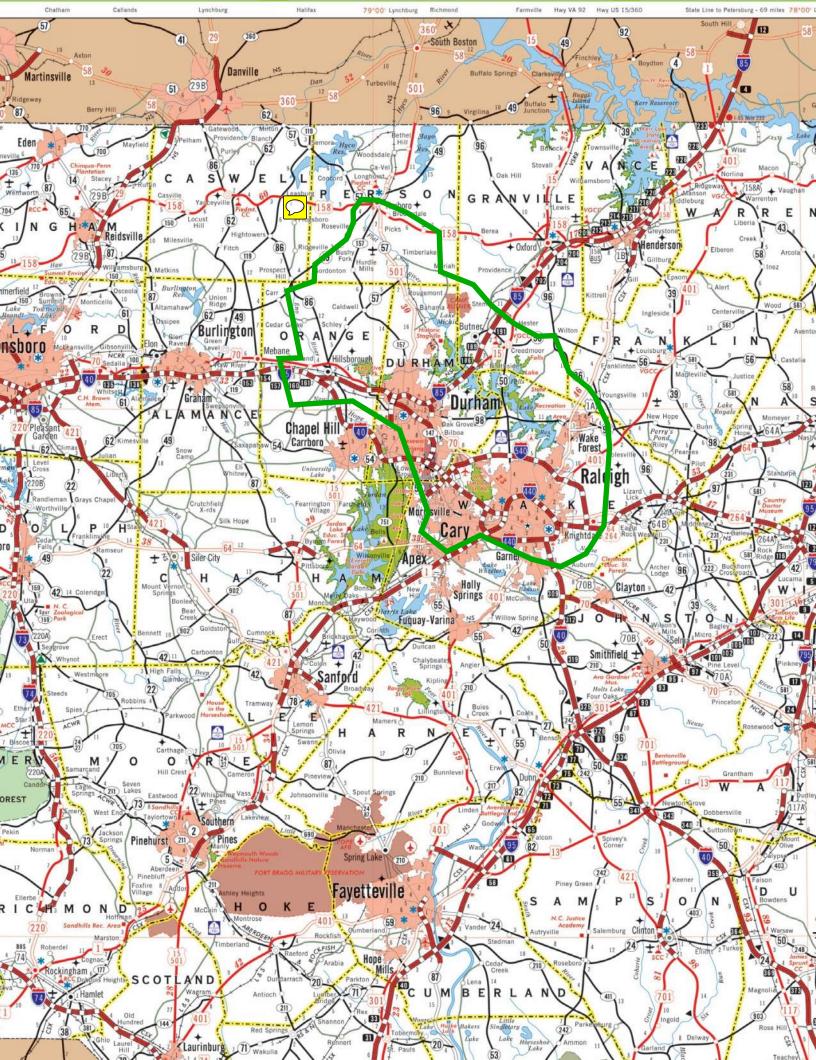


Looking Downstream from Proposed Crossing.

Page 1 of 1

#### **Site 48**





# P-percent chance exceedance peak-flow discharge estimate weighted for ungaged location near gaged location

To make use of this worksheet, enter the following within the yellow shaded cells: (1) the drainage area and percentages of ungaged basin within each of the hydrologic regions, and (2) station number of the nearby location.

Note:

Ungaged and gaged locations should be on the same stream.
 The drainage area for the ungaged location should between 0.5 to 1.5 times the drainage area for the gaged location.
 Station number of gaged location must be listed in Table 1 of the appropriate flood-frequency report (be sure to include leading zero where applicable).
 The adjusted ungaged estimates in this spreadsheet use only the annual peak flows prior to the 2007 water year. If estimates need to be computed using any peak flow data after the 2006 water year then refer to the weighting equations in the appropriate flood-frequency report.

### UNGAGED LOCATION

WARNING MESSAGES 0.0 percent 0.0 percent 0.0 percent 0.0 percent 0.0 percent 100.0 1089 Check sum of regions (must equal 100.0); Hydrologic region percentages (XX.X whole number to tenth) Hydrologic Region 1 (Ridge and Valley - Piedmont): Hydrologic Region 4 (Coastal): Hydrologic Region 5 (Southwest Georgia): Hydrologic Region 2 (Blue Ridge): Hydrologic Region 3 (Sand Hills): Drainage area (sqmi):

## Adjusted ungaged estimate based on nearby gaged location

17,100 cfs rounded 20,800 cfs rounded 24,000 cfs rounded 27,000 cfs rounded 30,100 cfs rounded 10,100 cfs rounded 14,200 ofs rounded 10070 14188 17086 20833 23975 26974 30134 34779 0.5% chance exceedance: 0.2% chance exceedance: 50% chance exceedance: 20% chance exceedance: 2% chance exceedance: 1% chance exceedance: 4% chance exceedance:

### NEARBY GAGED LOCATION

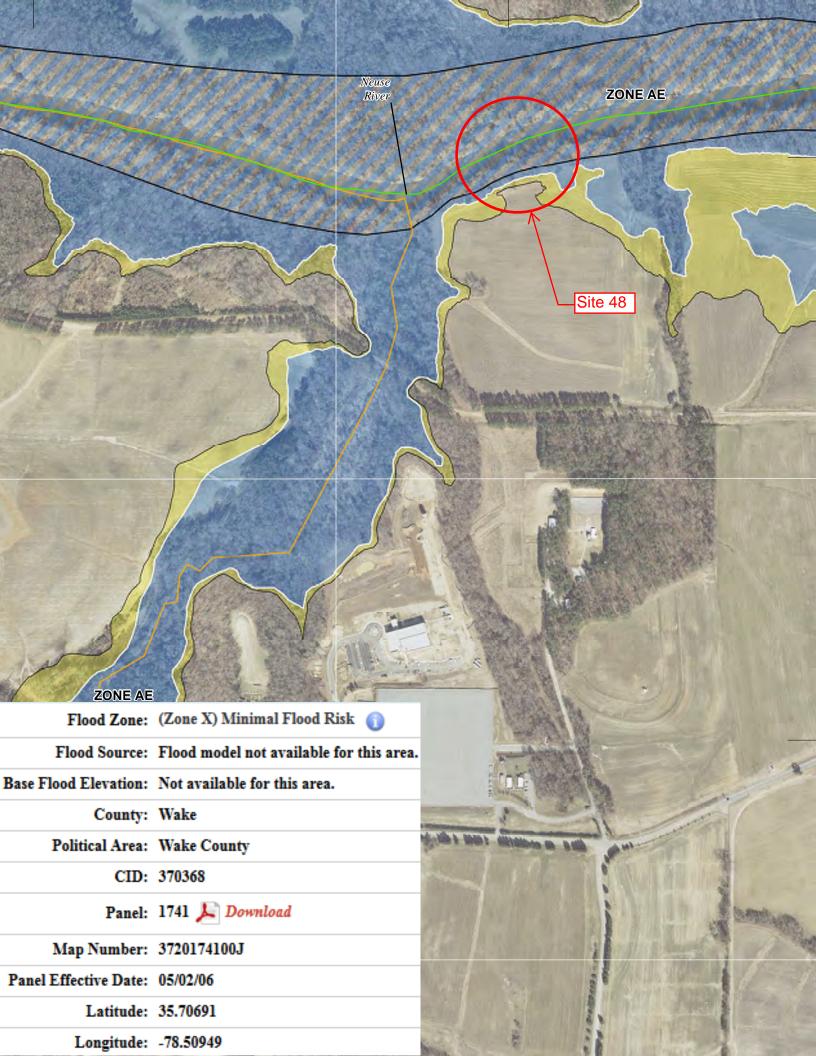
Nearby gaged location...station number of gaged location must be listed in LPIII\_RUN GLSNet initial worksheet (be sure to include leading zero where applicable);

#### FOUNDE 02087500

(map identification number from Table 1 in flood-frequency reports) Neuse River near Clayton, NC 1928-1980 129 Systematic period of record: Number of systematic peaks: Map identification number:

Note: For some sites, available period of record indicated above may include peaks affected by regulation that were not used in the flood-frequency analyses. Please check Table 1 in corresponding flood-frequency for additional information concerning this site.

Drainage area (DA):	1150 sqmi	Ratio ungaged DA to gaged DA: 0.95	0.95
Hydrologic region percentages		Difference in DA (absolute value)	61.00
Hydrologic Region 1 (Ridge and Valley - Pledmont): Hydrologic Region 2 (Blue Ridge): Hydrologic Region 3 (Sand Hills): Hydrologic Region 4 (Coastal): Hydrologic Region 5 (Southwest Georgia):	99.9 percent 0.0 percent 0.0 percent 0.1 percent 0.0 percent		



#### **FLOOD INSURANCE STUDY**

#### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Source	Riverine	Sources	Affected Communities
	From	То	
Middle Creek	The confluence with Swift Creek	Approximately 0.7 mile upstream of confluence of Middle Creek Tributary	Rdu Town Of Apex Town Of Cary Town Of Fuquay-Varina Town Of Holly Springs Wake County
Millbrook Tributary to Marsh Creek (Basin 18, Stream 19)	The confluence with Marsh Creek (Basin 18, Stream 17)	East Millbrook Road	City Of Raleigh
Mills Branch (Basin 22, Stream 5)	The confluence with Middle Creek (Basin 22, Stream 1)	Railroad	Rdu Town Of Fuquay-Varina Wake County
Mine Creek (Basin 18, Stream 31)	The confluence with Crabtree Creek (Basin 18, Stream 9)	The confluences of East Fork Mine Creek (Basin 18, Stream 34) and West Fork Mine Creek (Basin 12, Stream 33)	City Of Raleigh
Morrisville Tributary (Basin 18, Stream 26)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Approximately 0.3 mile upstream of Railroad	Town Of Morrisville
Mud Branch (Basin 4, Stream 15)	The confluence with Horse Creek (Basin 4, Stream 1)	Approximately 3.0 miles upstream of confluence with Horse Creek (Basin 4, Stream 1)	Rdu Wake County
Neil Branch (Basin 24, Stream 8)	The confluence with Neil Creek (Basin 24, Stream 7)	East Spring Avenue	Town Of Fuquay-Varina
Neil Creek (Basin 24, Stream 7)	The confluence with Angier Creek (Basin 24, Stream 4)	Holland Road	Town Of Fuquay-Varina
Neuse River	Entire shoreline in Wake County	Entire shoreline within Granville County	Rdu Wake County
Neuse River	Wayne/Lenoir County boundary	Falls of the Neuse Road	City Of Raleigh Rdu Town Of Clayton Town Of Knightdale Town Of Wake Forest Wake County
New Light Creek	The confluence with Neuse River (Basin 15, Stream 1)	The confluence of Basin 3, Stream 8	Rdu Wake County
nther Branch (Basin 22, Stream 2)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.5 mile upstream of Banks Road	Rdu Wake County
Panther Creek	The Chatham/Wake County Boundary	Approximately 1.0 mile upstream of Green Level to Durham Road	Town Of Cary
Perry Creek East Branch (Basin 15, Stream 27)	The confluence with Perry Creek (Basin 15, stream 26)	Approximately 0.3 mile upstream of Bivens Drive	City Of Raleigh
Pigeon House Branch (Basin 18, Stream 27)	The confluence with Crabtree Creek (Basin 18, Stream 9)	West Peace Street	City Of Raleigh
Poplar Branch (Basin 13, Stream 2)	The confluence with Poplar Creek (Basin 13, Stream 1)	Farm Road	Town Of Knightdale
Poplar Creek (Basin 13, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 900 Feet upstream of Fayetteville Street	Rdu Town Of Knightdale Wake County
Powell Creek (Basin 8, Stream 7)	The confluence with Hodges Creek (Basin 8, Stream 1)	Approximately 1.3 miles upstream of Peebles Road	City Of Raleigh Rdu Town Of Rolesville Wake County
Reedy Creek (Basin 20, Stream 11)	The confluence with Swift Creek (Basin 20, Stream 1)	Seventh Avenue	Rdu Town Of Garner Wake County
Reedy Creek (Basin 6, Stream 8)	The confluence with Sanford Creek (Basin 6, Stream 7)	Rogers Road	Town Of Rolesville Town Of Wake Forest
Reedy Creek Tributary (Basin 20, Stream 9)	The confluence with Reedy Creek (Basin 20, Stream 11)	Claymore Drive	Town Of Garner
Richland Creek (Basin 18, Stream 3)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Trinity Road	City Of Raleigh
Rocky Branch (Basin 22, Stream 8)	The confluence with Middle Creek (Basin 22, Stream 1)	Holly Springs Road	Rdu Town Of Holly Springs Wake County
Rocky Branch (Basin 30, Stream 5)	Approximately 60 feet downstream of Western Boulevard (upstream crossing)	Approximately 900 feet upstream of Pullen Road	City Of Raleigh
Rocky Branch (Basin 30, Stream 5)	The confluence with Walnut Creek (Basin 30, Stream 1)	Approximately 215 feet upstream of Fayetteville Road	City Of Raleigh
Rocky Ford Branch (Basin 24, Stream 5)	The confluence with Kenneth Creek (Basin 24, Stream 2)	Approximately 0.9 mile upstream of confluence with Kenneth Creek (Basin 24, Stream 2)	Rdu Town Of Fuquay-Varina Wake County
Sanford Creek (Basin 6, Stream 7)	The confluence with Smith Creek (Basin 6, Stream 1)	Approximately 300 feet upstream of the confluence of Basin 6, Stream 9	Rdu Town Of Rolesville Town Of Wake Forest Wake County
Smith Creek	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 0.9 mile upstream of Oak Grove Church Road	Rdu Town Of Wake Forest Wake County
Southeast Prong Beaverdam Creek (Basin 18, Stream 30)	The confluence with Beaverdam Creek (Basin 18, Stream 28)	Wade Avenue	City Of Raleigh

**Table 13 - Summary of Discharges** 

Flooding Source				rges (cfs)	
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annua Chance
Approximately 1.2 miles upstream of Sheppard School Road	11.60	*	*	4,310	*
Approximately 1,060 feet downstream of Williams-White Road	10.54	*	*	4,060	*
Approximately 530 feet upstream of Williams-White Road	9.47	*	*	3,800	*
Approximately 0.6 mile downstream of Pearces Road	8.19	*	*	3,470	*
At confluence of Moccasin Creek Tributary 3	4.18	*	*	2,369	*
Approximately 1,580 feet upstream of Furney Pearce Road	2.94	*	*	1,899	*
Approximately 530 feet downstream of Henry Baker Road	2.05	*	*	1,520	*
Approximately 0.7 mile upstream of Henry Baker Road	1.29	*	*	1,130	*
Morris Branch					
At Chatham/Wake County boundary	1.40	821	1,380	1,730	2,730
Approximately 0.4 mile upstream of Chatham/Wake County boundary	1.20	707	1,300	1,630	2,490
Just downstream of Green Level to Durham Road	0.80	765	1,080	1,230	1,840
Approximately 0.7 mile upstream of Green Level to Durham Road	0.50	490	772	893	1,230
Approximately 975 feet upstream of Howard Road	0.10	155	241	277	378
Morrisville Tributary (Basin 18, Stream 26)					
At mouth	1.00	*	*	1,030	*
Approximately 1,500 feet upstream of Railroad	0.70	*	*	850	*
Mud Branch (Basin 4, Stream 15)	<u> </u>				
At mouth	2.10	*	*	1,630	*
Neil Branch (Basin 24, Stream 8)					
At mouth	1.30	670	1,180	1,400	2,400
At East Spring Avenue	1.10	580	1,020	1,250	2,150
At SR 2767	1.10	580	1,020	1,250	2,150
Neills Creek					
At Harnett/Wake County boundary	2.10	*	*	1,187	*
Approximately 1,060 feet upstream of Harnett/Wake County boundary	2.00	*	*	1,137	*
Approximately 0.6 mile upstream of Harnett/Wake County boundary	1.80	*	*	1,057	*
At mouth	1.30	670	1,180	1,400	2,400
Approximately 0.9 mile upstream of Harnett/Wake County boundary	1.20	*	*	840	*
Neuse River					
At County boundary	1099.00	*	*	18,300	*
Just downstream of Crabtree Creek (Basin 18, Stream 9)	1027.00	*	*	16,700	*
Lungthorn of Crohtron Crook (Poois 40, Ctroom 0)	883.00	*	*	13,500	*
At Falls Dam	770.00	*	*	11,100	*
New Hope Tributary to Marsh Creek (Basin 18, Stream 18)					
At confluence with Marsh Creek (Basin 18, Stream 17)	1.43	*	*	760	*
Approximately 1,060 feet upstream of confluence with Marsh Creek (Basin 18, Stream 17)	1.40	*	*	976	*
Approximately 1,580 feet downstream of New Hope Church Road	1.16	*	*	1,160	*
Approximately 530 feet upstream of New Hope Church Road	0.62	*	*	971	*
Approximately 330 feet upstream of Waterbury Road	0.18	*	*	639	*
New Light Creek					
Just upstream of Buckhorn Branch (Basin 3, Stream 9)	13.30	*	*	4,500	*
At confluence of Basin 3, Stream 8	10.42	*	*	3,220	*

**Table 16 - Roughness Coefficients** 

Stream	Channel "n"	Overbank "n
Big Branch	0.050	0.140
Big Branch (Basin 10, Stream 8)	0.030 to 0.070	0.070 to 0.130
Big Branch (Basin 18, Stream 21)	0.035 to 0.055	0.090 to 0.200
Big Branch (Basin 26, Stream 5)	0.050	0.140
Big Branch Tributary No. 3	0.030 to 0.070	0.070 to 0.120
Big Branch Tributary No.1 (Basin 30, Stream 6)	0.030 to 0.070	0.070 to 0.120
Black Creek	0.025 to 0.060	0.030 to 0.150
Bradley Creek (Basin 24, Stream 3)	0.030 to 0.070	0.070 to 0.110
Bridges Branch	0.050	0.130
Brier Creek (Basin 18, Stream 14)	0.024 to 0.040	0.100 to 0.200
Buckhorn Creek	0.040 to 0.048	0.145
Buffalo Creek (Basin 9, Stream 1)	0.030 to 0.070	0.035 to 0.140
Buffalo Creek West	0.045 to 0.052	0.030 to 0.140
Burdens Creek	0.042 to 0.050	0.100 to 0.200
Cary Branch	0.040	0.140
Cedar Fork (Basin 10, Stream 15)	0.420 to 0.042	0.130
Clark Branch (Basin 28, Stream 3)	0.050	0.150
Coles Branch (Basin 18, Stream 24)	0.030 to 0.070	0.070 to 0.200
Crabtree Creek (Basin 18, Stream 9)	0.030 to 0.070	0.070 to 0.150
Crabtree Creek Tributary No. 6 (Basin 18, Stream 20)	0.030 to 0.070	0.070 to 0.130
Fowlers Mill Creek (Basin 10, Stream 12)	0.042	0.130
Guffy Branch (Basin 21, Stream 4)	0.047	0.130
Hatchet Grove Tributary (Basin 18, Stream 25)	0.030 to 0.070	0.070 to 0.130
Hodges Creek (Basin 8, Stream 1)	0.030 to 0.070	0.070 to 0.160
Hominy Creek (Basin 10, Stream 7)	0.030 to 0.070	0.070 to 0.130
Horse Creek	0.042 to 0.050	0.080 to 0.150
Horse Creek Tributary 1	0.048	0.120 to 0.150
Jack Branch (Basin 28, Stream 4)	0.055	0.155
Jim Branch	0.045	0.145
Juniper Branch (Basin 21, Stream 2)	0.045	0.110 to 0.130
Kenneth Branch (Basin 24, Stream 6)	0.030 to 0.070	0.070 to 0.150
Kenneth Creek	0.030 to 0.070	0.070 to 0.160
Kit Creek	0.030 to 0.070	0.070 to 0.110
Kit Creek Tributary 2 (Basin 29, Stream 8)	0.030 to 0.070	0.070 to 0.110
Lakemont Tributary (Basin 18, Stream 22)	0.050 to 0.062	0.120 to 0.200
Ledge Creek	0.050	0.150
Little Beaver Creek	0.045 to 0.055	0.100 to 0.220
Little Beaverdam Creek (Basin 2, Stream 2)	0.030 to 0.070	0.070 to 0.150
Little Black Creek	0.030 to 0.070	0.070 to 0.130
Little Branch (Basin 26, Stream 3)	0.040	0.148
Little Brier Creek (Basin 18, Stream 15)	0.030 to 0.070	0.070 to 0.130
Little Brier Creek (Basin 18, Stream 16)	0.030 to 0.070	0.070 to 0.140
Little Brief Creek Last (Basin 10, Stream 10)	0.030 to 0.080	0.070 to 0.140
Little Creek (Into Middle Creek)	0.033 to 0.047	0.070 to 0.130
Little Greek (Into Middle Greek)	0.040 to 0.066	0.070 to 0.240
Little White Oak Creek (Basin 26, Stream 9)	0.035 to 0.050	0.070 to 0.240
Little White Oak Creek Tributary 2	0.040	0.148
Marks Creek	0.040 0.025 to 0.070	0.070 to 0.130
Marsh Creek (Basin 18, Stream 17)	0.038 to 0.060	0.090 to 0.200
Middle Creek	0.042 to 0.050	0.030 to 0.140
Mill Branch	0.042 to 0.030	0.030 to 0.140
Mills Branch (Basin 22, Stream 3)	0.030 to 0.070	0.070 to 0.130
Mingo Creek (Basin 12, Stream 2)	0.041 to 0.044	0.100 to 0.200
Morris Propeh	0.030 to 0.070	0.070 to 0.220
Morris Branch Neil Branch (Besin 24, Streem 8)	0.030 to 0.050	0.100 to 0.200
Neil Branch (Basin 24, Stream 8)	0.030 to 0.070	0.070 to 0.130
Neil Creek (Basin 24. Stream 7)	0.030 to 0.070	0.070 to 0.110
Neuse River	0.035 to 0.060	0.055 to 0.250
New Hope hibutary to Marsh Creek (Basin 18, Stream 18)	0.040 to 0.065	0.110 to 0.200
8 w Light Creek	0.040 to 0.070	0.070 to 0.150

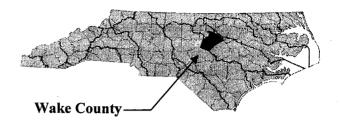
			Tal	ole 21 - Fl	oodway D	ata			
	y Source		Floodway				ter Surface Eleva		
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
132	13,230	293	2,397	0.3	421.8	*	421.8	421.8	0.0
140	14,000	80	138	5.0	421.8	*	421.8	421.8	0.0
149	14,860	359	3,739	0.2	447.2	*	447.2	447.2	0.0
156	15,590	40 10	137	4.8	447.2	*	447.2	447.2	0.0
Neil Branch (I	Basin 24, Strea	ım 8)							
002	210	70	358	3.9	319.3 <sup>1</sup>	*	318.6	319.3	0.7
021	2,100	50	157	8.3	329.1	*	329.1	329.1	0.0
028	2,780	120	257	5.1	338.4	*	338.4	338.4	0.0
031	3,090	110	221	5.9	339.5	*	339.5	339.5	0.0
032	3,200	110	204	6.2	340.5	*	340.5	340.5	0.0
Neil Creek (Ba	asin 24, Strean	n 7)			T	T		ı	
003	340	210	442	4.8	307.1 <sup>1</sup>	*	303.4	304.4	1.0
006	560	150	791	2.7	307.1 <sup>1</sup>	*	306.7	307.6	0.9
013	1,300	200	359	5.7	311.4	*	311.4	311.4	0.0
016	1,560	210	450	4.6	313.0	*	313.0	313.0	0.0
028	2,840	70	294	4.7	321.2	*	321.2	321.2	0.0
Neuse River	T	Г	Г	Г	T	T	Г	T	Г
11056	1,105,557	340	5,809	3.2	162.7	*	162.7	162.9	0.2
11166	1,116,640	500	7,573	2.4	165.9	*	165.9	166.2	0.3
11268	1,126,775	340	5,618	3.1	168.6	*	168.6	168.8	0.2
11320	1,131,990	300	5,189	3.3	170.3	*	170.3	170.5	0.2
Site 48	1,141,325	350	5,809	2.9	173.5	*	173.5	173.8	0.3
11464	1,146,390	400	5,404	3.1	174.6	*	174.6	175.0	0.4
11474	1,147,390	500	1,105	1.9	174.9	*	174.9	175.3	0.4
11493	1,149,335	300	5,203	2.6	175.2	*	175.2	175.6	0.4
11548	1,154,790	700	7,809	1.7	176.4	*	176.4	176.8	0.4
11574	1,157,375	329	6,099	2.2	176.7	*	176.7	177.1	0.4
11603	1,160,345	600	7,517	1.8	177.3	*	177.3	177.7	0.4
11733	1,173,340	350	4,305	3.0	186.5	*	186.5	187.1	0.6
11812	1,181,225	350	4,661	2.8	189.4	*	189.4	190.2	0.8
11913	1,191,290	700	8,917	1.5	192.1	*	192.1	193.0	0.9
11971	1,197,075	345	4,420	2.8	193.3	*	193.3	194.3	1.0
12065	1,206,540	250	3,908	3.1	197.1	*	197.1	197.9	0.8
12157	1,215,740	1,100	9,689	1.2	199.8	*	199.8	200.7	0.9
12199	1,219,870	400	5,242	2.2	200.8	*	200.8	201.6	0.8
12208	1,220,835	280	4,017	2.9	201.1	*	201.1	201.9	0.8
12237	1,223,740	500	5,927	1.9	202.0	*	202.0	202.8	0.8
12377	1,237,675	402	4,099	2.8	205.5	*	205.5	206.4	0.9
	butary to Mars				,	·	,	,	1
009	942	17	85	10.7	214.8 <sup>1</sup>	*	211.2	211.2	0.0
016	1,451	315	431	2.4	216.9	*	216.9	216.9	0.0
022	2,026	240	904	1.0	217.2	*	217.2	217.2	0.0
028	2,643	58	120	8.2	217.3	*	217.3	217.9	0.6
033	3,275	90	240	4.3	224.3	226.1	224.3	224.3	0.0
037	3,744	25	160	6.4	227.1	227.6	227.1	227.3	0.2
J J J J	10,177	1-0	100	J U. T	<del></del>	11.0		1.0	V. <u>~</u>

#### FLOOD INSURANCE STUDY

A Report of Flood Hazards in

WAKE COUNTY, NORTH CAROLINA

**AND INCORPORATED AREAS** 



#### **VOLUME 6 OF 7**

Community Name	<b>Community Number</b>	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





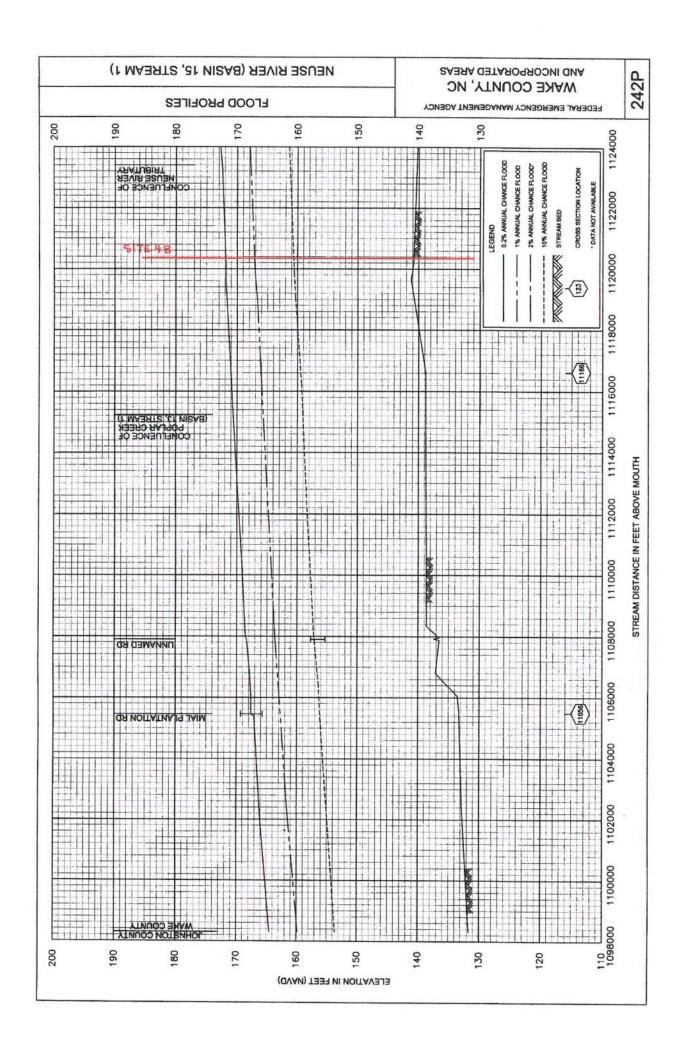
May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV006A

www.fema.gov and www.ncfloodmaps.com





#### PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake PROJECT NUMBER R-2721, R-2828, & R-2829
STREAM Neuse River (Site 48) ROUTE New Location
ASSESSMENT PREPARED BY Mulkey, INC. DATE 1/9/2014 (MLH)
HYDROLOGIC EVALUATION
NEAREST GAGING STATION ON THIS STREAM (NONE _X_)
ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: Yes
FLOOD DATA: Q <sub>10</sub> 39,000 CFS EST. BKWTR. $N/A$ FT. Q <sub>25</sub> 45,000 CFS EST. BKWTR. $N/A$ FT. Q <sub>50</sub> 50,000 CFS EST. BKWTR. $N/A$ FT. Q <sub>100</sub> 54,000 CFS EST. BKWTR. $N/A$ FT. Q <sub>500</sub> 140,000 CFS EST. BKWTR. $N/A$ FT.
DRAINAGE AREA <u>1,089 Sq.Mi.</u> METHOD USED TO COMPUTE Q: <u>USGS Urban</u> <u>Regression</u>
PROPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: LOW MODERATE X HIGH
COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: YES NO $\underline{X}$
EXPLANTION: A floodway modification may be required at this site.
LIST BUILDINGS IN FLOOD PLAIN: None LOCATION:
UPSTREAM LAND Residential
ANTICIPATE ANY CHANGE? No
ANY FLOOD ZONING? (FIA STUDIES, ETC.) YES $\underline{X}$ NO
TYPE OF STUDY: FEMA - Special Flood Hazard Zone AE
REGULATORY FLOODWAY WIDTH 475 ft. Section 1125275 (AS NOTED IN FIS)

COMMENTS:

#### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 19,600 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 49,100 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? N/A
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS  NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Chewacla TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service
ENVIRONMENTAL CONSIDERATIONS

LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN:

#### MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED
ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
ALTERNATIVES
RECOMMENDED DESIGN <u>Dual 675</u> Bridges
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING 33,745 Sq. Ft.
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YESNO $\underline{X}$ DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1) NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:
(4)

		Net	use River Ba
Name	Index Number	Classification	Class Dat
Description		Special	Designation
NEUSE RIVER	27-(75.3)	WS-IV;NSW,CA	08/01/02
From a point 0.6 mile upstream of Lenoir County proposed water water supply intake.	r supply intake to Lenoir	County proposed	
IEUSE RIVER	27-(70.5)	WS-IV;NSW	08/01/02
From a point 0.7 mile downstream of the mouth of Coxes Creek County proposed water supply intake.	to a point 0.6 mile upstr	eam of Lenoir	
IEUSE RIVER	27-(55.5)	WS-IV;NSW,CA	08/03/92
From a point 0.8 mile upstream of Little River to City of Goldsbor upstream of Little River)	ro water supply intake (I	ocated 0.4 mile	
IEUSE RIVER	27-(85)	C;Sw,NSW	05/01/88
From mouth of Contentnea Creek to Streets Ferry			
IEUSE RIVER	27-(96)	SC;Sw,NSW	05/01/88
From Streets Ferry to a line across Neuse River from Johnson Poi	nt to McCotter Point		
EUSE RIVER	27-(39.3)	WS-IV;NSW,CA	04/01/97
From a point 1.4 mile downstream of Johnston County SR 1908 to intake (located 1.9 mile downstream of Johnston County SR 1908)		osed water supply	
EUSE RIVER	27-(22.5)	C;NSW	08/03/92
From Town of Wake Forest proposed water supply intake to mou	uth of Beddingfield Cree	k	
EUSE RIVER	27-(75.7)	C;NSW	08/03/92
From Lenoir County proposed water supply intake to mouth of Co	ontentnea Creek.		
Trom Lenon County proposed water supply intake to mouth of C			
	27-(5.5)	WS-IV,B;NSW,CA	08/03/92
	27-(5.5)	WS-IV,B;NSW,CA	08/03/92
EUSE RIVER (Falls Lake below normal pool elevation) From I-85 bridge to dam at Falls Lake	27-(5.5)	WS-IV,B;NSW,CA WS-IV;NSW,CA	
EUSE RIVER (Falls Lake below normal pool elevation) From I-85 bridge to dam at Falls Lake	27-(1)	WS-IV;NSW,CA	
EUSE RIVER (Falls Lake below normal pool elevation)  From I-85 bridge to dam at Falls Lake  EUSE RIVER (Falls Lake below normal pool elevation)  From source (confluence of Eno River Arm of Falls Lake and Flat Falls Lake and Flat Falls Lake and Flat Falls Lake and Flat Falls Lake and Flat Falls Lake and Flat Falls Lake and Flat Falls Lake and Flat Falls Lake and Flat Falls Lake Arm of Falls Lake and Flat Falls Lake Arm of F	27-(1)	WS-IV;NSW,CA	08/03/92
EUSE RIVER (Falls Lake below normal pool elevation)  From I-85 bridge to dam at Falls Lake  EUSE RIVER (Falls Lake below normal pool elevation)  From source (confluence of Eno River Arm of Falls Lake and Flat Falls Lake and Flat Falls Lake and Flat Falls Lake and Flat Falls Lake and Flat Falls Lake and Flat Falls Lake and Flat Falls Lake and Flat Falls Lake and Flat Falls Lake Arm of Falls Lake and Flat Falls Lake Arm of F	<b>27-(1)</b> River Arm of Falls Lake) t	WS-IV;NSW,CA	
EUSE RIVER (Falls Lake below normal pool elevation) From I-85 bridge to dam at Falls Lake  EUSE RIVER (Falls Lake below normal pool elevation) From source (confluence of Eno River Arm of Falls Lake and Flat Falls Elevation)  euse River Cut-Off  From source to Neuse River	<b>27-(1)</b> River Arm of Falls Lake) t	WS-IV;NSW,CA	08/03/92 05/01/88
EUSE RIVER (Falls Lake below normal pool elevation) From I-85 bridge to dam at Falls Lake  EUSE RIVER (Falls Lake below normal pool elevation) From source (confluence of Eno River Arm of Falls Lake and Flat F  euse River Cut-Off  From source to Neuse River	27-(1) River Arm of Falls Lake) t 27-59 27-148.5 se Island, and extending	WS-IV;NSW,CA to I-85 bridge C;NSW  SA;ORW,NSW northwest along	08/03/92 05/01/88
EUSE RIVER (Falls Lake below normal pool elevation) From I-85 bridge to dam at Falls Lake  EUSE RIVER (Falls Lake below normal pool elevation) From source (confluence of Eno River Arm of Falls Lake and Flat F  euse River Cut-Off From source to Neuse River  euse-Southeast Pamlico Sound ORW Area  All waters within a line beginning at the southwest tip of Ocracok the Tar-Pamlico River Basin and Neuse River Basin boundary line southwest direction to Ship Point	27-(1) River Arm of Falls Lake) t 27-59 27-148.5 se Island, and extending	WS-IV;NSW,CA to I-85 bridge C;NSW  SA;ORW,NSW northwest along	08/03/92 05/01/88 01/01/90
EUSE RIVER (Falls Lake below normal pool elevation) From I-85 bridge to dam at Falls Lake  EUSE RIVER (Falls Lake below normal pool elevation) From source (confluence of Eno River Arm of Falls Lake and Flat F  euse River Cut-Off From source to Neuse River  euse-Southeast Pamlico Sound ORW Area  All waters within a line beginning at the southwest tip of Ocracok the Tar-Pamlico River Basin and Neuse River Basin boundary line southwest direction to Ship Point	27-(1) River Arm of Falls Lake) t 27-59  27-148.5 Re Island, and extending to Lat. 35 06'50, Long 76	WS-IV;NSW,CA to I-85 bridge C;NSW  SA;ORW,NSW northwest along 6 06'30, thence in a	08/03/92 08/03/92 05/01/88 01/01/90
From I-85 bridge to dam at Falls Lake  EUSE RIVER (Falls Lake below normal pool elevation)  From source (confluence of Eno River Arm of Falls Lake and Flat Falls Eake River Cut-Off  From source to Neuse River  Euse-Southeast Pamlico Sound ORW Area  All waters within a line beginning at the southwest tip of Ocracok the Tar-Pamlico River Basin and Neuse River Basin boundary line southwest direction to Ship Point  Ew Light Creek	27-(1) River Arm of Falls Lake) t 27-59  27-148.5 Re Island, and extending to Lat. 35 06'50, Long 76	WS-IV;NSW,CA to I-85 bridge C;NSW  SA;ORW,NSW northwest along 6 06'30, thence in a	08/03/92 05/01/88 01/01/90

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NC DEPARTMENT OF TRANSPORTATION **DIVISION OF HIGHWAYS** BRIDGE MANAGEMENT UNIT

ATTENTION PM ISSUED ON BENT 4 CAP

#### **BRIDGE INSPECTION REPORT**

INSPECTION TYPE:	Routine Inspection	
COUNTY WAKE	BRIDGE NUMBER 910237 INSPECTION CYCLE 2 YRS	3
ROUTE SR2555	ACROSS NEUSE RIVER M.P	0
LOCATION 0.7MI.E.JCT.SR2552		
SUPERSTRUCTURE REINFORCED CONC	RETE FLOOR ON STEEL BEAMS	
SUBSTRUCTURE E.BTS:REINF CONC C	AP/PPC PILES;INT.BTS:RCP&B/ROCK FTGS.	
SPANS 5@70'		
LONGITUDE 78° 30' 29.1"	LATITUDE 35° 43' 22.0"	
PRESENT CONDITION POOR	INVENTORY RATING	
INSPECTION DATE 03/04/2010	OPERATING RATING	
PRESENT POSTING Not Posted	PROPOSED POSTING	
COMPUTER UPDATE	ANALYSIS DATE	
POSTING LETTER DATE	SUFFICIENCY RATING	
OTHER SIGNS PRESENT DELINEATORS	-	



LOOKING NORTH

SIGN NOTICE ISSUED FOR

WEIGHT LIMIT

NUMBERED

REQUIRED

No

No No

No

**DELINEATORS** 

NARROW BRIDGE

ONE LANE BRIDGE

No

LOW CLEARANCE



NC DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS **BRIDGE MANAGEMENT UNIT** 

OTHER SIGNS PRESENT (4) DELINEATORS

**ATTENTION PRIORITY MAINTENANCES** 

#### BRIDGE INSPECTION REPORT

INSPECTION TYPE: Routine Inspection - Contract COUNTY WAKE INSPECTION CYCLE 0 YRS BRIDGE NUMBER 910240 M.P. 0 ROUTE SR2509 ACROSS NEUSE RIVER LOCATION 0.3MI.E.JCT.SR2542 SUPERSTRUCTURE REINFORCED CONCRETE FLOOR ON PRESTRESSED CONCRETE GIRDERS SUBSTRUCTURE EBTS:RC CAP/PPC PILES;BTS1-4:RCP&B;BTS5&6:PPC PILES SPANS 1@50'4,5@50',1@50'4 LONGITUDE 78° 28' 41.29" LATITUDE 35° 42' 9.30" INSPECTION DATE 12/17/2013 PRESENT CONDITION FAIR PRESENT POSTING N NOT POSTED PROPOSED POSTING



Fracture Critical **Temporary Shoring** Scour Critical Scour POA

No

No

No Yes

SIGN NOTICE ISSUED FOR

No

No

NUMBERED REQUIRED

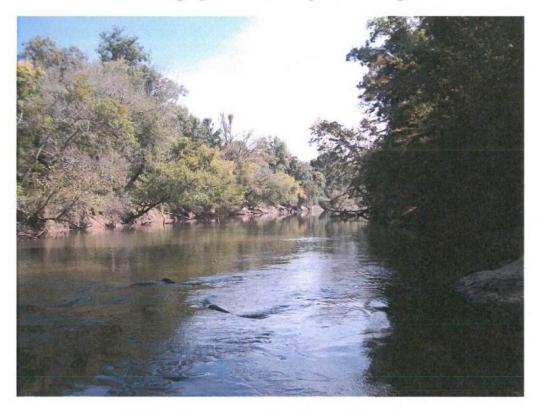
No WEIGHT LIMIT No **DELINEATORS** 

NARROW BRIDGE No ONE LANE BRIDGE

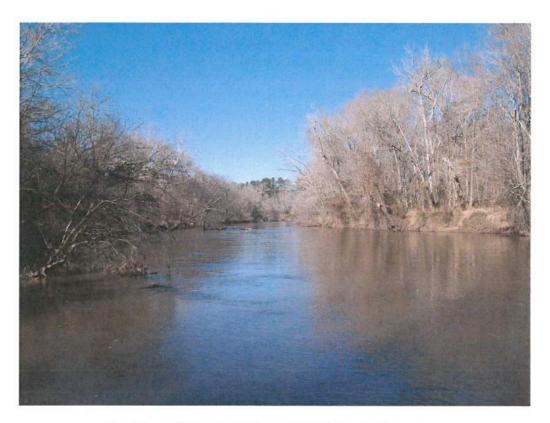
LOW CLEARANCE



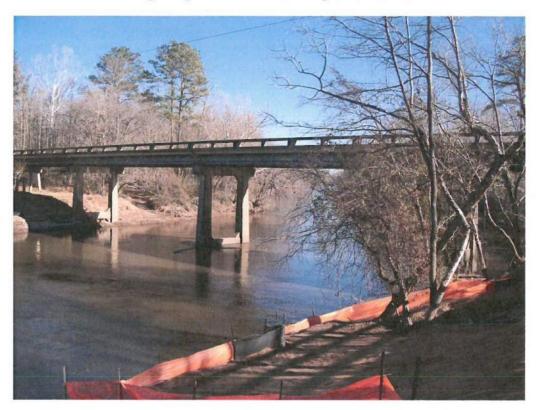
Looking Upstream from Proposed Crossing.



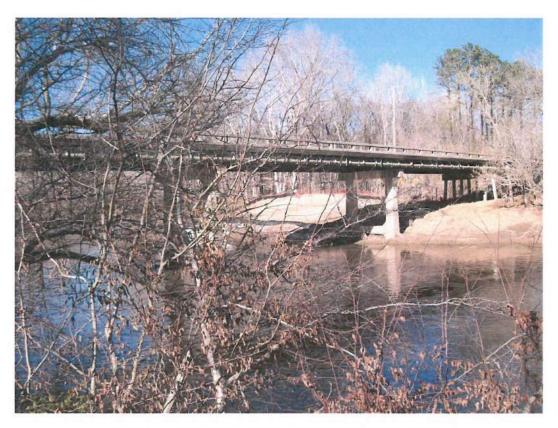
Looking Downstream from Proposed Crossing.



Looking at Upstream Channel of Upstream Structure.



Looking at Upstream Face of Upstream Structure



Looking at Downstream Face of Upstream Structure.



Looking at Downstream Channel of Upstream Structure.

Page 3 of 5



Looking at Upstream Channel of Downstream Structure.



Looking at Upstream Face of Downstream Structure

Page 4 of 5

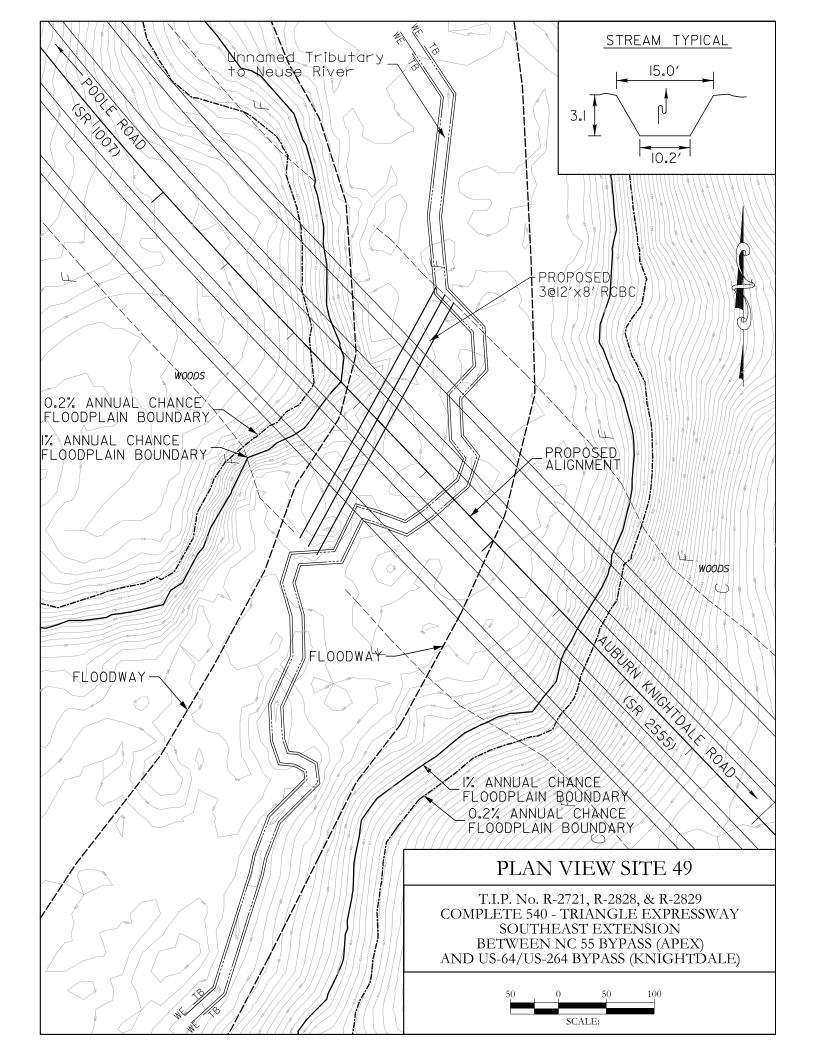


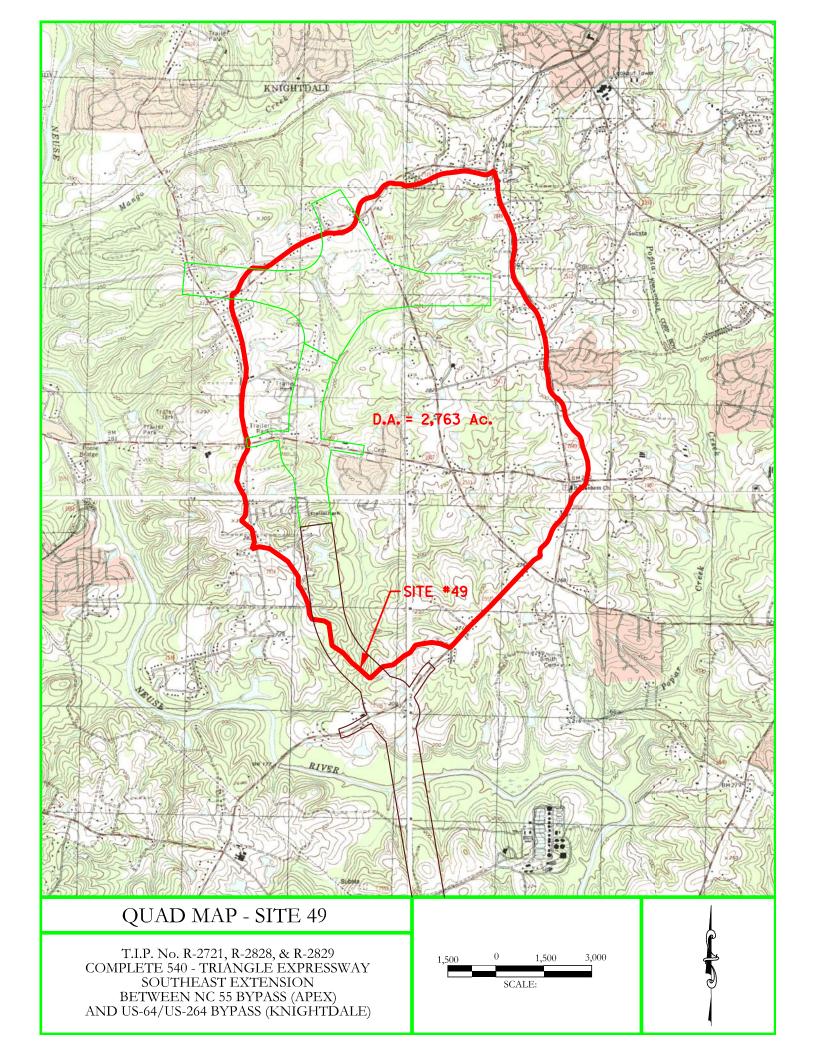
Looking at Downstream Face of Downstream Structure.



Looking at Downstream Channel of Downstream Structure.

#### Site 49





REGION: BLUE RIDGE METHOD USED: Fact Sheet: 007-00 STREAM NAME: Unnamed to Tributary Neuse River sq. miles 4.32 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = 3/18/2014 ENGLISH

<b>USGS RUR</b>	<b>USGS RURAL REGRES</b>	SIONE	ATIONS (OLD)	RUF	SAL EQUA	TIONS Rep	oort 01-4207
FREQUENCY	Sand Hills	Coastal P	lain Blue Ridge	FREQUENCY	ENCY Blue Ridge C	- 47	Sand Hills
	(cfs)	(cts)	(cfs)		(cfs)		(cfs)
2YR	86.81	174.98	395.81	2YR	377.09	173.21	94.95
5YR	143.68	349.17	661.04	5YR	651.69	326.68	154.80
10YR	190.17	509.82	883.78	10YR	879.91	462.36	202.14
25YR	258.68	788.47	1217.75	25YR	1223.19	669.19	270.43
50YR	317.87	1039.52	1503.97	SOYR	1524.50	856.27	329.84
100YR	384.81	1351.29	1842.23	100YR	1859.23	1071.35	391.34
200YR	474.07	1733.42	2216.12	200YR	2236.37	1318.12	463.86
500YR	571.29	2346.45	2811.80	500YR	2811.42	1701 00	57133

# **USGS URBAN REGRESSION EQUATIONS**

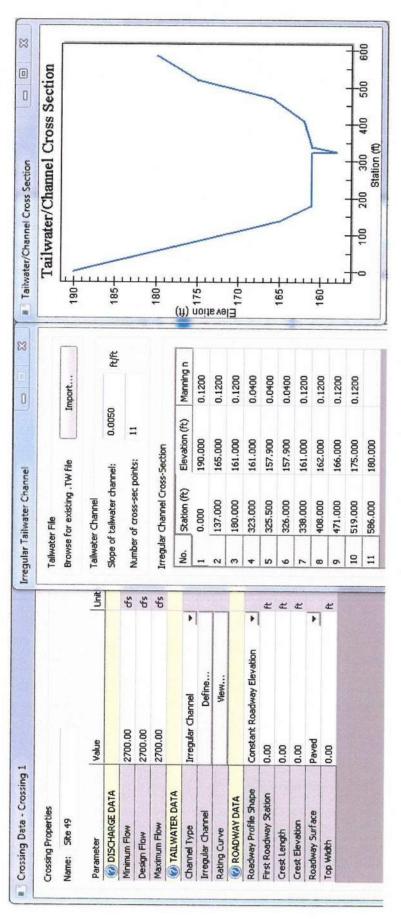
BDF=

(These Equations are used only for comparison)

							(Based on 2.80xQ10)	
Blue Ridge	(cfs)	1643.28	1991.12	2511.53	3004.79	3656.51	5575.15	5162.46
Coastal Plain								
Sand Hills	(cfs)	499.71	591.58	727.27	853.24	1012.47	1656.41	1397.37
FREQUENCY					50YR			

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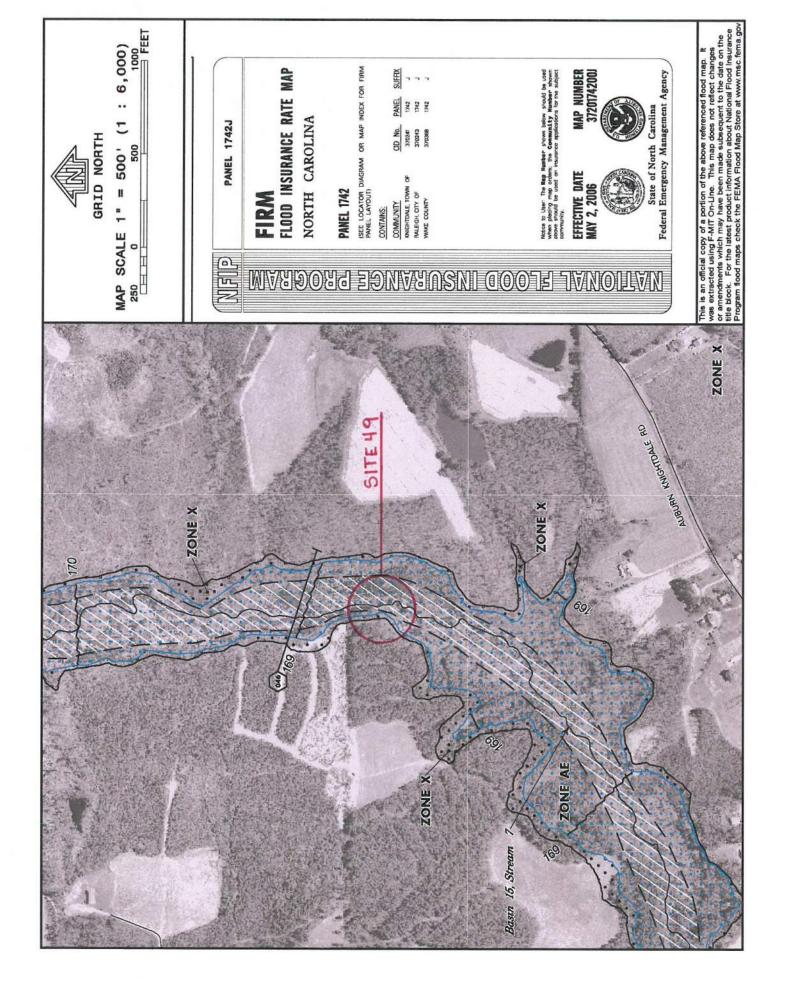
Impervious =	30				11	MA
QUENCY	Sand Hills	Coastal Plain	Blue Ridge	Discharge Used	FREQUENCY	Disharges
	(cts)	(cts)	(cts)			
5YR	966.57	1244.34	1495.39			
10YR	1173.44	1567.91	1833.66		10YB	
25YR	1447.06	2120.30	2456.07		SOYR	
SOYR	1660.32	2436.12	2746.58	2700	100YR	
100YR	1843.42	2731.02	3009.70		SOOYR	
200YR	3285.64	4390.15	5134.25	(Based on 2.80xQ10)		
500YR	4294.80	5738.55	6711.20	(Based on 3.66xQ10)		

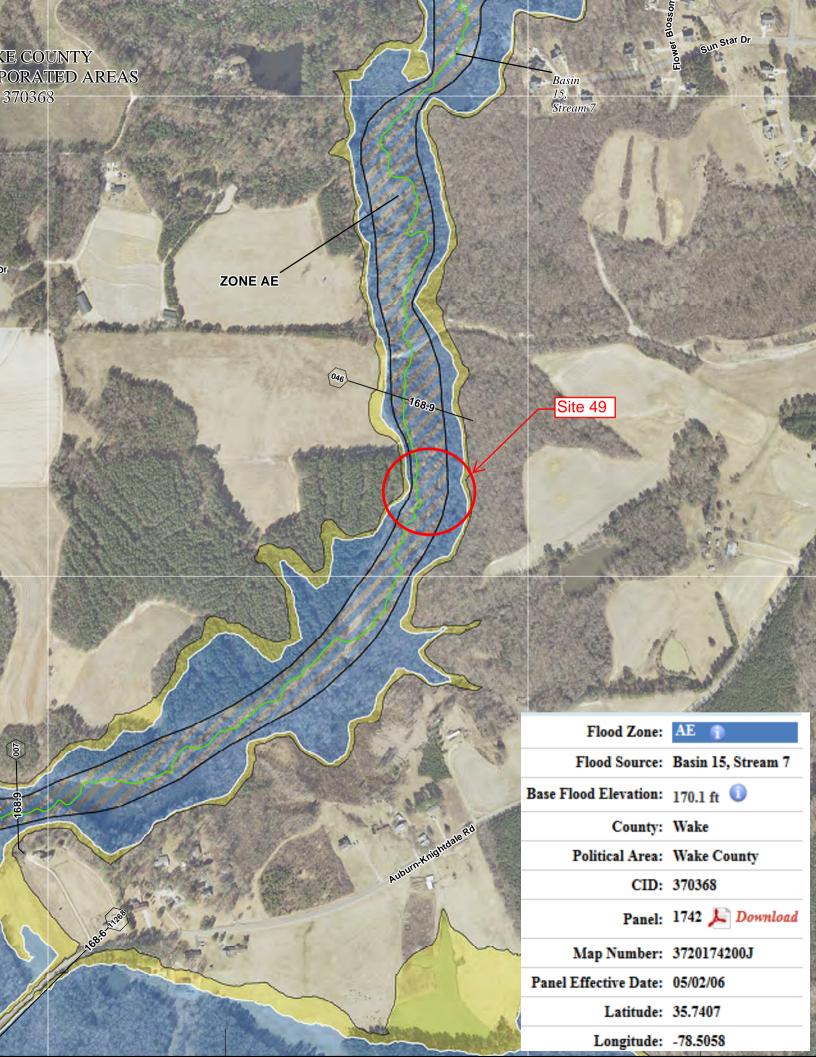


Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s) Shear (psf)	Shear (psf
2700.000	165.168	7.268	2.429	2.268
2700,000	165,168	7.268	2.429	2.268
2700,000	165.168	7.268	2,429	2.268
2700,000	165.168	7.268	2.429	2.268
2700.000	165.168	7.268	2,429	2.268
2700.000	165.168	7.268	2.429	2.268
2700.000	165.168	7.268	2.429	2.268
2700,000	165.168	7,268	2,429	2.268
2700,000	165,168	7,268	2.429	2,268
2700.000	165.168	7.268	2.429	2.268
2700.000	165,168	7,268	2.429	2.268

SITE 49 **CHART 9B** (1) (2) - 12 - 400 3.0 - 11 300 -3.0 2.5 SCALE ENTRANCE TYPE EXAMPLE - 10 5'x 5' BOX Q= 250 CFS (I) 45° WINGWALL FLAIR WITH 6= .043 D -200 Q/NB = 50 CFS / FT. 2.0 (2) I8°TO 33.7° WINGWALL FLAIR WITH 6 = .083 D FT. PER HW /D (FEET) INLET -2.0 1.8 (1) 7.1 NI (Q/ 1.41 1.6 (2) 1.33 6.7 FOOT 1.6 100 MH 1.4 CULVERT FACE IN TERMS OF HEIGHT CFS 1.2 Z 6 1.1 1.1 WIDTH (Q/NB -1.0 5.5 1.0 - 30 .9 - 20 TOP EDGE 10 BEVEL ANGLE REQUIRED DISCHARGE HEADWATER DEPTH AT d/D ANGLE .7 0.042 45° 0.083 18°-33.7° 745° OR 33.7° -10 3.5 OF 9 TOP BEVEL - 8 RATIO - HEIGHT DIM FEET BEVEL d BEVEL ANGLE LONGITUDINAL SECTION 2.5 (2) 2 HEADWATER DEPTH FOR INLET CONTROL RECTANGULAR BOX CULVERTS FLARED WINGWALLS 18° TO 33.7° & 45° WITH BEVELED EDGE AT TOP OF INLET

$$\frac{Q}{NB} = \frac{2700}{(3)(12)} = 75$$





# **FLOOD INSURANCE STUDY**

### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 9, "Flooding Sources Studied by Detailed Methods: Redelineated", lists all flooding sources that were studied by detailed methods for the prestatewide FIS and redelineated for previous FISs. These flooding sources were not part of this revision and their effective analyses remain valid.

Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	Riverine	Sources	Affected Communities
Source	From	To	Anected Communities
Adams Branch (Basin 30, Stream 9)	The confluence with Big Branch Tributary No. 1 (Basin 30, Stream 6)	Corwin Road	Town Of Garner
Angier Creek (Basin 24, Stream 4)	The confluence with Kenneth Creek (Basin 24, Stream 2)	Railroad	Town Of Fuquay-Varina
Armory Tributary (Basin 18, Stream 38)	The confluence with Richland Creek (Basin 18, Stream 3)	Approximately 0.5 mile upstream of confluence with Richland Creek (Basin 18, Stream 3)	City Of Raleigh
Austin Creek (Basin 6, Stream 10)	The confluence with Smith Creek (Basin 6, Stream 1)	Approximately 350 feet upstream of Averette Road	Rdu Town Of Wake Forest Wake County
Bagwell Branch (Basin 20, Stream 10)	The confluence with Swift Creek (Basin 20, Stream 1)	NC Route 50	Town Of Garner
Basal Creek (Basin 22, Stream 16)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.8 mile upstream of State Road 55	Rdu Town Of Fuquay-Varina Town Of Holly Springs Wake County
Basin 10, Stream 10	The confluence with Little River (Basin 10, Stream 1)	Highway 96/Zebulon Road	Rdu Wake County
Basin 10, Stream 2	The confluence with Little River (Basin 10, Stream 1)	Approximately 0.9 mile upstream of confluence with Little River (Basin 10, Stream 1)	Rdu Wake County
Basin 10, Stream 3	The confluence with Little River (Basin 10, Stream 1)	Moss Road	Rdu Wake County
Basin 10, Stream 5	The confluence with Little River (Basin 10, Stream 1)	Lizard Lick Rd	Rdu Wake County
Basin 10, Stream 6	The confluence with Little River (Basin 10, Stream 1)	Lizard Lick Rd	Rdu Wake County
Basin 10, Stream 9	The confluence with Little River (Basin 10, Stream 1)	Zebulon Road	Rdu Wake County
Basin 12, Stream 3	The confluence with Beaverdam Creek (Basin 12, Stream 1)	Old Crews Road	Town Of Knightdale
Basin 15, Stream 22	The confluence with Neuse River (Basin 15, Stream 1)	Forestville Road	City Of Raleigh
Basin 15, Stream 25	The confluence with Neuse River (Basin 15, Stream 1)	The intersection between Forestville Rd and Mitchell Mill Road	City Of Raleigh
Basin 15, Stream 28	The confluence with Perry Creek (Basin 15, stream 26)	Approximately 0.7 mile upstream of Berkshire Downs Drive	City Of Raleigh
Basin 15, Stream 32	The confluence with Falls Lake	Just upstream of Raven Ridge Road	Rdu Wake County
Basin 15, Stream 33	The confluence with Honeycutt Creek (Basin 15, Stream 31)	Approximately 0.3 mile upstream of Honeycutt Road	Rdu Wake County
Basin 15, Stream 7	The confluence with Neuse River (Basin 15, Stream 1)	Clifton Road	Rdu Town Of Knightdale Wake Countv
Basin 15 Stream 8	The confluence with Basin 15, Stream 7	Grasshopper Road	Rdu Wake County
.9 sin 5, Stream 9	The confluence with Neuse River (Basin 15, Stream 1)	Battle Ridge Road	Rdu Wake County
Basin 16, Stream 2	The confluence with Upper Barton Creek (Basin 16, Stream 1)	State Route 50	Rdu Wake County
Basin 16, Stream 5	The confluence with Upper Barton Creek (Basin 16, Stream 1)	Approximately 0.2 mile upstream of State Route 50	Rdu Wake County
Basin 17, Stream 4	The confluence with Lower Barton Creek (Basin 17, Stream 1)	Old Creedmoor Road	Rdu Wake County
Basin 18, Stream 13	The confluence with Stirrup Iron Creek (Basin 18, Stream 12)	Sorrell Grove Church Road	Town Of Morrisville
Basin 18, Stream 4	The confluence with Turkey Creek (Basin 18, Stream 5)	Approximately 0.3 mile upstream of Lynn Road	City Of Raleigh
Basin 18, Stream 8	The confluence with Sycamore Creek (Basin 18, Stream 6)	Approximately 0.6 mile upstream of West Gate Road	City Of Raleigh
Basin 19, Stream 3	The confluence with White Oak Creek (Basin 19, Stream 1)	Railroad	Rdu Town Of Garner Wake County
Basin 20, Stream 20	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 0.8 mile upstream of confluence with Swift Creek (Basin 20, Stream 1)	Rdu Wake County
Basin 20, Stream 7	The confluence with Mahlers Creek (Basin 20, Stream 6)	Bryan Road	Town Of Garner
Basin 20, Stream 8	The confluence with Basin 20, Stream 7	Bryan Road	Town Of Garner
Basin 22, Stream 20	The confluence with Terrible Creek (Basin 22, Stream 19)	Approximately 1.0 mile upstream of confluence with Terrible Creek (Basin 22, Stream 19)	Town Of Fuquay-Varina

Site 4

Table 13 - Summary of Discharges

Table 13 - Summ	ary of Dis	<u>charges</u>			
Flooding Source	Discharges (cfs)				
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Approximately 0.4 mile upstream of confluence with Marks Creek (Basin 14, Stream 1)	2.45	*	*	1,310	*
Approximately 0.4 mile downstream of Lake Myra Road	1.47	*	*	947	*
Basin 14, Stream 3					
At confluence with Marks Creek (Basin 14, Stream 1)	0.39	*	*	410	*
Basin 15, Stream 22					
At mouth	1.60	*	*	1,410	*
At Forestville Road	0.80	*	*	950	*
Basin 15, Stream 25	•				
At mouth	1.40	*	*	1,300	*
Approximately 700 feet upstream of Wake Crossroads	0.40	*	*	680	*
Basin 15, Stream 28	14:14	L		1222	
At mouth	4.00	*	*	2,300	*
At U.S. Route 1	3.10	*	*	2,000	*
Basin 15, Stream 32	3.10			2,000	
At mouth	2.10	*	*	1,600	*
At Raven Ridge Road	1.60	*	*	1,410	*
Basin 15, Stream 33	•				
At mouth	0.90	*	*	1,000	*
Approximately 1,500 feet upstream of Honeycutt Road	0.70	*	*	975	*
Just downstream of Honeycutt Road	0.70	*	*	830	*
Basin 15, Stream 7					
At mouth	4.70	*	*	2,490	*
Just downstream of Basin 15, Stream 8	3.20	*	*	2,080	*
9 prox/mately 500 feet downstream of Clifton Road	0.90	*	*	890	*
Basin 15, Stream 8					
At mouth	1.10	*	*	1,160	*
Basin 15, Stream 9				1,,.00	
At mouth	1.20	*	*	1,150	*
Basin 16, Stream 2	1.20			1,100	
At mouth	2.10	*	*	1,600	*
Approximately 0.4 mile upstream of mouth just upstream of tributary	1.60	*	*	1,350	*
Just downstream of tributary just downstream of State Route 50	0.70	*	*	890	*
Just upstream of tributary just downstream of State Road 50	0.40	*	*	650	*
Basin 16, Stream 5	10.40			1000	
At mouth <sup>1</sup>	1.60		*	1,050	
Just downstream of State Route 50 <sup>1</sup>		*	*		*
Just downstream of State Route 50	1.40	*	*	920 1,180	*
Just downstream of tributary just upstream of State Route 50	1.20	*	*	1,100	*
Just upstream of tributary just upstream of State Route 50	0.30	*	*	590	*
	10.00			1090	
Basin 17, Stream 4	2 40	*	*	1.750	*
At mouth	2.40	*	*	1,750	*
At Baileywick Road	1.40	*	*	1,170	*
Just upstream of Baileywick Road	0.70	L	1	880	<u>1                                    </u>

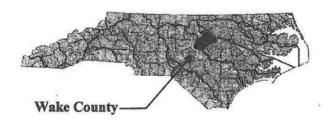
Table 21 - Floodway Data									
	ay Source		Floodway				ter Surface Eleva		
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
045	4,490	85	537	1.6	305.1	*	305.1	305.2	0.1
Basin 15, Str	eam 7	T	T		T	T		T	
007	700	145	413	6.0	168.9 <sup>1</sup>	*	154.6	154.6	0.0
046	4,570	285	1,020	2.4	168.9 <sup>1</sup>	*	165.7	165.7	0.0
102	10,180	320	812	2.4	182.2	*	182.2	182.2	0.0
125	12,500	195	1,251	1.5	198.5	*	198.5	199.0	0.5
Site 4	9 <sub>5,300</sub>	385	394	4.9	208.0	*	208.0	208.0	0.0
Basin 15, Str	eam 8								
017	1,730	85	297	3.9	186.6	*	186.6	187.6	1.0
038	3,800	135	467	2.5	193.8	*	193.8	194.8	1.0
055	5,500	135	219	5.3	207.6	*	207.6	207.6	0.0
Basin 15, Str									
005	500	210	242	4.8	171.1	*	171.1	172.1	1.0
025	2,450	90	455	2.5	180.3	*	180.3	181.3	1.0
047 Basin 16, Str	4,665	70	155	7.4	195.3	*	195.3	195.3	0.0
		05	050	5.0	007.4		007.4	000.4	0.7
070	7,400	95	258 545	5.2	287.4	*	287.4	288.1	0.7
Basin 16, Str	1	100	545	0.5	292.0		292.0	292.8	0.8
006	600	415	6,441	0.2	282.5	*	282.5	283.1	0.6
034	3,410	140	561	1.6	290.8	*	290.8	291.1	0.3
046	4,550	150	235	4.6	296.5	*	296.5	296.9	0.4
Basin 17, Str	•	1.00	1200		1200.0		200.0	1200.0	
028	2,770	90	376	4.7	301.1	*	301.1	302.0	0.9
073	7,320	125	485	3.6	330.5	*	330.5	331.1	0.6
084	8,420	119	198	5.9	338.3	*	338.3	338.3	0.0
107	10,744	160	150	5.9	362.4	*	362.4	362.4	0.0
Basin 18, Str	eam 13								
016	1,590	95	219	2.4	288.1	*	288.1	289.1	1.0
019	1,875	180	497	1.1	289.0	*	289.0	289.9	0.9
023	2,290	115	128	4.1	289.5	*	289.5	290.3	0.8
Basin 18, Str	eam 4								
013	1,290	60	315	4.9	287.7	*	287.7	288.7	1.0
037	3,690	50	407	3.8	304.3	*	304.3	304.4	0.1
060	6,040	105	187	6.2	318.4	*	318.4	318.4	0.0
Basin 18, Str					250.1				
001	110	570	424	3.1	358.41	*	358.4	357.7	-0.7
007	670	54	432	4.4	365.2		365.2	365.3	0.1
012	1,200	0	0	0.0	363.0		363.0	0.0	0.0
021	2,140	100	692	2.6	374.4	*	374.4	374.4	0.0
029	2,850	100	540	3.3	375.5	*	375.5	376.0	0.5
039	3,910	100	432	4.2	380.4	*	380.4	380.6	0.2
057	5,720	120	395	4.3	388.9	*	388.9	389.4	0.5
076	7,573	230	2,220	0.7	409.8	*	409.8	410.1	0.3
085	8,450	105	387	3.7	409.8	*	409.8	410.3	0.5
105	10,450	90	236	4.8	424.1	*	424.1	424.3	0.2

# FLOOD INSURANCE STUDY

A Report of Flood Hazards in

WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 1 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV001A

www.fema.gov and www.ncfloodmaps.com



### **Section 5.0 - Engineering Methods**

Table 10-Roughness Coefficients

Stroam	Channel "n"	Overbank "n"
Stream Stream 6	0.030 - 0.070	0.070 - 0.110
Basin 3, Stream 6	0.030 - 0.070	0.070 - 0.110
Basin 3, Stream 8		0.070 - 0.110
Basin 4, Stream 3	0.030 - 0.070	
Basin 4, Stream 13	0.030 - 0.070	0.070 - 0.110
Basin 6, Stream 9	0.030 - 0.070	0.070 - 0.110
Basin 10, Stream 2	0.030 - 0.070	0.070 - 0.110
Basin 10, Stream 3	0.030 - 0.070	0.070 - 0.110
Basin 10, Stream 5	0.030 - 0.070	0.070 - 0.180
Basin 10, Stream 6	0.030 - 0.070	0.070 - 0.110
Basin 10, Stream 9	0.030 - 0.070	0.070 - 0.110
Basin 10, Stream 10	0.030 - 0.070	0.070 - 0.110
Basin 10, Stream 13	0.045	0.130
Basin 10, Stream 14	0.050	0.150
Basin 11, Stream 4	0.047	0.140
Basin 11, Stream 7	0.042	0.130
Basin 12, Stream 3	0.024 - 0.070	0.070 - 0.150
Basin 14, Stream 2	0.045	0.100
Basin 14, Stream 3	0.050	0.130
Basin 15, Stream 7	0.030 - 0.070	0.070 - 0.110
Basin 15, Stream 8	0.030 - 0.070	0.070 - 0.110
Basin 15, Stream 9	0.030 - 0.070	0.070 - 0.110
Basin 15, Stream 22	0.030 - 0.070	0.070 - 0.110
Basin 15, Stream 25	0.030 - 0.070	0.070 - 0.110
Basin 15, Stream 28	0.030 - 0.070	0.070 - 0.110
Basin 15, Stream 32	0.030 - 0.070	0.070 - 0.110
Basin 15, Stream 33	0.030 - 0.070	0.070 - 0.110
Basin 16, Stream 2	0.030 - 0.070	0.070 - 0.110
Basin 16, Stream 5	0.030 - 0.070	0.070 - 0.110
Basin 17, Stream 4	0.030 - 0.070	0.070 - 0.110
Basin 18, Stream 4	0.030 - 0.070	0.070 - 0.130
Basin 18, Stream 7	0.055	0.150
Basin 18, Stream 8	0.030 - 0.070	0.070 - 0.110
Basin 18, Stream 13	0.024 - 0.070	0.070 - 0.150
Basin 18, Stream 13 Tributary	0.050	0.150
Basin 18, Stream 16	0.030 - 0.070	0.070 - 0.130
Basin 19, Stream 3	0.030 - 0.070	0.070 - 0.110
Basin 19, Stream 4	0.030 - 0.070	0.070 - 0.110
Basin 20, Stream 5	0.047	0.130
Basin 20, Stream 7	0.030 - 0.070	0.070 - 0.130
Basin 20, Stream 8	0.030 - 0.070	0.070 - 0.110
Basin 20, Stream 20	0.030 - 0.070	0.070 - 0.110
Dasili 20, Stream 20	1 0.030 - 0.070	0.070 - 0.110

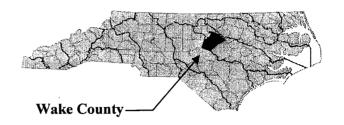
SITE 49

# FLOOD INSURANCE STUDY

A Report of Flood Hazards in

WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 3 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





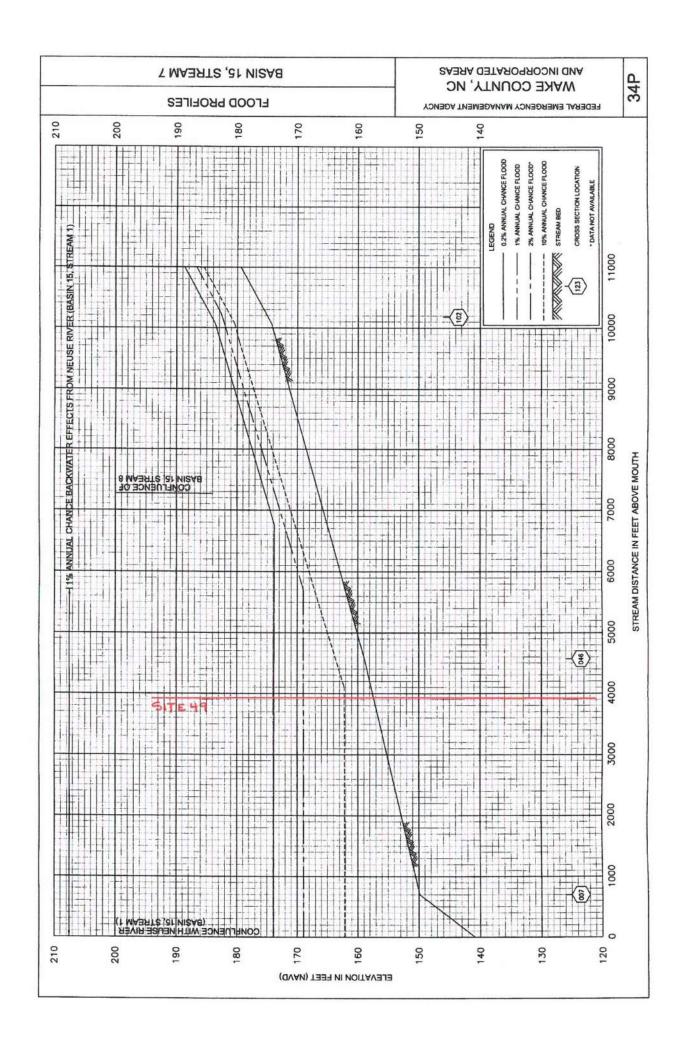
May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV003A







# PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake PROJECT NUMBER R-2721, R-2828, & R-2829
STREAM <u>Unnamed Tributary to Neuse River</u> ROUTE <u>New Location</u> (Site 49)
ASSESSMENT PREPARED BY Mulkey, INC. DATE 1/9/2014 (MLH)
HYDROLOGIC EVALUATION
NEAREST GAGING STATION ON THIS STREAM (NONE _X_)
ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: Yes
FLOOD DATA: Q <sub>10</sub> 1,800 CFS EST. BKWTR. $N/A$ FT. Q <sub>25</sub> 2,500 CFS EST. BKWTR. $N/A$ FT. Q <sub>50</sub> 2,700 CFS EST. BKWTR. $N/A$ FT. Q <sub>100</sub> 3,000 CFS EST. BKWTR. $N/A$ FT. Q <sub>500</sub> 6,700 CFS EST. BKWTR. $N/A$ FT.
DRAINAGE AREA <u>4.32 Sq.Mi.</u> METHOD USED TO COMPUTE Q: <u>USGS Urban Regression</u>
PROPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: LOW MODERATE X HIGH
COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: YES NO X
EXPLANTION: A floodway modification may be required at this site.
LIST BUILDINGS IN FLOOD PLAIN: None LOCATION:
UPSTREAM LAND Woods & Agriculture
ANTICIPATE ANY CHANGE? No
ANY FLOOD ZONING? (FIA STUDIES, ETC.) YES $\underline{X}$ NO
TYPE OF STUDY: FEMA - Special Flood Hazard Zone AE
REGULATORY FLOODWAY WIDTH 475 ft. Section 3960 (AS NOTED IN FIS)
COMMENTS:

### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 19,600 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 49,100 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? <u>N/A New Location</u> LENGTH OF DETOUR <u>N/A</u> MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? N/A
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS
NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Chewacla TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service
ENTAR ON MENTAL CONGIDER ATIONS

### **ENVIRONMENTAL CONSIDERATIONS**

LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: <u>Buried culverts 1 foot to allow for fish passage.</u>

### MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES NO $\underline{X}$ PROTECTION NEEDED
ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
ALTERNATIVES
RECOMMENDED DESIGN <u>3@12'x8' RCBC</u>
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING 252 Sq. Ft.
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YESNO $\underline{X}$ DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:
(4)

			Neus	se River Bas
Name I	ndex Number	Classification		Class Date
Description			Special D	esignation
NEUSE RIVER	27-(75.3)	WS-IV;NSW	,CA	08/01/02
From a point 0.6 mile upstream of Lenoir County proposed water water supply intake.	supply intake to Lenoi	r County proposed		
IEUSE RIVER	27-(70.5)	WS-IV;NSW		08/01/02
From a point 0.7 mile downstream of the mouth of Coxes Creek to County proposed water supply intake.	a point 0.6 mile upstr	ream of Lenoir		
IEUSE RIVER	27-(55.5)	WS-IV;NSW	,CA	08/03/92
From a point 0.8 mile upstream of Little River to City of Goldsboro upstream of Little River)	water supply intake (l	located 0.4 mile		
IEUSE RIVER	27-(85)	C;Sw,NSW		05/01/88
From mouth of Contentnea Creek to Streets Ferry				
IEUSE RIVER	27-(96)	SC;Sw,NSW		05/01/88
From Streets Ferry to a line across Neuse River from Johnson Poin	t to McCotter Point			
IEUSE RIVER	27-(39.3)	WS-IV;NSW	,CA	04/01/97
From a point 1.4 mile downstream of Johnston County SR 1908 to intake (located 1.9 mile downstream of Johnston County SR 1908)		posed water supply		
IEUSE RIVER	27-(22.5)	C;NSW		08/03/92
From Town of Wake Forest proposed water supply intake to mout	h of Beddingfield Cree	k		
IEUSE RIVER	27-(75.7)	C;NSW		08/03/92
From Lenoir County proposed water supply intake to mouth of Co	ntentnea Creek.			
EUSE RIVER (Falls Lake below normal pool elevation)	27-(5.5)	WS-IV,B;NS	W,CA	08/03/92
From I-85 bridge to dam at Falls Lake				
EUSE RIVER (Falls Lake below normal pool elevation)	27-(1)	WS-IV;NSW	,CA	08/03/92
From source (confluence of Eno River Arm of Falls Lake and Flat Ri	iver Arm of Falls Lake)	to I-85 bridge		
leuse River Cut-Off	27-59	C;NSW		05/01/88
From source to Neuse River				
leuse-Southeast Pamlico Sound ORW Area	27-148.5	SA;ORW,NS	w	01/01/90
All waters within a line beginning at the southwest tip of Ocracoke the Tar-Pamlico River Basin and Neuse River Basin boundary line t southwest direction to Ship Point				
lew Light Creek	27-13-(2)	WS-IV;NSW	,CA	08/01/98
From Wake County SR 1911 to Falls Lake, Neuse River				
lew Light Creek	27-13-(0.1)	WS-IV;NSW		08/01/98
From source to Wake County SR 1911	- A - A			

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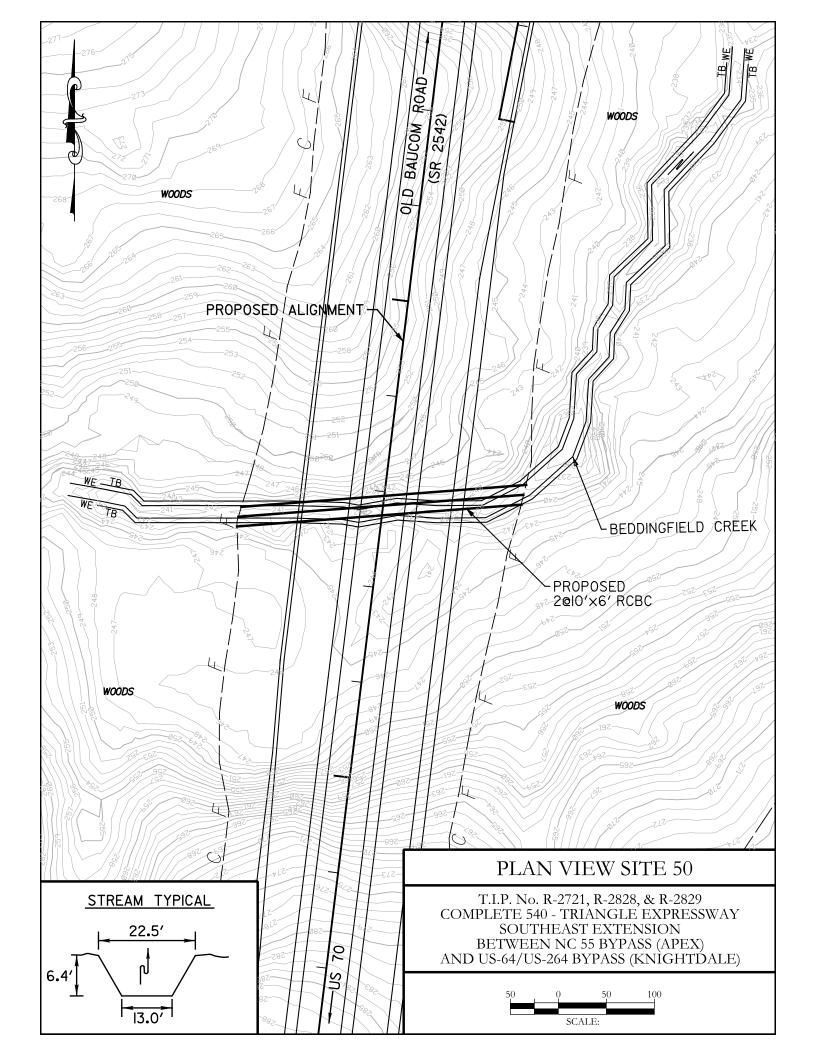


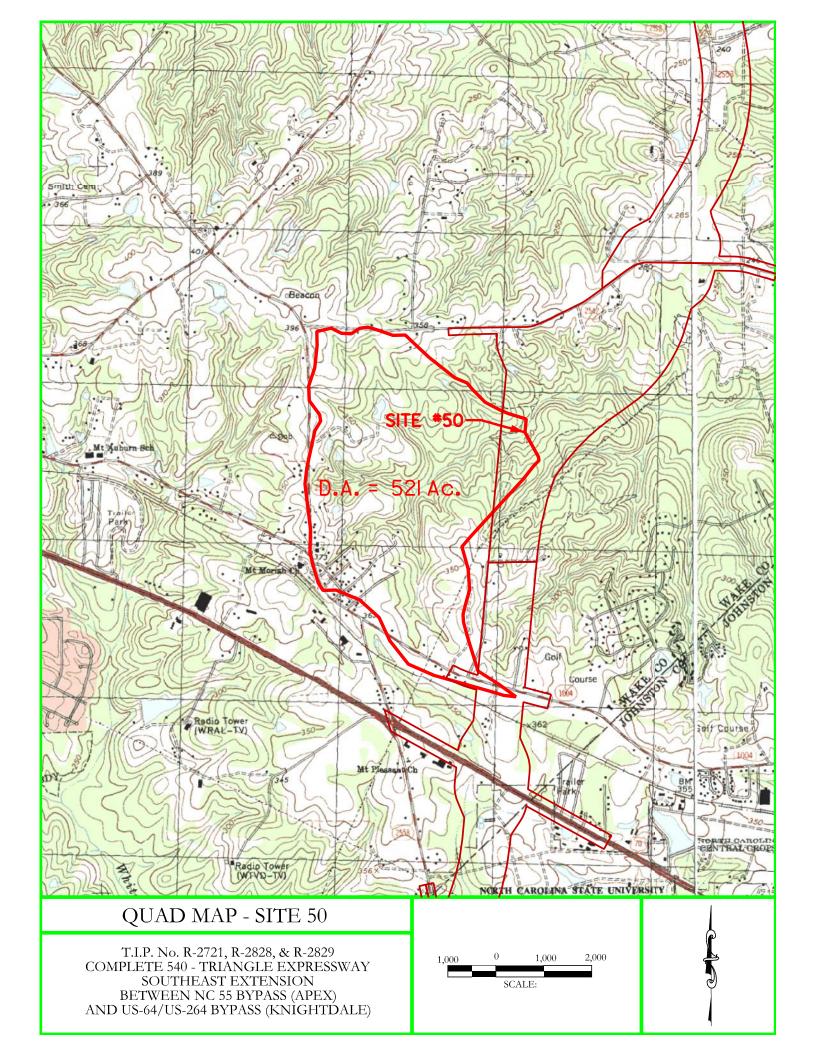
Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

# Site 50





Sec.

REGION: BLUE RIDGE METHOD USED: Fact Sheet: 007-00 STREAM NAME: Unnamed to Tributary Neuse River sq. miles 0.81 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = 3/18/2014 ENGLISH

SGS RURAL I	<b><i>RAL REGRE</i></b>	SSION EQU	ATIONS (OLD)	RUR	RAL EQUA	TIONS Reg	oort 01-4207
EQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cts)	(cts)	(cfs)		(cfs)	(cfs)	(cfs)
2YR	25.54	60.94	124.91	2YR	116.84	56.33	28.93
5YR	41.92	132.18	216.06	5YR	210.53	113.20	48.04
10YR	55.30	200.55	291.28	10YR	291.46	165.65	63.16
25YR	73.86	324.46	408.11	25YR	416.83	248.72	85.06
50YR	89.85	440.82	508.26	SOYR	528.25	325.77	104.09
100YR	107.69	589.51	629.88	100YR	655.08	416.54	124.12
200YR	132.45	774.10	762.80	200YR	799.89	522.86	147.62
500YR	155.93	1081.62	994.03	500YR	1024.20	691.84	182.43

# **USGS URBAN REGRESSION EQUATIONS**

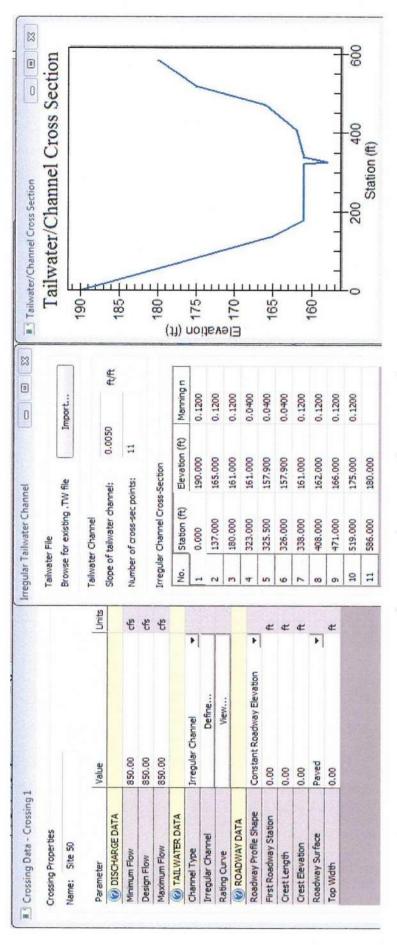
BDF= 11

(These Equations are used only for comparison)

VOIATI CHOR				
FREGUENCT	Sand HIIIS	Coastal Plain		
	(cts)	(cts)		
5YR	143.96	352.55		
10YR	170.72	472.35		
25YR	207.72	678.72		
50YR	238.72	865.70		
100YR	277.42	277.42 1118.30	1180.72	
200YR	478.01	1322.58		(Based on 2.80xQ10)
500YR	368.90	1805.74		

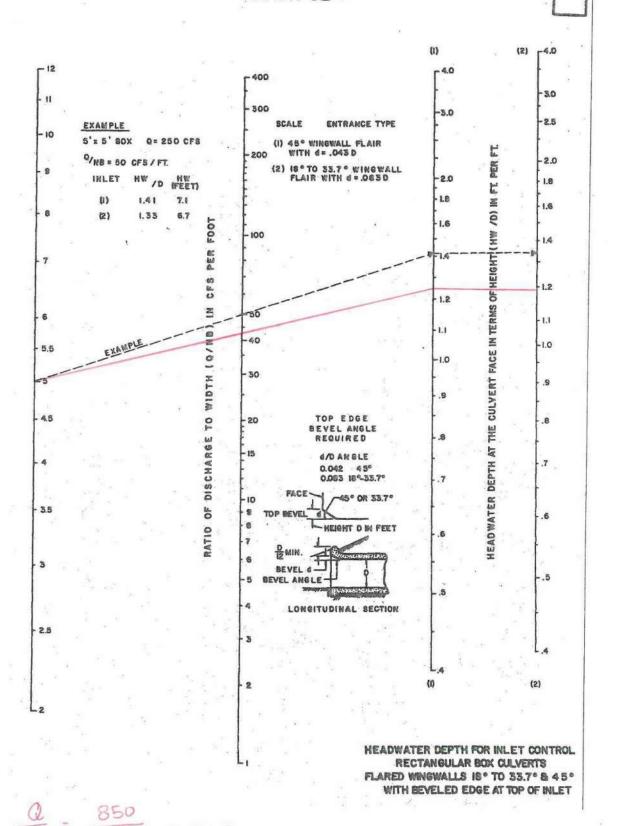
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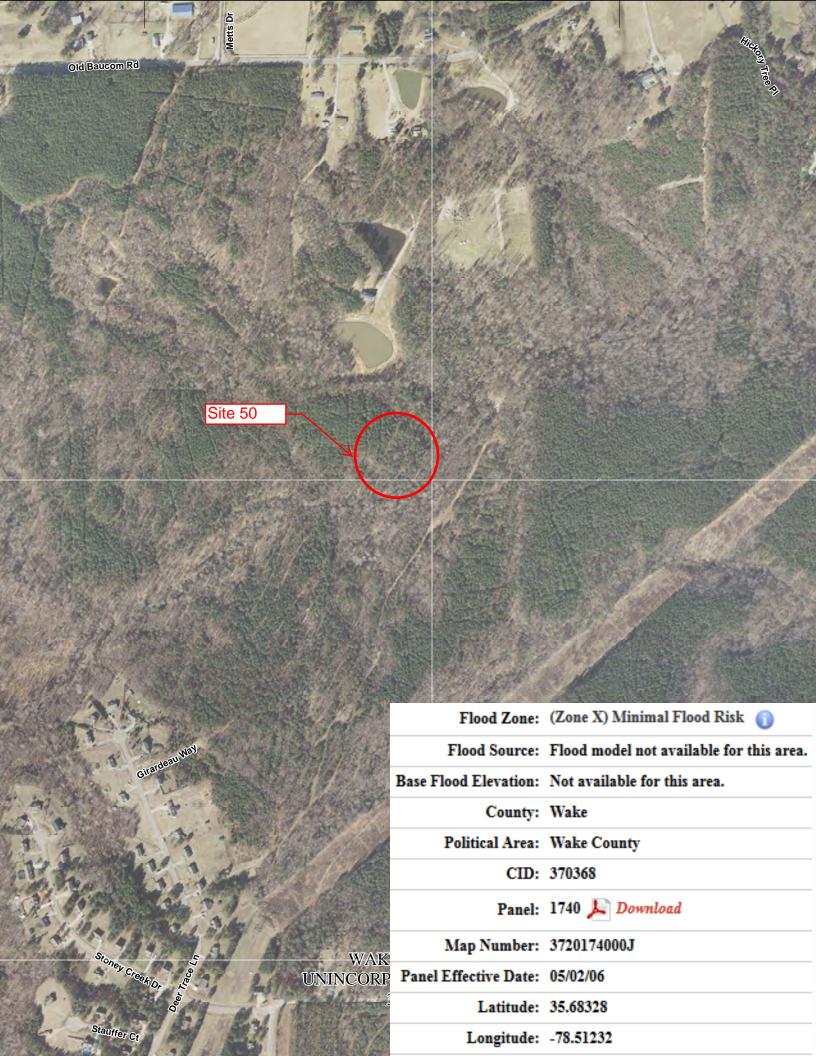
% Impervious =	20				FEN	MA
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Discharge Used	FREQUENCY	Disharges
	(cts)	(cts)	(cts)			
5YR	238.29	330.70	380.54			
10YR	307.64	448.33	498.71		10YR	800
25YR	413.91	686.20	742.29		50YR	5945
50YR	488.34	817.51	856.44	850	100YR	
100YR	557.09	947.95	967.48		500YR	2000
200YR	861.40	1255.32	1396.39	(Based on 2.80xQ10)		
500YR	1125.97	1640.89	1825.28	(Based on 3.66xQ10)		



Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
850.000	163.023	5.123	1.769	1.598
850.000	163.023	5.123	1,769	1.598
850.000	163.023	5.123	1.769	1.598
850.000	163.023	5.123	1,769	1.598
850.000	163.023	5.123	1.769	1.598
850.000	163.023	5.123	1.769	1.598
850.000	163.023	5.123	1.769	1.598
850.000	163.023	5.123	1.769	1.598
850.000	163.023	5.123	1.769	1.598
850.000	163.023	5.123	1.769	1.598
850,000	163.023	5,123	1.769	1.598







# PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake	PROJECT NUMBER	R R-2721, R-2828, &	R-2829
STREAM <u>Unnamed Tributa</u> (Site 50)	ry to Neuse River	ROUTE New Locat	ion
ASSESSMENT PREPARED	BY Mulkey, INC. (MLH)	DATE <u>1/9/2014</u>	
	HYDROLOGIC E	VALUATION	
NEAREST GAGING STATI	ON ON THIS STREA	AM (NONE _X	
ARE FLOOD STUDIES AV	AILABLE ON THIS	STREAM: Yes	
FLOOD DATA: Q <sub>10</sub> 500 CFS EST. BKWT Q <sub>50</sub> 850 CFS EST. BKWT Q <sub>500</sub> 1,800 CFS EST. BKW	R. <u>N/A</u> FT. Q <sub>100</sub> <u>95</u>		
DRAINAGE AREA <u>0.81 Sq.</u>	Mi. METHOD USED	TO COMPUTE Q: <u>L</u>	JSGS Urban Regression
PI	ROPERTY RELATEI	D EVALUATIONS	
DAMAGE POTENTIAL: LO	OW MOD	ERATE X HIG	Н
COULD THIS BE SI	GNIFICANTLY INC	REASED BY PROPO	OSED
ENCROACHMENT:	YES	NO $\underline{X}$	
EXPLANTION: A flo	odway modification i	may be required at thi	s site.
LIST BUILDINGS IN	FLOOD PLAIN: No	one LOCATION	:
UPSTREAM LAND	Woods & Residential		
ANTICIPATE ANY	CHANGE? No		
ANY FLOOD ZONI	NG? (FIA STUDIES,	ETC.) YES X	NO
TYPE OF STUDY: 1	EMA – Zone X		
REGULATORY FLO	ODWAY WIDTH <u>N</u>	<u>A</u>	
COMMENTS:			

### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 19,600 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 49,100 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? N/A
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS  NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE  EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Wehadkee TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from 1970 "Soil Survey Wake County North Carolina" which was published by the United States Department of Agriculture Soil Conservation Service
ENVIRONMENTAL CONSIDERATIONS

LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: Buried culverts 1 foot to allow for fish passage.

### MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED
ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
ALTERNATIVES
RECOMMENDED DESIGN <u>2@10'x6' RCBC</u>
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING 100 Sq. Ft.
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YESNO $\underline{X}$ DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1) X NORMAL PROCESS
(2)NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:

	SITE 5	0		
	1)			
			TQ-TB-	22.5
WOODS			WE-WE	13.0
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Name	Index Number	Classification	use River Basii Class Date
Description			I Designation
Beaverdam Run	27-86-22	C;Sw,NSW	05/01/88
From source to Contentnea Creek			
Beaverdam Swamp	27-52-6-4	C;NSW	05/01/88
From source to Hannah Creek			
Beaverdam Swamp	27-101-3	C;Sw,NSW	05/01/88
From source to Trent River			
Beaverdam Swamp	27-97-8-3-1	C;Sw,NSW	05/01/88
From source to Fisher Swamp			
Beaverdam Swamp	27-86-11-3	WS-III;NSW	08/03/92
From source to Toisnot Swamp			
Beddingfield Creek	27-37	C;NSW	05/01/88
From source to Neuse River			
Bee Tree Creek	27-150-7-2	SC;Sw,HQW,NSW	08/01/90
From source to Chapel Creek			
Beech Tree Branch	27-98-2.4	C;Sw,NSW	05/01/88
From source to Bachelor (Batchelder) Creek			
Beetle Branch (Beaver Branch)	27-86-14-5	C;Sw,NSW	05/01/88
From source to Nahunta Swamp			
Belch Branch	27-73	WS-IV;Sw,NSW	08/01/02
From source to Neuse River			
Bells Lake	27-43-15-6	C;NSW	05/01/88
Entire lake and connecting stream to Middle Creek			
Bennett Creek	27-150-28-1	SA;HQW,NSW	05/01/88
From source to Bear Creek			
Benneys Creek	27-148-1-3	SA;HQW,NSW	05/01/88
From source to Long Bay			
Bens Branch	27-71-2-3	WS-IV;NSW	08/01/02
From source to Trotters Creek			
Bernal Branch (Johnson Pond)	27-52-6-3	C;NSW	05/01/88
From source to Hannah Creek			
Berrys Creek	27-132	SA;HQW,NSW	05/01/88
From source to Neuse River			



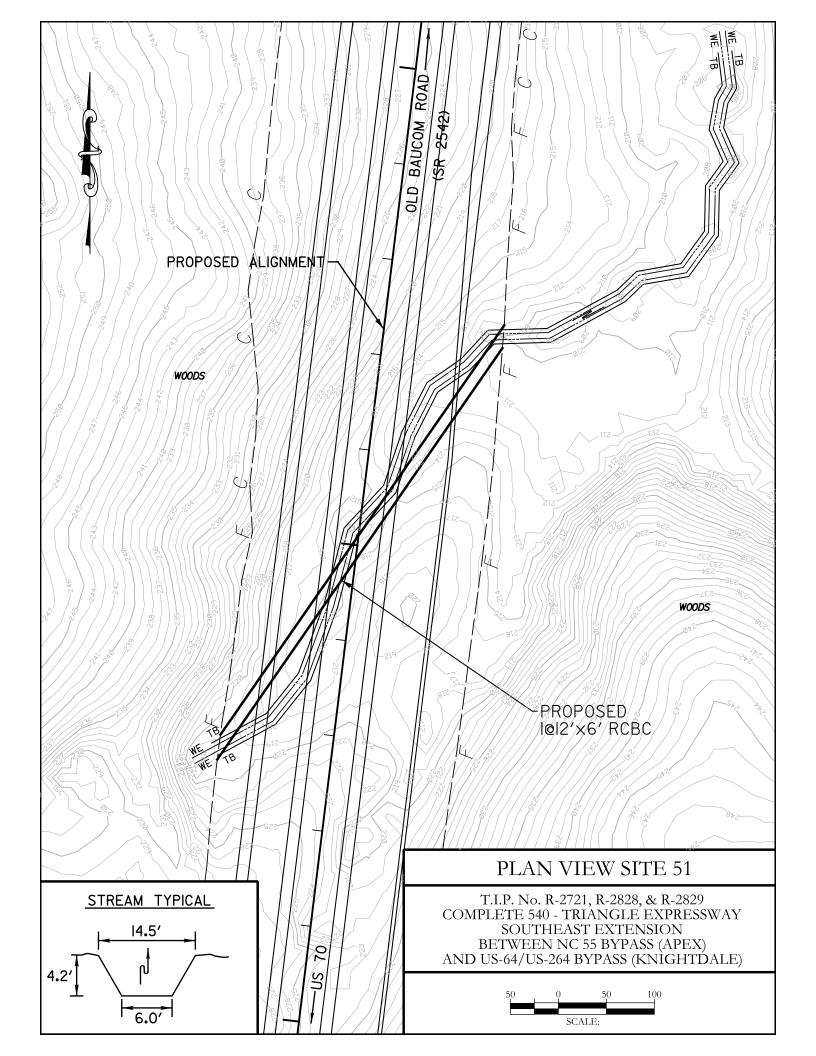
Looking Upstream from Proposed Crossing.

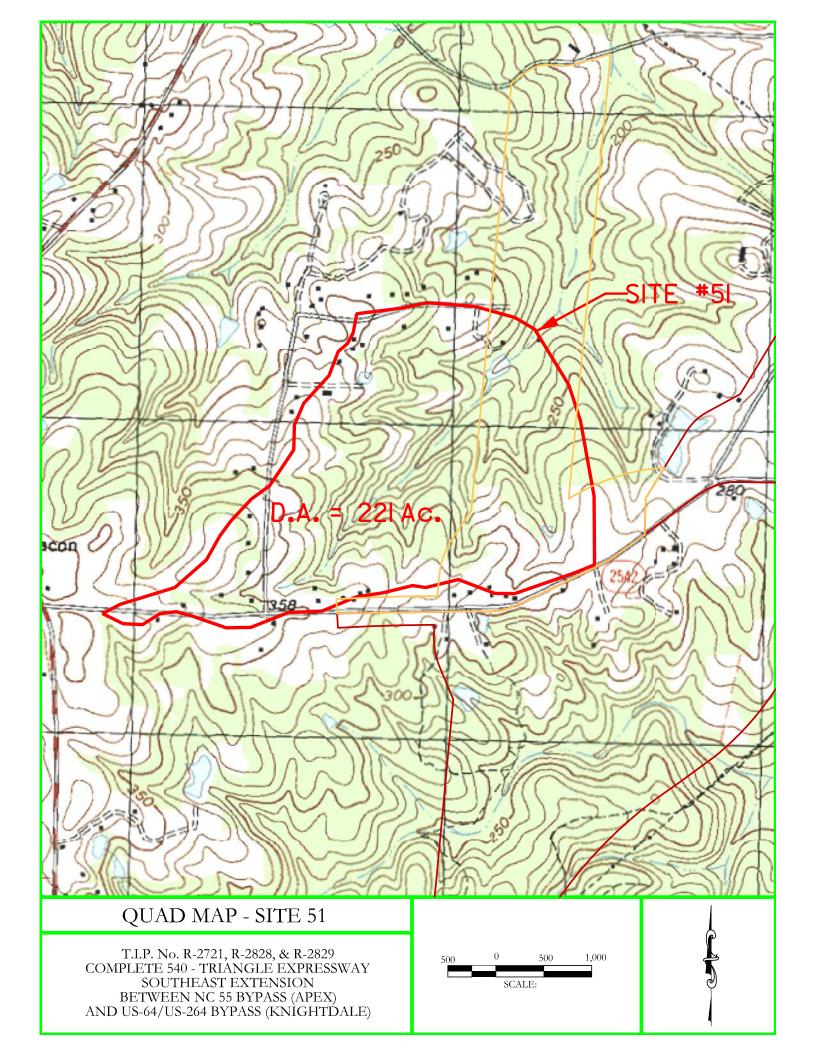


Looking Downstream from Proposed Crossing.

Page 1 of 1

# Site 51





SH Drainage Area = 0.35 so miles	PROJECT	NAME: Triangle Expressway	SE Ext.	STREAM NAME: Unnamed to Tributary Neuse River	REGION: BLUE RIDGE
	FNGI ISH	Drainage Area =	0.35	en miles	5224 Shaat: 007 00

<b>USGS RURAL R</b>	AL REGRE	SSION EQU	ATIONS (OLD)	RUR	RAL EQUA	TIONS Rep	oort 01-4207
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cfs)	(cts)	(cfs)		(cfs)	(cfs)	(cfs)
2YR	13.61	35.42	69.02	2YR	63.96	31.61	15.70
SYR	22.25	80.20	121.56	SYR	117.74	65.63	26.32
10YR	29.30	124.11	164.59	10YR	165.11	97.70	34.72
25YR	38.76	205.51	232.59	25YR	239.61	149.50	46.92
50YR	46.92	283.55	290.91	SOYR	306.28	198.18	57.52
100YR	55.94	384.78	362.70	100YR	383.08	256.24	68.76
200YR	68.74	511.37	440.74	200YR	471.39	324.97	81.92
500YR	96.62	726.26	582.29	500YR	609.31	435.58	101.41

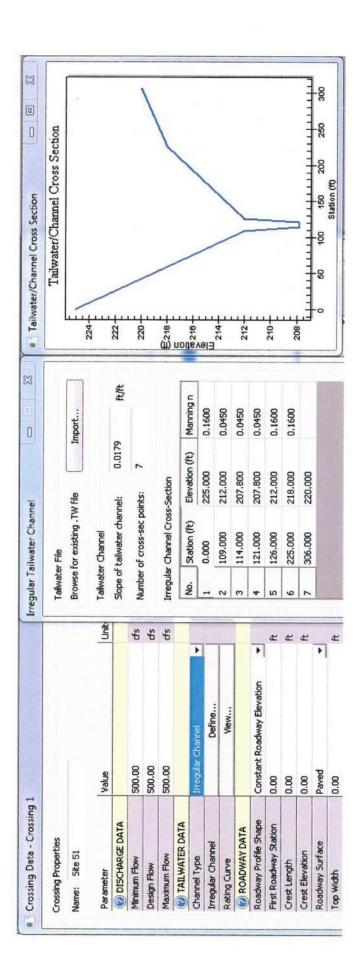
# USGS URBAN REGRESSION EQUATIONS BDF= 11

(These Equations are used only for comparison)

GUENCY	Sand Hills (cfs)	FREQUENCY Sand Hills Coastal Plain (cfs) (cfs)	Blue Ridge (cfs)	
5YR	75.90	206.35		
10YR	60.06	281.83		
25YR	109.04	414.10		
50YR	123.98	532.39		
100YR	142.55	692.96		
200YR	252.26	789.11		(Based on 2.80xQ10)
500YR	185.96	1135.43	947.28	

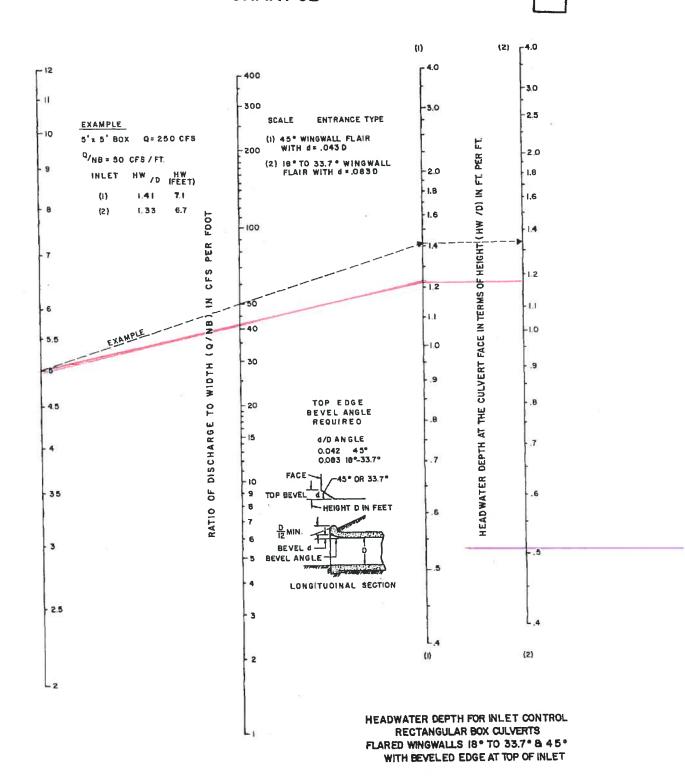
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POLIATIONIC /0/	ECONICACIÓN (%)
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EMA	Y Disharges								
4	FREQUENCY			10YR	50YR	100YR	500YR		
	Discharge Used					500		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	Blue Ridge	(cfs)	212.09	284.22	439.33	510.82	581.52	795.83	1040.26
	Coastal Plain	(cfs)	188.47	262.18	420.68	506.37	592.74	734.09	959.57
20	Sand Hills	(cfs)	130.66	172.05	238.13	282.65	324.38	481.74	629.70
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

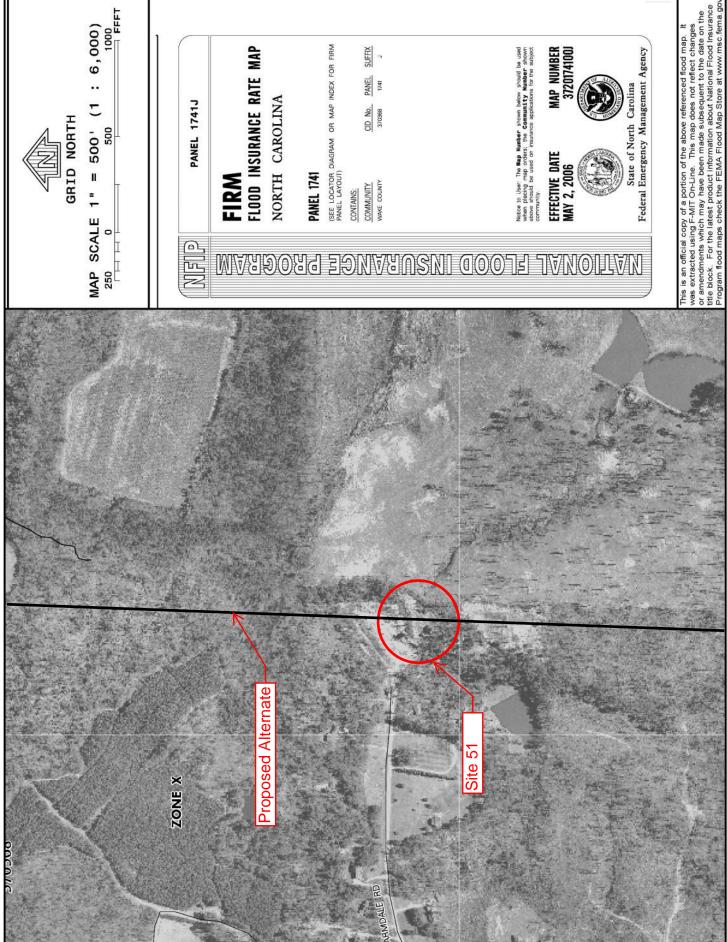


500.000         212.365         4.565         8.583         5.099           500.000         212.365         4.565         8.583         5.099           500.000         212.365         4.565         8.583         5.099           500.000         212.365         4.565         8.583         5.099           500.000         212.365         4.565         8.583         5.099           500.000         212.365         4.565         8.583         5.099           500.000         212.365         4.565         8.583         5.099           500.000         212.365         4.565         8.583         5.099           500.000         212.365         4.565         8.583         5.099           500.000         212.365         4.565         8.583         5.099           500.000         212.365         4.565         8.583         5.099           500.000         212.365         4.565         8.583         5.099	How (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583	200,000	212,365	4.565	8,583	5.099
212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583	200,000	212,365	4,565	8,583	5.099
212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583	200,000	212,365	4.565	8,583	5,099
212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583	200,000	212.365	4.565	8,583	5.099
212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583	200,000	212.365	4.565	8,583	5.099
212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583	200,000	212.365	4,565	8,583	5.099
212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583         212.365       4.565       8.583	200,000	212.365	4,565	8,583	5,099
212.365     4.565     8.583       212.365     4.565     8.583       212.365     4.565     8.583	200,000	212,365	4,565	8,583	5.099
212.365 4.565 8.583 212.365 4.565 8.583	200,000	212.365	4,565	8.583	5.099
212.365 4.565 8.583	200,000	212,365	4.565	8,583	5,099
	200,000	212,365	4.565	8.583	5.099

### **CHART 9B**



$$\frac{Q}{NB} = \frac{500}{(1)(12)} = 41.7$$



		Ne	use River Bas
Name	Index Number	Classification	Class Date
Description		Special	Designation
NEUSE RIVER	27-(75.3)	WS-IV;NSW,CA	08/01/02
From a point 0.6 mile upstream of Lenoir County proposed water supply intake.	er supply intake to Lenoir	County proposed	
NEUSE RIVER	27-(70.5)	WS-IV;NSW	08/01/02
From a point 0.7 mile downstream of the mouth of Coxes Creek County proposed water supply intake.	to a point 0.6 mile upstr	eam of Lenoir	
NEUSE RIVER	27-(55.5)	WS-IV;NSW,CA	08/03/92
From a point 0.8 mile upstream of Little River to City of Goldsbo upstream of Little River)	ro water supply intake (le	ocated 0.4 mile	
NEUSE RIVER	27-(85)	C;Sw,NSW	05/01/88
From mouth of Contentnea Creek to Streets Ferry			
NEUSE RIVER	27-(96)	SC;Sw,NSW	05/01/88
From Streets Ferry to a line across Neuse River from Johnson Po	int to McCotter Point		
IEUSE RIVER	27-(39.3)	WS-IV;NSW,CA	04/01/97
From a point 1.4 mile downstream of Johnston County SR 1908 intake (located 1.9 mile downstream of Johnston County SR 190		osed water supply	
IEUSE RIVER	27-(22.5)	C;NSW	08/03/92
From Town of Wake Forest proposed water supply intake to mo	uth of Beddingfield Creel	<b>(</b>	
IEUSE RIVER	27-(75.7)	C;NSW	08/03/92
From Lenoir County proposed water supply intake to mouth of C	Contentnea Creek.		
IEUSE RIVER (Falls Lake below normal pool elevation)	27-(5.5)	WS-IV,B;NSW,CA	08/03/92
From I-85 bridge to dam at Falls Lake			
IEUSE RIVER (Falls Lake below normal pool elevation)	27-(1)	WS-IV;NSW,CA	08/03/92
From source (confluence of Eno River Arm of Falls Lake and Flat	River Arm of Falls Lake) t	o I-85 bridge	
leuse River Cut-Off	27-59	C;NSW	05/01/88
From source to Neuse River			
leuse-Southeast Pamlico Sound ORW Area	27-148.5	SA;ORW,NSW	01/01/90
All waters within a line beginning at the southwest tip of Ocraco			4 com \$5000 to \$1000000
the Tar-Pamlico River Basin and Neuse River Basin boundary line southwest direction to Ship Point			

**New Light Creek** 

From source to Wake County SR 1911

27-13-(0.1)

WS-IV;NSW

08/01/98

	SITE	51		
			WOODS	n=0.
	16		TB-TB	14.5
WUODS	1/1/		WE WE	
n= 0.16	11/1			4.2
//	//		H20 D	
			OHW	2.0
	11			
	1/1	f-n=0.0	45	
	111			
DEBRIS PO	TENTIAL	. MoDF	RATE	
BED MATER				
RECENT DRI				



Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.



Looking upstream from downstream structure 1@ 9'-6" x 6'-5" CMPA.



Upstream face of downstream structure 1@ 9'-6" x 6'-5" CMPA.

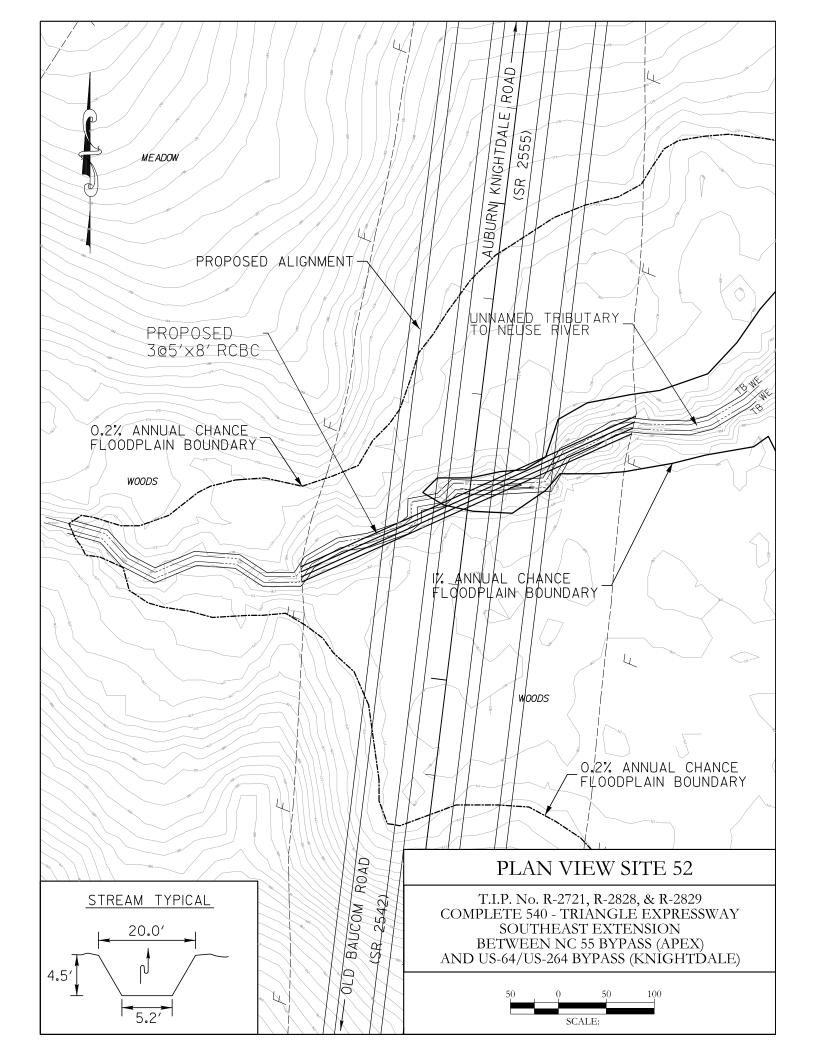


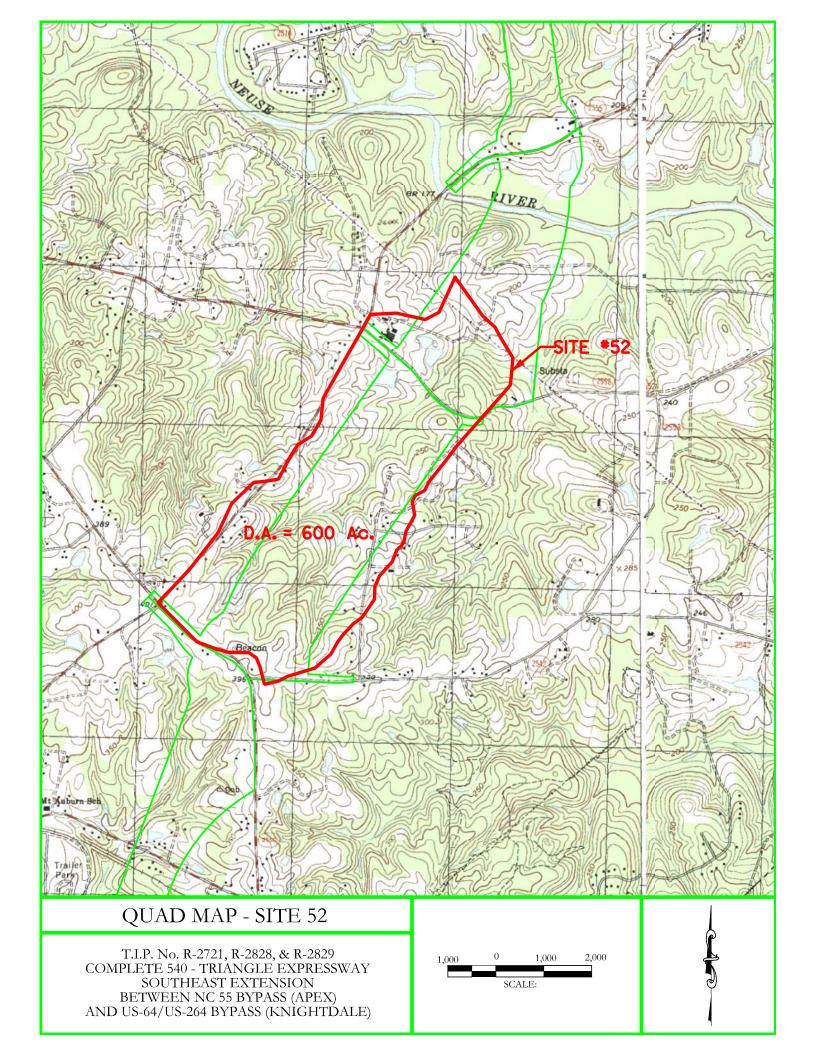
Looking downstream from downstream structure



Downstream face of downstream structure.

# Site 52





	REGION: BLUE RIDGE	Rep. 01-4207
	STREAM NAME: Unnamed to Tributary Neuse River	sq. miles METHOD USED:
3/19/2014	PROJECT NAME: Triangle Expressway SE Ext.	ENGLISH Drainage Area = 0.94

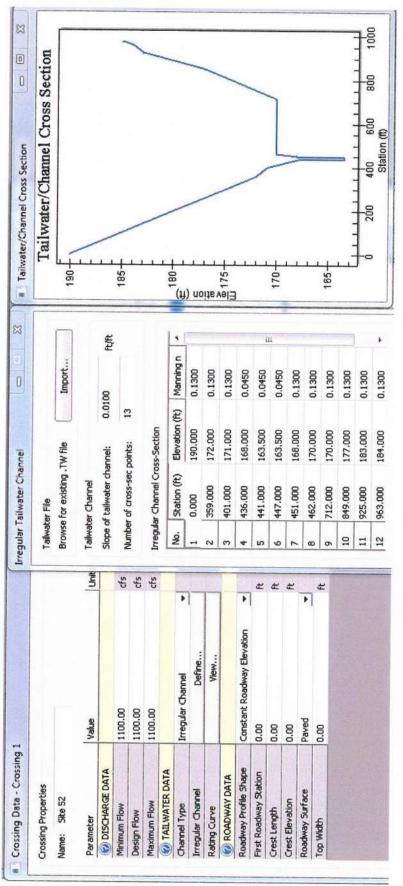
USGS KU	ISGS RURAL REGRE	SSION EQUA	ATIONS (OLD)	RUR	RAL EQUA	TIONS Rec	oort 01-4207
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cts)	(cfs)	(cfs)		(cfs)		(cfs)
2YR	28.34	66.65	137.77	2YR	129.07		32.01
SYR	46.55	143.55	237.59	5YR	231.74		53.06
10YR	61.42	217.09	320.08	10YR	320.14		69 72
25YR	82.15	349.88	447.83	25VR	456 75		93.84
50YR	100.03	474.14	557.32	SOYR	578 02		114 81
100YR	119.99	632.55	690.01	100YR	715 79		136.84
200YR	147.60	828.97	835.14	200YR	872.90		162.70
500YR	174.11	1155.18	1085.83	500YR	1115.94	746.79	201.00

# USGS URBAN REGRESSION EQUATIONS BDF= 11 ( These Equations are used only for comparison)

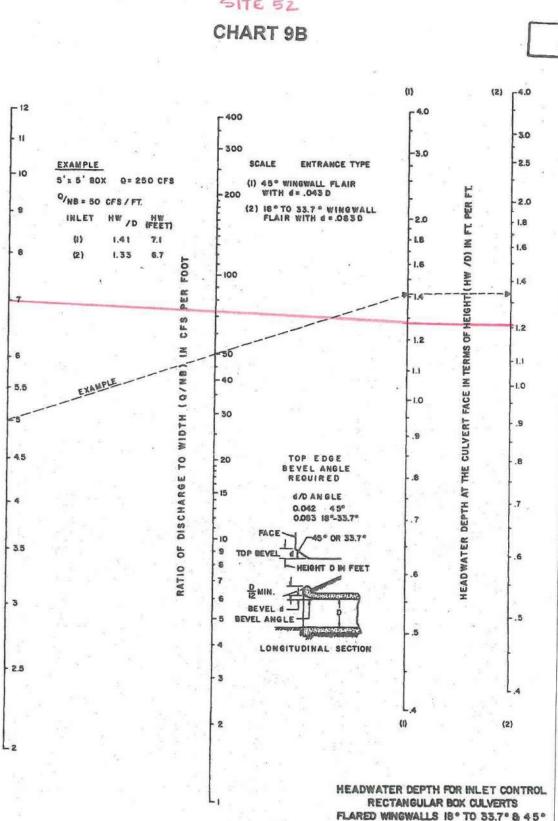
000000	ייים מספים פייים	CIOCUPALION IN		
FREQUENCY	Sand Hills	Coastal Plain		
	(cfs)	(cfs)		
5YR	160.01	385.16		
10YR	189.73	514.41		
25YR	231.05	736.44		
50YR	266.00	938.09		
100YR	309.67	100YR 309.67 1210.30	1299.73	
200YR	531.24	1440.35		(Based on 2.80xQ10)
500YR	413.09	1949.56		

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" Impervious =	30				FEN	MA
REQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Discharge Used	FREQUENCY	Disharges
5YR	331.85	457.60	528.52			
10YR	417.27	603.63	674.33		10VR	
25YR	541.17	887.82	966.00		SOYR	
50YR	627.60	1038.93	1095.21	1100	100YR	
100YR	704.30	1184.43	1216.74		SOOVE	tone
200YR	1168.37	1690.16	1888.11	(Based on 2.80xQ10)	11000	
500YR	1527.22	2209.29	2468.03	(Based on 3.66xQ10)		



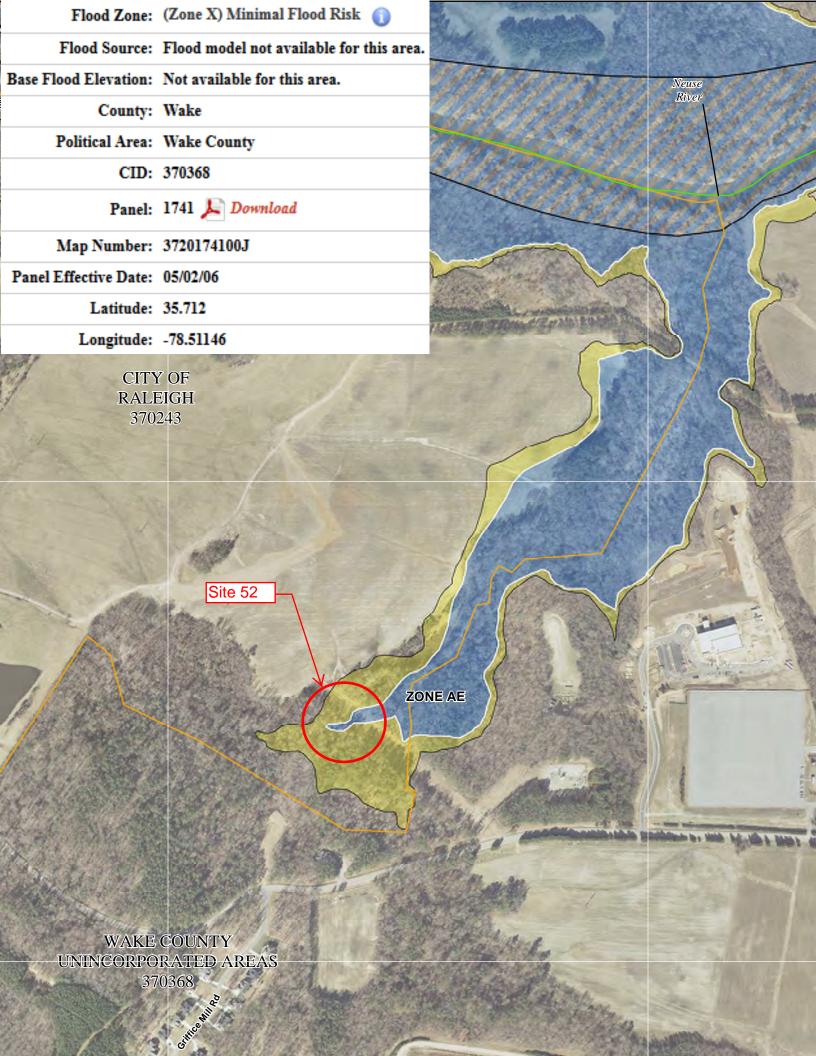
Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s) Shear (psf)	Shear (psf)
1100,000	170.766	7,266	3.142	4.534
1100,000	170.766	7.266	3,142	4.534
1100,000	170.766	7.266	3.142	4.534
1100,000	170.766	7,266	3,142	4.534
1100,000	170.766	7.266	3,142	4.534
1100,000	170.766	7.266	3,142	4.534
1100.000	170.766	7.266	3.142	4.534
1100,000	170.766	7.266	3,142	4.534
1100.000	170.766	7.266	3,142	4.534
1100.000	170.766	7.266	3,142	4.534
1100,000	170.766	7.266	3.142	4.534



$$\frac{Q}{NB} = \frac{1100}{(3)(5)} = 73.3$$

WITH BEVELED EDGE AT TOP OF INLET

	SITE	52		
/	111		TB-TB	20
//			WEINE	
				0.5
10005 n=0.13	1		60	45
n=0.13		1.11	OHW	2.3
		1911	BASE	15
		14/1	2.70	
	11	11	1	1
	1/1	//	n=0.08	
	1//	/	11-0.00	
	11			
2.2.21/2	1			E
N=0.045	1	E		1
	1	1		1
	1)		-	
DEBRIS POT	ENTIAL	MODER	ATE	
BEO MATER	ZIAL	GRAVEL	ISAND	
RECENT DRI			1	



	Ne	use	Rive	er B	asin
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		Nei	use River Basi
Name	Index Number	Classification	Class Date
Description		Special	Designation
NEUSE RIVER	27-(75.3)	WS-IV;NSW,CA	08/01/02
From a point 0.6 mile upstream of Lenoir County proposed water supply intake.	er supply intake to Lenoir	r County proposed	
NEUSE RIVER	27-(70.5)	WS-IV;NSW	08/01/02
From a point 0.7 mile downstream of the mouth of Coxes Creek County proposed water supply intake.	to a point 0.6 mile upstr	ream of Lenoir	
NEUSE RIVER	27-(55.5)	WS-IV;NSW,CA	08/03/92
From a point 0.8 mile upstream of Little River to City of Goldsbo upstream of Little River)	ro water supply intake (I	ocated 0.4 mile	
NEUSE RIVER	27-(85)	C;Sw,NSW	05/01/88
From mouth of Contentnea Creek to Streets Ferry			
NEUSE RIVER	27-(96)	SC;Sw,NSW	05/01/88
From Streets Ferry to a line across Neuse River from Johnson Po	int to McCotter Point		
NEUSE RIVER	27-(39.3)	WS-IV;NSW,CA	04/01/97
From a point 1.4 mile downstream of Johnston County SR 1908 intake (located 1.9 mile downstream of Johnston County SR 190		oosed water supply	
NEUSE RIVER	27-(22.5)	C;NSW	08/03/92
From Town of Wake Forest proposed water supply intake to mo	uth of Beddingfield Cree	k	
NEUSE RIVER	27-(75.7)	C;NSW	08/03/92
From Lenoir County proposed water supply intake to mouth of C	Contentnea Creek.		
NEUSE RIVER (Falls Lake below normal pool elevation)	27-(5.5)	WS-IV,B;NSW,CA	08/03/92
From I-85 bridge to dam at Falls Lake			
NEUSE RIVER (Falls Lake below normal pool elevation)	27-(1)	WS-IV;NSW,CA	08/03/92
From source (confluence of Eno River Arm of Falls Lake and Flat	River Arm of Falls Lake)	to I-85 bridge	
Neuse River Cut-Off	27-59	c;nsw	05/01/88
From source to Neuse River			
Neuse-Southeast Pamlico Sound ORW Area	27-148.5	SA;ORW,NSW	01/01/90
All waters within a line beginning at the southwest tip of Ocraco the Tar-Pamlico River Basin and Neuse River Basin boundary line southwest direction to Ship Point			
New Light Creek	27-13-(2)	WS-IV;NSW,CA	08/01/98
From Wake County SR 1911 to Falls Lake, Neuse River			
New Light Creek	27-13-(0.1)	WS-IV;NSW	08/01/98
From source to Wake County SR 1911			

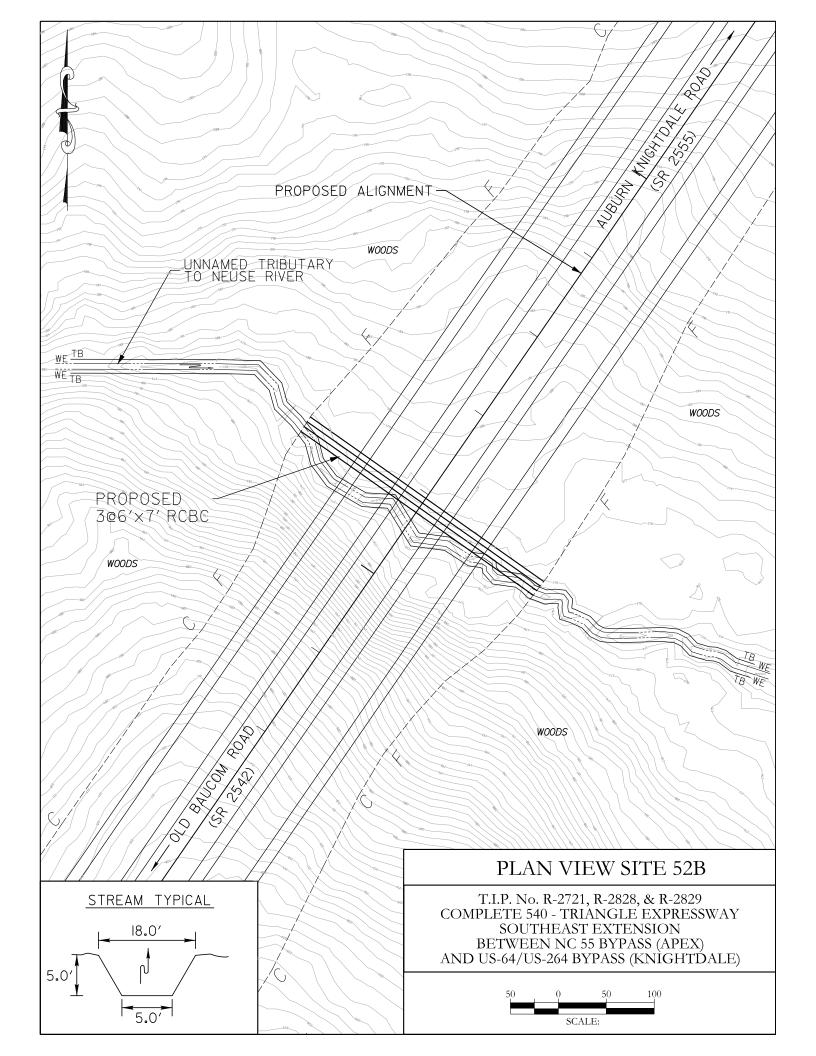


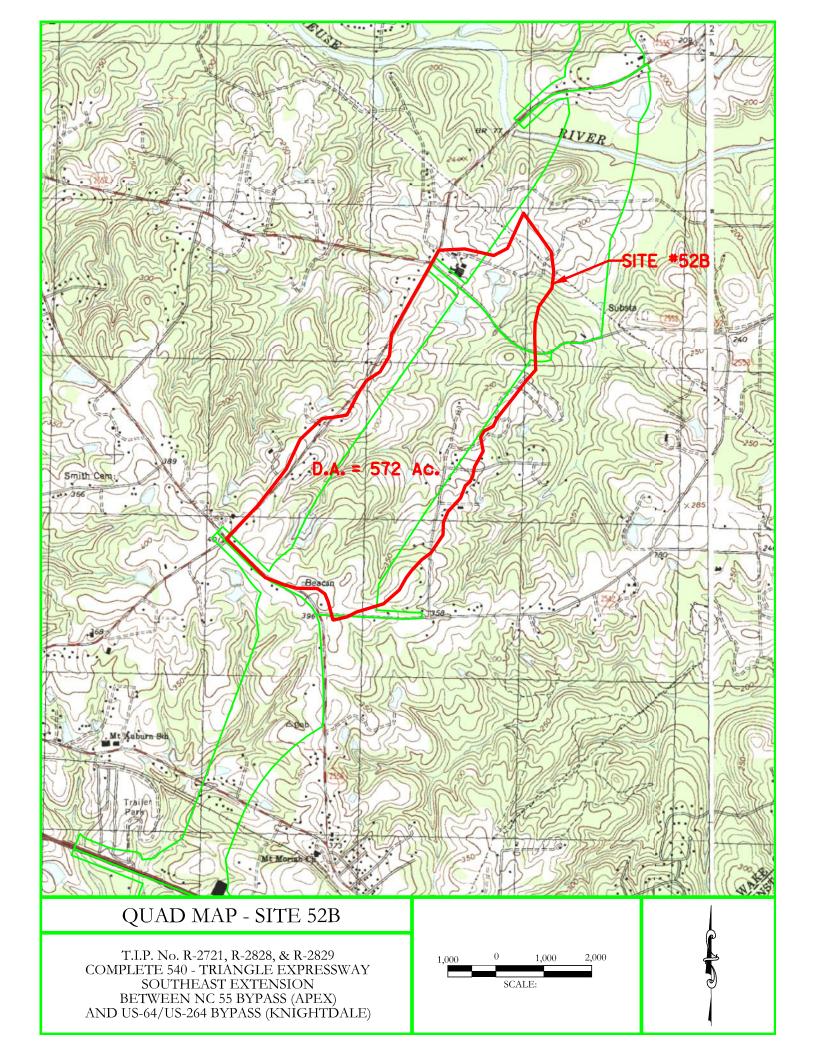
Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

# Site 52B





PROJECT NAME: Tria	ngle Expressway	SE Ext.	STREAM NAME: Unnamed to Tributary Neuse River	REGION: BILLE BIDGE	SILE
ENGLISH Drainag	ge Area =	0.89	sq. miles METHOD USED: F.	act SI	

<b>USGS RURAL</b>	AL REGRE	SSION EQU	ATIONS (OLD)	RUR	AL FOUR	ATIONS Rer	7021-4207	
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills	
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)	
2YR	27.36	64.66	133.27	2YR	124 79	60.00	30 93	
5YR	44.93	139.59	230.06	5YR	224.32	120 14	51.33	
10YR	59.28	211.34	310.02	10VR	310 12	175.14	67.42	
25YR	79.24	341.05	433.95	25VB	442.81	262.04	24.70	
50YR	96.46	462.58	540.19	50VR	560 66	343 05	11106	
100YR	115.68	617.63	669.02	100VR	694 61	439.24	132.30	
200YR	142.28	809.96	809.89	200YR	847 44	550 73	157.42	
500YR	167.72	1129.71	1053.81	500YR	1083.97	727 70	194 51	

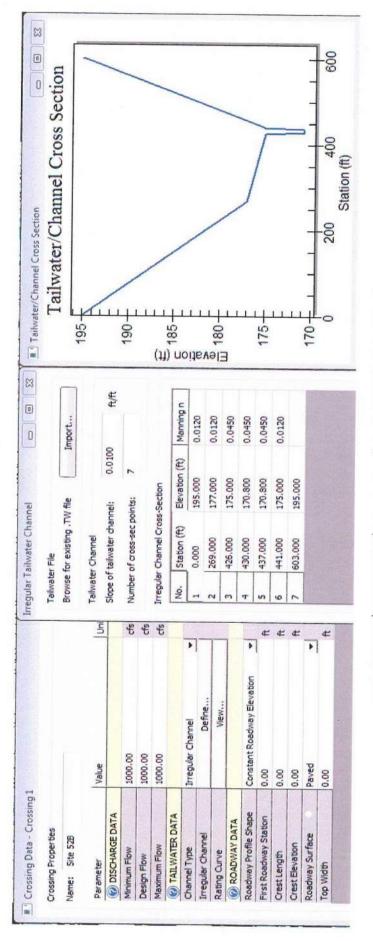
# USGS URBAN REGRESSION EQUATIONS

BDF= 11 (These Equations are used only for comparison)

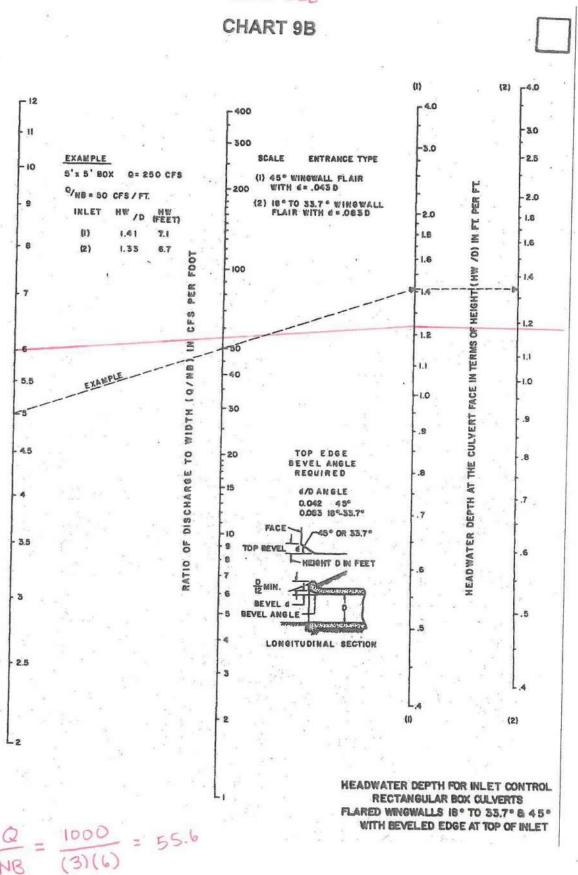
							(Based on 2.80xQ10)	
ш	(cfs)							,
Coastal Plain	(cfs)	373.79	499.76	716.35	912.91	1178.31	1399.32	1899.59
Sand Hills	(cts)	154.38	183.06	222.86	256.42	298.35	512.57	397.55
FREQUENCY Sand Hills Coastal Plain		5YR	10YR	25YR	50YR	100YR	200YR	500YR

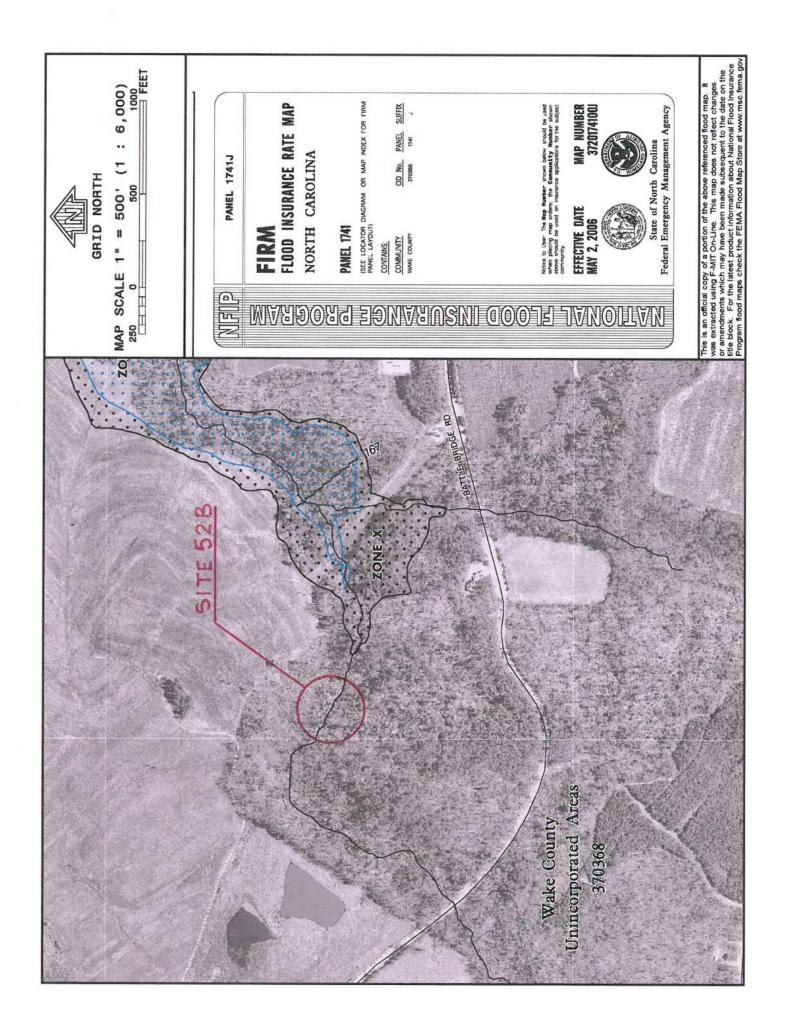
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% Impervious =	25				FEMA	MM
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Blue Ridge Discharge Used	FREDIENCY	Diehara
	(cfs)	(cfs)	(cfs)		DATE OF THE PERSON NAMED IN COLUMN 1	Disilarye
5YR	289.09	399.51	460.85			
10YR	367.72	533.28	594.87		40VD	
25YR	484.59	797.83	866.37		AVA	500
50YR	566.29	941.00	989.88	1000	100VP	1000
100YR	640.13	1080.81	1107.84		STOOL	200
200YR	1029.61	1493.17	1665.65	(Based on 2.80xQ10)	NI POO	
500YR	1345.85	1951.79	2177.24	(Based on 3.66xQ10)		



Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
000	176.176	5.376	8.082	3.355
1000.0001	176.176	5.376	8.082	3.355
000	176.176	5.376	8.082	3.355
000	176.176	5.376	8.082	3.355
1000.0001	176.176	5.376	8.082	3.355
000	176.176	5.376	8.082	3.355
000	176,176	5.376	8.082	3.355
1000,000	176.176	5.376	8.082	3,355
1000,000	176.176	5.376	8.082	3.355
1000,000	176.176	5.376	8.082	3,355
1000,000	176.176	5.376	8.082	3.355





		Ne	use River Basiı
Name	Index Number	Classification	Class Date
Description		Special	Designation
NEUSE RIVER	27-(75.3)	WS-IV;NSW,CA	08/01/02
From a point 0.6 mile upstream of Lenoir County proposed water water supply intake.	r supply intake to Lenoi	County proposed	
IEUSE RIVER	27-(70.5)	WS-IV;NSW	08/01/02
From a point 0.7 mile downstream of the mouth of Coxes Creek County proposed water supply intake.	to a point 0.6 mile upstr	eam of Lenoir	
IEUSE RIVER	27-(55.5)	WS-IV;NSW,CA	08/03/92
From a point 0.8 mile upstream of Little River to City of Goldsbor upstream of Little River)	o water supply intake (I	ocated 0.4 mile	
IEUSE RIVER	27-(85)	C;Sw,NSW	05/01/88
From mouth of Contentnea Creek to Streets Ferry			
EUSE RIVER	27-(96)	SC;Sw,NSW	05/01/88
From Streets Ferry to a line across Neuse River from Johnson Point	nt to McCotter Point		
IEUSE RIVER	27-(39.3)	WS-IV;NSW,CA	04/01/97
From a point 1.4 mile downstream of Johnston County SR 1908 to intake (located 1.9 mile downstream of Johnston County SR 1908	o Johnston County prop 3)	osed water supply	
EUSE RIVER	27-(22.5)	C;NSW	08/03/92
From Town of Wake Forest proposed water supply intake to mou	th of Beddingfield Creel	k	
EUSE RIVER	27-(75.7)	C;NSW	08/03/92
From Lenoir County proposed water supply intake to mouth of Co	ontentnea Creek.		
EUSE RIVER (Falls Lake below normal pool elevation)	27-(5.5)	WS-IV,B;NSW,CA	08/03/92
From I-85 bridge to dam at Falls Lake			
EUSE RIVER (Falls Lake below normal pool elevation)	27-(1)	WS-IV;NSW,CA	08/03/92
From source (confluence of Eno River Arm of Falls Lake and Flat R	tiver Arm of Falls Lake) t	o I-85 bridge	
euse River Cut-Off	27-59	C;NSW	05/01/88
From source to Neuse River			Brand Mark Constitution of Constitution
euse-Southeast Pamlico Sound ORW Area	27-148.5	SA;ORW,NSW	01/01/90

Neuse-	Sout	heas
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52B

the Tar-Pamlico River Basin and Neuse River Basin boundary line to Lat. 35 06'50, Long 76 06'30, thence in a southwest direction to Ship Point

# **New Light Creek**

27-13-(2)

WS-IV;NSW,CA

08/01/98

From Wake County SR 1911 to Falls Lake, Neuse River

### **New Light Creek**

27-13-(0.1)

WS-IV;NSW

08/01/98

From source to Wake County SR 1911

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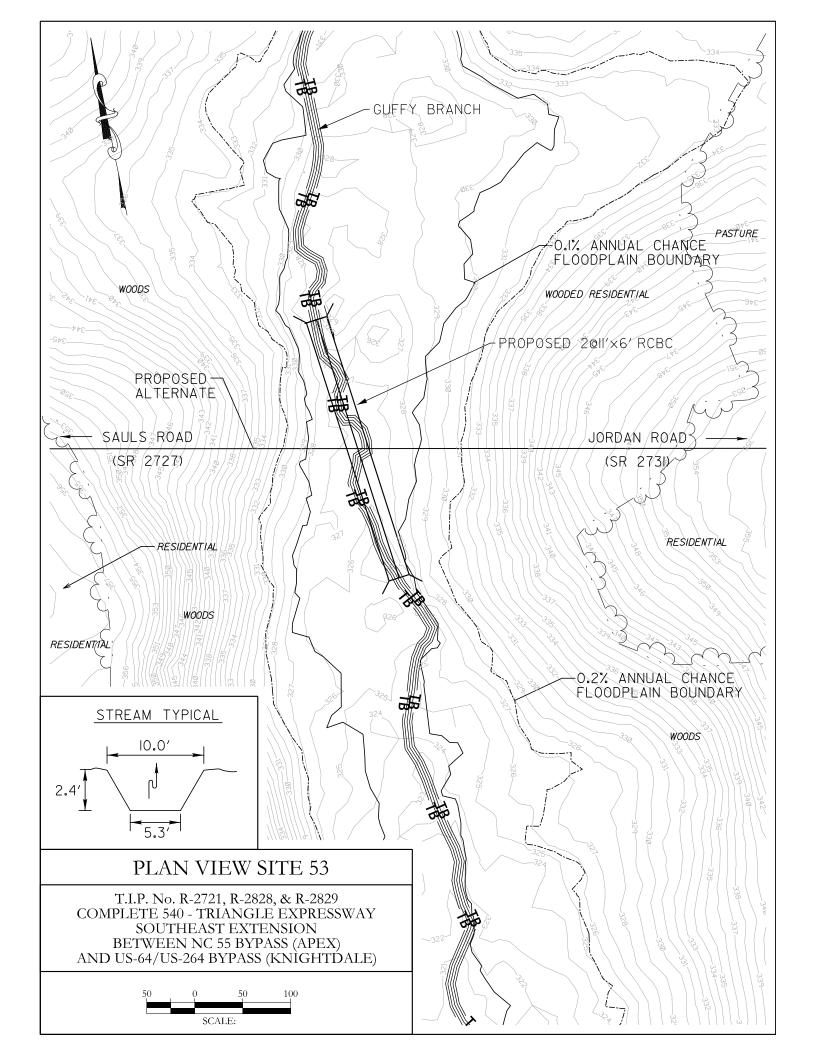


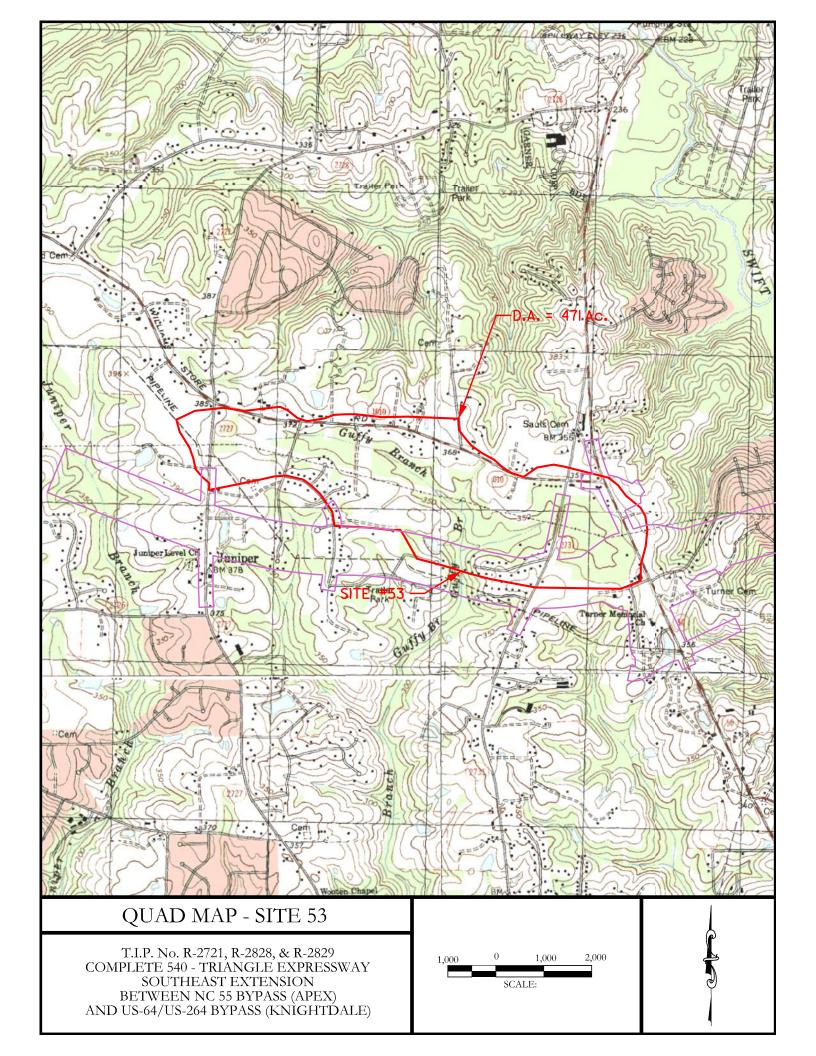
Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

# Site 53





Site #53

4/17/2014

REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00 STREAM NAME: Guffy Branch sq. miles PROJECT NAME: Triangle Expressway SE Ext.

Orange Area = 0.74 ENGLISH

JSGS RURAL REGRESSION EQUION           FREQUENCY         Sand Hills         Coastal Plain           2YR         (cfs)         (cfs)           5YR         39.08         125.05           10YR         51.54         190.14           25YR         68.75         308.42           50YR         83.60         419.74           100YR         100.14         562.24           200YR         123.15         739.27		FREQUENCY  2YR 5YR 10YR 25YR 50YR 200YR	Elue Ridge (cfs) 109.28 197.37 273.64 391.98 497.23 617.20	KURAL EQUATIONS Report 01-4207           QUENCY         Blue Ridge         Coastal Plain         Sand Hills           CYR         (CfS)         (CfS)           CYR         109.28         52.83         27.04           SYR         197.37         106.55         44.94           OYR         273.64         156.22         59.10           SOYR         391.98         235.05         79.62           SOYR         497.23         308.28         97.46           OOYR         617.20         394.67         116.24           OOYR         754.28         495.97         138.27	Sand Hills (cfs) 27.04 44.94 59.10 79.62 97.46 116.24
1034	83 036 72	SOUVE	066 81	657 20	170 01

# **USGS URBAN REGRESSION EQUATIONS**

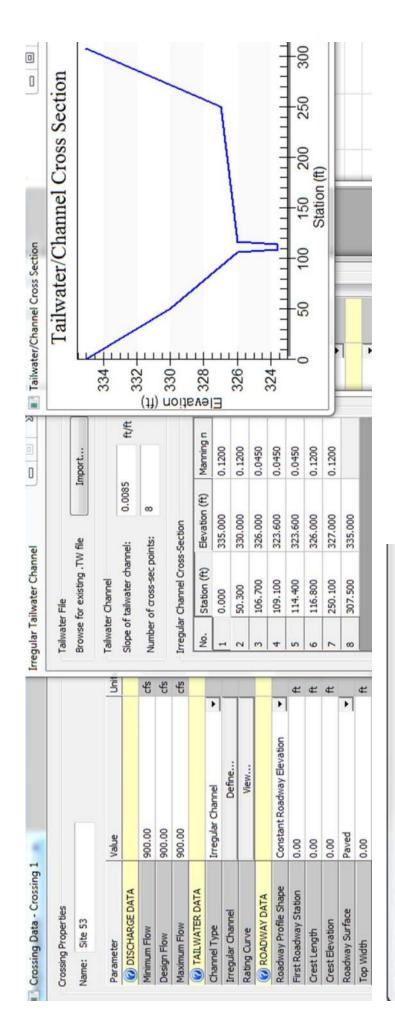
BDF=

(These Equations are used only for comparison)

								(Based on 2.80xQ10)	
	Щ	(cfs)							1580.55
ioi compansoni)	Coastal Plain	(cfs) (cfs)	332.20	446.03	642.49	820.21	1060.43	1248.88	1715.07
IIIS AIE USEU OIIIS	Sand Hills	(cfs)	134.08	159.02	193.37	221.97	257.65	445.26	341.88
( These Eduations	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

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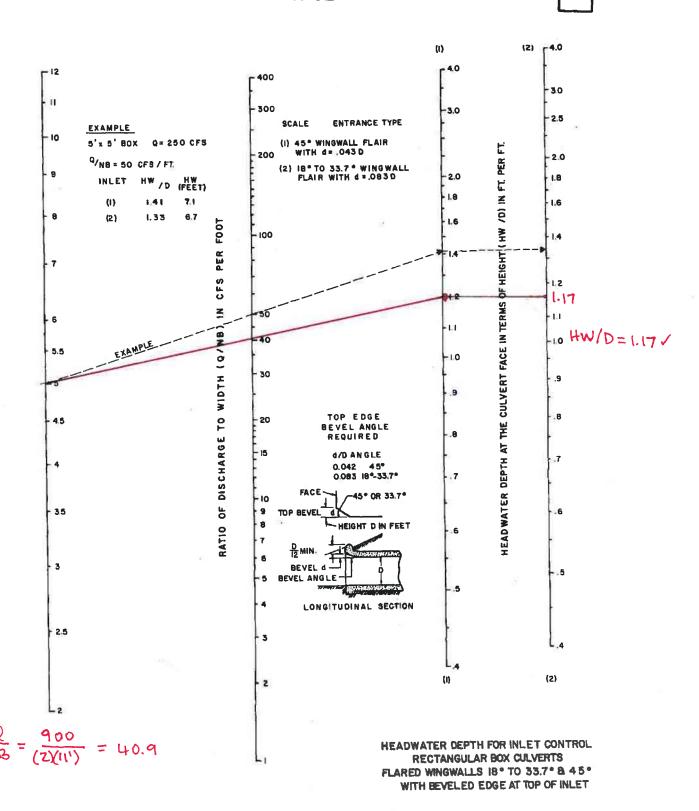
FEMA	REQUENCY Disharges			10YR	50YR	100YR 410	00YR (Future) 762	500YR	
	FRE						101		
	Blue Ridge Discharge Used					006		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	<b>Blue Ridge</b>	(cfs)	405.18	525.59	771.86	883.39	990.35	1471.65	1923.65
	Coastal Plain	(cfs)	352.98	473.84	716.33	846.79	974.63	1326.76	1734.27
25	Sand Hills	(cfs)	253.26	323.54	429.04	502.03	568.25	905.92	1184.16
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR



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Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
000.006	328.577	4.977	2.386	2.640
900.006	328.577	4.977	2.386	2.640
900.006	328.577	4.977	2.386	2.640
900.006	328.577	4.977	2.386	2.640
900.006	328.577	4.977	2.386	2.640
900.000	328.577	4.977	2.386	2.640
900.006	328.577	4.977	2.386	2.640
900.000	328.577	4.977	2.386	2.640
900.006	328.577	4.977	2.386	2.640
900.006	328.577	4.977	2.386	2.640
900.000	328.577	4.977	2.386	2.640





# PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake	PROJECT NUMBER	R-2721, R-2828 & R-2829
	Branch ROUTE New Location e 53)	<u>n</u>
,	REPARED BY Mulkey, INC. (WBP)	DATE <u>2/7/2014</u>
	HYDROLOGIC EV.	'ALUATION
NEAREST GAGIN	NG STATION ON THIS STREAM	M (NONE <u>X</u> )
ARE FLOOD STU	UDIES AVAILABLE ON THIS ST	TREAM: Yes
Q <sub>50</sub> <u>900</u> CFS		750 CFS EST. BKWTR. <u>N/A</u> FT. ,000 CFS EST. BKWTR. <u>N/A</u> FT.
DRAINAGE ARE	A <u>0.74 Sq.Mi.</u> METHOD USED 7	TO COMPUTE Q: <u>USGS Urban Regression</u>
	PROPERTY RELATED	<u>EVALUATIONS</u>
DAMAGE POTEN	NTIAL: LOW MODE	RATE X HIGH
COULD TI	HIS BE SIGNIFICANTLY INCRI	EASED BY PROPOSED
ENCROAC	CHMENT: YES	NO <u>X</u>
	maximum one foot rise in the nat ny existing insurable structures.	tural base flood is allowed, but this rise
LIST BUIL	DINGS IN FLOOD PLAIN: <u>Non</u>	ne LOCATION:
	M LAND USE: <u>Residential</u> TE ANY CHANGE? <u>No</u>	
ANY FLOO	OD ZONING? (FIA STUDIES, E	TC.) YES <u>X</u> NO
TYPE OF S	STUDY: FEMA – N/A	
REGULAT	ORY FLOODWAY WIDTH <u>N/A</u>	A (Limited Detail)
COMMEN'	TS:	

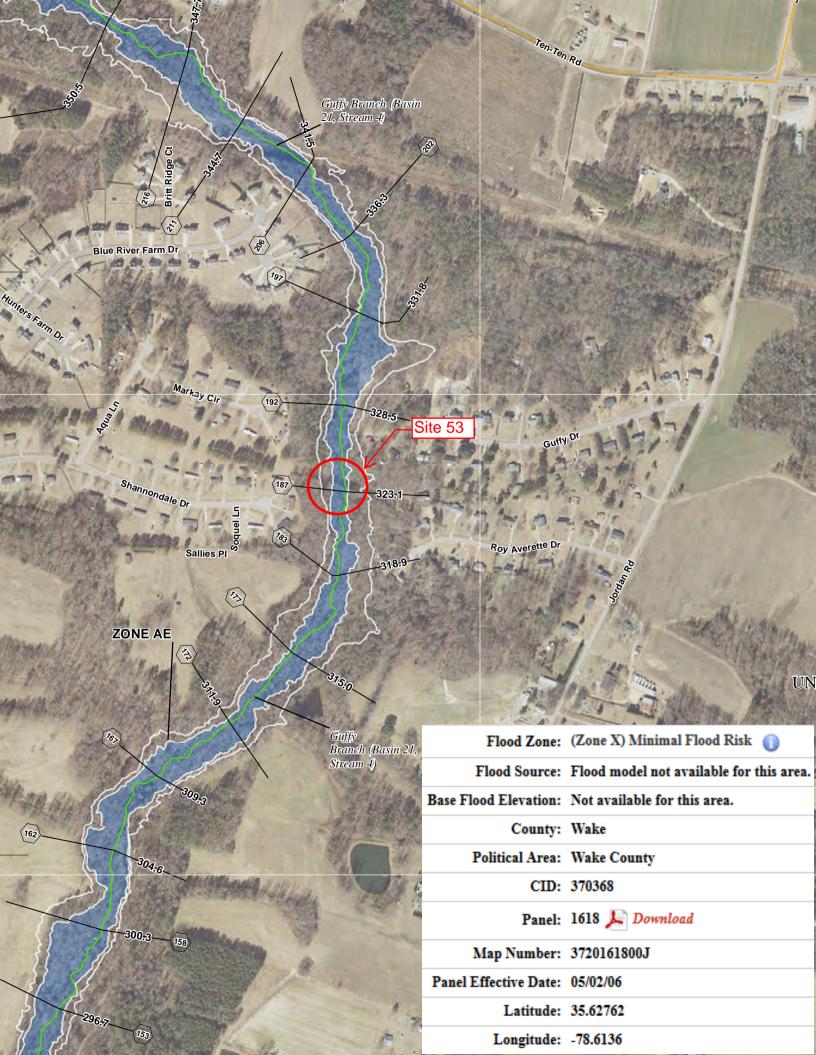
## TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 14,200 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 44,800 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? <u>N/A New Location</u> LENGTH OF DETOUR <u>N/A</u> MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? N/A
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS  NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE <u>X</u> ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE: Wehadkee, Bibb and Appling TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from Web Soil Survey website of Wake County, NC.

**ENVIRONMENTAL CONSIDERATIONS** 

LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: <u>Buried culverts 1 foot to allow for fish passage.</u>

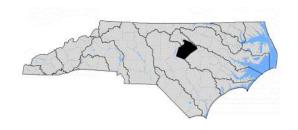
# MISCELLANEOUS COMMENTS



# PRELIMINARY FLOOD INSURANCE STUDY

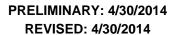
# FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

State of North Carolina

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed

Source	Riverin	e Sources	Affected Communties		
	From	То			
Buckhorn Creek	The confluence with Harris Reservoir	Approximately 0.5 mile upstream of Honeycutt Road	Rdu Town Of Holly Springs Wake County  Rdu Wake County  Rdu Town Of Holly Springs Wake County		
Buffalo Creek (Basin 9, Stream 1)	State Highway 42	The Johnston/Wake County boundary			
Cary Branch	The confluence with Harris Reservoir	Approximately 2.5 miles upstream of Rex Road			
Guffy Branch (Basin 21, Stream 4)	The confluence with Little Creek (Basin 21, Stream 1)	Approximately 4.3 miles upstream of confluence with Little Creek (Basin 21, Stream 1)	Rdu Wake County		
Reservoir	Entire shoreline within Chatham County	Entire shoreline within Chatham County	Rdu Wake County		
Jim Branch	The confluence with Harris Reservoir	Approximately 0.5 mile upstream of confluence with Harris Reservoir	Rdu Wake County		
Juniper Branch (Basin 21, Stream 2)	The confluence with Little Creek (Basin 21, Stream 1)	Approximately 0.8 mile upstream of Pagen Road	Rdu Wake County		
Little Black Creek	The confluence with Black Creek	Approximately 0.6 mile upstream of Walter Myatt Road	Rdu Wake County		
Little Creek (Into Middle Creek)	The confluence with Middle Creek	Approximately 2.3 miles upstream of the confluence of Juniper Branch	Rdu Wake County		
Marks Creek	The confluence with the Neuse River	Approximately 0.8 mile downstream of Knightdale Eagle Rock Road	Rdu Town Of Clayton Town Of Wendell Wake County		
Nancy Branch	Approximately 0.4 mile upstream of confluence with Panther Creek  Approximately 0.1 miles upstream of Del Webb Avenue  Town Of Ca		Town Of Cary		
		Approximately 500 feet upstream of Avent Ferry Road	Rdu Town Of Holly Springs Wake County		
Snipes Creek The confluence with the Little River		Approximately 0.6 mile upstream of State Highway 96	Rdu Town Of Zebulon Wake County		
Thomas Creek The confluence with Harris Reservoir		Approximately 100 feet downstream of Highway 1	Rdu Wake County		

Table 11, "Stream Name Changes" is not applicable in Wake County.

This FIS also incorporates the determinations of letters issued by FEMA resulting in map changes (Letters of Map Revision [LOMRs]), as shown in Table 12, "Letters of Map Revision".

**Table 12 - Letters of Map Revision** 

Case Number	Date Issued	Flooding Source/Description	Communities
06-04-C341P	12/3/2007	Marks Creek / 06-04-C341P	Rdu
06-04-C341P	12/3/2007	Marks Creek / 06-04-C341P	Town Of Wendell
07-04-2076P	4/13/2007	Panther Creek / 07-04-2076P	Town Of Cary

# 5.0 Engineering Methods

For the flooding sources in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded at least once on the average during any 10-, 25-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2% annual chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedance) during the term of a 30-year mortgage is approximately 26 percent (about 3 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

**Table 13 - Summary of Discharges** 

Flooding Source Discharges (cfs)						
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annu Chance	
Approximately 0.8 mile upstream of Highway 1	0.10	*	*	198	*	
Black Creek						
Approximately 0.6 mile downstream of Wake/Johnston County boundary	14.50	*	*	2,130	*	
Buckhorn Creek						
Approximately 250 feet upstream of Cass Holt Road	11.40	*	*	3,395	*	
Approximately 1,580 feet downstream of Sweet Springs Road	10.20	*	*	3,176	*	
Just downstream of Sweet Springs Road	8.70	*	*	2,887	*	
Approximately 0.6 mile upstream of Sweet Springs Road	8.50	*	*	2,842	*	
Approximately 1.6 miles upstream of Sweet Springs Road	7.90	*	*	2,704	*	
Approximately 1.2 miles downstream of Buckhorn Duncan Road	5.90	*	*	2,268	*	
Approximately 0.8 mile downstream of Buckhorn Duncan Road	5.60	*	*	2,180	*	
Approximately 0.4 mile downstream of Buckhorn Duncan Road	5.30	*	*	2,105	*	
Approximately 180 feet downstream of Buckhorn Duncan Road	3.10	*	*	1,508	*	
Approximately 1,060 feet upstream of Buckhorn Duncan Road	2.80	*	*	1,429	*	
Approximately 0.4 mile upstream of Buckhorn Duncan Road	2.70	*	*	1,396	*	
Buffalo Branch (Basin 10, Stream 22)						
At Morphus Bridge Road	0.40	*	*	600	*	
Buffalo Creek (Basin 9, Stream 1)						
At County boundary	18.40	*	*	5,300	*	
Buffalo Creek West						
At Johnston-Wake County Boundary	1.81	251	442	542	778	
Cary Branch						
Approximately 0.8 mile downstream of Rex Road	4.50	*	*	1,904	*	
Approximately 1,060 feet downstream of Rex Road	4.20	*	*	1,822	*	
Just upstream of confluence with Cary Branch Tributary	2.10	*	*	1,188	*	
Approximately 1,580 feet upstream of confluence with Cary Branch Tributary	1.70	*	*	1,028	*	
Guffy Branch (Basin 21, Stream 4)						
At confluence with Little Creek (Basin 21, Stream 1)	4.02	*	*	1,029	*	
At downstream side of Sauls Road	3.32	*	*	923	*	
Approximately 0.7 mile upstream of Sauls Road	2.89	*	*	853	*	
Approximately 1.3 miles upstream of Sauls Road	2.38	*	*	764	*	
Approximately 2.1 miles upstream of Sauls Road	1.84	*	*	660	*	
Jim Branch						
3 pproximately 0.4 mile upstream of confluence with Buckhorn Creek	1.80	*	*	1,082	*	
Approximately 0.8 mile upstream of confluence with Buckhorn Creek	1.60	*	*	1,011	*	
Approximately 1.2 miles upstream of confluence with Buckhorn Creek	1.20	*	*	816	*	
Juniper Branch (Basin 21, Stream 2)						
At confluence with Little Creek (Basin 21, Stream 1)	2.03	*	*	700	*	
Approximately 530 feet downstream of Pagan Road	1.59	*	*	607	*	
Approximately 1,580 feet upstream of Pagan Road	1.36	*	*	557	*	
Approximately 530 feet downstream of Lakefield Drive	1.08	*	*	489	*	
Kit Creek						

**Table 16 - Roughness Coefficients** 

Stream	Channel "n"	Overbank "n"
Beaver Creek	0.043 to 0.050	0.100 to 0.200
Beddingfield Creek	0.050	0.130
Big Branch	0.050	0.140
Black Creek	0.025 to 0.060	0.030 to 0.150
Buckhorn Creek	0.040 to 0.048	0.145
Buffalo Creek (Basin 9, Stream 1)	0.030 to 0.070	0.035 to 0.140
Buffalo Creek West	0.045 to 0.052	0.030 to 0.140
Cary Branch	0.040	0 140
Guffy Branch (Basin 21, Stream 4)	0.047	0.130
Jim Bra <mark>ro</mark> h	0.045	0.145
unipe Branch (Basin 21, Stream 2)	0.045	0.110 to 0.130
t Creek	0.030 to 0.070	0.070 to 0.110
Little Beaver Creek	0.045 to 0.055	0.100 to 0.220
Little Black Creek	0.030 to 0.070	0.070 to 0.130
Little Creek (Basin 11, Stream 2)	0.030 to 0.080	0.070 to 0.150
Little Creek (Into Middle Creek)	0.033 to 0.047	0.095 to 0.140
Little River	0.040 to 0.066	0.070 to 0.240
Marks Creek	0.025 to 0.070	0.070 to 0.130
Middle Creek	0.042 to 0.050	0.030 to 0.140
Mill Branch	0.050	0.030 to 0.150
Mill Creek (South)	0.035 to 0.060	0.040 to 0.160
Moccasin Creek	0.030 to 0.070	0.070 to 0.220
Morris Branch	0.030 to 0.050	0.100 to 0.200
Nancy Branch	0.045 to 0.050	0.120 to 0.150
Neuse River	0.035 to 0.060	0.055 to 0.250
Norris Branch	0.048	0.145
Panther Creek	0.030 to 0.070	0.070 to 0.130
Reedy Branch (Basin 27, Stream 5)	0.045 to 0.050	0.100 to 0.200
Snipes Creek	0.042 to 0.045	0.120 to 0.130
Swift Creek	0.040 to 0.072	0.035 to 0.240
Thomas Creek	0.050	0.145
Unnamed Tributary (#1) to Swift Creek	0.045 to 0.060	0.050 to 0.150
White Oak Creek	0.035 to 0.050	0.035 to 0.150

For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained using digital elevation data obtained with LIDAR technology developed as part of the North Carolina Statewide Floodplain Mapping Program. The hydraulic model is prepared using this digital elevation data, without surveying bathymetric or structural data. Where bridge or culvert data are readily available, such as from the North Carolina Department of Transportation, these data have been reflected in the hydraulic model. If these structural data are not readily available, field measurements of these structures were made to approximate their geometry in the hydraulic models. In addition, this method does not include field surveys that determine specifics on channel and floodplain characteristics. A limited detailed study is a "buildable" product that can be upgraded to a fully detailed study at a later date by verifying stream channel characteristics, bridge and culvert opening geometry, and by analyzing multiple recurrence intervals.

The results of the HEC-RAS computations are tabulated for all cross sections (Table 17, "Limited Detailed Flood Hazard Data"). Flood Profiles have not been developed for streams studied by limited detailed methods. Water-surface elevation rasters were developed for steams studied by limited detailed methods. In addition, floodways for streams studied by limited detailed methods are not delineated on the FIRM. However, the 1% annual chance water-surface elevations, flood discharges, and non-encroachment widths from the limited detailed studies for every modeled cross section are given in Table 17. The non-encroachment widths given at modeled cross sections can be used by communities to enforce floodplain management ordinances that meet the requirement defined in 44 CFR 60.3(c)(10).

Between cross sections for streams studied by limited detailed methods, 1% annual chance water-surface elevations can be calculated by mathematical interpolation using the distance along the stream centerline. Non-encroachment widths and, therefore, the location of a non-encroachment area boundary between cross sections should be determined based on either 1) mathematical interpolation, or 2) the non-encroachment width at the upstream or downstream cross section, whichever is larger. If the width determined by this second method is wider than the Special Flood Hazard Area (SFHA) or the 1% annual chance floodplain delineated on the FIRM for this location along the stream, the non-encroachment area shall be considered to

Table 17 - Limited Detailed Flood Hazard Data

	<u> </u>	<u>imited Detailed Flo</u> c	od Hazard Data	
Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water- Surface Elevation (feet NAVD 88)	Non-Encroachment Width (feet) Left/Right from Stream Centerline
046	4,623	1,822	238.7	80 / 197
050	4,961	1,822	239.0	150 / 94
052	5,250	1,188	239.4	33 / 100
057	5,677	1,188	240.2	14 / 53
060	5,969	1,188	241.9	14 / 57
063	6,327	1,188	243.3	14 / 24
069	6,851	1,028	246.3	92 / 14
073	7,303	1,028	248.2	65 / 13
078	7,812	1,028	251.1	13 / 14
Guffy Branch (Basin 21, S			20111	107 11
005	500	1,029	231.31	121 / 97
010	1,028	1,029	233.3	16 / 109
015	1,500	1,029	235.6	23 / 32
021	2,140	923	238.4	-9,999 / -9,999
022	2,175	923	238.4	-9,999 / -9,999
027	2,749	923	241.8	22 / 44
033	3,290	923	246.1	53 / 33
039	3,855	923	247.6	37 / 158
044	4,374	923	249.1	5 / 175
049	4,860	923	250.9	31 / 53
053	5,340	923	252.5	94 / 16
058	5,775	923	253.9	12 / 22
063	6,275	853	256.4	28 / 8
068	6,775	853	258.5	60 / 15
073	7,275	853	260.2	41 / 74
078	7,775	853	262.2	4 / 159
083	8,275	853	264.0	40 / 103
088	8,775	853	266.4	38 / 80
092	9,228	853	268.9	77 / 34
098	9,793	764	271.0	70 / 110
103	10,342	764	272.6	3 / 116
108	10,801	764	275.4	45 / 99
113	11,314	764	278.1	35 / 76
118	11,821	764	280.5	111 / 6
123	12,321	764	282.3	66 / 34
128	12,801	764	284.2	81 / 7
143	14,269	660	291.3	93 / 11
148	14,769	517	293.7	40 / 31
153	15,269	517	296.7	2/108
221	22,065	287	350.5	6/4
226	22,633	287	354.7	25 / 45
Vim Site 53	,			
002 Site 55	227	1,082	232.21	13 / 147
006	568	1,082	232.21	13 / 80
009	871	1,082	232.21	44 / 20
012	1,221	1,082	232.21	21 / 45

# **FLOOD INSURANCE STUDY**

### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





**Table 17 - Limited Detailed Flood Hazard Data** 

		<u>-imited Detailed Floo</u>		
Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water- Surface Elevation (feet NAVD 88)	Non-Encroachment Width (feet) Left/Right from Stream Centerline
065	6,522	710	321.2	8 / 10
072	7,225	710	336.0	10 / 12
075	7,518	710	336.7	18 / 55
Fowlers Mill Creek (Basin	10, Stream 12)			T
006	648	3,101	266.3 <sup>1</sup>	158 / 90
011	1,086	3,101	266.31	191 / 90
015	1,472	3,101	266.3 <sup>1</sup>	100 / 125
020	2,033	3,101	266.3	50 / 150
026	2,584	3,101	267.2	200 / 90
030	3,023	3,101	267.9	170 / 80
039	3,949	3,101	272.6	37 / 200
044	4,390	3,101	274.2	209 / 202
050	5,048	3,101	275.9	209 / 202
055	5,530	3,101	277.5	209 / 202
071	7,092	2,556	286.0	431 / 273
081	8,130	1,590	286.1	276 / 428
088	8,753	1,590	289.9	35 / 30
093	9,275	1,590	298.5	48 / 126
098	9,787	1,373	301.9	116 / 50
103	10,335	1,373	308.5	30 / 50
107	10,653	1,373	312.6	26 / 35
Guffy Branch (Basin 21, S	tream 4)			
005	500	1,029	231.3 <sup>1</sup>	121 / 97
010	1,028	1,029	233.3	16 / 109
015	1,500	1,029	235.6	23 / 32
027	2,749	923	241.8	22 / 44
033	3,290	923	246.1	53 / 33
039	3,855	923	247.6	37 / 158
044	4,374	923	249.1	5 / 175
049	4,860	923	250.9	31 / 53
053	5,340	923	252.5	94 / 16
058	5,775	923	253.9	12 / 22
063	6,275	853	256.4	28 / 8
068	6,775	853	258.5	60 / 15
073	7,275	853	260.2	41 / 74
078	7,775	853	262.2	4 / 159
083	8,275	853	264.0	40 / 103
088	8,775	853	266.4	38 / 80
092	9,228	853	268.9	77 / 34
098	9,793	764	271.0	70 / 110
103	10,342	764	272.6	3 / 116
108	10,801	764	275.4	45 / 99
113	11,314	764	278.1	35 / 76
118	11,821	764	280.5	111 / 6
123	12,321	764	282.3	66 / 34
128	12,801	764	284.2	81 / 7
	1.2,001		1-01.2	10.,,

**Table 17 - Limited Detailed Flood Hazard Data** 

	Table 17 - Li	mited Detailed Floo	d Hazard Data	
Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water- Surface Elevation (feet NAVD 88)	Non-Encroachment Width (feet) Left/Right from Stream Centerline
133	13,331	660	286.7	7 / 128
138	13,812	660	288.8	49 / 51
143	14,269	660	291.3	93 / 11
148	14,769	517	293.7	40 / 31
153	15,269	517	296.7	2 / 108
158	15,793	517	300.3	2 / 99
162	16,224	517	304.6	2 / 61
167	16,728	517	309.3	46 / 26
172	17,234	452	311.9	22 / 4
177	17,734	452	315.0	50 / 10
183	18,276	410	318.9	4 / 27
187	18,745	410	323.1	8 / 14
	19,212	410	328.5	17 / 13
53	19,743	287	331.8	27 / 9
202	20,196	287	336.3	4/7
206	20,648	287	341.5	20 / 60
211	21,068	287	344.7	14 / 13
216	21,565	287	347.7	15 / 90
221	22,065	287	350.5	6/4
226	22,633	287	354.7	25 / 45
Hodges Creek (Basin 8, Str	1 '		334.7	257 45
154	15,401	2,390	221.9	120 / 50
160	15,980	2,390	223.6	52 / 27
163	16,293	2,390	226.0	18 / 143
170	16,975	2,390	229.8	17 / 21
175	17,537	2,390	234.8	39 / 65
180	18,008	2,390	236.8	20 / 173
183	18,307	1,880	237.7	29 / 92
191	19,054	1,880	247.9	102 / 23
195	19,534	1,880	254.2	34 / 48
200		1,780		
	19,952	1,780	267.4	34 / 27
204	20,369 20,933	1,780	273.2 277.4	21 / 41
209		1,780		53 / 41
214	21,377	1,780	280.9	29 / 25
222	22,160	1,450	290.5	93 / 130
226	22,626	1,450	290.6	212 / 86
230	23,047	1,450	290.8	154 / 64
235	23,516	1,450	291.8	90 / 156
241	24,117	1,450	295.5	170 / 33
246	24,623	1,450	300.1	15 / 100
250	25,030	816	302.7	132 / 43
255	25,521	816	304.5	185 / 48
262	26,210	816	308.5	12 / 32
269	26,852		313.8	92 / 51
273	27,336	756	317.4	76 / 12

#### Site 53

			Neuse River Basin
Name	Index Number	Classification	Class Date
Description		Spe	ecial Designation
Groundnut Creek	27-77-2-2	C;Sw,NSW	05/01/88
From source to Mosely Creek			
Guffy Branch	27-43-15-10-2	C;NSW	05/01/88
From source to Little Creek			
Gulden Creek	27-123-3	SA;HQW,NSW	05/01/88
From source to Clubfoot Creek	4004-141-141-141-141-141-141-141-141-141	game federal of \$1.00 to \$1.00	***************************************
Gum Branch	27-117	SC;Sw,NSW	05/01/88
From source to Neuse River			
Gum Swamp	27-97-1	C;Sw,NSW	05/01/88
From source to Swift Creek			
Gum Swamp	27-45-11	C;NSW	05/01/88
From source to Black Creek			
Gum Swamp	27-84-1-1	C;Sw,NSW	05/01/88
From source to Tracey Swamp		. [	
Gum Swamp (Long Lake)	27-101-40-2-1	C;Sw,NSW	05/01/88
From source to Brice Creek			
Gum Swamp Creek	27-77-3	C;Sw,NSW	05/01/88
From source to Falling Creek			
Gum Tricket Creek	27-140	SA;HQW,NSW	05/01/88
From source to Neuse River			
Haleys Branch	27-33-7	C;NSW	05/01/88
From source to Crabtree Creek	SALES MANAGEMENT TO A RESERVE TO AND A RESERVE TO AND A RESERVE TO AND A RESERVE TO AND A RESERVE TO AND A RESERVE TO AND A RESERVE TO AND A RESERVE TO AND A RESERVE TO AND A RESERVE TO AND A RESERVE TO AND A RESERVE TO A RESE		APPEN STREETSTOPPEN BARBASE PARKETINEN MINER GLA LINE VITO THE
Halfmile Branch	27-54.5	WS-IV;NSW	08/03/92
From source to Neuse River			
Halfmoon Creek	27-88	C;Sw,NSW	05/01/88
From source to Neuse River			
Hallam Branch	27-86-24-1	C;Sw,NSW	05/01/88
From source to Wheat Swamp Creek			
Hams Prong	27-86-14-3-1	C;Sw,NSW	05/01/88
From source to Button Branch			
Hancock Creek	27-115	SC;Sw,NSW	05/01/88
From source to Neuse River			

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n=0,045	111		YARD	
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BED MATER			PEL 1 ST.	MES
RECENT DRI	FT	2.4		

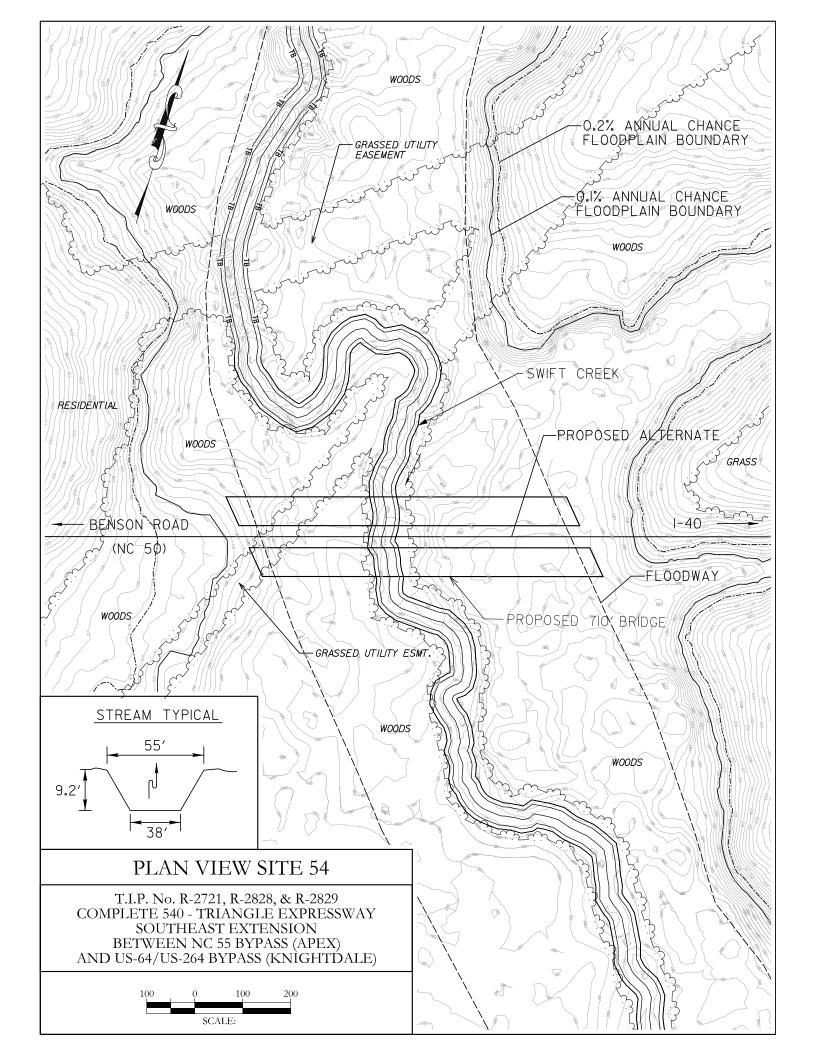


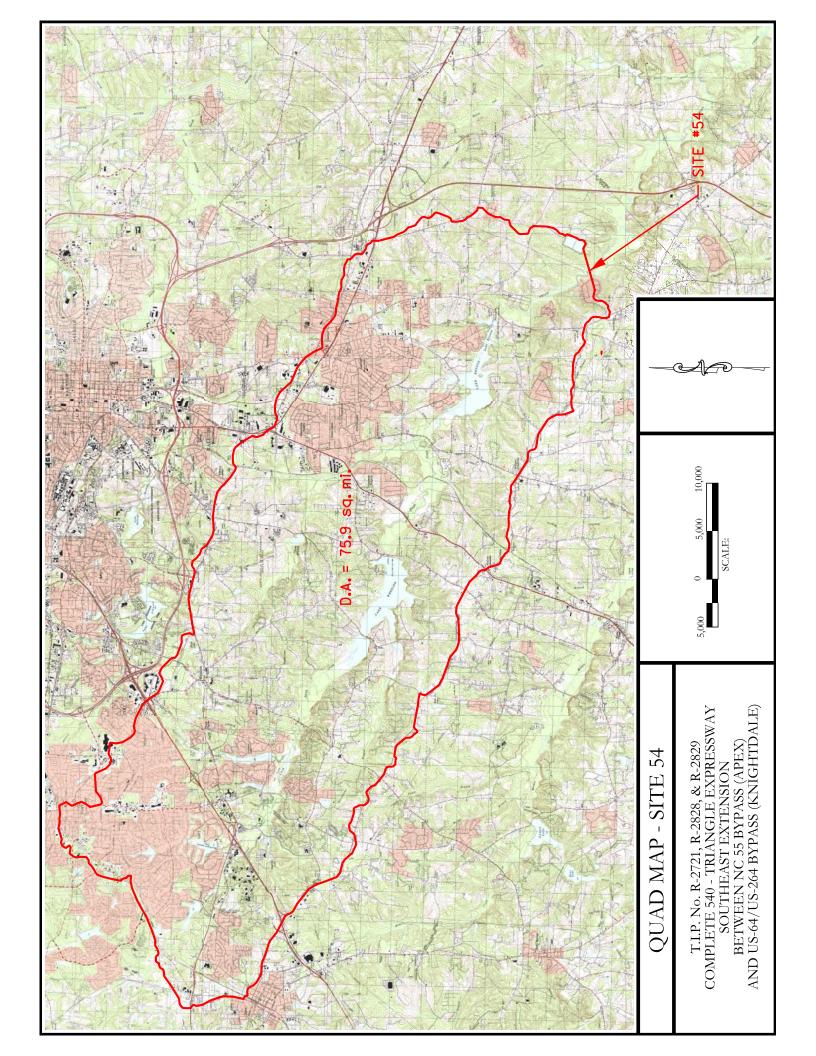
Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

# Site 54





This spreadsheet computes the 50, 20, 10, 4, 2, 1, 0,5, and 0.2-percent chance exceedance flows for an ungaged site in Georgia, South Carolina, and North Carolina. The spreasheet also includes the 95-percent prediction intervals, the minus and plus standard error of prediction intervals, and the average standard error of prediction. To use the spreadsheet, enter requested information in the yellow cells below.

Enter a site-description name:

Site 54

Percent of basin in Hydrologic Region 3 Percent of basin in Hydrologic Region 4 Enter the explanatory variables:
Drainage area, in square miles
Percent of basin in Hydrologic Regior

Sum of region percentages

Applicable range of draingage area is 1 to 9,000 square miles.

Hydrologic Region 1 corresponds to the USEPA Level III Ridge and Valley and Piedmont ecoregions

Hydrologic Region 2 corresponds to the USEPA Level III Blue Ridge accoragion

Hydrologic Region 3 corresponds to the USEPA Level IV Sand Hills ecoregion

Hydrologic Region 4 corresponds to the USEPA Level III Southasstem, Middle Atlantic Coastal, and Southern Coastal Plain ecoregions

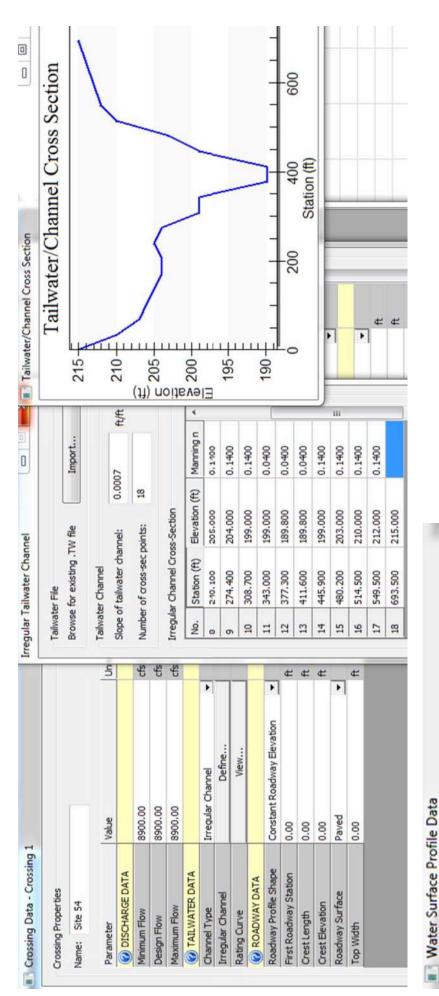
Hydrologic Region 5 corresponds to the lower portion of the USEPA Level IV Tifton Uplands ecoregion.

: LIMITS.	Average S <sub>p.i</sub> (percent)	34.3	33.8	34.9	37.2	39.3	41.5	43.9	47.3
4PPLICABLE	+S <sub>P,i</sub> (percent)	39.5	38.9	40.3	43.3	46.1	49.0	52.2	299
A WITHIN ,	-S <sub>P,i</sub> (percent)	-28.3	-28.0	-28.7	-30.2	-31.5	-32.9	-34.3	-36.2
Drainage area check Drainage area within applicable limits.	Upper 95 percent prediction interval flow,	5,050	8,490	11,200	15,000	18,600	22,300	26,000	32,300
	Lower 95 percent prediction interval flow, in ft³/s	1,370		2,970	3,660	4,220	4,670	2,000	5,550
	Percent chance exceedance flow, in ft³/s	2,630	4,460	5,760	7,400	8,870	10,200	11,400	13,400
1		20	20	10	4	7	-	.5	7.5

10,000 10,000 10,000 10,000 10,00 10						0.1		
Site 54						1.0	dance	nce Exceedance Flow roent Prediction Interval
10,000 1,000 1000 1000						10.0	Percent chance exceed	Percent Char — Upper 95 Per
	Site 54	100,000	10,000	1,000	000	10.00		

Percent chance exceedance

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Flow (cfs)	Elevation (ft) Depth (ft)	Depth (ft)	Velocity (ft/s) Shear (psf)	Shear (psf)
8900.000	206.950	17.150	3,464	0.749
8900.000	206.950	17.150	3,464	0.749
8900.000	206.950	17.150	3,464	0.749
8900.000	206.950	17.150	3.464	0.749
8900.000	206.950	17.150	3.464	0.749
8900.000	206.950	17.150	3,464	0.749
8900.000	206.950	17.150	3,464	0.749
8900.000	206.950	17.150	3.464	0.749
8900.000	206.950	17.150	3,464	0.749
8900.000	206.950	17.150	3.464	0.749
8900.000	206.950	17.150	3.464	0.749

# PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY: <u>Wake</u>	PROJECT NUMBER: 1	R-2721, R-2828 &	: R-2829
STREAM: Swift Creek	ROUTE New Location		
(Site 54) ASSESSMENT PREPARED	BY <u>Mulkey, INC.</u> D (WBP)	ATE <u>2/7/2014</u>	
	HYDROLOGIC EVA	<u>LUATION</u>	
NEAREST GAGING STAT NC. Period of record: 1992 to		: 0208758850 near	r McCullars Crossroads,
ARE FLOOD STUDIES AV	AILABLE ON THIS STI	REAM: Yes	
FLOOD DATA: Q <sub>10</sub> <u>5,800</u> CFS EST. BKV Q <sub>50</sub> <u>8,900</u> CFS EST. BKV Q <sub>500</sub> 13,400 CFS EST. BKV	VTR. <u>N/A</u> FT. Q <sub>25</sub> <u>7,4</u> VTR. <u>N/A</u> FT. Q <sub>100</sub> <u>10,</u> WTR. <u>N/A</u> FT.	00 CFS EST. B 200 CFS EST.	BKWTR. <u>N/A</u> FT. BKWTR. <u>N/A</u> FT.
DRAINAGE AREA: 75.9 S Regression Equations	<u>q. Mi. M</u> ETHOD USED '	ГО СОМРИТЕ Q	: <u>USGS Rural</u>
<u>P</u>	ROPERTY RELATED E	<u>VALUATIONS</u>	
DAMAGE POTENTIAL: LO	OW MODERA	ATE <u>X</u> HIG	Н
COULD THIS BE SI	GNIFICANTLY INCREA	ASED BY PROPO	OSED
ENCROACHMENT:	YES	NO <u>X</u>	
EXPLANTION: A flo	oodway modification may	be required at thi	s site.
LIST BUILDINGS I	N FLOOD PLAIN: None	LOCATION	J:
UPSTREAM LAND ANTICIPATE ANY			
ANY FLOOD ZONII	NG? (FIS STUDIES, ETC	C.) YES <u>X</u>	NO
TYPE OF STUDY: 1	FEMA – Special Flood H	azard Zone AE	
REGULAT	ORY FLOODWAY WII	OTH 305 ft. Section	on 1581
COMMENTS:			

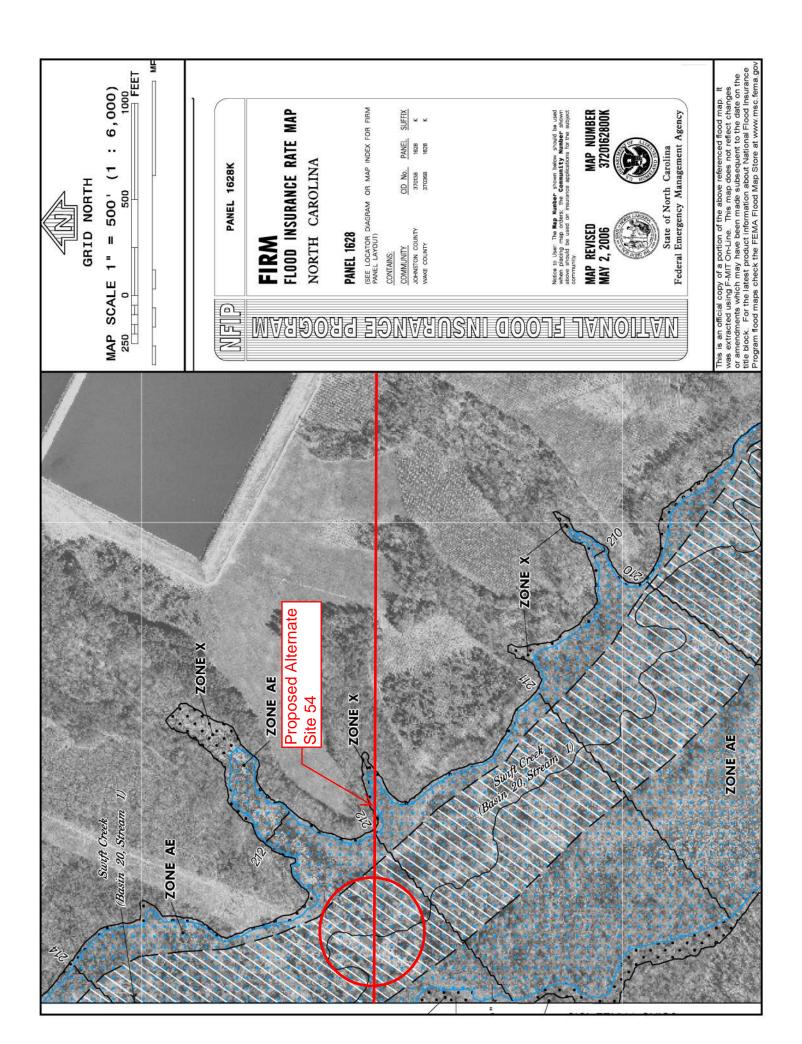
#### TRAFFIC RELATED EVALUATIONS

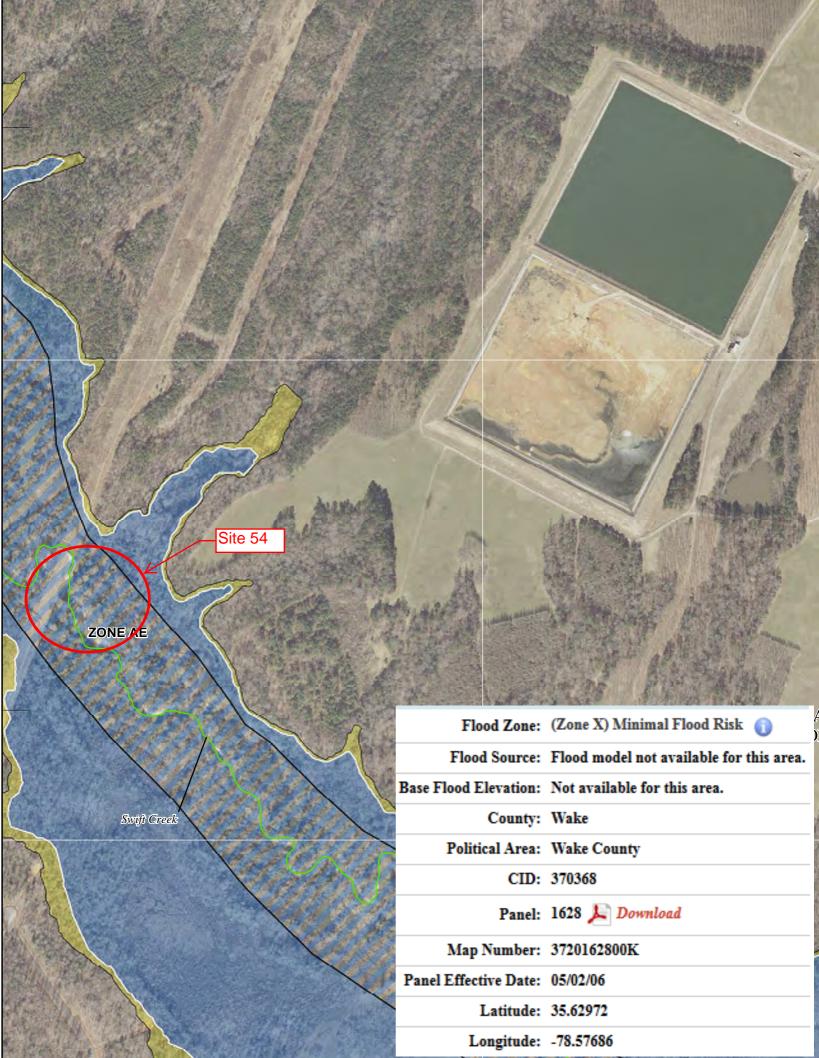
PRESENT YEAR 2012 TRAFFIC COUNT 14,200 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 44,800 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? <u>N/A - New Location</u> LENGTH OF DETOUR <u>N/A</u> MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? $N/A$ - New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? <u>N/A</u>
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS
NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Wehadkee TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from Web Soil Survey website of Wake County, NC.
ENVIRONMENTAL CONSIDERATIONS
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC

DESIGN:

#### MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED
ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? $\underline{\text{No}}$
COMMENTS:
<u>ALTERNATIVES</u>
RECOMMENDED DESIGN: 710 ft. Bridge
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO X DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:





# **FLOOD INSURANCE STUDY**

### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



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TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	Source Riverine Sources				
	From	То			
Southwest Prong Beaverdam Creek Basin 18, Stream 29)	The confluence with Beaverdam Creek (Basin 18, Stream 28)	Wade Avenue	City Of Raleigh		
Spring Branch (Basin 6, Stream 6)	The confluence with Dunn Creek (Basin 6, Stream 5)	Approximately 875 feet upstream of Franklin Street	Town Of Wake Forest		
Stirrup Iron Creek	The confluence with Brier Creek (Basin 18, Stream 14)	The Wake/Durham County boundary	Rdu Town Of Cary Town Of Morrisville Wake County		
Straight Branch (Basin 20, Stream 23)	The confluence with Lens Branch (Basin 20, Stream 22)	Approximately 1,000 feet upstream of US Route 164	Town Of Cary		
Swift Creek	The confluence with the Neuse River	The confluence of Yates Branch (Basin 20, Stream 13)	Rdu Town Of Garner Wake County		
Swift Creek Tributary No. 7 (Basin 20, eam 24)	The confluence with Swift Creek (Basin 20, Stream 1)	Maynard Road	Town Of Cary		
ift Creek Tributary No. 7A (Basin 20, Stream 25)	The confluence with Swift Creek Tributary No. 7 (Basin 20, Stream 24)	Approximately 0.5 mile upstream of confluence with Swift Creek Tributary No. 7 (Basin 20, Stream 24)	Town Of Cary		
Sycamore Creek (Basin 18, Stream 6)	Approximately 0.9 mile downstream of Basin 18, Stream 8	Approximately 0.5 mile upstream of A.C.C. Boulevard	City Of Raleigh Rdu Wake County		
Ferrible Creek (Basin 22, Stream 19)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 1.0 mile upstream of Sunset Lake Road	Rdu Town Of Fuquay-Varina Wake County		
Foms Creek (Basin 7, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 0.9 mile upstream of Forestville Road	Rdu Town Of Rolesville Town Of Wake Forest Wake County		
Fributary to Big Branch Tributary No. 1 Basin 30, Stream 8)	The confluence with Big Branch Tributary No. 1 (Basin 30, Stream 6)	Approximately 0.5 mile upstream of confluence with Big Branch Tributary No. 1 (Basin 30, Stream 6)	Town Of Garner		
Furkey Creek (Basin 18, Stream 23)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Approximately 1,200 feet upstream of High House Road	Town Of Cary		
Furkey Creek (Basin 18, Stream 5)	Approximately 1,160 feet upstream of Sendero Drive	Glenwood Avenue	City Of Raleigh		
Jnnamed Stream	The confluence with Basin 19, Stream 3	Railroad	Rdu Town Of Garner Wake County		
Jnnamed Tributary (#1) to Swift Creek	The confluence with Swift Creek	The Johnston/Wake County boundary	Rdu Wake County		
Jpper Barton Creek (Basin 16, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Victory Church Road	Rdu Wake County		
West Fork Mine Creek (Basin 18, Stream 33)	The confluence with Mine Creek (Basin 18, Stream 31)	Approximately 0.4 mile upstream of confluence of Mine Creek (Basin 18, Stream 31)	City Of Raleigh		
Wheelers Creek (Basin 10, Stream 25)	The confluence with Little River (Basin 10, Stream 1)	Worth Hinton Road	Town Of Zebulon		
Vhite Oak Creek	The confluence with Swift Creek	Approximately 0.4 mile upstream of Pergo Parkway	Rdu Town Of Clayton Town Of Garner Wake County		
Wildcat Branch (Basin 30, Stream 4)	The confluence with Walnut Creek (Basin 30, Stream 1)	Approximately 1,000 feet upstream of Rush Street	City Of Raleigh		
/ates Branch (Basin 20, Stream 13)	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 3.6 miles upstream of Lake Wheeler Road	City Of Raleigh Rdu Town Of Garner Wake County		

Table 10, "Flooding Sources Studied by Detailed Methods: Limited Detailed", lists all flooding sources within the county that were studied by limited detailed methods for either this FIS or previous FISs.

Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed

Table 10 - Flooding Sources Studied by Detailed Methods. Limited Detailed							
Source	Riverine	Riverine Sources					
	From To						
Adams Branch (Basin 30, Stream 9)	Corwin Road	Approximately 0.2 mile upstream of Meadowbrook Drive	Town Of Garner				
Angier Creek (Basin 24, Stream 4)	Railroad	Approximately 0.7 mile upstream of Old Baron Drive	Town Of Fuquay-Varina				
Armory Tributary (Basin 18, Stream 38)	The confluence with Richland Creek (Basin 18, Stream 3)	Approximately 0.5 mile upstream of confluence with Richland Creek (Basin 18, Stream 3)	City Of Raleigh				
Bachelor Branch (Basin 28, Stream 6)	The confluence with White Oak Creek	Approximately 530 feet upstream of Highway 55	Rdu Town Of Cary Wake County				

**Table 13 - Summary of Discharges** 

Table 13 - Summ	ary or Dis	Charges		( )	
Flooding Source Location	Drainage Area	Discharges (cfs)  Drainage Area 10% Annual 2% Annual 1% Annual			
Locatori	(square miles)	Chance	Chance	Chance	0.2% Annual Chance
At mouth	1.20	*	*	1,450	*
At Wade Avenue	0.50	*	*	1,050	*
Southwest Prong Beaverdam Creek (Basin 18, Stream 29)					
At mouth	1.90	*	*	1,900	*
At Brooks Avenue	1.20	*	*	1,550	*
At Wade Avenue	0.50	*	*	1,050	*
Spring Branch (Basin 6, Stream 6)					
At mouth	1.00	*	*	1,120	*
At East Holding Ave	0.30	*	*	360	*
Stirrup Iron Creek					
At mouth <sup>14</sup>	25.60	*	*	2,735	*
Just upstream of Brier Creek (Basin 18, Stream 14) 14	12.30	*	*	2,235	*
Just upstream of Basin 18, Stream 13	9.40	*	*	1,150	*
Just downstream of NRCS Dam No. 5A	8.70	*	*	165	*
At Wake/Durham County boundary	8.50	*	*	3,500	*
Straight Branch (Basin 20, Stream 23)					
At mouth	1.10	*	*	1,150	*
At US Route 64/1	0.50	*	*	750	*
Swift Creek					
At County boundary	79.10	*	*	11,900	*
At Lake Benson Dam	66.20	*	*	10,800	*
54 Old/Stage Road	55.20	*	*	9,600	*
At confluence of Yates Branch	41.66	*	*	4,550	*
Approximately 1.0 mile upstream of confluence of Yates Branch (Basin 20, Stream 13)	39.06	*	*	4,560	*
Approximately 1.8 miles upstream of confluence of Yates Branch (Basin 20, Stream 13)	38.45	*	*	4,580	*
Approximately 250 feet upstream of Fayetteville Highway	36.77	*	*	4,580	*
Approximately 1,060 feet downstream of Lake Wheeler Road	35.79	*	*	4,610	*
Approximately 170 feet upstream of Lake Wheeler Road	35.73	*	*	8,480	*
Approximately 500 feet downstream of confluence of Dutchmans Branch (Basin 20, Stream 17)	26.60	*	*	8,170	*
Approximately 0.5 mile upstream of confluence of Basin 20, Stream 20	24.63	*	*	9,270	*
Approximately 0.8 mile upstream of confluence of Basin 20, Stream 20	22.49	*	*	9,370	*
Approximately 0.5 mile downstream of Holly Springs Road	21.38	*	*	9,420	*
At Holly Springs Road	19.18	*	*	9,230	*
At confluence of Lens Branch	13.44	*	*	7,540	*
Approximately 225 feet upstream of Kildare Farm Road	12.80	*	*	7,650	*
Approximately 1,580 feet downstream of confluence of Swift Creek Trib No. 7 (Basin 20, Stream 24)	10.39	*	*	6,800	*
At confluence of Swift Creek Tributary No. 7 (Basin 20, Stream 24)	5.44	*	*	3,550	*
At US Highway 1	5.12	*	*	4,230	*
Approximately 530 feet upstream of US Highway 64	2.75	*	*	1,970	*
Swift Creek Tributary No. 7 (Basin 20, Stream 24)					
At mouth <sup>15</sup>	5.00	*	*	2,350	*

**Table 16 - Roughness Coefficients** 

Stream	Channel "n"	Overbank "n"	
Panther Creek	0.030 to 0.070	0.070 to 0.130	
Perry Creek (Basin 10, Stream 19)	0.042	0.130	
Perry Creek (Basin 15, Stream 26)	0.032 to 0.052	0.100 to 0.200	
Reedy Branch (Basin 27, Stream 5)	0.045 to 0.050	0.100 to 0.200	
Reedy Branch Tributary (Basin 27, Stream 6)	0.045 to 0.050	0.100 to 0.200	
Richland Creek	0.038 to 0.070	0.035 to 0.200	
Richland Creek Tributary	0.040	0.100 to 0.200	
Richland Creek Tributary 2	0.050	0.070 to 0.130	
Rocky Branch (Basin 30, Stream 5)	0.030 to 0.070	0.070 to 0.110	
Rocky Ford Branch (Basin 24, Stream 5)	0.030 to 0.070	0.070 to 0.110	
Smith Creek	0.048	0.100 to 0.150	
Snipes Creek	0.042 to 0.045	0.120 to 0.130	
Stirrup Iron Creek	0.045 to 0.068	0.080 to 0.170	
Swift Creek	0.040 to 0.072	0.035 to 0.240	
Sycamore/Creek (Basin 18, Stream 6)	0.030 to 0.070	0.070 to 0.150	
Thomas Creek	0.050	0.145	
4 key Creek (Basin 18, Stream 5)	0.030 to 0.070	0.070 to 0.150	
Turkey Creek Tributary	0.046	0.100 to 0.150	
Unnamed Tributary (#1) to Swift Creek	0.045 to 0.060	0.050 to 0.150	
Utley Creek	0.050	0.147	
Walnut Creek (Basin 30, Stream 1)	0.038 to 0.050	0.100 to 0.200	
White Oak Creek	0.035 to 0.050	0.035 to 0.150	
White Oak Creek (Basin 26, Stream 1)	0.050	0.150	

For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained using digital elevation data obtained with LIDAR technology developed as part of the North Carolina Statewide Floodplain Mapping Program. The hydraulic model is prepared using this digital elevation data, without surveying bathymetric or structural data. Where bridge or culvert data are readily available, such as from the North Carolina Department of Transportation, these data have been reflected in the hydraulic model. If these structural data are not readily available, field measurements of these structures were made to approximate their geometry in the hydraulic models. In addition, this method does not include field surveys that determine specifics on channel and floodplain characteristics. A limited detailed study is a "buildable" product that can be upgraded to a fully detailed study at a later date by verifying stream channel characteristics, bridge and culvert opening geometry, and by analyzing multiple recurrence intervals.

The results of the HEC-RAS computations are tabulated for all cross sections (Table 17, "Limited Detailed Flood Hazard Data"). Flood Profiles have not been developed for streams studied by limited detailed methods. Water-surface elevation rasters were developed for steams studied by limited detailed methods. In addition, floodways for streams studied by limited detailed methods are not delineated on the FIRM. However, the 1% annual chance water-surface elevations, flood discharges, and non-encroachment widths from the limited detailed studies for every modeled cross section are given in Table 17. The non-encroachment widths given at modeled cross sections can be used by communities to enforce floodplain management ordinances that meet the requirement defined in 44 CFR 60.3(c)(10).

Between cross sections for streams studied by limited detailed methods, 1% annual chance water-surface elevations can be calculated by mathematical interpolation using the distance along the stream centerline. Non-encroachment widths and, therefore, the location of a non-encroachment area boundary between cross sections should be determined based on either 1) mathematical interpolation, or 2) the non-encroachment width at the upstream or downstream cross section, whichever is larger. If the width determined by this second method is wider than the Special Flood Hazard Area (SFHA) or the 1% annual chance floodplain delineated on the FIRM for this location along the stream, the non-encroachment area shall be considered to be coincident with the SFHA. A full detailed study incorporating field survey data in the HEC-RAS hydraulic model may be submitted for a Letter of Map Revision (LOMR) request to map a regulatory floodway along a section of a stream in lieu of applying the non-encroachment widths listed in Table 17.

Table 17 - Limited Detailed Flood Hazard Data

Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water- Surface Elevation (feet NAVD 88)	Non-Encroachment Width (feet) Left/Right from Stream Centerline			
Adams Branch (Basin 30, Stream 9)							
196	19,551	1,093	274.6	24 / 54			
197	19,681	1,093	275.6	35 / 40			

Table 21 - Floodway Data

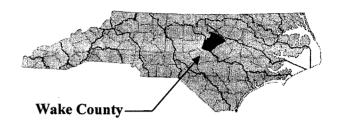
Table 21 - Floodway Data									
Floodway Source Floodway Water Surface Elevation									
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
175	17,540	50	212	0.8	292.2	*	292.2	293.0	0.8
180	18,030	41	216	0.8	292.3	*	292.3	293.1	0.8
Straight Brand	ch (Basin 20, S	Stream 23)	T		T	1			
020	1,950	174	1,331	0.9	366.5	*	366.5	366.5	0.0
034	3,395	375	5,172	0.1	391.6	*	391.6	391.6	0.0
Swift Creek		I	I		I	ı		T	
1445	144,485	1,090	9,478	1.3	202.1	*	202.1	202.7	0.6
1581	158,130	305	3,678	3.2	220.0	*	220.0	220.9	0.9
1651	165,050	335	3,992	2.7	224.9	*	224.9	225.9	1.0
Site 54	165,760	370 <sup>10</sup>	16,395	0.7	238.0	*	238.0	238.0	0.0
1828	182,775	1,240	10,913	0.9	245.6	*	245.6	245.8	0.2
1901	190,090	1,240	11,576	0.8	245.6	246.0	245.6	245.8	0.2
1915	191,516	1,320	10,623	0.4	246.0	246.4	246.0	246.2	0.2
1920	192,042	1,420	10,823	0.4	246.0	246.4	246.0	246.2	0.2
1928	192,778	1,325	9,780	0.5	246.1	246.5	246.1	246.3	0.2
1934	193,389	1,230	8,569	0.5	246.2	246.5	246.2	246.4	0.2
1938	193,832	1,220	7,720	0.6	246.2	246.6	246.2	246.5	0.2
1948	194,763	1,250	7,763	0.6	246.4	246.7	246.4	246.6	0.2
1955	195,550	1,240	6,527	0.7	246.5	246.9	246.5	246.8	0.3
				0.9					
1970	197,039	1,100	4,810		247.3	247.7	247.3	247.7	0.4
1976	197,649	1,220	4,332	1.0	247.5	248.0	247.5	248.0	0.4
1986	198,554	1,050	4,149	1.1	248.0	248.4	248.0	248.6	0.6
1997	199,666	765	3,699	1.2	248.6	248.9	248.6	249.5	0.9
2006	200,615	825	3,523	1.3	249.1	249.4	249.1	250.1	1.0
2013	201,300	620	3,780	1.2	249.5	249.8	249.5	250.5	1.0
2019	201,907	550	2,605	1.8	249.7	250.0	249.7	250.7	1.0
2030	203,040	490	1,811	2.5	250.4	250.6	250.4	251.3	0.9
2048	204,835	530	2,114	2.2	252.3	252.7	252.3	252.9	0.6
2058	205,790	740	2,393	1.9	253.2	253.6	253.2	253.7	0.5
2067	206,702	570	1,503	3.0	254.3	254.6	254.3	254.6	0.4
2075	207,523	710	1,655	2.8	255.7	255.9	255.7	256.1	0.4
2091	209,116	650	2,052	2.2	258.9	259.1	258.9	259.1	0.3
2111	211,103	575	2,690	1.7	262.4	262.6	262.4	263.2	0.8
2116	211,570	430	2,467	1.9	263.3	263.6	263.3	263.8	0.5
2121	212,081	340	1,994	2.3	263.7	264.0	263.7	264.2	0.5
2136	213,608	1,545	24,733	0.3	289.4	289.8	289.4	289.4	0.0
2151	215,087	1,931	31,285	0.3	289.4	289.8	289.4	289.4	0.0
2179	217,930	1,697	28,088	0.3	289.4	289.8	289.4	289.4	0.0
2204	220,417	1,490	25,038	0.3	289.4	289.8	289.4	289.4	0.0
2227	222,727	1,717	29,347	0.3	289.7	290.2	289.7	289.7	0.0
2235	223,518	1,935	15,367	0.5	289.7	290.2	289.7	289.7	0.0
2251	225,128	1,625	13,321	0.6	289.8	290.2	289.8	289.8	0.0
2258	225,815	1,175	8,021	1.2	289.8	290.2	289.8	289.8	0.0
	,								
2265	226,458	900	5,607	1.6	289.9	290.4	289.9	289.9	0.0

# FLOOD INSURANCE STUDY

A Report of Flood Hazards in

## WAKE COUNTY, NORTH CAROLINA

**AND INCORPORATED AREAS** 



#### **VOLUME 7 OF 7**

Community Name	<b>Community Number</b>	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





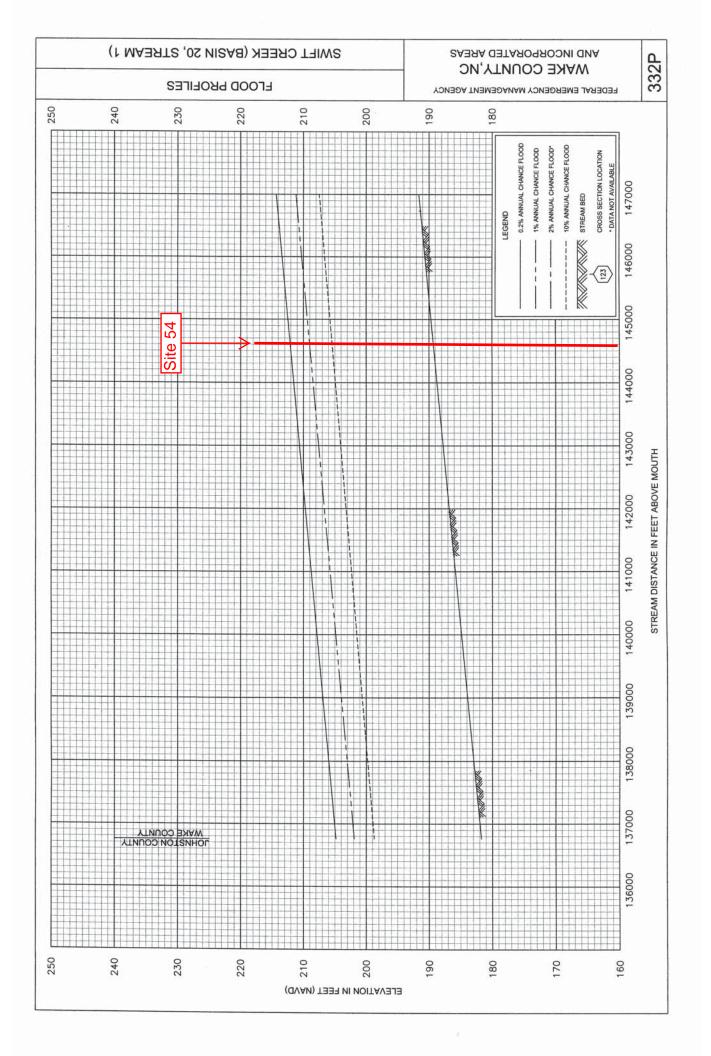
May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV007A

www.fema.gov and www.ncfloodmaps.com





Site 54		Ne	euse River Bas
Name	Index Number	Classification	Class Date
Description		Specia	al Designation
Strouds Creek	27-2-9	C;NSW	12/01/83
From source to Eno River			
Stump Bay	27-148-1-6	SA;HQW,NSW	05/01/88
From source to Long Bay			
Swan Creek	27-144	SA;HQW,NSW	05/01/88
From source to Neuse River			
Swan Pond	27-52-7	C;NSW	05/01/88
Entire pond and connecting stream to Mill Creek			
Swift Creek	27-97-(6)	SC;Sw,NSW	05/01/88
From mouth of Bear Branch to Neuse River			
Swift Creek	27-97-(0.5)	C;Sw,NSW	05/01/88
From source to mouth of Bear Branch			
Swift Creek	27-43-(8)	C;NSW	05/01/88
From dam at Lake Benson to Neuse River			
Swift Creek (Lake Benson)	27-43-(5.5)	WS-III;NSW,CA	08/03/92
From a point 0.6 mile upstream of Wake County SF	R 1006 to dam at Lake Benson		
Swift Creek (Lake Wheeler)	27-43-(1)	WS-III;NSW	08/03/92
From source to a point 0.6 mile upstream of Wake	County SR 1006		
Swindell Bay	27-150-8-(2)	SC;Sw,NSW	05/01/88
From the narrows to Bay River			
Swindell Bay	27-150-8-(1)	SC;Sw,HQW,NSW	08/01/90
From source to the narrows			
Sycamore Creek (Big Lake)	27-33-9	B;NSW	05/01/88
From source to Crabtree Creek			
Tar Creek	27-150-31-4	SA;HQW,NSW	05/01/88
From source to Gale Creek			
Tar Creek	27-141-4	SA;HQW,NSW	05/01/88
From source to Broad Creek			
Tar Kiln Branch	27-54-6	WS-IV;NSW	08/03/92
From source to Falling Creek			
Tar River	27-71-2-2	WS-IV;NSW	08/01/02
From source to Trotters Creek		•	

Nense	Neuse River Basin	ii		10-digit Watershed	0302020110		Swift Creek	reek
> AU N	AU Number	Name		Description		Length or Area Units	Classification	Category
	Category	Rating	Use	Reason for Rating	Parameter		Year	
> 27-43	27-43-(1)d	Swift Creek		From Lake Wheeler Dam to a point 0.6 mile upstream of Wake County SR 1006	.6 mile upstream of Wake County SR	2.4 FW Miles	WS-III;NSW	ъ
	5 II	Impaired	Aquatic Life	Poor Bioclassification	on Ecological/biological Integrity Benthos	egrity Benthos	2008	
> 27-43	27-43-(5.5)a	Swift Creek (Lake Benson)	د (Lake	From a point 0.6 mile upstream of W. Lake Benson	From a point 0.6 mile upstream of Wake County SR 1006 to backwaters of Lake Benson	0.9 FW Miles	WS-III;NSW,CA	rv
	5 Ir	Impaired	Aquatic Life	Poor Bioclassification	on Ecological/biological Integrity Benthos	egrity Benthos	2008	
				12-digit Subwatershed	030202011005		Little	Little Creek
> 27-43-12	3-12	Little Creek		From source to Swift Creek		11.4 FW Miles	C;NSW	īV
	5 II	Impaired	Aquatic Life	Fair Bioclassification	in Ecological/biological Integrity Benthos	egrity Benthos	1998	
				12-digit Subwatershed	030202011003		Whiteoak Creek	Creek
> 27-43-(8)a	3-(8)a	Swift Creek	J	From dam at Lake Benson to Little Creek	eek	20.6 FW Miles	C;NSW	ī,
	JI	Impaired	Aquatic Life	Fair Bioclassification	in Ecological/biological Integrity Benthos	egrity Benthos	2012	
Neuse	Neuse River Basin	ii		10-digit Watershed	0302020111	Wal	Walnut Creek-Neuse River	liver
				12-digit Subwatershed	030202011104		Mill Creek-Neuse Rive	e Rive
> 27-(38.5)	18.5)	NEUSE RIVER	ER	From a point 0.2 mile downstream of Johnston County SR 1700 to point 1.4 mile downstream of Johnston County SR 1908	f Johnston County SR 1700 to point unty SR 1908	9.7 FW Miles	WS-IV;NSW	гv
	5 Ir	Impaired	Aquatic Life	Standard Violation	Copper		2012	
				12-digit Subwatershed	030202011103		Poplar Creek-Neuse Rive	e Rive
> 27-(22.5)c	.2.5)c	<b>NEUSE RIVER</b>	ER	From Crabtree Creek to Auburn Knightdale Road	htdale Road	3.9 FW Miles	C;NSW	Ŋ
	S Ir	Impaired	Aquatic Life	Standard Violation	Copper		2008	
	5	Impaired	Aquatic Life	Standard Violation	Turbidity		2010	
	5	Impaired	Fish Consumption	nption Standard Violation	PCB		2010	

	4	,	
		WOODS	N=0.17
U=0-1/P			
	12/1	TB-TB -	55
	///		38
		HLO D	1.1
			9.2
		MHO	3.2
	) # "	= 0. 040	
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DEBRIS	POTENTIAL	H16H	
70-1	TERIAL SI		
RECENT	DRIFT 5.3		

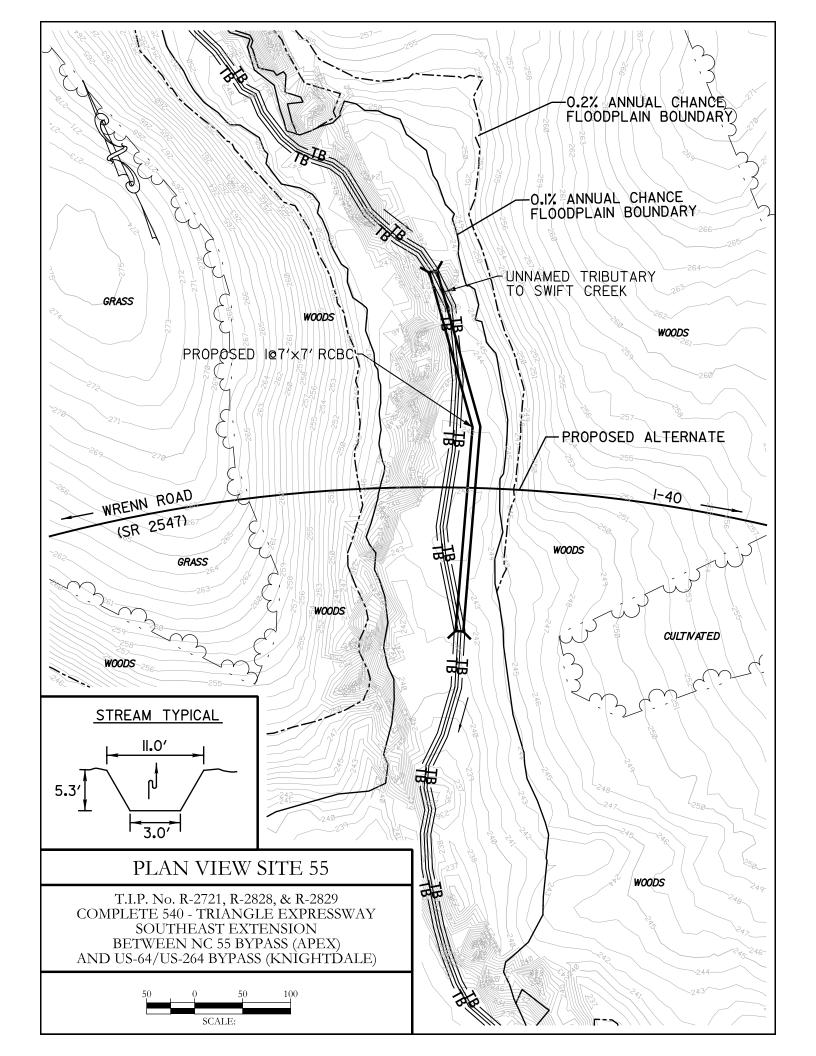


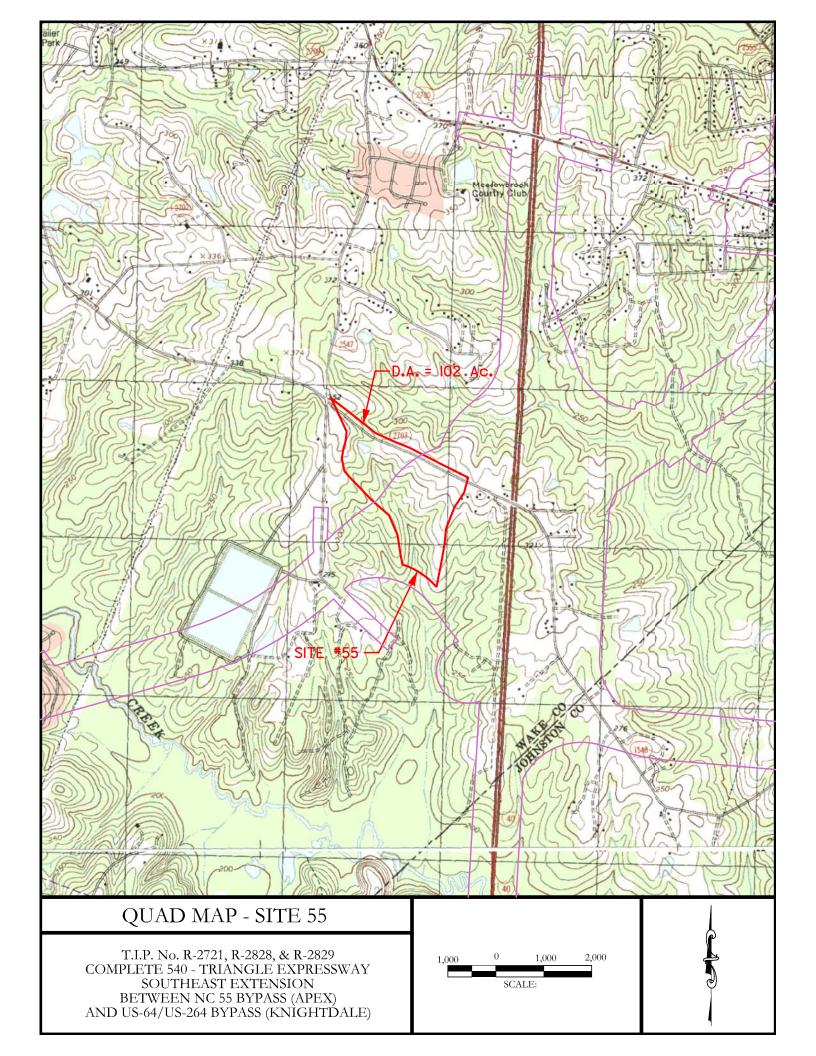
Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

# Site 55





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REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00 STREAM NAME: Unnamed Trib to Swift Creek sq. miles M 0.16 PROJECT NAME: Triangle Expressway SE Ext. ENGLISH Drainage Area = 0.16 Drainage Area =

207	401									
ort 01-42	Sand Hills	(cfs)	60.6	15.36	20.32	27.55	33.82	40.53	48.36	96.69
<b>RURAL EQUATIONS Report 01-4207</b>	Coastal Plain	(cfs)	18.85	40.29	60.91	94.79	127.01	165.87	212.31	287.87
SAL EQUI	Blue Ridge	(cfs)	37.29	86.69	99.28	145.97	188.02	236.99	293.65	382.78
RUF	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR
<u> </u>										
$\vdash$	m			72.65						
<b>USGS RURAL REGRESSION EQUA:</b>	Coastal Plain	(cfs)	21.80	51.28	80.78	136.55	191.04	262.64	352.82	508.46
AL REGRE	Sand Hills	(cfs)	7.75	12.62	16.59	21.77	26.22	31.13	38.22	43.98
64					_					

# **USGS URBAN REGRESSION EQUATIONS**

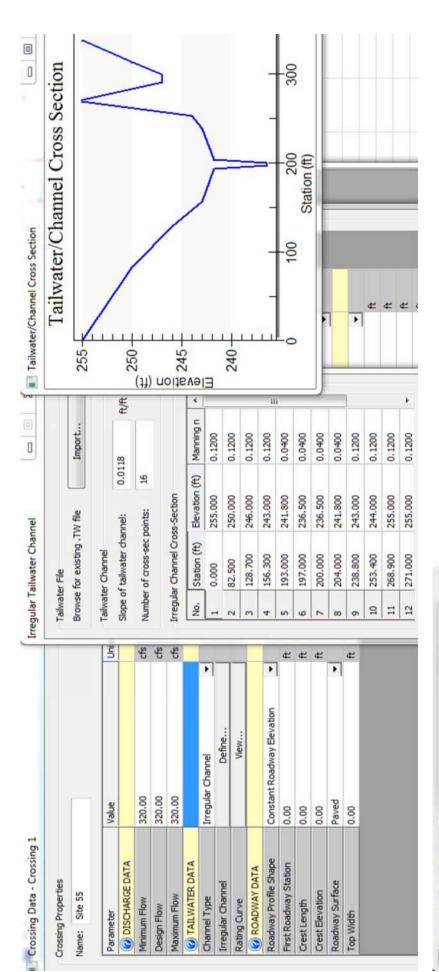
BDF= 11

(These Equations are used only for comparison)

							(Based on 2.80xQ10)	
ш						392.34	582.47	565.73
Coastal Plain	(cfs)	127.76	177.51	266.09	344.55	451.50	497.03	749.55
Sand Hills	(cts)	42.80	50.84	61.24	68.98	78.55	142.36	100.73
FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR
	ш	ш	ш	ш	ш	FREQUENCY         Sand Hills         Coastal Plain         Blue Ridge           (cfs)         (cfs)         (cfs)         (cfs)           5YR         42.80         127.76         167.63           10YR         50.84         177.51         208.02           25YR         61.24         266.09         272.40           50YR         68.98         344.55         323.22	ш	lain Blue Ridge (cfs) (cfs) 167.63 208.02 272.40 323.22 392.34 582.47 (

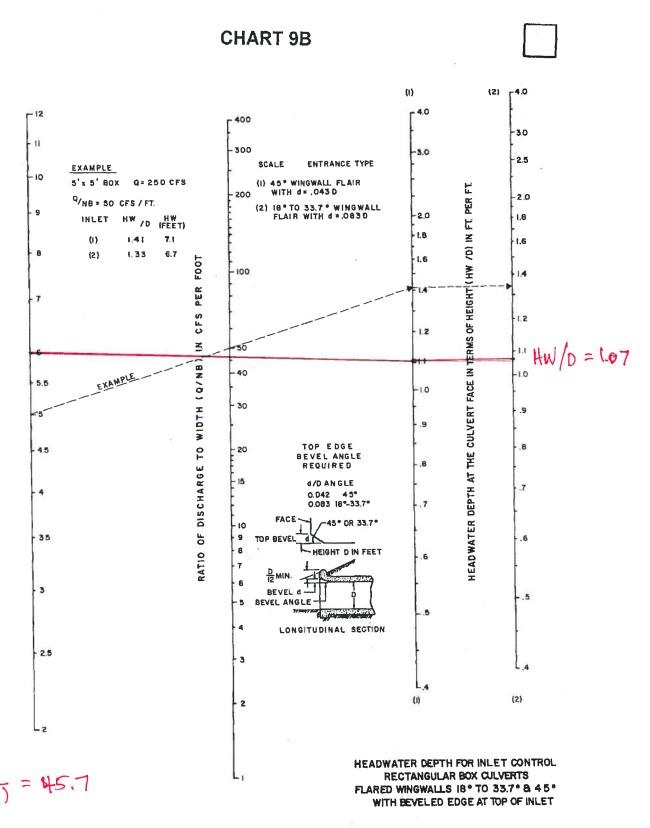
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% Impervious =	20				FEMA	IA
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Blue Ridge Discharge Used	FREQUENCY	Disharges
	(cts)	(cts)	(cts)			
5YR	76.31	113.94	125.68			
10YR	102.27	162.19	171.83		10YR	
25YR	145.18	271.48	274.73		50YR	
50YR	173.25	329.81	321.65	320	100YR	546
100YR	199.91	389.34	368.71		100YR (Future)	917
200YR	286.35	454.14	481.11	(Based on 2.80xQ10)	500YR	
500YR	374.30	593.63	628.88	(Based on 3.66xQ10)		ı

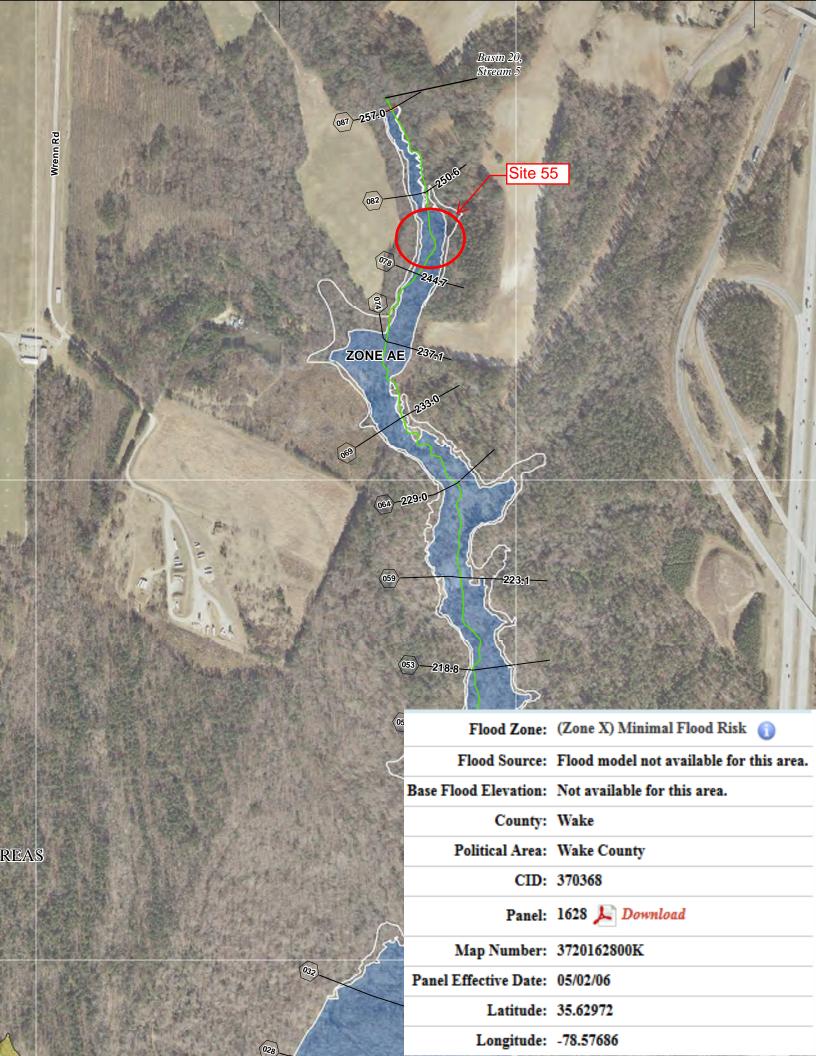


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242.772 242.772 242.772 242.772 242.772 242.772 242.772 242.772 242.772	Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s) Shear (psf)	Shear (psf
242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272	320.000	242.772	6.272	4.213	4.618
242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272	320.000	242.772	6.272	4.213	4.618
242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272	320.000	242.772	6.272	4.213	4.618
242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272	320.000	242.772	6.272	4.213	4.618
242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272	320.000	242.772	6.272	4.213	4.618
242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272	320.000	242.772	6.272	4.213	4.618
242.772 6.272 242.772 6.272 242.772 6.272 242.772 6.272	320.000	242.772	6.272	4.213	4.618
242.772 6.272 242.772 6.272 242.772 6.272	320.000	242.772	6.272	4.213	4.618
242.772 6.272	320.000	242.772	6.272	4.213	4.618
242.772 6.272	320.000	242.772	6.272	4.213	4.618
	320.000	242.772	6.272	4.213	4.618



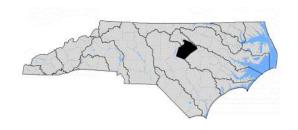
PROPOSED STRUCTURE



## PRELIMINARY FLOOD INSURANCE STUDY

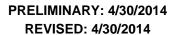
## FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

State of North Carolina

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 9, "Flooding Sources Studied by Detailed Methods: Redelineated", lists all flooding sources that were studied by detailed methods for the prestatewide FIS and redelineated for previous FISs. These flooding sources were not part of this revision and their effective analyses remain valid.

Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	Riverine	Sources	Affected Communities
	From	То	
Basin 10, Stream 2	The confluence with Little River (Basin 10, Stream 1)	Approximately 0.9 mile upstream of confluence with Little River (Basin 10, Stream 1)	Rdu Wake County
Basin 10, Stream 3	The confluence with Little River (Basin 10, Stream 1)	Moss Road	Rdu Wake County
Buffalo Branch (Basin 10, Stream 22)	The confluence with Little River (Basin 10, Stream 1)	Morphus Bridge Road	Rdu Town Of Wendell Wake County
Buffalo Creek (Basin 9, Stream 1)	The Wake/Johnston County boundary	Robertsons Pond Dam	Rdu Town Of Wendell Wake County
Kit Creek	The Chatham/Wake County Boundary	Approximately 475 feet upstream of Railroad	Rdu Town Of Cary Wake County
Little Creek (Basin 11, Stream 2)	The Wake/Johnston County boundary	Cemetery Road	Rdu Town Of Zebulon Wake County
Middle Creek	The confluence with Swift Creek	Approximately 0.7 mile upstream of confluence of Middle Creek Tributary	Rdu Town Of Apex Town Of Cary Town Of Fuquay-Varina Town Of Holly Springs Wake County
Panther Branch (Basin 22, Stream 2)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.5 mile upstream of Banks Road	Rdu Wake County
Panther Creek	The Chatham/Wake County Boundary	Approximately 1.0 mile upstream of Green Level to Durham Road	Town Of Cary
Poplar Creek (Basin 13, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 900 Feet upstream of Fayetteville Street	Rdu Town Of Knightdale Wake County
Swift Creek	The confluence with the Neuse River	The confluence of Yates Branch (Basin 20, Stream 13)	Rdu Town Of Garner Wake County
White Oak Creek	The confluence with Swift Creek	Approximately 0.4 mile upstream of Pergo Parkway	Rdu Town Of Clayton Town Of Garner Wake County

Table 10, "Flooding Sources Studied by Detailed Methods: Limited Detailed", lists all flooding sources within the county that were studied by limited detailed methods for either this FIS or previous FISs.

Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed

Source	Riverine	Sources	Affected Communities
	From	То	
Bachelor Branch (Basin 28, Stream 6)	The confluence with White Oak Creek	Approximately 530 feet upstream of Highway 55	Rdu Town Of Cary Wake County
Basin 11, Stream 7	The Wake/Johnston County boundary	Approximately 0.4 mile upstream of Wake/Johnston County boundary	Rdu Wake County
Basin 14, Stream 2	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.4 mile upstream of Lake Myra Road	Rdu Wake County
Basin 14, Stream 3	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.7 mile upstream of confluence with Marks Creek (Basin 14, Stream 1)	Rdu Town Of Knightdale Town Of Wendell Wake County
Basin 20, Stream 5	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 1.7 miles upstream of confluence with Swift Creek (Basin 20, Stream 1)	Rdu Wake County
Basin 28, Stream 7	The confluence with Basin 28, Stream 8	Approximately 0.4 mile upstream of confluence with Basin 28, Stream 8	Town Of Cary
eddingfield Creek	Approximately 0.4 mile upstream of the confluence with Neuse River	Approximately 0.2 mile upstream of Shotwell Road	Rdu Town Of Clayton Wake County
Big Branch	The confluence with Harris Reservoir	Approximately 0.9 mile upstream of Highway 1	Rdu Town Of Apex Wake County
Black Creek	Approximately 260 feet upstream of State HWY 210	Approximately 1.0 mile upstream of dam along Black Creek (Basin 23, Stream 1)	Rdu Town Of Fuquay-Varina Wake County

Table 13 - Summary of Discharges

		<del></del>			
Flooding Source			Dischar	ges (cfs)	
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Thomas Creek					
Approximately 1.0 mile downstream of Highway 1	1.60	*	*	992	*
Approximately 0.7 mile downstream of Highway 1	0.80	*	*	649	*
Approximately 0.4 mile downstream of Highway 1	0.70	*	*	606	*

The stillwater elevations have been determined for the 1% [add 10%, 2%, and 0.2% here if that data is available] annual chance flood for the flooding sources studied by detailed methods and are summarized in Table 14, "Summary of Stillwater Elevations."

**Table 14 - Summary of Stillwater Elevations** 

Flooding Source	FIRM Panel Number(s)		Elevations	(feet NAVD)	
		10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Harris Reservoir	3720060600	*	*	252	*

Table 15, "Gage Information" is not applicable in Wake County.

### 5.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the flood elevations for the selected recurrence intervals. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles and/or Water-surface elevation rasters. For stream segments for which BFEs were computed, selected cross-section locations are also shown on the FIRM. Flood Profiles and/or Water-surface elevation rasters were developed showing computed water-surface elevations for floods of the selected recurrence intervals.

Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles and/or Water-surface elevation rasters or in the Floodway Data tables in the FIS Report. For construction and/or floodplain management purposes, users are encouraged to use the flood elevation data presented in the FIS in conjunction with the data shown on the FIRM.

The hydraulic analyses for this FIS were based on unobstructed flow. The flood elevations shown on the Flood Profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

For details on the county's hydraulic analyses, the hydraulic report is available by request.

For the streams studied by detailed methods, water surface elevations of floods of the selected recurrence intervals were computed through use of the Army Corps of Engineers' HEC RAS step backwater computer program. The hydraulic analyses were based on unobstructed flow. The flood elevations shown on the Profiles and/or Water-surface elevation rasters are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail. The computer models were calibrated using historic high water data collected during field investigations.

The cross section geometries were obtained from a combination of digital elevation data obtained by Light Detection and Ranging (LIDAR) and field surveys. All bridges, dams, and culverts were field surveyed to obtain elevation data and structural geometry. Natural floodplain cross sections were surveyed approximately every 4000 feet along the detail study reaches to obtain the channel geometry between bridges and culverts. Overbank cross section data for the backwater analyses were obtained from recently flown LIDAR data.

Channel roughness factors (Manning's "n") used in the hydraulic computations were made in the field by an engineer where stream access was possible, with orthophotos used to supplement areas that could not be accessed. The channel and overbank "n" values for all of the streams studied by detailed methods are shown in Table 16, "Roughness Coefficients".

Table 16 - Roughness Coefficients

Table 10 Reaginiese 300	1110101110	
Stream	Channel "n"	Overbank "n"
Bachelor Branch (Basin 28, Stream 6)	0.050	0.140 to 0.155
Basin 11, Stream 7	0.042	0.130
Basin 14, Stream 2	0.045	0.100
Basin 14. Stream 3	0.050	0.130
Basin 20, Stream 5	0.047	0.130
Basin 28, Stream 7	0.050 to 0.055	0.150 to 0.155
n 28 Stream 8	0.047 to 0.050	0.100 to 0.200

## 5.1 Hydrologic Analyses

Site 5

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for floods of the selected recurrence intervals for each flooding source studied. Hydrologic analyses are typically performed at the watershed level. Depending on factors such as watershed size and shape, land use and urbanization, and natural or man-made storage, various models or methodologies may be applied. For details on the county's hydrologic analyses, the hydrologic report is available by request.

A summary of the drainage area-peak discharge relationships for the flooding sources studied by detailed methods is shown in Table 13, "Summary of Discharges".

**Table 13 - Summary of Discharges** 

Flooding Source	,	onar goo	Dischar	ges (cfs)	_
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Basin 10, Stream 2					
Just downstream of tributary draining pond near County boundary	0.50	*	*	701	*
Basin 14, Stream 2					
At confluence with Marks Creek (Basin 14, Stream 1)	2.54	*	*	1,340	*
Approximately 0.4 mile upstream of confluence with Marks Creek (Basin 14, Stream 1)	2.45	*	*	1,310	*
Approximately 0.4 mile downstream of Lake Myra Road	1.47	*	*	947	*
Basin 14, Stream 3					
At confluence with Marks Creek (Basin 14, Stream 1)	0.39	*	*	410	*
Basin 19, Stream 3					
At mouth	2.40	*	*	1,795	*
Basin 20, Stream 5					
Approximately 600 feet downstream of Wake/Johnston County boundary	0.87	*	*	433	*
Approximately 1.0 mile upstream of Wake/Johnston County boundary	0.61	*	*	353	*
Basin 28, Stream 7					
55 confidence with Basin 28, Stream 8	0.50	*	*	806	*
Approximately 0.4 mile upstream of confluence with Basin 28, Stream 8	0.20	*	*	462	*
Basin 28, Stream 8					
Approximately 1,060 feet downstream of Mills Road	1.00	481	860	1,030	1,530
Approximately 1,060 feet upstream of Mills Road	0.70	440	785	932	1,380
Just downstream of Hendricks Road	0.40	305	526	623	899
Beaver Creek					_
At Chatham/Wake County boundary	19.20	*	*	5,890	*
Approximately 1,060 feet upstream of Chatham/Wake County boundary	17.50	*	*	5,810	*
Just upstream of New Hill Olive Chapel Road	16.50	*	*	5,730	*
Approximately 530 feet upstream of New Hill Olive Chapel Road	16.40	*	*	7,040	*
Approximately 0.4 mile upstream of New Hill Olive Chapel Road	15.40	*	*	6,960	*
At confluence of Reedy Branch	11.10	2,790	4,480	5,310	8,460
Big Branch		ı			
Approximately 0.5 mile upstream of Shearon Harris Road	1.20	*	*	844	*
Approximately 0.5 mile downstream of Highway 1	1.10	*	*	766	*
Approximately 1,060 feet downstream of Highway 1	0.90	*	*	694	*
Approximately 220 feet upstream of Highway 1	0.40	*	*	418	*
Approximately 530 feet upstream of Highway 1	0.40	*	*	394	*
Approximately 0.6 mile upstream of Highway 1	0.20	*	*	251	*
Approximately 1,580 feet upstream of Highway 1	0.20	*	*	286	*

be coincident with the SFHA. A full detailed study incorporating field survey data in the HEC-RAS hydraulic model may be submitted for a Letter of Map Revision (LOMR) request to map a regulatory floodway along a section of a stream in lieu of applying the non-encroachment widths listed in Table 17.

**Table 17 - Limited Detailed Flood Hazard Data** 

Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water- Surface Elevation (feet NAVD 88)	Non-Encroachment Width (feet) Left/Right from Stream Centerline
Bachelor Branch (Basin	28, Stream 6)		,	
033	3,349	2,580	278.3	9 / 403
040	3,984	2,580	280.0	71 / 347
Basin 11, Stream 7				
001	123	406	278.1	14 / 61
004	358	406	281.4	4 / 27
006	602	406	283.4	24 / 21
009	862	406	284.9	25 / 4
011	1,055	406	292.6	-9,999 / -9,999
011	1,080	406	292.6	-9,999 / -9,999
014	1,428	406	293.0	150 / 60
017	1,709	406	295.6	15 / 15
021	2,051	406	301.3	32 / 4
022	2,154	406	306.7	-9,999 / -9,999
022	2,179	406	306.7	-9,999 / -9,999
024	2,384	406	308.2	110 / 40
Basin 14, Stream 2				
009	936	1,335	183.0 <sup>1</sup>	14 / 128
016	1,632	1,335	184.0	14 / 114
024	2,434	1,306	187.6	72 / 83
031	3,074	1,306	190.9	83 / 13
037	3,741	1,306	193.8	83 / 30
043	4,330	1,306	195.3	78 / 69
049	4,945	1,306	196.8	132 / 25
057	5,724	947	200.1	12 / 107
065	6,522	947	205.0	41 / 17
071	7,124	947	207.7	12 / 80
078	7,777	947	214.9	-9,999 / -9,999
078	7,817	947	214.9	18 / 18
Basin 14, Stream 3				
004	386	410	202.5	14 / 79
009	864	410	205.9	14 / 19
018	1,775	410	213.2	5/5
023	2,311	410	220.2	5/5
029	2,918	410	227.6	5/5
035	3,466	410	235.5	5/5
039	3,867	410	243.8	5/4
Basin 20, Stream 5				
018	1,815	756	202.01	5 / 112
025	2,497	756	202.01	153 / 10
028	2,818	756	202.01	4 / 496
032	3,224	756	202.01	62 / 31
036	3,565	756	205.7	21 / 61
040	3,997	756	208.6	4 / 105

	<b>Table 17 - </b>	Limited Detailed Flo	od Hazard Data	
Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water- Surface Elevation (feet NAVD 88)	Non-Encroachment Width (feet) Left/Right from Stream Centerline
044	4,385	684	210.8	3 / 141
050	5,013	684	216.0	35 / 32
053	5,329	546	218.8	100 / 2
059	5,867	546	223.1	3 / 32
064	6,378	546	229.0	43 / 33
069	6,920	546	233.0	3 / 74
074	7,366	546	237.1	30 / 15
078	7,769	546	244.7	20 / 16
082	8,235	546	250.6	10 / 50
087	8,728	546	257.0	10 / 11
Basin 28, Stream 7				
Site 55	347	806	276.1	23 / 98
008	754	806	279.5	62 / 37
012	1,234	806	283.7	25 / 53
016	1,645	806	286.6	60 / 33
021	2,131	462	289.8	32 / 35
Beddingfield Creek				
046	4,642	1,902	163.4	25 / 21
055	5,477	1,902	165.9	16 / 17
Big Branch				
054	5,425	927	245.2	193 / 61
057	5,744	927	245.3	197 / 43
062	6,178	927	245.3	14 / 243
066	6,571	844	245.4	134 / 26
071	7,096	844	245.6	148 / 13
075	7,472	844	245.7	235 / 13
079	7,897	766	245.7	13 / 16
084	8,375	766	248.3	15 / 82
089	8,850	766	249.6	15 / 17
092	9,199	694	251.5	13 / 48
097	9,675	694	253.7	13 / 37
099	9,940	694	255.0	16 / 16
102	10,172	694	261.3	16 / 16
106	10,589	418	261.5	171 / 34
109	10,946	394	261.5	20 / 13
113	11,265	394	261.9	10 / 10
118	11,800	286	265.6	10 / 13
122	12,157	286	267.9	10 / 15
125	12,528	286	272.6	40 / 12
130	13,007	286	277.4	30 / 16
134	13,381	251	279.3	13 / 12
139	13,903	251	283.3	7/10
142	14,248	198	287.8	11 / 11
146	14,621	198	291.4	11/7
150	15,025	198	297.7	9/7
Black Creek	10,020		1201	10,1

	te 55		use River Basin
Name	Index Number	Classification	Class Date
Description		Specia	l Designation
Strouds Creek	27-2-9	C;NSW	12/01/83
From source to Eno River			
Stump Bay	27-148-1-6	SA;HQW,NSW	05/01/88
From source to Long Bay			
Swan Creek	27-144	SA;HQW,NSW	05/01/88
From source to Neuse River			
Swan Pond	27-52-7	C;NSW	05/01/88
Entire pond and connecting stream to Mill Cr	reek		
Swift Creek	27-97-(6)	SC;Sw,NSW	05/01/88
From mouth of Bear Branch to Neuse River			
Swift Creek	27-97-(0.5)	C;Sw,NSW	05/01/88
From source to mouth of Bear Branch			
Swift Creek	27-43-(8)	C;NSW	05/01/88
From dam at Lake Benson to Neuse River		and the state of t	
Swift Creek (Lake Benson)	27-43-(5.5)	WS-III;NSW,CA	08/03/92
From a point 0.6 mile upstream of Wake Cou	inty SR 1006 to dam at Lake Benson		
Swift Creek (Lake Wheeler)	27-43-(1)	WS-III;NSW	08/03/92
From source to a point 0.6 mile upstream of	Wake County SR 1006		
Swindell Bay	27-150-8-(2)	SC;Sw,NSW	05/01/88
From the narrows to Bay River			
Swindell Bay	27-150-8-(1)	SC;Sw,HQW,NSW	08/01/90
From source to the narrows			
Sycamore Creek (Big Lake)	27-33-9	B;NSW	05/01/88

**Tar Creek** 

Tar Creek

**Tar River** 

Tar Kiln Branch

From source to Crabtree Creek

From source to Gale Creek

From source to Broad Creek

From source to Falling Creek

From source to Trotters Creek

05/01/88

05/01/88

08/03/92

08/01/02

SA;HQW,NSW

SA;HQW,NSW

WS-IV;NSW

WS-IV;NSW

27-150-31-4

27-141-4

27-54-6

27-71-2-2

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RECENT	DRIFT	3.8		

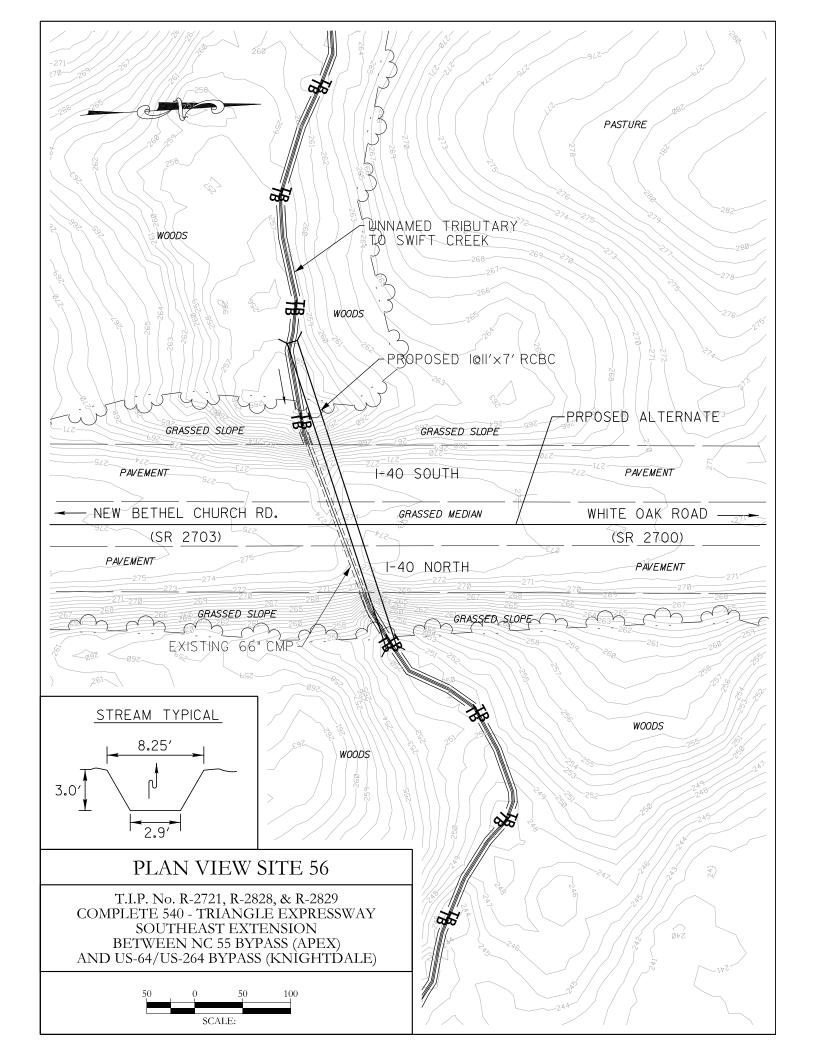


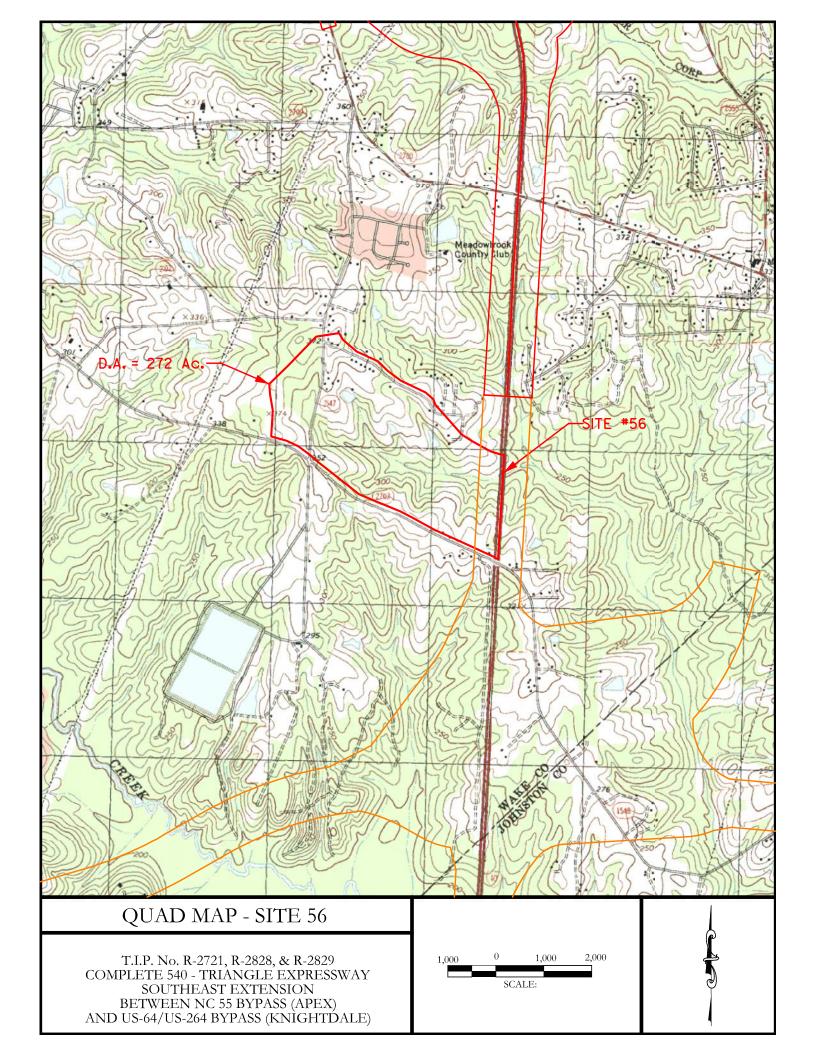
Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

## Site 56





## North Carolina

Site #56

4/18/2014

AD IECT NAME: Triandle Evanoseway SE Ext STDE AN

REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00 STREAM NAME: Unnamed Trib to Swift Creek sq. miles M 0.43 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = ENGLISH

<b>USGS RUR</b>	AL REGRE	<b>USGS RURAL REGRESSION EQUAT</b>	JATIONS (OLD)	RU	RAL EQUA	ATIONS Rep	RURAL EQUATIONS Report 01-4207
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)
2YR	16.00	40.71	80.37	2YR	74.65	36.66	18.37
5YR	26.18	91.17	140.89	5YR	136.67	75.48	30.72
10YR	34.49	140.38	190.55	10YR	191.03	111.88	40.48
25YR	45.73	231.05	268.68	25YR	276.18	170.35	54.66
50YR	55.43	317.54	335.68	50YR	352.25	225.14	26.99
100YR	66.18	429.29	417.88	100YR	439.62	290.26	80.01
200YR	81.34	568.76	507.35	200YR	539.89	367.15	95.28
500YR	94.91	804.41	667.93	500YR	696.16	490.48	117.90

# **USGS URBAN REGRESSION EQUATIONS**

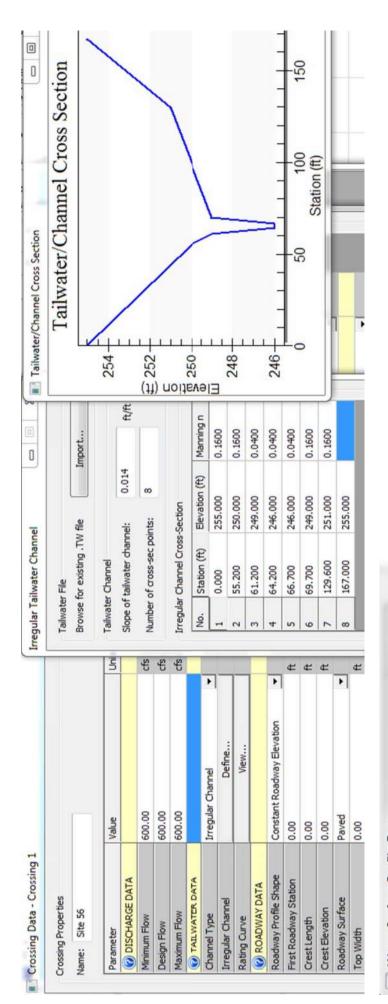
BDF= 11

(These Equations are used only for comparison)

								(Based on 2.80xQ10)	
	Blue Ridge	(cfs)	332.44	409.61	530.37	630.89	766.38	1146.90	1098.11
o companson)	Coastal Plain	(cfs)	236.75	321.75	470.07	603.12	783.49	900.91	1278.96
is all a deca of its	Sand Hills	(cfs)	89.45	106.15	128.64	146.68	169.11	297.21	221.69
( These Equations are used only for companison)	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

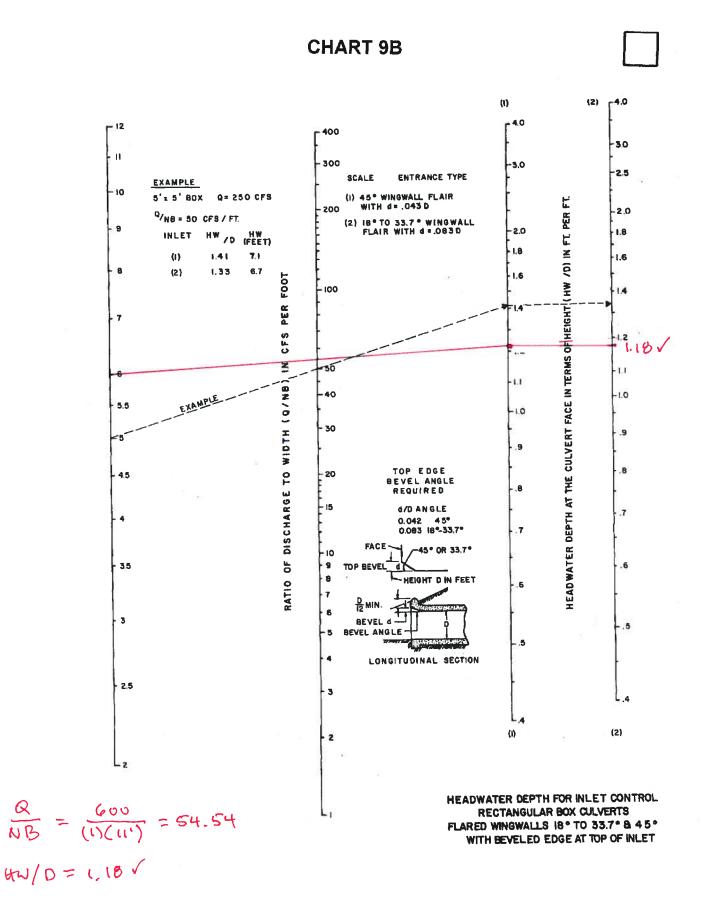
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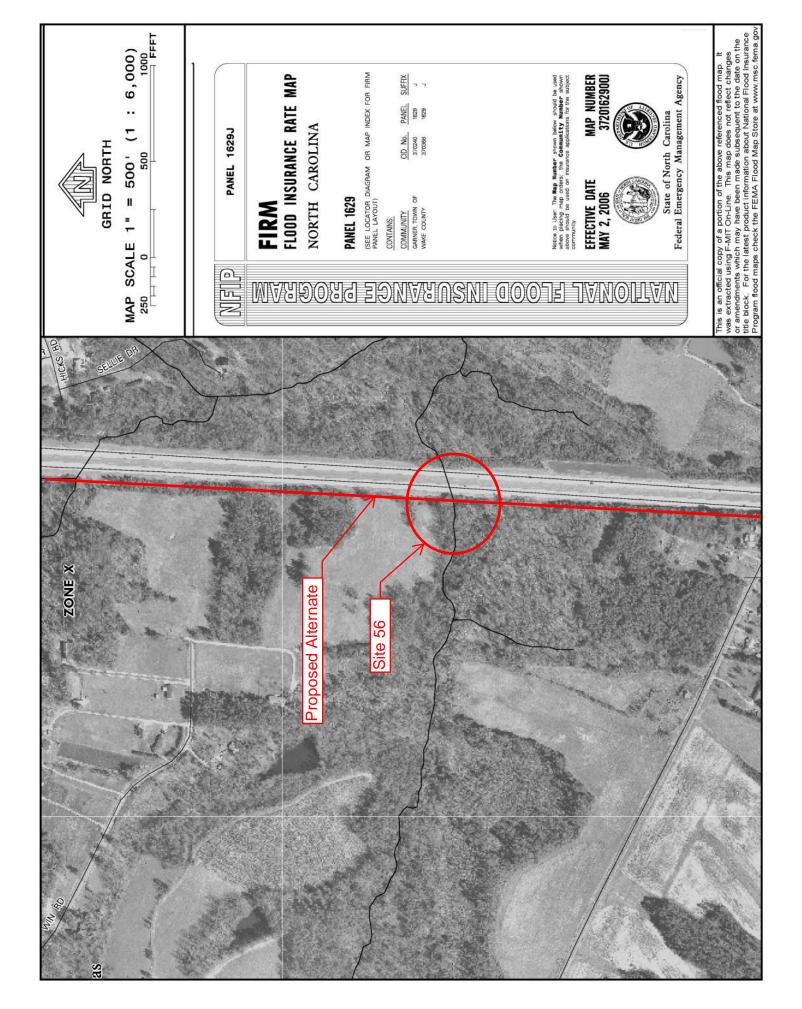
% Impervious =	20				FEMA	<b>₽</b>
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Blue Ridge Discharge Used	FREQUENCY	Disharges
	(cts)	(cts)	(cts)			
5YR	152.44	217.72	246.41			
10YR	199.71	300.87	328.33		10YR	
25YR	274.42	476.95	502.61		50YR	
50YR	325.22	572.59	583.24	009	100YR	
100YR	372.66	668.62	662.65		100YR	
200YR	559.20	842.43	919.33	(Based on 2.80xQ10)	500YR	
500YR	730.96	1101.17	1201.69	(Based on 3.66xQ10)		ı



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Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s) Shear (psf)	Shear (psf)
000.009	251.710	5.710	3,453	4.989
000.009	251.710	5.710	3,453	4.989
000.00	251.710	5.710	3.453	4.989
000.00	251.710	5.710	3.453	4.989
000.009	251.710	5.710	3.453	4.989
000.00	251.710	5.710	3,453	4.989
000.00	251.710	5.710	3,453	4.989
000.00	251.710	5.710	3.453	4.989
000.00	251.710	5.710	3,453	4.989
000.009	251.710	5.710	3.453	4.989
900.009	251.710	5.710	3.453	4.989





	6	Ne	use River Ba
Name	Index Number	Classification	Class Da
Description			Designation
Strouds Creek	27-2-9	C;NSW	12/01/83
From source to Eno River			
Stump Bay	27-148-1-6	SA;HQW,NSW	05/01/88
From source to Long Bay			
Swan Creek	27-144	SA;HQW,NSW	05/01/88
From source to Neuse River			AMMERICAN AMERICAN E SANSANIAN PER MAN AMERICAN PER MAN AMERICAN PER MANAGET FOR F
Swan Pond	27-52-7	C;NSW	05/01/88
Entire pond and connecting stream to Mill Creek			
Swift Creek	27-97-(6)	SC;Sw,NSW	05/01/88
From mouth of Bear Branch to Neuse River			
Swift Creek	27-97-(0.5)	C;Sw,NSW	05/01/88
From source to mouth of Bear Branch			
Swift Creek	27-43-(8)	C;NSW	05/01/88
From dam at Lake Benson to Neuse River			
Swift Creek (Lake Benson)	27-43-(5.5)	WS-III;NSW,CA	08/03/92
From a point 0.6 mile upstream of Wake County SF	R 1006 to dam at Lake Benson		
Swift Creek (Lake Wheeler)	27-43-(1)	WS-III;NSW	08/03/92
From source to a point 0.6 mile upstream of Wake	County SR 1006		
Swindell Bay	27-150-8-(2)	SC;Sw,NSW	05/01/88
From the narrows to Bay River			
Swindell Bay	27-150-8-(1)	SC;Sw,HQW,NSW	08/01/90
From source to the narrows	TO BE A SECOND TO SECOND SECON		
Sycamore Creek (Big Lake)	27-33-9	B;NSW	05/01/88
From source to Crabtree Creek			
Tar Creek	27-150-31-4	SA;HQW,NSW	05/01/88
From source to Gale Creek			

Tar Kiln Branch

**Tar River** 

From source to Broad Creek

From source to Falling Creek

From source to Trotters Creek

08/03/92

08/01/02

WS-IV;NSW

WS-IV;NSW

27-54-6

27-71-2-2

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Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.



Site #56

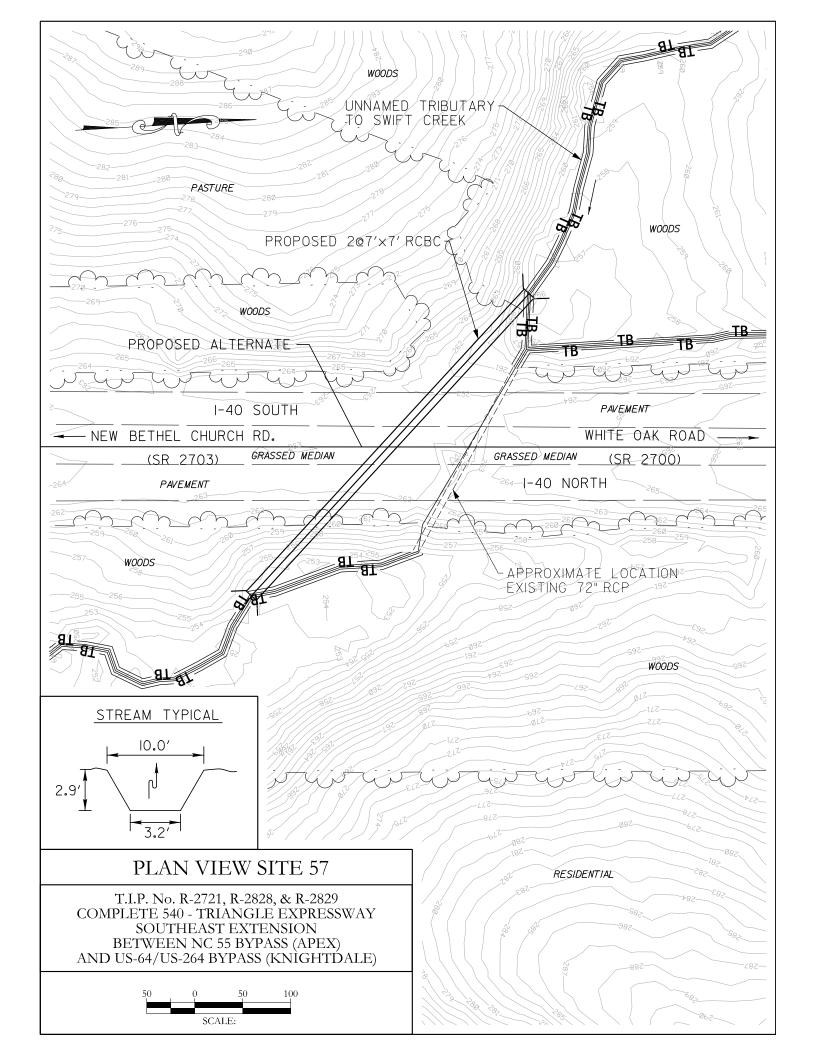
Inlet of Existing 60" CMP.

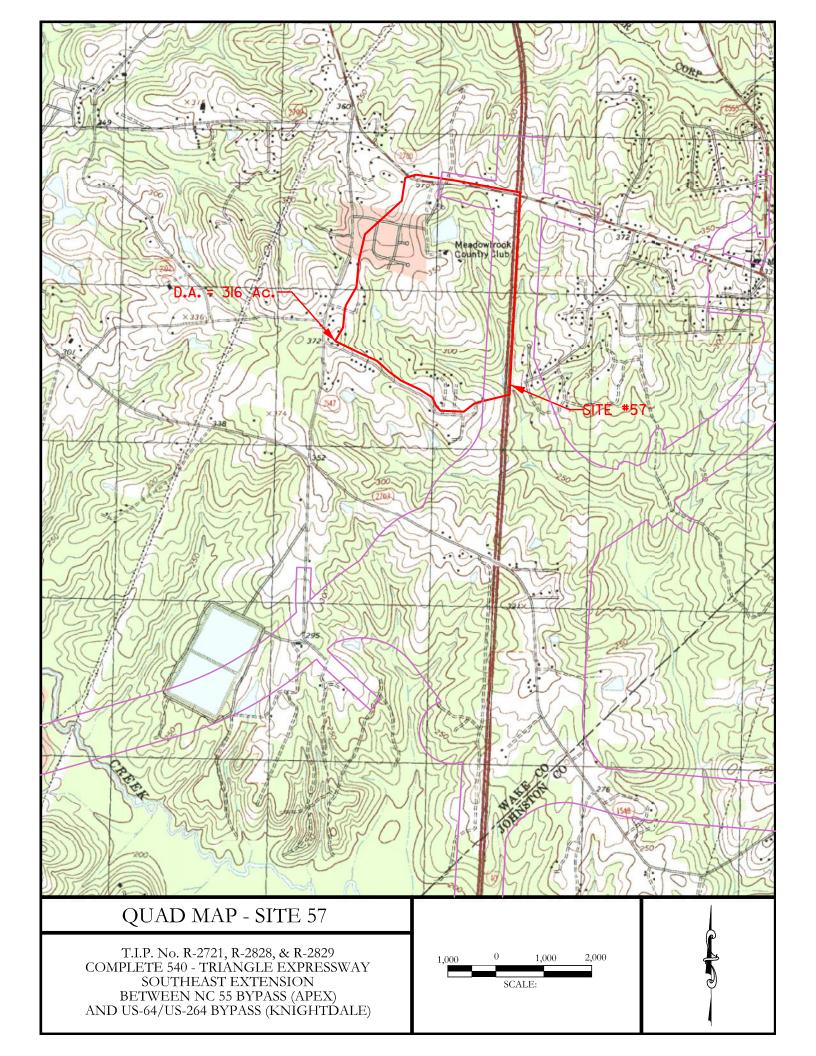


Outlet of Existing 60" CMP.

Page **2** of **2** 

## **Site 57**





Site #57

4/18/2014

REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00 STREAM NAME: Unnamed Trib to Swift Creek sq. miles PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = ENGLISH

<b>USGS RUR</b>	AL REGRE	<b>USGS RURAL REGRESSION EQUAT</b>	ATIONS (OLD)	RUF	SAL EQUA	TIONS Rep	RURAL EQUATIONS Report 01-4207	
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	<b>Blue Ridge</b>	Coastal Plain	Sand Hills	
	(cts)	(cfs)	(cfs)		(cts)	(cfs)	(cfs)	
2YR	17.61	44.21	87.96	2YR	81.82	40.03	20.16	
5YR	28.83	98.37	153.77	5YR	149.31	82.01	33.66	
10YR	37.99	151.01	207.84	10YR	208.28	121.24	44.34	
25YR	50.45	247.68	292.68	25YR	300.46	184.07	59.84	
50YR	61.19	339.59	365.43	50YR	382.71	242.82	73.30	
100YR	73.11	458.08	454.49	100YR	477.01	312.53	87.54	
200YR	89.88	605.80	551.51	200YR	585.12	394.70	104.21	
500YR	105.06	854.67	724.55	500YR	753.40	526.25	128.92	

# **USGS URBAN REGRESSION EQUATIONS**

BDF= 11

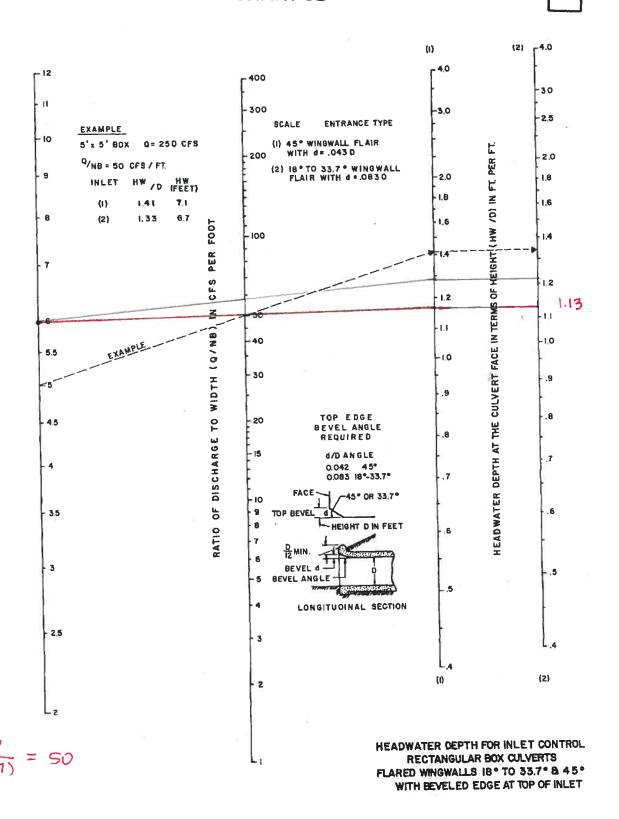
(These Equations are used only for comparison)

								(Based on 2.80xQ10)	
	щ	(cts)							1198.67
ioi companson)	Coastal Plain	(cfs) (cfs)	256.85	348.06	506.77	649.43	842.68	974.56	1372.52
ils ale used of ily	Sand Hills	(cfs)	09.86	116.99	141.90	162.05	187.14	327.57	246.04
( These Eduations	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

et 007-00
<b>USGS Fact Sheet 00</b>
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C REGRESSION
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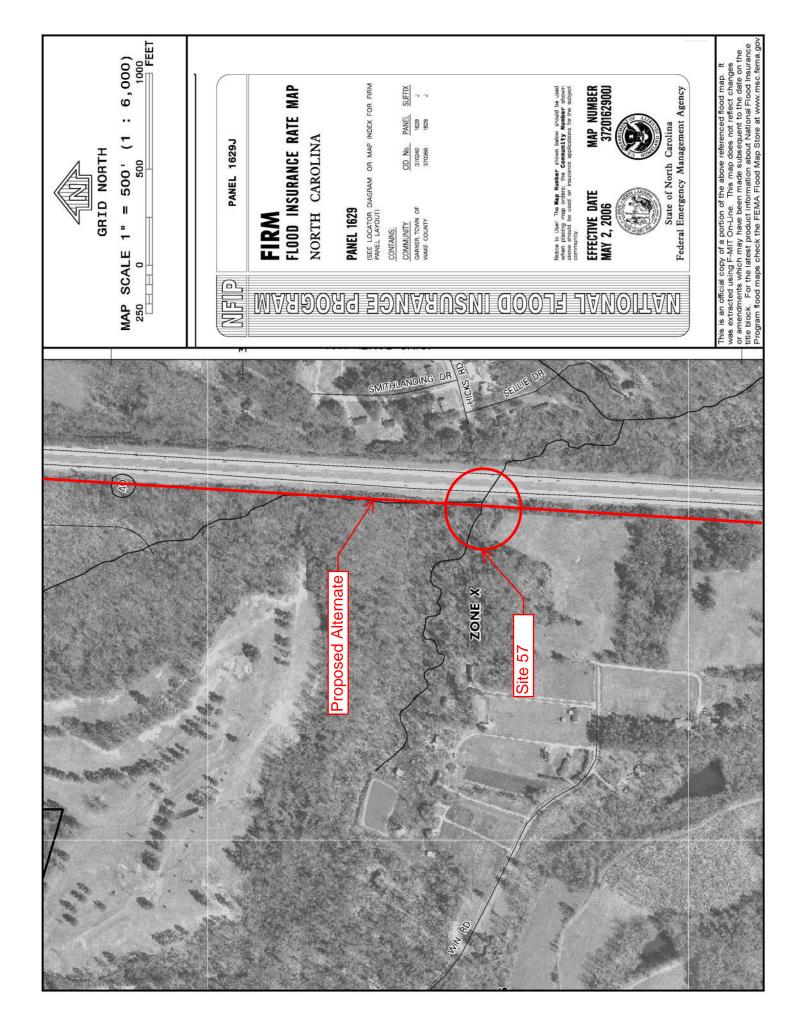
					L	4
= Snc	25				FEMA	₹
FREQUENCY		Coastal Plain	<b>Blue Ridge</b>	Blue Ridge Discharge Used	FREQUENCY	Disharges
		(cfs)	(cts)			
		269.45	306.00			
		366.22	401.22		10YR	
		566.32	599.99		50YR	
ı	386.09	672.78	689.25	200	100YR	
~		777.87	775.57		100YR	
~		1025.41	1123.40	(Based on 2.80xQ10)	500YR	
500YR		1340.35	1468.45	(Based on 3.66xQ10)		ı





HW= 1.13/

PROPOSED STRUCTURE:



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	One of		Neu	Neuse River Basi	
Name		Index Number	Classification	Class Date	
Description			Special	Designation	
Strouds Creek		27-2-9	C;NSW	12/01/83	
From source to Eno River					
Stump Bay		27-148-1-6	SA;HQW,NSW	05/01/88	
From source to Long Bay					
Swan Creek		27-144	SA;HQW,NSW	05/01/88	
From source to Neuse River					
Swan Pond		27-52-7	C;NSW	05/01/88	
Entire pond and connecting str	eam to Mill Creek				
Swift Creek		27-97-(6)	SC;Sw,NSW	05/01/88	
From mouth of Bear Branch to	Neuse River				
Swift Creek		27-97-(0.5)	C;Sw,NSW	05/01/88	
From source to mouth of Bear	Branch				
Swift Creek		27-43-(8)	C;NSW	05/01/88	
From dam at Lake Benson to N	euse River				
Swift Creek (Lake Benson)		27-43-(5.5)	WS-III;NSW,CA	08/03/92	
From a point 0.6 mile upstream	of Wake County SR 1006 to dam	at Lake Benson			
Swift Creek (Lake Wheeler)		27-43-(1)	WS-III;NSW	08/03/92	
From source to a point 0.6 mile	upstream of Wake County SR 10	06			
Swindell Bay		27-150-8-(2)	SC;Sw,NSW	05/01/88	
From the narrows to Bay River					
Swindell Bay		27-150-8-(1)	SC;Sw,HQW,NSW	08/01/90	
From source to the narrows	**************************************				
Sycamore Creek (Big Lake)		27-33-9	B;NSW	05/01/88	
From source to Crabtree Creek					
Tar Creek		27-150-31-4	SA;HQW,NSW	05/01/88	
From source to Gale Creek					
Tar Creek		27-141-4	SA;HQW,NSW	05/01/88	
From source to Broad Creek					
Tar Kiln Branch		27-54-6	WS-IV;NSW	08/03/92	
From source to Falling Creek					
Tar River		27-71-2-2	WS-IV;NSW	08/01/02	
From source to Trotters Creek					

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Looking Upstream from Proposed Crossing at stream channel running perpendicular to I-40.



Looking Upstream from Proposed Crossing at stream channel running parallel to I-40.



Inlet of Existing 72" RCP.

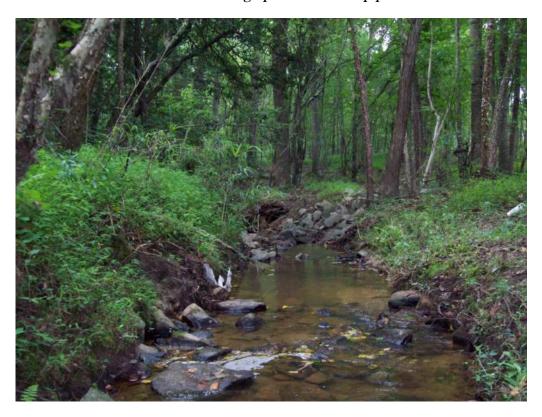


Outlet of Existing 72" RCP.

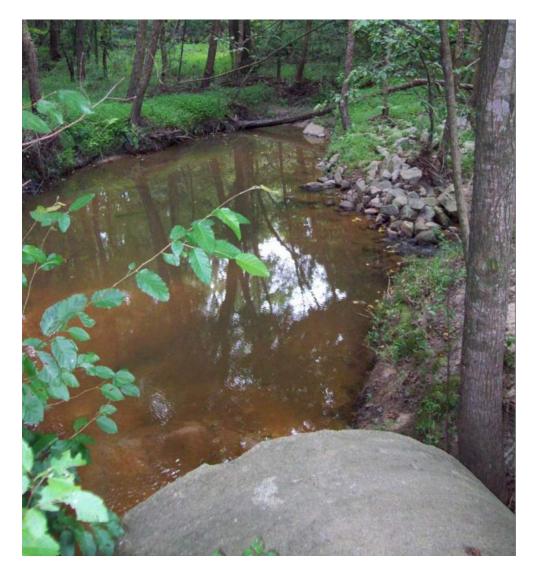
Page **2** of **4** 



Outlet channel looking upstream toward pipe outlet.

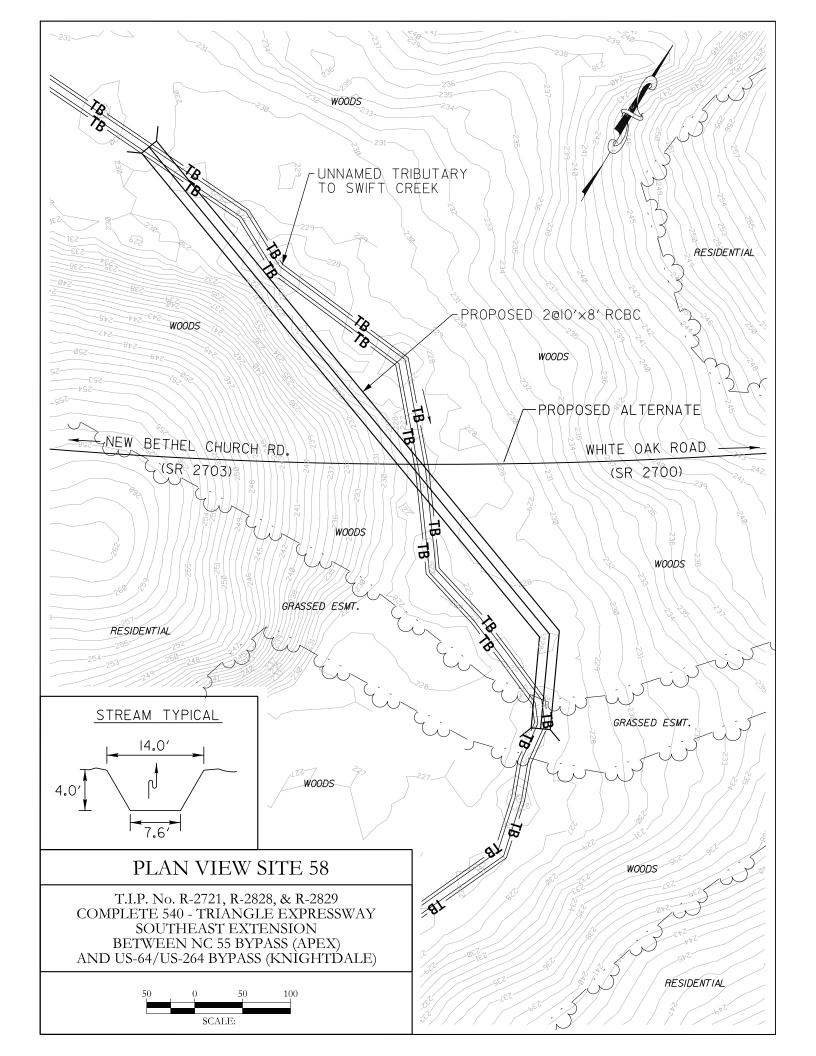


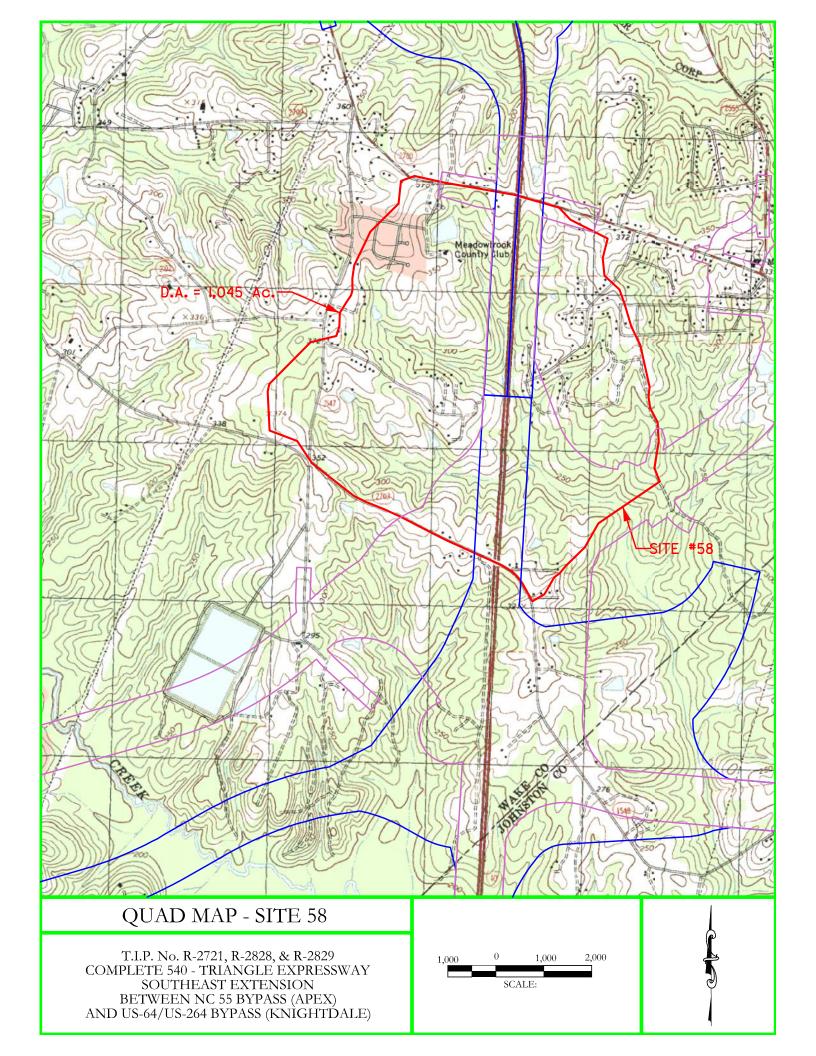
Outlet channel looking downstream.



View of scour hole at pipe outlet.

## Site 58





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REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00 STREAM NAME: Unnamed Trib to Swift Creek sq. miles 1.63 PROJECT NAME: Triangle Expressway SE Ext. ENGLISH Drainage Area = 1.63 Drainage Area =

2										
ort 01-420	Sand Hills	(cfs)	47.44	78.17	102.48	137.63	168.19	200.13	237.69	293.33
<b>RURAL EQUATIONS Report 01-4207</b>	Coastal Plain	(cfs)	89.89	175.93	253.89	375.43	486.99	617.08	768.16	1005.89
RAL EQUA	Blue Ridge	(cfs)	190.23	336.87	461.55	652.33	820.99	1011.05	1226.86	1558.95
RUI	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR
ATIONS (OLD)	Blue Ridge	(cfs)	201.83	344.05	462.22	643.13	798.17	984.39	1188.80	1532.04
SSION EQU	Coastal Plain	(cfs)	94.51	198.01	295.66	469.45	629.88	832.47	1082.56	1492.80
<b>JSGS RURAL REGRESSION EQ</b> I	Sand Hills	(cfs)	42.49	66.69	92.45	124.41	151.99	182.92	225.14	267.63
<b>USGS RUR</b>	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR

# **USGS URBAN REGRESSION EQUATIONS**

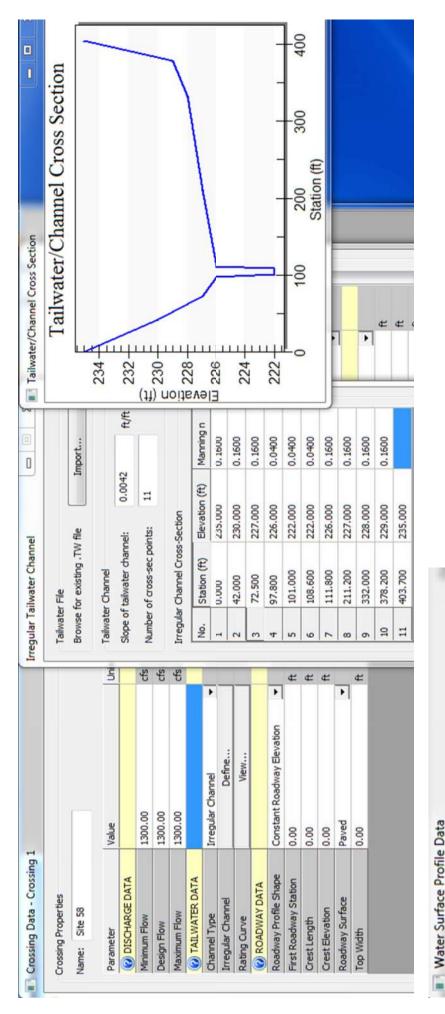
BDF=

(These Equations are used only for comparison)

								(Based on 2.80xQ10)	
	ш,	(cts)							2684.63
ioi compansoni)	Sand Hills Coastal Plain	(cfs)	543.73	717.28	1012.21	1282.79	1647.00	2008.38	2628.11
JIIS AIE USEU UIIIS	Sand Hills	(cfs)	241.59	286.30	349.85	405.53	475.39	801.65	642.01
	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

# NC REGRESSION EQUATIONS (% Impervious) USGS Fact Sheet 007-00

FEMA	<b>FREQUENCY</b> Disharges			10YR	50YR	100YR	500YR		
	Blue Ridge Discharge Used					1300		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	<b>Blue Ridge</b>	(cts)	610.61	785.91	1134.57	1300.88	1460.39	2200.55	2876.43
	Coastal Plain	(cts)	521.14	691.95	1019.39	1204.39	1385.93	1937.46	2532.53
20	Sand Hills	(cts)	387.44	492.27	647.30	760.01	862.79	1378.36	1801.71
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR



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Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
1300.000	229.405		1.723	1.941
1300.000	229.405	7.405	1.723	1.941
1300.000	229.405	7.405	1.723	1.941
1300.000	229.405	7.405	1.723	1.941
1300.000	229.405	7.405	1.723	1.941
1300.000	229.405	7.405	1.723	1.941
1300.000	229.405	7.405	1.723	1.941
1300.000	229.405	7.405	1.723	1.941
1300.000	229.405	7.405	1.723	1.941
1300.000	229.405	7.405	1.723	1.941
1300.000	229.405	7.405	1.723	1.941

# PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY: Wake PROJECT: NUMBER R-2721, R-2828 & R-2829
STREAM: <u>Unnamed Tributary to Swift Creek</u> ROUTE <u>New Location</u> (Site 58)
ASSESSMENT PREPARED BY Mulkey, INC. DATE <u>5/8/2014</u> (WBP)
HYDROLOGIC EVALUATION
NEAREST GAGING STATION ON THIS STREAM (NONE $\underline{X}$ )
ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: No
FLOOD DATA: $Q_{10} = 800 \text{ CFS} = \text{EST. BKWTR. } \frac{\text{N/A}}{\text{FT.}} = Q_{25} = \frac{1,100}{1,500} \text{ CFS} = \text{EST. BKWTR. } \frac{\text{N/A}}{\text{A}} \text{ FT.}$ $Q_{50} = \frac{1,300}{2,900} \text{ CFS} = \text{EST. BKWTR. } \frac{\text{N/A}}{\text{A}} \text{ FT.}$ $Q_{100} = \frac{1,500}{1,500} \text{ CFS} = \text{EST. BKWTR. } \frac{\text{N/A}}{\text{A}} \text{ FT.}$
DRAINAGE AREA: 1.63 Sq. Mi. METHOD USED TO COMPUTE Q: USGS Urban Regression
PROPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: LOW MODERATE X HIGH
COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: YES NO X
EXPLANTION: A maximum one foot rise in the natural base flood is allowed, but this rise should not affect any existing insurable structures.
LIST BUILDINGS IN FLOOD PLAIN: None LOCATION:
UPSTREAM LAND USE: <u>Residential</u> ANTICIPATE ANY CHANGE? <u>No</u>
ANY FLOOD ZONING? (FIA STUDIES, ETC.) YES NO $\underline{X}$
TYPE OF STUDY: N/A
REGULATORY FLOODWAY WIDTH N/A
COMMENTS:

### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 14,200 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 44,800 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A, New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? $N/A$ , New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? $\underline{\text{N/A}}$
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS  NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.  LEVEES AGGRADATION/DEGRADATION RESERVOIRS DIVERSIONS DRAINAGE DISTRICT NAVIGATION BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Appling, Wedowee, Wehadkee
TYPE SLOPE COVER <u>Vegetation</u>
COMMENTS: Soil Type from Web Soil Survey website of Wake County, NC.
ENVIRONMENTAL CONSIDERATIONS

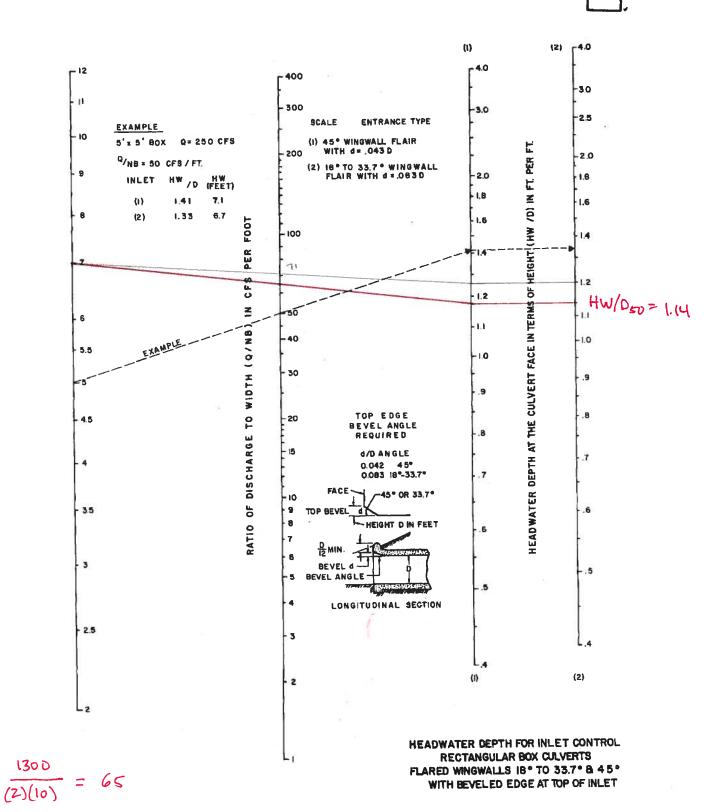
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC

DESIGN: Buried culverts 1 foot to allow for fish passage.

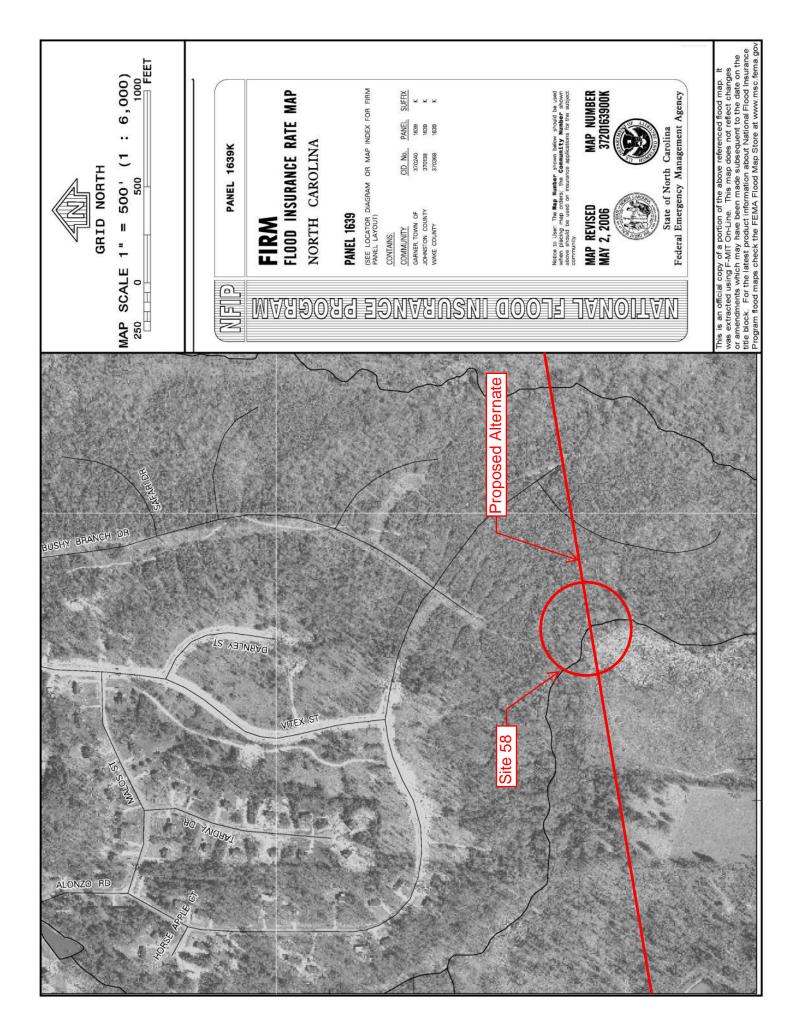
# MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED
ARE BANKS STABLE? <u>No</u> PROTECTION NEEDED <u>No</u>
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
<u>ALTERNATIVES</u>
RECOMMENDED DESIGN: 2@10'x8' RCBC
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING: <u>160 sq. ft.</u>
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO X DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1) X NORMAL PROCESS
(2) NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:





PROPOSED STRUCTURE Z9 10'x8' RCBC



Site 58
---------

		Neu	se River Bas
Name	Index Number	Classification	Class Date
Description		Special [	Designation
Strouds Creek	27-2-9	C;NSW	12/01/83
From source to Eno River			
Stump Bay	27-148-1-6	SA;HQW,NSW	05/01/88
From source to Long Bay			
Swan Creek	27-144	SA;HQW,NSW	05/01/88
From source to Neuse River			H. All-Addition and F. Sandracken and Addition of the State of the Sta
Swan Pond	27-52-7	C;NSW	05/01/88
Entire pond and connecting stream to Mill Creek			
Swift Creek	27-97-(6)	SC;Sw,NSW	05/01/88
From mouth of Bear Branch to Neuse River			
Swift Creek	27-97-(0.5)	C;Sw,NSW	05/01/88
From source to mouth of Bear Branch			
Swift Creek	27-43-(8)	C;NSW	05/01/88
From dam at Lake Benson to Neuse River		processor and thinking a large state of the same as a same	- 8 P 785 - 5 1970 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Swift Creek (Lake Benson)	27-43-(5.5)	WS-III;NSW,CA	08/03/92
From a point 0.6 mile upstream of Wake County SI	R 1006 to dam at Lake Benson		
Swift Creek (Lake Wheeler)	27-43-(1)	WS-III;NSW	08/03/92
From source to a point 0.6 mile upstream of Wake	County SR 1006		
Swindell Bay	27-150-8-(2)	SC;Sw,NSW	05/01/88
From the narrows to Bay River			
Swindell Bay	27-150-8-(1)	SC;Sw,HQW,NSW	08/01/90
From source to the narrows	PROPERTY OF THE REAL AND AND AND AND AND AND AND AND AND AND		
Sycamore Creek (Big Lake)	27-33-9	B;NSW	05/01/88
From source to Crabtree Creek			
Tar Creek	27-150-31-4	SA;HQW,NSW	05/01/88
From source to Gale Creek			
Tar Creek	27-141-4	SA;HQW,NSW	05/01/88
From source to Broad Creek			
Tar Kiln Branch	27-54-6	WS-IV;NSW	08/03/92
From source to Falling Creek			
Tar River	27-71-2-2	WS-IV;NSW	08/01/02

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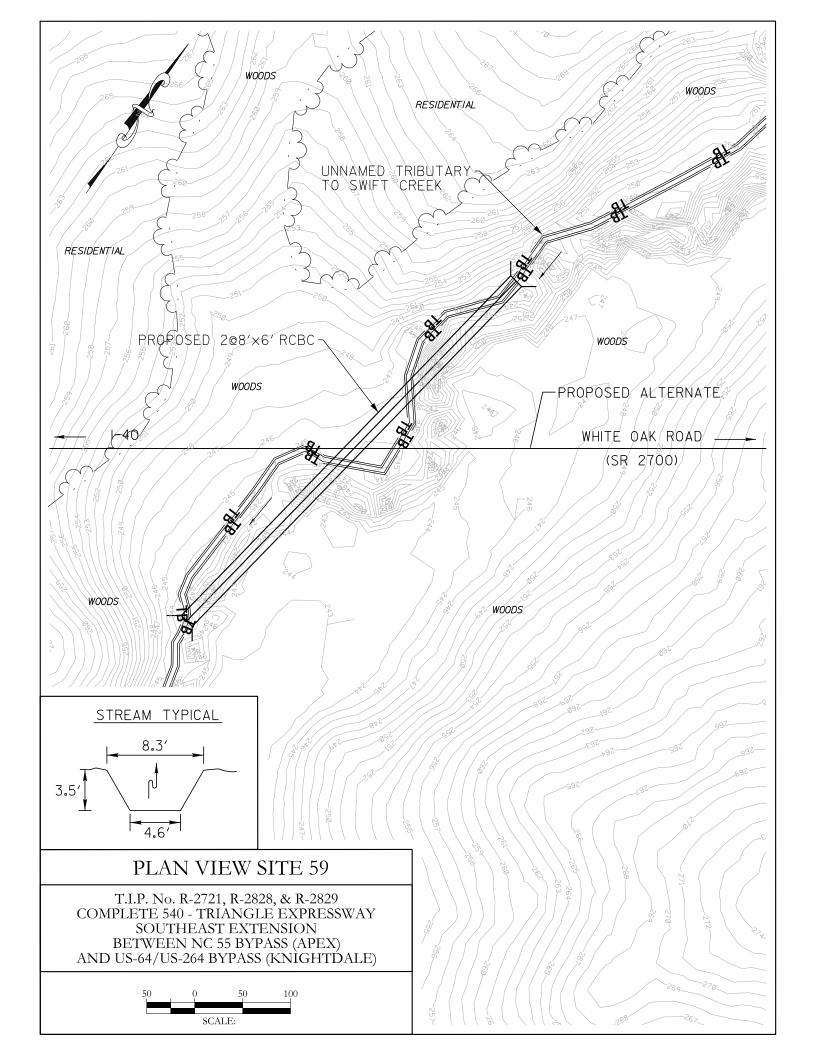


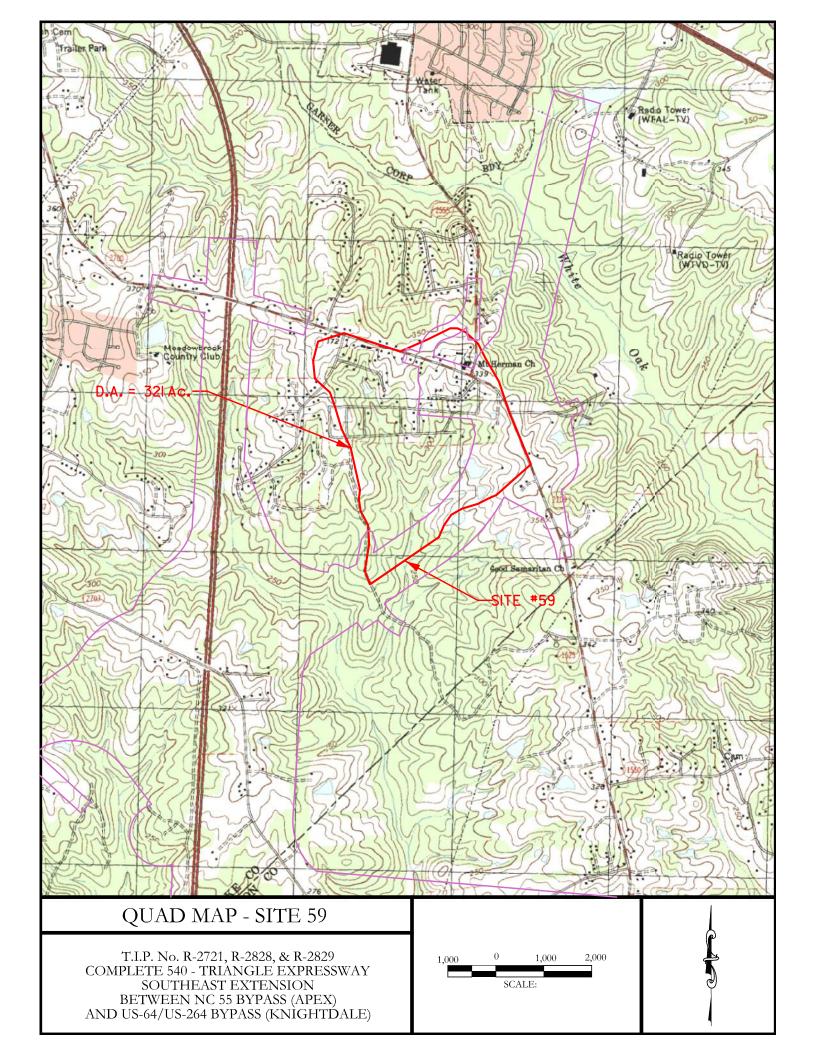
Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

# Site 59





**North Carolina** 

REGION: BLUE RIDGE

STREAM NAME: Unnamed Trib to Swift Creek sq. miles M PROJECT NAME: Triangle Expressway SE Ext. ENGLISH

METHOD USED: Fact Sheet 007-00 0.5 Drainage Area =

<b>USGS RUF</b>	<b>3AL REGRE</b>	<b>USGS RURAL REGRESSION EQUA</b>	ATIONS (OLD)	RUF	<b>3AL EQUA</b>	<b>ATIONS Rep</b>	RURAL EQUATIONS Report 01-4207	
FREQUENCY	Sand Hills	Coastal Plain	m)	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills	
	(cts)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)	
2YR	17.87	44.78		2YR	82.99	40.58	20.45	
5YR	29.26	99.54		5YR	151.36	83.07	34.14	
10YR	38.56	152.72		10YR	211.09	122.75	44.97	
25YR	51.22	250.36		25YR	304.40	186.29	89.09	
50YR	62.13	343.14		50YR	387.65	245.68	74.33	
100YR	74.25	462.70		100YR	483.07	316.13	88.76	
200YR	91.27	611.74		200YR	592.45	399.14	105.67	
500YR	106.72	862.72		500YR	762.67	532.02	130.71	

# **USGS URBAN REGRESSION EQUATIONS**

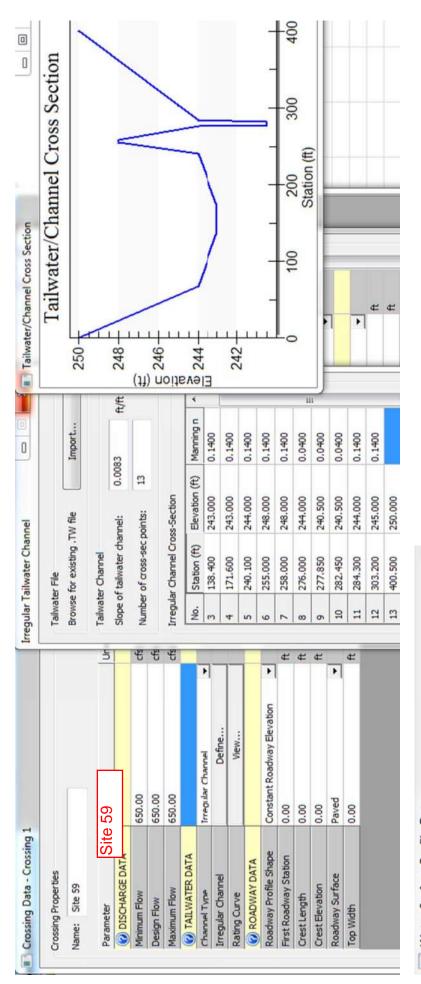
BDF= 11

(These Equations are used only for comparison)

								(Based on 2.80xQ10)	
	Blue Ridge	(cts)	369.05	454.21	587.12	698.65	848.80	1271.79	1215.03
ioi compansoni)	Coastal Plain	(cfs) (cfs)	260.11	352.32	512.70	06.969	852.22	986.48	1387.58
IIIS AIR USEU OIIIS	Sand Hills	(cfs)	100.09	118.76	144.07	164.57	190.09	332.54	250.04
( These Eduations	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

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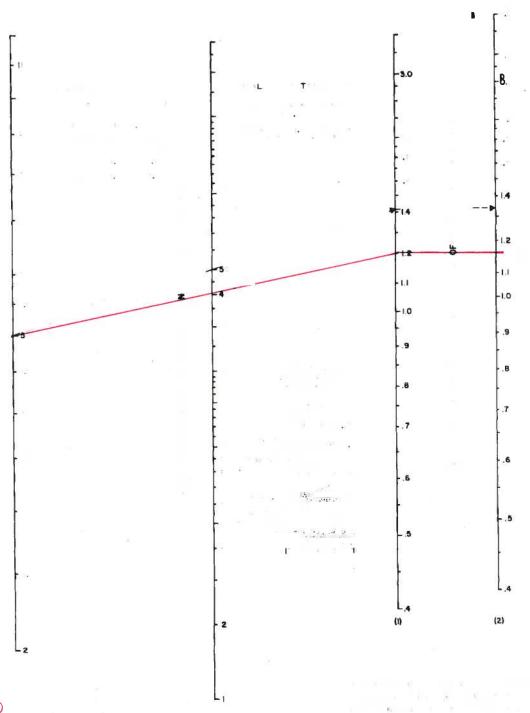
% Impervious =	20				FEMA	<b>₽</b>
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	lue Ridge Discharge Used	FREQUENCY	Disharges
	(cts)	(cts)	(cts)			
5YR	169.41	240.32	273.06			
10YR	221.18	330.61	362.42		10YR	
25YR	302.41	519.77	551.13		50YR	
50YR	358.01	622.86	638.67	650	100YR	
100YR	409.81	726.13	724.65		100YR	
200YR	619.32	925.70	1014.78	(Based on 2.80xQ10)	500YR	
500YR	809.54	1210.02	1326.47	(Based on 3.66xQ10)		ı



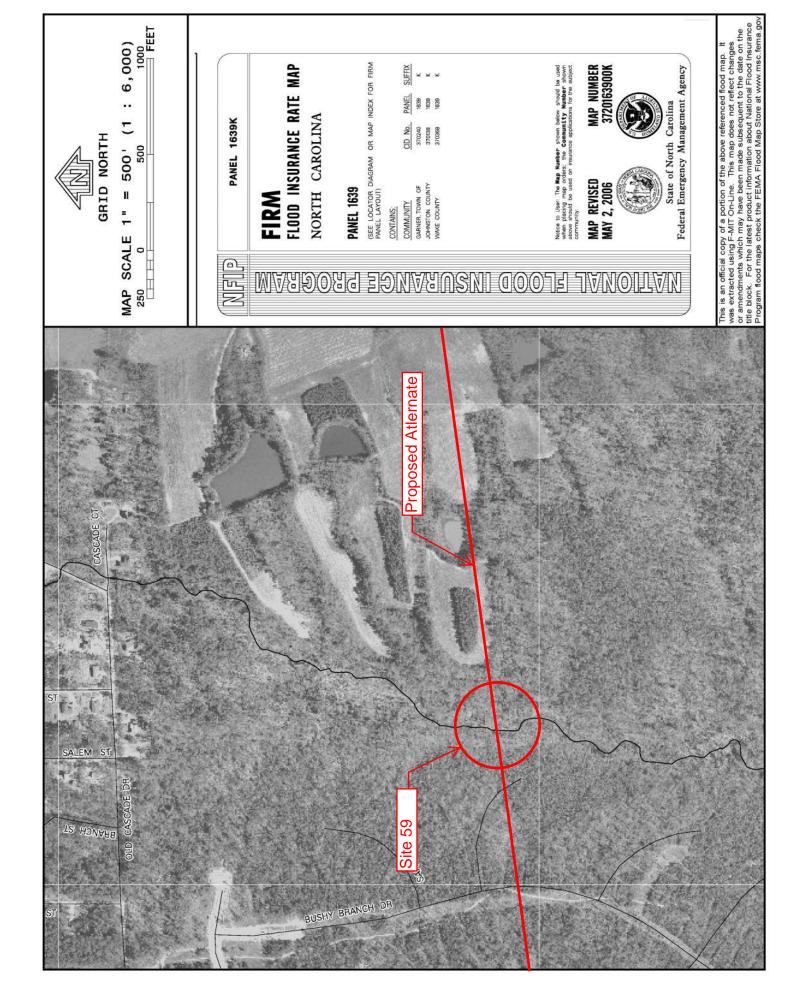
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Flow (cfs)	Elevation (ft) Depth (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
650.000	245, 190	4.690	1.767	2.429
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650.000	245, 190	4.690	1.767	2.429
650.000	245, 190	4.690	1.767	2.429
650.000	245, 190	4.690	1.767	2.429
650.000	245, 190	4.690	1.767	2.429
650.000	245, 190	4.690	1.767	2.429
650.000	245, 190	4.690	1.767	2.429
650.000	245.190	4.690	1.767	2.429
650.000	245, 190	4.690	1.767	2.429
650.000	245.190	4.690	1.767	2.429

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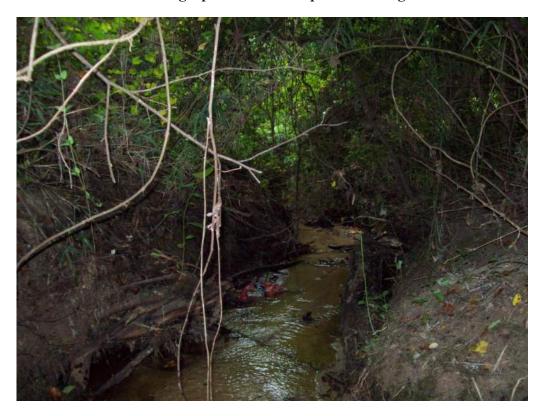
			ise River Ba
Name	Index Number	Classification	Class Dat
Description		Special	Designation
Strouds Creek	27-2-9	C;NSW	12/01/83
From source to Eno River			
Stump Bay	27-148-1-6	SA;HQW,NSW	05/01/88
From source to Long Bay			
Swan Creek	27-144	SA;HQW,NSW	05/01/88
From source to Neuse River			ME III-MAAMMATA T Suistaninkus PH MA AMAM MAT BAAAT T V T vo
Swan Pond	27-52-7	C;NSW	05/01/88
Entire pond and connecting stream to Mill Creek	11 21 41 41 41 41 41 41 41 41 41 41 41 41 41		
Swift Creek	27-97-(6)	SC;Sw,NSW	05/01/88
From mouth of Bear Branch to Neuse River			
Swift Creek	27-97-(0.5)	C;Sw,NSW	05/01/88
From source to mouth of Bear Branch			
Swift Creek	27-43-(8)	C;NSW	05/01/88
From dam at Lake Benson to Neuse River		-	
Swift Creek (Lake Benson)	27-43-(5.5)	WS-III;NSW,CA	08/03/92
From a point 0.6 mile upstream of Wake County SR			
Swift Creek (Lake Wheeler)	27-43-(1)	WS-III;NSW	08/03/92
From source to a point 0.6 mile upstream of Wake	•	•	
Swindell Bay	27-150-8-(2)	SC;Sw,NSW	05/01/88
From the narrows to Bay River	2. 255 5 (4/		
	27.450.0./4\	CC.C HOW NEW	09/01/00
Swindell Bay From source to the narrows	27-150-8-(1)	SC;Sw,HQW,NSW	08/01/90
Sycamore Creek (Big Lake)	27-33-9	B;NSW	05/01/88
From source to Crabtree Creek			
Tar Creek	27-150-31-4	SA;HQW,NSW	05/01/88
From source to Gale Creek			
Tar Creek	27-141-4	SA;HQW,NSW	05/01/88
From source to Broad Creek			
Tar Kiln Branch	27-54-6	WS-IV;NSW	08/03/92
From source to Falling Creek			
Tar River	27-71-2-2	WS-IV;NSW	08/01/02

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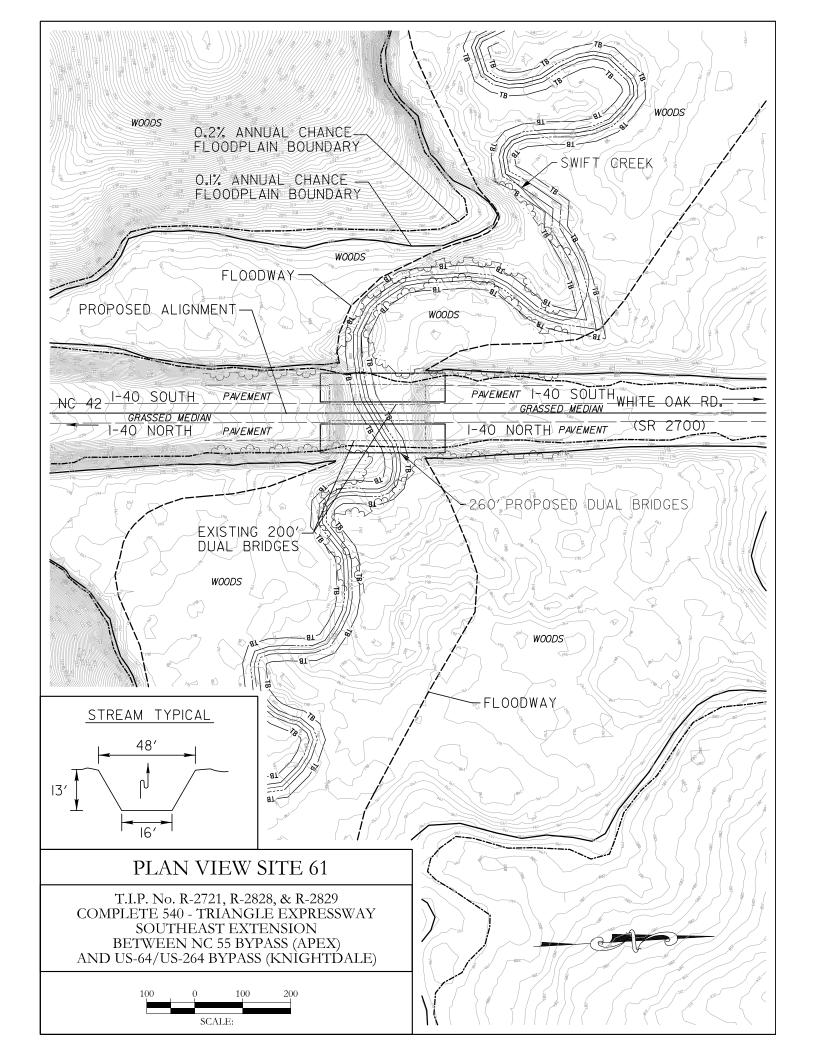
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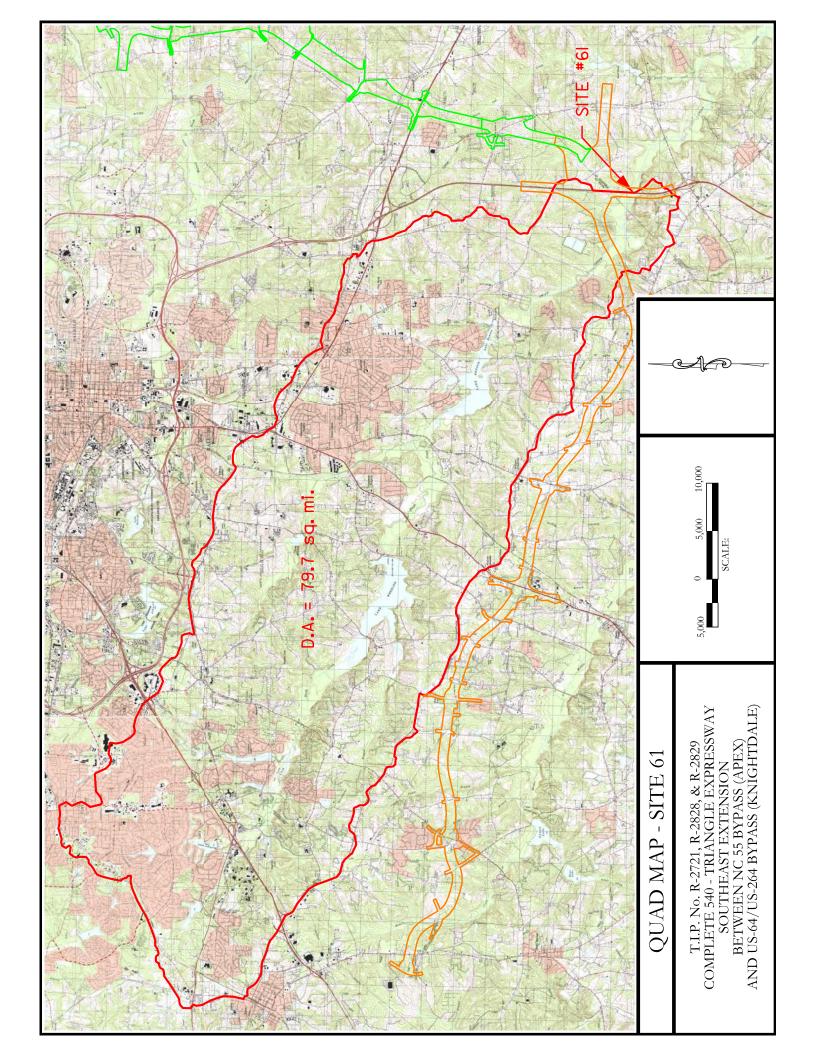
Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

# Site 61





This spreadsheet computes the 50, 20, 10, 4, 2, 1, 0,5, and 0.2-percent chance exceedance flows for an ungaged site in Georgia, South Carolina, and North Carolina. The spreasheet also includes the 95-percent prediction intervals, the minus and plus standard error of prediction intervals, and the average standard error of prediction. To use the spreadsheet, enter requested information in the yellow cells below.

Enter a site-description name:

Site 61

# Enter the explanatory variables:

Drainage area, in square miles	79.7
Percent of basin in Hydrologic Region 1	100
Percent of basin in Hydrologic Region 2	0
Percent of basin in Hydrologic Region 3	0
Percent of basin in Hydrologic Region 4	0
Percent of basin in Hydrologic Region 5	0

Applicable range of draingage area is 1 to 9,000 square miles.

Hydrologic Region 1 corresponds to the USEPA Level III Ridge and Valley and Piedmont ecoregions

Hydrologic Region 2 corresponds to the USEPA Level III Blue Ridge ecoregion

Hydrologic Region 3 corresponds to the USEPA Level IV Sand Hills ecoregion

Hydrologic Region 4 corresponds to the USEPA Level III Southassem, Middle Atlantic Coastal, and Southern Coastal Plain ecoregions

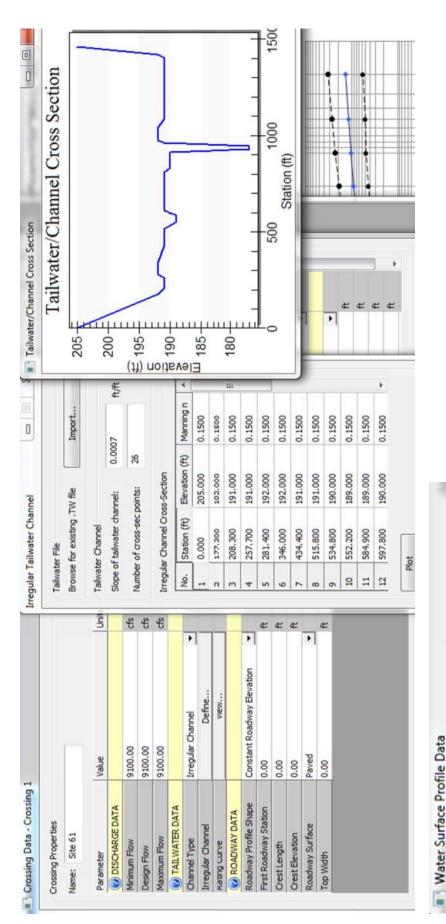
Hydrologic Region 5 corresponds to the lower portion of the USEPA Level IV Tifton Uplands ecoregion.

Drainage area check DRAINAGE AREA WITHIN APPLICABLE LIMITS. Sum of region percentages

	Percent chance	Lower 95 percent prediction	Upper 95 percent prediction			Average
_	exceedance	interval flow,	interval flow,		+S <sub>P,i</sub>	S <sub>i,q</sub>
Percent chance exceedance 50	110W, IN 117S 2.720	In IT /s	In It /s 5,230	(percent) -28.3	(percent) 39.5	(percent) 34.3
20	ľ			-28.0	38.9	33.8
10	5,930		11,500	-28.7	40.3	34.9
4	7,630	3,770	15,400	-30.2	43.3	
2	9,140	4,350	19,200	-31.5	46.1	39.3
	10,500	4,800	23,000	-32.9	49.0	41.5
0.5	11,700	5,130	26,700	-34.3	52.2	43.9
0.2	13,800	5,720	33,300	-36.2	56.7	47.3

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	REQUENCY	Disharges
	TOYR	6.040
-	SOYR	8,180
500YR 12,200	100YR	9,290
	SOOYR	12,200

					0.1			
					1.0	eedance	— Percent Chance Exceedance Flow  — Upper 95 Percent Prediction Interval	
					10.0	Percent chance exceedance	Percent C	• Lower 95
Site 61	100,000	10,000	1,000	100	10 100.0			
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Flow (cfs)	Elevation (ft) Depth (ft)	Depth (ft)	Velocity (ft/s) Shear (psf)	Shear (psf)	
9100.000	196.688	19,688	1.184	0.860	
9100.000	196.688	19.688	1.184	0.860	
9100.000	196.688	19.688	1.184	0.860	
9100.000	196.688	19.688	1.184	0.860	
9100.000	196.688	19.688	1.184	0.860	
9100.000	196.688	19.688	1.184	0.860	
9100.000	196.688	19.688	1.184	0.860	
9100.000	196.688	19.688	1.184	0.860	
9100.000	196.688	19.688	1.184	0.860	
9100.000	196.688	19.688	1.184	0.860	
9100.000	196.688	19.688	1.184	0.860	

# PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY: Johnston PROJECT NUMBER: R-2721, R-2828 & R-2829 STREAM: Swift Creek ROUTE: I-40 (Site 61) ASSESSMENT PREPARED BY Mulkey, INC. DATE 2/7/2014 (WBP) **HYDROLOGIC EVALUATION** NEAREST GAGING STATION ON THIS STREAM: 0208758850 near McCullars Crossroads, NC. Period of record: 1992 to 1996. ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: Yes FLOOD DATA:  $Q_{10}$  5,900 CFS EST. BKWTR. N/A FT.  $Q_{25} = \frac{7,600}{100}$ CFS EST. BKWTR. N/A FT. Q<sub>50</sub> 9,100 CFS EST. BKWTR. N/A FT. Q<sub>100</sub> 10,500 CFS EST. BKWTR. N/A FT. Q<sub>500</sub> 13,800 CFS EST. BKWTR. N/A FT. DRAINAGE AREA: 79.7 Sq. Mi. METHOD USED TO COMPUTE Q: USGS Rural **Regression Equations** PROPERTY RELATED EVALUATIONS DAMAGE POTENTIAL: LOW \_\_\_\_\_ MODERATE X HIGH COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED ENCROACHMENT: YES NO X EXPLANTION: A floodway modification may be required at this site. LIST BUILDINGS IN FLOOD PLAIN: None LOCATION: UPSTREAM LAND USE Agricultural and Residential ANTICIPATE ANY CHANGE? No ANY FLOOD ZONING? (FIA STUDIES, ETC.) YES X NO \_\_\_\_\_ TYPE OF STUDY: FEMA – Special Flood Hazard Zone AE REGULATORY FLOODWAY WIDTH 416 ft. Section 1421 (AS NOTED IN FIS)

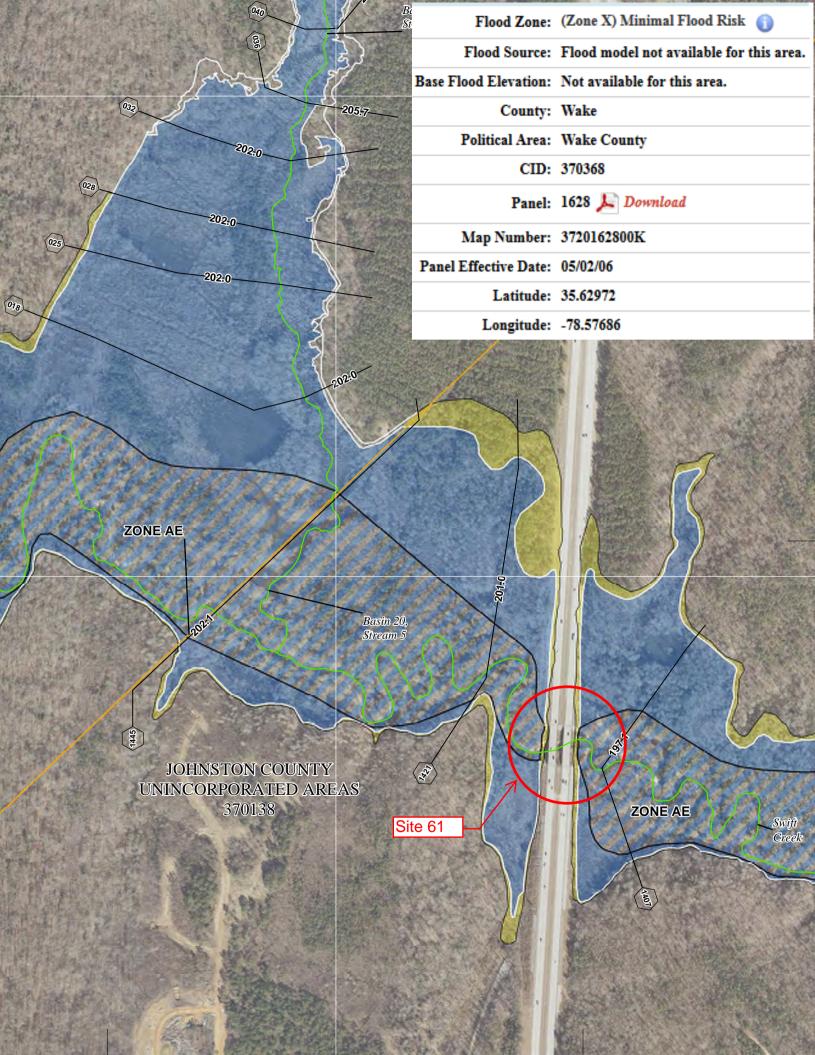
COMMENTS: \_\_\_\_\_

## TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2010 TRAFFIC COUNT 27,000 VPD % TRUCKS 23
DESIGN YEAR 2025 TRAFFIC COUNT 54,000 VPD % TRUCKS 23
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? YES LENGTH OF DETOUR 6 MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? $\underline{\text{NO}}$
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? NO
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS
NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE <u>X</u> ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Wehadkee TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from Web Soil Survey website of Johnston County, NC.
ENVIRONMENTAL CONSIDERATIONS
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN:

# MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED
ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
ALTERNATIVES
RECOMMENDED DESIGN: Dual 260 ft. bridges
DETOUR STRUCTURE <u>N/A</u>
BRIDGE WATERWAY OPENING
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO X DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:



# PRELIMINARY FLOOD INSURANCE STUDY

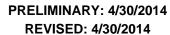
# FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in JOHNSTON COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
JOHNSTON COUNTY	370138
TOWN OF ARCHER LODGE	370138
TOWN OF BENSON	370504
TOWN OF CLAYTON	370139
TOWN OF FOUR OAKS	370502
TOWN OF KENLY	370501
TOWN OF MICRO	370500
TOWN OF PINE LEVEL	370505
TOWN OF PRINCETON	370485
TOWN OF SELMA	370499
TOWN OF SMITHFIELD	370140
TOWN OF WILSON'S MILLS	370262





**Federal Emergency Management Agency** 

State of North Carolina

Flood Insurance Study Number 37101CV000

www.fema.gov and www.ncfloodmaps.com





Table 8P - Scope of Revisions: Revised or New Detailed Study - Preliminary

Table of - occ	pe of Revisions. Revise	ca of New Detailed Olda	y - i i Cililililai y
Source	Riverine	Sources	Affected Communties
	From	То	
Stone Creek	The confluence with Mill Creek (South)	Approximately 1,640 feet upstream of U.S. Highway 701	Johnston County Town Of Archer Lodge
Stony Fork	The confluence with Hannah Creek	Approximately 1,550 feet upstream of U.S. Highway 301	Johnston County Town Of Archer Lodge
Swift Creek	The confluence with Neuse River	The Johnston/Wake County boundary	Johnston County Town Of Archer Lodge Town Of Smithfield
Unnamed Tributary (#1) to Swift Creek	The confluence with Swift Creek	The Johnston/Wake County boundary	Johnston County Town Of Archer Lodge
1 nnamed Tributary (#2) to Swift Creek	The confluence with Swift Creek	Approximately 190 feet upstream of Cornwallis Road	Johnston County Town Of Archer Lodge
White Oak Creek	The confluence with Swift Creek	The Johnston/Wake County boundary	Johnston County Town Of Archer Lodge Town Of Clayton

Table 9P, "Scope of Revisions: Redelineated - Preliminary", contains a list of flooding sources that were studied by detailed methods for previous FISs, but were only partially revised in the current study. There effective analyses remain valid; however, their floodplain delineations have been revised on the current FIRM.

Table 9P - Scope of Revisions: Redelineated - Preliminary

Source	Riverine	Sources	Affected Communties
	From	То	
Poplar Creek <sup>1</sup>	The confluence with the Neuse River	Approximately 0.3 mile upstream of Wilson's Mills Road	Town Of Smithfield Town Of Wilson's Mills

<sup>&</sup>lt;sup>1</sup>Revised to reflect backwater effects from new detailed study

Table 10P, "Scope of Revisions: Limited Detailed - Preliminary", lists flooding sources that were newly studied by limited detailed methods or were previously studied by limited detailed methods and had a change in backwater elevation due to flooding effects from a newly studied flooding source.

Table 10P - Scope of Revisions: Limited Detailed - Preliminary

Source	Riverin	Riverine Sources			
	From	То			
Arters Branch <sup>1</sup>	The confluence with the Neuse River	Approximately 635 feet downstream of Galilee Road	Town Of Smithfield		
Bawdy Creek <sup>1</sup>	The confluence with the Neuse River	Approximately 1.7 miles upstream of confluence with Neuse River	Johnston County Town Of Archer Lodge		
Beaverdam Swamp <sup>1</sup>	The confluence with Hannah Creek	Approximately 2,900 feet upstream of Parkertown Road	Johnston County Town Of Archer Lodge Town Of Four Oaks		
Beddingfield Creek <sup>1</sup>	Approximately 0.4 mile upstream of the confluence with Neuse River	Approximately 385 feet downstream of Shotwell Road	Town Of Clayton		
Bernal Branch <sup>1</sup>	The confluence with Hannah Creek	Just downstream of Mulberry Road	Johnston County Town Of Archer Lodge		
Black Creek Tributary 1	The confluence with Black Creek	Approximately 1,500 feet upstream of confluence with Black Creek	Johnston County Town Of Archer Lodge		
Buffalo Creek <sup>1</sup>	The confluence with Middle Creek	Approximately 0.54 mile upstream of confluence with Middle Creek	Johnston County Town Of Archer Lodge		
Buffalo Creek	U.S. Highway 301	Approximately 1,000 feet upstream of U.S. Highway 70	Town Of Selma Town Of Smithfield		
Burnt Stocking Branch	The confluence with Little Creek	Approximately 0.5 mile upstream of Pine Level Micro Road	Johnston County Town Of Archer Lodge		
Camp Branch <sup>1</sup>	The confluence with Black Creek	Approximately 620 feet upstream of confluence with Black Creek	Johnston County Town Of Archer Lodge		
Cooper Branch <sup>1</sup>	The confluence with Swift Creek	Approximately 0.3 mile upstream of Little Creek Church Road	Johnston County Town Of Archer Lodge		
Cow Branch	The confluence with Middle Creek	Approximately 0.9 mile upstream of Sommerset Drive	Johnston County Town Of Archer Lodge		
Dicks Branch <sup>1</sup>	The confluence with Black Creek	Approximately 0.37 mile upstream of confluence with Black Creek	Johnston County Town Of Archer Lodge		
Hardee Mill Branch <sup>1</sup>	The confluence with Black Creek	Approximately 690 feet downstream of Benson-Hardee Road	Johnston County Town Of Archer Lodge		
Johnson Swamp <sup>1</sup>	The confluence with Stone Creek	Approximately 1,450 feet upstream of confluence with Stone Creek	Johnston County Town Of Archer Lodge		

**Table 13 - Summary of Discharges** 

Flooding Source		100:		rges (cfs)	
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annu Chance
Approximately 5,950 feet downstream of Stone Creek Road	11.12	835	1,415	1,708	2,393
Approximately 1,685 feet downstream of Stone Creek Road	10.24	793	1,346	1,626	2,280
Approximately 3,300 feet upstream of Stone Creek Road	8.58	711	1,211	1,463	2,056
At N.C. 96	7.40	649	1,108	1,340	1,886
Approximately 3,145 feet upstream of N.C. 96	6.13	578	990	1,199	1,692
Approximately 4,650 feet downstream of Adams Road	5.03	511	879	1,066	1,506
Approximately 2,350 feet downstream of Adams Road	1.79	271	473	578	826
Approximately 800 feet downstream of Adams Road	1.24	216	380	464	667
Approximately 1,750 feet downstream of Interstate 40	1.09	198	351	430	618
At Interstate 40	0.62	140	250	308	445
Stone Creek Tributary					
Approximately 0.2 mile upstream of the confluence with Stone Creek	2.59	*	*	1,350	*
Approximately 0.1 mile downstream of Adams Road	1.43	*	*	933	*
Approximately 0.2 mile upstream of Adams Road	1.33	*	*	889	*
Approximately 0.5 mile upstream of Adams Road	1.06	*	*	773	*
Stony Fork					
At the mouth at Hannah Creek	9.43	1,589	2,539	2,943	3,963
At the mouth at Hannah Creek	8.70	*	*	1,920	*
At Railroad	7.95	1,431	2,293	2,664	3,589
Approximately 0.5 mile downstream of Raleigh Road	7.68	*	*	2,660	*
Approximately 0.1 mile upstream of Shade Tree Road	2.78	*	*	1,410	*
Approximately 0.6 mile upstream of Shade Tree Road	1.87	*	*	1,100	*
Stony Fork Tributary					
Approximately 0.4 mile upstream of the confluence with Stony Fork	3.78	*	*	1,710	*
Approximately 0.6 mile downstream of Federal Road	3.39	*	*	1,600	*
Approximately 0.2 mile downstream of Federal Road	3.12	*	*	1,520	*
Approximately 0.1 mile upstream of Interstate 40	2.64	*	*	1,370	*
Swift Creek					
At the mouth	286.80	9,523	14,739	17,036	22,489
Above Middle Creek (at NC 210)	155.22	7,904	12,164	13,961	18,358
Just upstream of confluence with Swift Creek Tributary 3	153.01	7,894	12,145	13,934	18,318
Approximately 2.0 miles downstream of Lee Road	120.85	7,424	11,387	13,022	17,083
Approximately 0.9 mile upstream of Barver Mill Road	109.88	7,070	10,853	12,412	16,290
Approximately 0.9 mile downstream of Cornwallis Road	89.45	6.195	9.547	10.936	14.389
Approximately 0.3 mile upstream of NC 42	81.22	6,002	9,243	10,577	13,911
Swift Creek Tributary 3					
stream of confluence with Swift Creek	1.62	477	904	1,069	1,572
Approximately 3,225 feet upstream of confluence with Swift Creek	0.57	122	220	271	395
Approximately 1,150 feet downstream of Market Street	0.40	99	178	220	322
Approximately 1,265 feet upstream of Market Street	0.21	65	119	148	218
Unnamed Tributary (#1) to Swift Creek					
At the confluence with Swift Creek	4.77	1,044	1,687	1,963	2,664
Approximately 100 feet downstream of New Bethel Church Road	3.98	934	1,513	1,763	2,397
Approximately 3,050 feet upstream of New Bethel Road	3.12	804	1,309	1,527	2,082

**Table 16 - Roughness Coefficients** 

Stream	Channel "n"	Overbank "n"
Mill Branch	0.050	0.030 to 0.150
Mill Creek (Near Clayton)	0.045	0.100
Mill Creek (Near Selma)	0.055	0.150
Mill Creek (South)	0.035 to 0.060	0.040 to 0.160
Mill Creek Tributary 2	0.050	0.150
Mill Creek Tributary 3	0.050	0.150
Mill Creek Tributary 4	0.050	0.150
Mill Creek Tributary 6	0.050	0.150
Mill Swamp Branch	0.050	0.150
Moccasin Creek	0.030 to 0.070	0.030 to 0.220
Moccasin Creek Tributary 1	0.045 to 0.050	0.120 to 0.140
Moccasin Creek Tributary 2	0.046	0.130
Moccasin Swamp	0.048	0.035 to 0.150
Neuse River	0.035 to 0.060	0.055 to 0.250
Neuse River Tributary 1	0.051 to 0.052	0.050 to 0.150
Neuse River Tributary 2	0.048 to 0.052	0.065 to 0.150
Oak Creek	0.050	0.150
Pole Branch	0.045	0.130
Polecat Branch	0.045	0.130
Poplar Creek	0.051	0.055 to 0.150
Quincosin Swamp	0.050	0.150
Reedy Creek	0.045	0.130
Reedy Prong	0.050	0.150
Reedy Prong Tributary	0.050	0.150
Sams Creek	0.035 to 0.055	0.070 to 0.150
Snipes Creek	0.042 to 0.045	0.120 to 0.130
Spring Branch	0.020 to 0.060	0.030 to 0.140
Spring Branch Tributary 1	0.042	0.130
Stone Creek	0.040 to 0.060	0.030 to 0.150
Stone Creek Tributary	0.050	0.150
Stony Fork	0.045 to 0.060	0.030 to 0.150
Stony Fork Tributary	0.050	0.150
Swift Creek	0.040 to 0.072	0.035 to 0.240
Swift Creek Moutary 3	0.055	0.060 to 0.150
Unnamed Tylbutary (#1) to Swift Creek	0.045 to 0.060	0.050 to 0.150
Unnamed /ributary (#2) to Swift Creek	0.043	0.050 to 0.150
White Oak Creek	0.035 to 0.050	0.035 to 0.150

Site 61

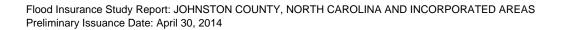
For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained using digital elevation data obtained with LIDAR technology developed as part of the North Carolina Statewide Floodplain Mapping Program. The hydraulic model is prepared using this digital elevation data, without surveying bathymetric or structural data. Where bridge or culvert data are readily available, such as from the North Carolina Department of Transportation, these data have been reflected in the hydraulic model. If these structural data are not readily available, field measurements of these structures were made to approximate their geometry in the hydraulic models. In addition, this method does not include field surveys that determine specifics on channel and floodplain characteristics. A limited detailed study is a "buildable" product that can be upgraded to a fully detailed study at a later date by verifying stream channel characteristics, bridge and culvert opening geometry, and by analyzing multiple recurrence intervals.

The results of the HEC-RAS computations are tabulated for all cross sections (Table 17, "Limited Detailed Flood Hazard Data"). Flood Profiles have not been developed for streams studied by limited detailed methods. Water-surface elevation rasters were developed for steams studied by limited detailed methods. In addition, floodways for streams studied by limited detailed methods are not delineated on the FIRM. However, the 1% annual chance water-surface elevations, flood discharges, and non-encroachment widths from the limited detailed studies for every modeled cross section are given in Table 17. The non-encroachment widths given at modeled cross sections can be used by communities to enforce floodplain management ordinances that meet the requirement defined in 44 CFR 60.3(c)(10).

Between cross sections for streams studied by limited detailed methods, 1% annual chance water-surface elevations can be calculated by mathematical

Table 21 - Floodway Data

Flandus				ole Z1 - FI	oodway D		t 0f	41	
Cross Section	y Source Distance (Feet	Width (Feet)	Floodway Section Area	Mean Velocity	Regulatory	1% Annual	ter Surface Eleva Without	With Floodway	Increase
Cross Occilon	Above Mouth)	widir (r cct)	(Square Feet)	(Feet Per Second)	regulatory	Chance Future Water-Surface Elevation	Floodway	William loodway	morease
1258	125,845	1,648	15,257	0.7	189.4	*	189.4	190.3	0.9
1265	126,477	1,720	15,454	0.7	189.4	*	189.4	190.3	0.9
1271	127,074	1,492	12,651	0.9	189.5	*	189.5	190.4	0.9
1276	127,615	1,198	9,386	1.2	189.6	*	189.6	190.6	0.9
1281	128,134	1,025	7,808	1.4	189.8	*	189.8	190.7	0.9
1287	128,678	932	7,040	1.6	190.0	*	190.0	190.9	0.8
1290	129,024	912	6,551	1.7	190.2	*	190.2	191.0	0.8
1296	129,606	933	7,634	1.4	190.5	*	190.5	191.3	0.8
1301	130,128	943	6,372	1.7	190.6	*	190.6	191.5	0.9
1308	130,771	935	6,542	1.7	191.0	*	191.0	191.8	0.8
1318	131,761	669	6,785	1.6	193.7	*	193.7	194.2	0.5
1320	132,050	697	6,328	1.7	193.7	*	193.7	194.2	0.5
1326	132,592	726	6,592	1.7	194.0	*	194.0	194.6	0.6
1331	133,098	735	8,096	1.3	194.1	*	194.1	194.7	0.6
1336	133,575	770	5,956	1.8	194.3	*	194.3	194.9	0.6
1338	133,841	758	5,279	2.0	194.4	*	194.4	195.1	0.7
1343	134,343	895	7,097	1.5	194.7	*	194.7	195.5	0.9
1349	134,911	862	6,623	1.6	194.8	*	194.8	195.7	0.9
1355	135,466	1,013	7,690	1.4	195.2	*	195.2	196.1	0.9
1361	136,087	953	7,950	1.3	195.4	*	195.4	196.4	0.9
1366	136,579	876	5,848	1.8	195.7	*	195.7	196.6	0.9
1371	137,065	829	6,454	1.6	196.2	*	196.2	197.1	0.8
1376	137,569	711	5,171	2.0	196.8	*	196.8	197.7	0.9
1380	138,045	674	4,490	2.4	197.3	*	197.3	198.3	1.0
1386	138,591	560	5,229	2.0	198.3	*	198.3	199.3	1.0
1393	139,252	574	5,439	1.9	199.0	*	199.0	199.8	0.8
1396	139,643	649	6,188	1.7	199.3	*	199.3	200.2	0.8
1411	141,092	384	4,882	2.2	202.2	*	202.2	202.8	0.6
1415	141,524	758	8,922	1.2	202.3	*	202.3	203.1	0.8
1427	142,676	953	10,580	1.0	202.4	*	202.4	203.2	0.8
1431	143,118	1,002	10,614	1.0	202.5	*	202.5	203.3	0.9
1435	143,473	1,090	12,492	0.8	202.5	*	202.5	203.4	0.9
	outary (#1) to S								
Site 61	378	131	663	3.0	194.1 <sup>1</sup>	*	188.0	188.9	0.9
008	840	188	883	2.2	194.1 <sup>1</sup>	*	189.2	190.2	1.0
011	1,130	194	916	2.1	194.1 <sup>1</sup>	*	190.0	191.0	1.0
015	1,472	155	644	3.0	194.1 <sup>1</sup>	*	191.1	192.0	0.9
019	1,940	93	530	3.7	194.1 <sup>1</sup>	*	193.2	194.1	0.9
022	2,178	120	649	3.0	194.3	*	194.3	195.2	0.9
023	2,322	197	1,141	1.7	194.7	*	194.7	195.7	1.0
027	2,660	273	1,423	1.4	195.0	*	195.0	196.0	1.0
030	2,971	238	1,170	1.7	195.2	*	195.2	196.2	1.0
033	3,288	157	607	3.2	195.8	*	195.8	196.7	0.9
035	3,453	145	650	3.0	196.5	*	196.5	197.5	1.0



# FLOOD INSURANCE STUDY

A Report of Flood Hazards in

# JOHNSTON COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



Community Name	<b>Community Number</b>	River Basins
Benson, Town of	370504	Cape Fear/Neuse
Clayton, Town of	370139	Neuse
Four Oaks, Town of	370502	Neuse
Johnston County (Unincorporated Areas)	370138	Cape Fear/Neuse
Kenly, Town of	370501	Neuse
Micro, Town of	370500	Neuse
Pine Level, Town of	370505	Neuse
Princeton, Town of	370485	Neuse
Selma, Town of	370499	Neuse
Smithfield, Town of	370140	Neuse
Wilson's Mills, Town of	370262	Neuse



**VOLUME 2 OF 2** 



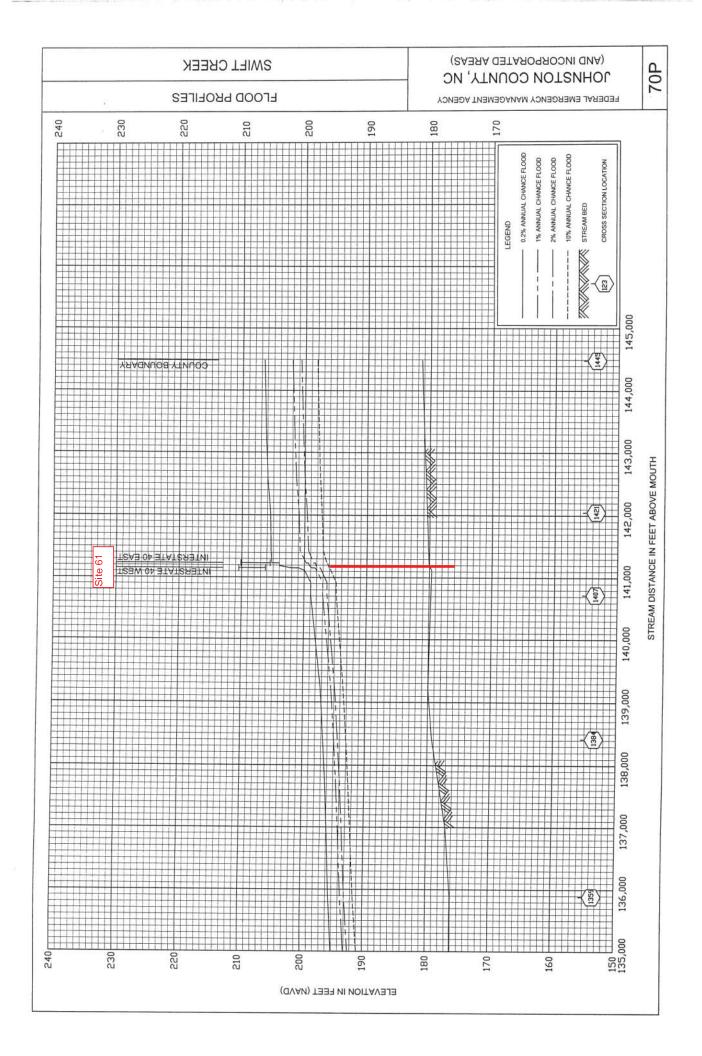
Federal Emergency Management Agency State of North Carolina

> Flood Insurance Study Number 37101CV002A

www.fema.gov and www.ncfloodmaps.com



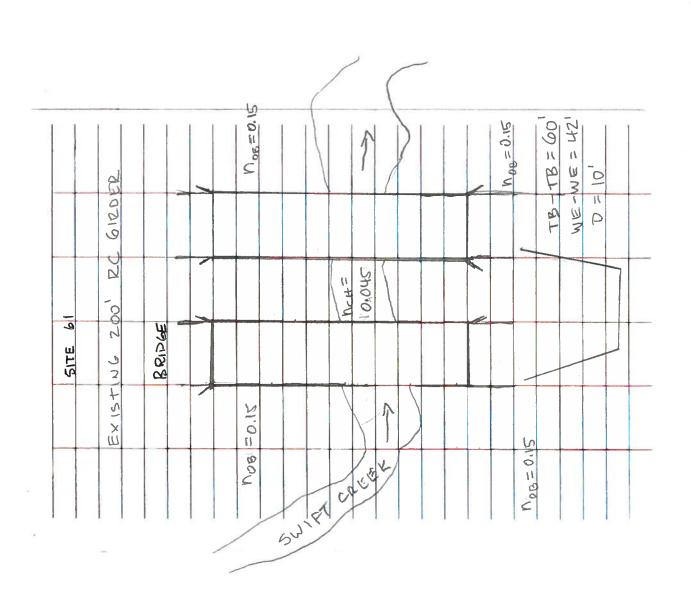




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		Neu	ise River Basi
Name	Index Number	Classification	Class Date
Description		Special	Designation
Strouds Creek	27-2-9	C;NSW	12/01/83
From source to Eno River			
Stump Bay	27-148-1-6	SA;HQW,NSW	05/01/88
From source to Long Bay			
Swan Creek	27-144	SA;HQW,NSW	05/01/88
From source to Neuse River			MR RE-SANDARMAN AT Existandarios PM AND SIGNER BAT FALLATITY Trussman
Swan Pond	27-52-7	C;NSW	05/01/88
Entire pond and connecting stream to Mill Creek			
Swift Creek	27-97-(6)	SC;Sw,NSW	05/01/88
From mouth of Bear Branch to Neuse River			
Swift Creek	27-97-(0.5)	C;Sw,NSW	05/01/88
From source to mouth of Bear Branch			
Swift Creek	27-43-(8)	C;NSW	05/01/88
From dam at Lake Benson to Neuse River			
Swift Creek (Lake Benson)	27-43-(5.5)	WS-III;NSW,CA	08/03/92
From a point 0.6 mile upstream of Wake County SR 1	006 to dam at Lake Benson		
Swift Creek (Lake Wheeler)	27-43-(1)	WS-III;NSW	08/03/92
From source to a point 0.6 mile upstream of Wake Co	ounty SR 1006		
Swindell Bay	27-150-8-(2)	SC;Sw,NSW	05/01/88
From the narrows to Bay River			
Swindell Bay	27-150-8-(1)	SC;Sw,HQW,NSW	08/01/90
From source to the narrows			
Sycamore Creek (Big Lake)	27-33-9	B;NSW	05/01/88
From source to Crabtree Creek			
Tar Creek	27-150-31-4	SA;HQW,NSW	05/01/88
From source to Gale Creek			
Tar Creek	27-141-4	SA;HQW,NSW	05/01/88
From source to Broad Creek			
Tar Kiln Branch	27-54-6	WS-IV;NSW	08/03/92
From source to Falling Creek			
Tar River	27-71-2-2	WS-IV;NSW	08/01/02
From source to Trotters Creek			

Neuse	Neuse River Basin	ii		10-digit Watershed	0302020110			Swift Creek	reek
> AU N	AU Number	Name		Description		Length or Area	rea Units	Classification	Category
	Category	Rating	Use	Reason for Rating		Parameter		Year	
> 27-43	27-43-(1)d	Swift Creek		From Lake Wheeler Dam to a point 0.6 mile upstream of Wake County SR 1006	nt 0.6 mile upstream of Wake Co	ounty SR 2.4	FW Miles	WS-III;NSW	ហ
	S II	Impaired	Aquatic Life	Poor Bioclassification		Ecological/biological Integrity Benthos	hos	2008	
> 27-43	27-43-(5.5)a	Swift Creek (Lake Benson)	د (Lake	From a point 0.6 mile upstream of Wake County SR 1006 to backwaters of Lake Benson	f Wake County SR 1006 to backv	vaters of 0.9	FW Miles	WS-III;NSW,CA	rv.
	5 II	Impaired	Aquatic Life	Poor Bioclassification		Ecological/biological Integrity Benthos	hos	2008	
				12-digit Subwatershed	030202011005			Little	Little Creek
> 27-43-12	3-12	Little Creek	<u>.</u>	From source to Swift Creek		11.4	FW Miles	C;NSW	ī
	5	Impaired	Aquatic Life	Fair Bioclassification		Ecological/biological Integrity Benthos	hos	1998	
				12-digit Subwatershed	030202011003			Whiteoak Creek	Creek
> 27-43	27-43-(8)a	Swift Creek	J	From dam at Lake Benson to Little Creek	e Creek	20.6	FW Miles	C;NSW	r.
	5 II	Impaired	Aquatic Life	Fair Bioclassification		Ecological/biological Integrity Benthos	hos	2012	
Neuse	Neuse River Basin	sin		10-digit Watershed	0302020111		Waln	Walnut Creek-Neuse River	liver
				12-digit Subwatershed	030202011104			Mill Creek-Neuse Rive	e Rive
> 27-(38.5)	18.5)	NEUSE RIVER	ER	From a point 0.2 mile downstream of Johnston County SR 1700 to point 1.4 mile downstream of Johnston County SR 1908	n of Johnston County SR 1700 to County SR 1908	point 9.7	FW Miles	WS-IV;NSW	ம
	5	Impaired	Aquatic Life	Standard Violation	on Copper			2012	
				12-digit Subwatershed	030202011103			Poplar Creek-Neuse Rive	e Rive
> 27-(2	27-(22.5)c	<b>NEUSE RIVER</b>	ER	From Crabtree Creek to Auburn Kn	to Auburn Knightdale Road	3.9	FW Miles	C;NSW	ıs
	5 lı	Impaired	Aquatic Life	Standard Violation	on Copper			2008	
	5	Impaired	Aquatic Life	Standard Violation	on Turbidity			2010	
	5	Impaired	Fish Consumption	nption Standard Violation	on PCB			2010	





Looking Upstream from Existing Crossing.

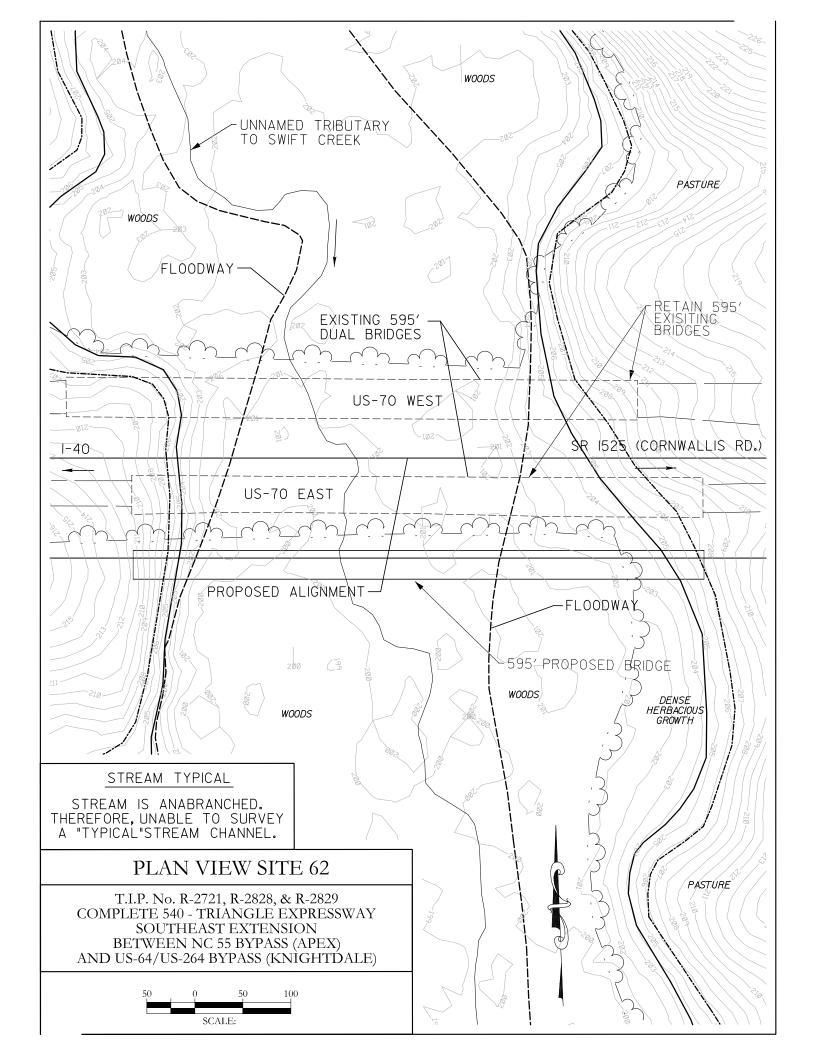


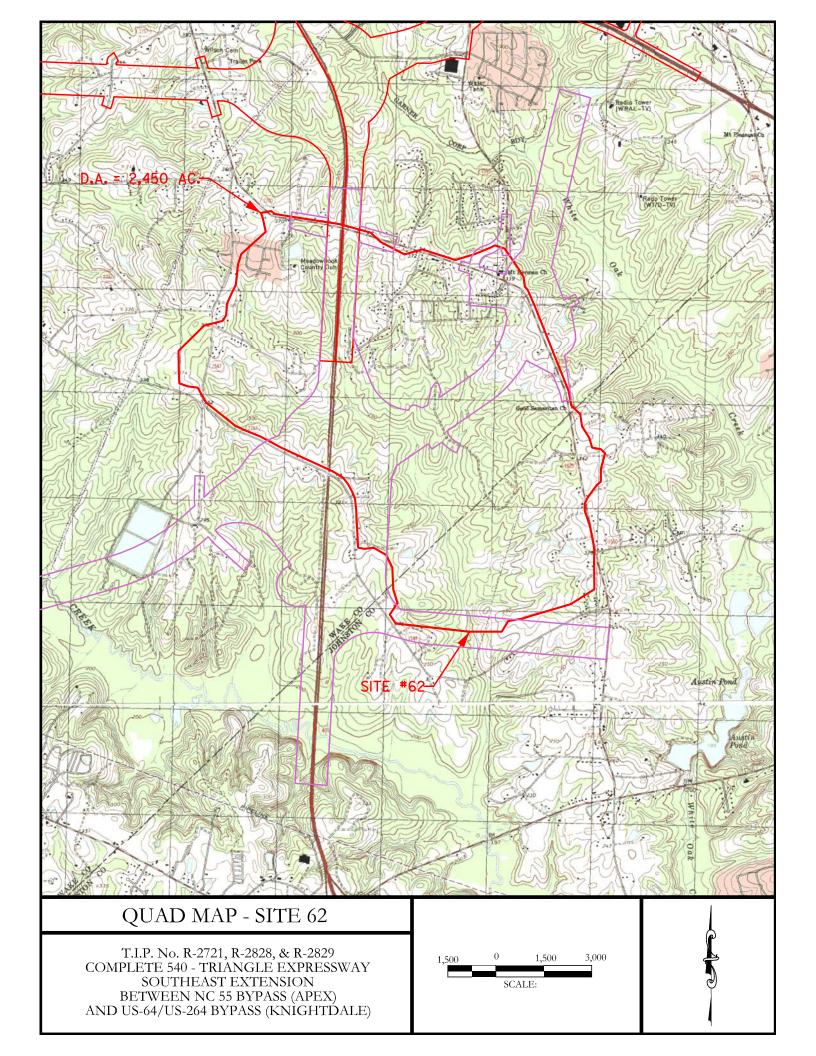
Another Shot Looking Upstream from Existing Crossing.



Looking Downstream from Existing Crossing.

#### Site 62





## **North Carolina**

PROJECT NAME: Triangle Expressway SE Ext. 4/18/2014 ENGLISH

REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00 STREAM NAME: Unnamed Trib to Swift Creek sq. miles METHOD 3.83 Drainage Area =

JSGS RUKAL REGRESSION EQUINEQUENCY Sand Hills Coastal Plain (cfs) (cfs)	QUATIONS (OLD)   ain   Blue Ridge   (cfs)	FREQUENCY	RAL EQUA Blue Ridge (cfs)	Coastal Plain (cfs)	RURAL EQUATIONS Report 01-4207  QUENCY Blue Ridge Coastal Plain Sand Hills (cfs) (cfs) (cfs)
32.16		2YR	346.53	159.73	87.15
.54		5YR	89.009	302.64	142.27
34		10YR	812.50	429.36	185.87
Ŋ		25YR	1131.80	623.08	248.79
LΩ		50YR	1412.30	798.62	303.51
$\overline{}$		100YR	1724.47	1000.77	360.23
$\circ$		200YR	2076.52	1233.08	427.09
2218.97		500YR	2613.93	1594.13	526.17

# **USGS URBAN REGRESSION EQUATIONS**

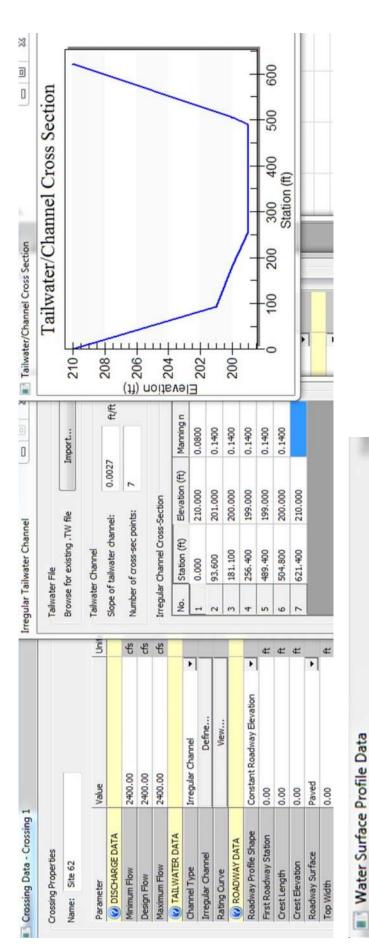
BDF=

(These Equations are used only for comparison)

								(Based on 2.80xQ10)	
	Blue Ridge	(cfs)	1511.82	1833.43	2315.79	2769.77	3370.20	5133.61	4761.90
These Equations are used only for companison)	Coastal Plain	(cfs)	926.58	1199.20	1655.11	2081.01	2651.84	3357.76	4170.30
is are ased of hy	Sand Hills	(cfs)	456.80	540.85	664.42	778.34	922.21	1514.39	1269.38
ל וווכפה באממווח	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

Fact Sheet 007-00
USGS Fact Sheet
3 Fact
USGS
S (% Impervious)
% Imp
N EQUATIONS (
<b>IC REGRESSIO</b>
2

% Impervious =	25				FEMA	<b>4</b>
Sar	d Hills	Coastal Plain	Blue Ridge	lue Ridge Discharge Used	FREQUENCY	Disharges
	(cts)	(cts)	(cts)			
~	300.47	1036.10	1241.24			
•	984.66	1323.93	1542.74		10YR	2,020
_	236.78	1828.40	2107.52		50YR	3,560
	1430.64	2119.18	2376.63	2400	100YR	4,430
_	08.009	2395.40	2625.25		500YR	7,380
•	2757.05	3707.00	4319.69	(Based on 2.80xQ10)		
	3603.86	4845.58	5646.45	(Based on 3.66xQ10)		



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Velocity (ft/s) Shear (psf)	0.757	0.757	0.757	0.757	0.757	0.757	0.757	0.757	0.757	0.757	0 757
Velocity (A	1.352	1.352	1.352	1.352	1.352	1.352	1.352	1.352	1.352	1.352	1 257
Depth (ft)	4.496	4.496	4.496	4.496	4.496	4.496	4.496	4.496	4.496	4.496	4 405
Elevation (ft)	203.496	203.496	203.496	203.496	203.496	203.496	203.496	203.496	203.496	203.496	202 205
Flow (cfs)	2400.000	2400.000	2400.000	2400.000	2400.000	2400.000	2400.000	2400.000	2400.000	2400.000	2400 000

#### PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

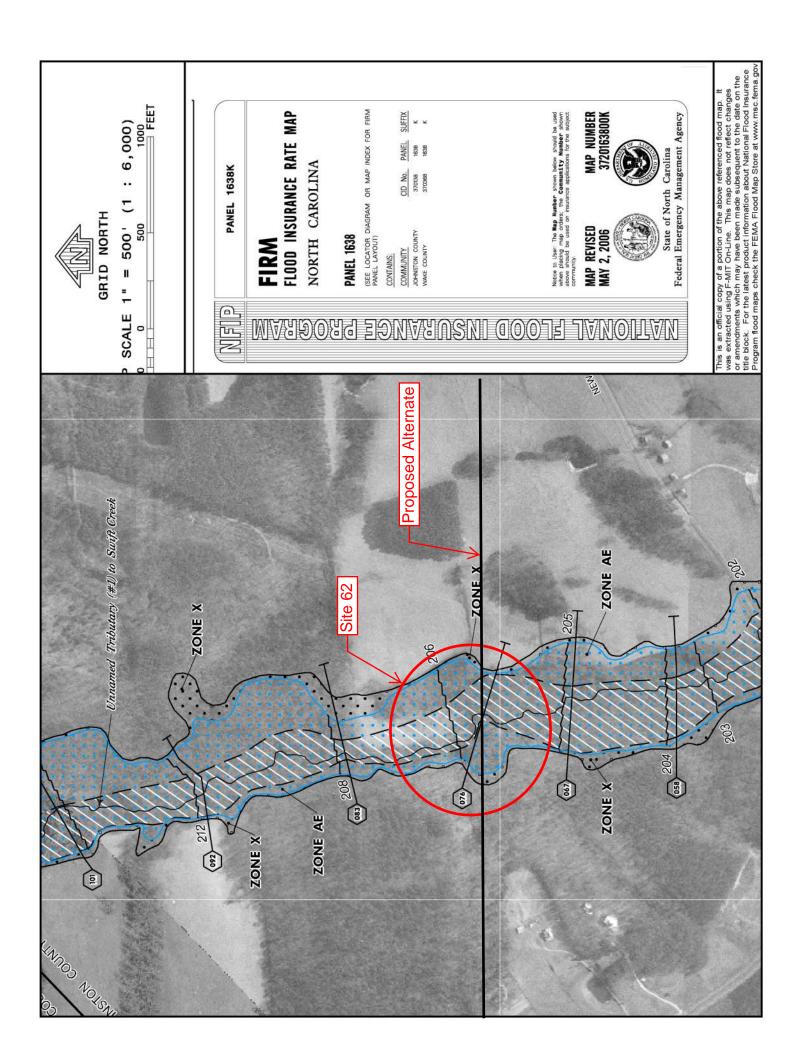
COUNTY: Johnston PROJECT: NUMBER R-2721, R-2828 & R-2829
STREAM: <u>Unnamed Tributary to Swift Creek</u> ROUTE <u>US 70</u> (Site 62)
ASSESSMENT PREPARED BY Mulkey, INC. DATE 2/7/2014 (WBP)
HYDROLOGIC EVALUATION
NEAREST GAGING STATION ON THIS STREAM (NONE $\underline{X}$ )
ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: Yes
FLOOD DATA: Q <sub>10</sub> 1,500 CFS EST. BKWTR. $N/A$ FT. Q <sub>25</sub> 2,100 CFS EST. BKWTR. $N/A$ FT. Q <sub>50</sub> 24,000 CFS EST. BKWTR. $N/A$ FT. Q <sub>100</sub> 26,000 CFS EST. BKWTR. $N/A$ FT. Q <sub>500</sub> 56,000 CFS EST. BKWTR. $N/A$ FT.
DRAINAGE AREA: 3.83 Sq. Mi. METHOD USED TO COMPUTE Q: USGS Urban Regression
PROPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: LOW MODERATE X HIGH
COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: YES NO X
EXPLANTION: A floodway modification may be required at this site.
LIST BUILDINGS IN FLOOD PLAIN: None LOCATION:
UPSTREAM LAND USE <u>Agricultural and Residential</u> ANTICIPATE ANY CHANGE? <u>No</u>
ANY FLOOD ZONING? (FIA STUDIES, ETC.) YES X NO
TYPE OF STUDY: FEMA – Special Flood Hazard Zone AE
REGULATORY FLOODWAY WIDTH 240 ft. Section 076 (AS NOTED IN FIS)
COMMENTS:

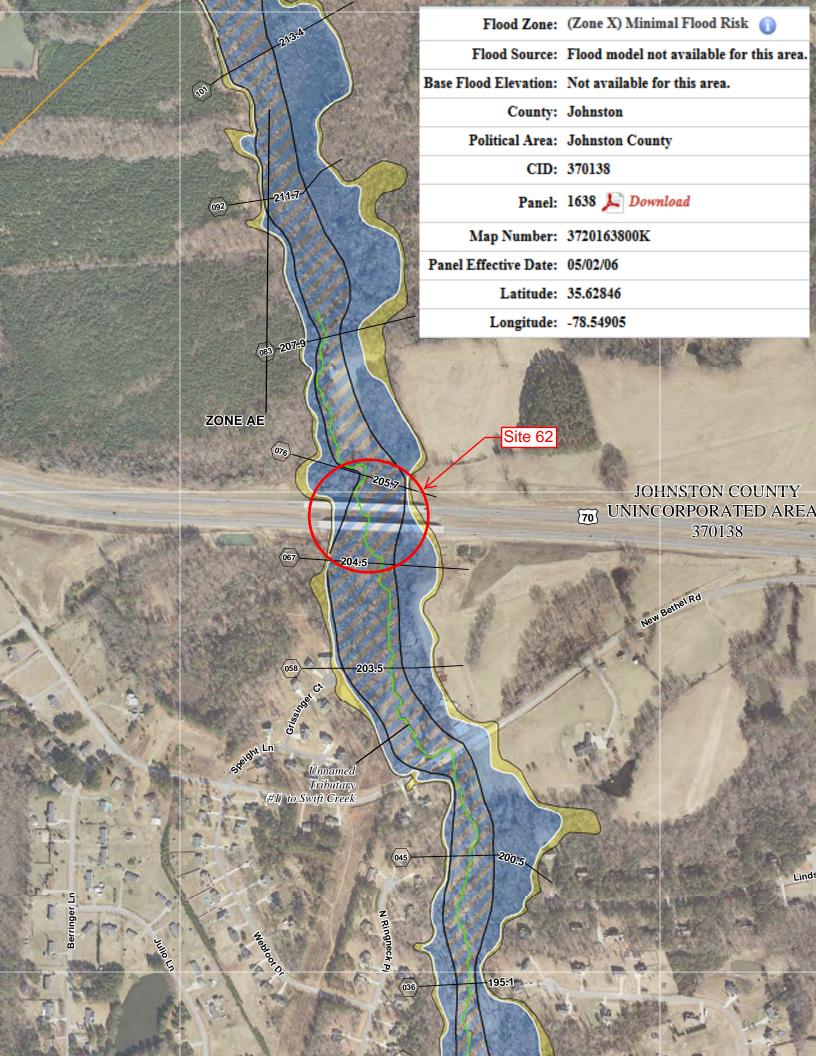
#### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR $N/A$ TRAFFIC COUNT $N/A$ VPD % TRUCKS $N/A$
DESIGN YEAR $N/A$ TRAFFIC COUNT $N/A$ VPD % TRUCKS $N/A$
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? <u>N/A</u> LENGTH OF DETOUR <u>N/A</u> MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? <u>N/A – BMU Report Not Available</u>
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? $\underline{\text{N/A}}$
COMMENTS: All above data Not Available (N/A) due to no BMU Report Available.
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS
NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE <u>X</u> ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE <u>Wehadkee</u> TYPE SLOPE COVER <u>Vegetation</u>
COMMENTS: Soil Type from Web Soil Survey website of Wake County, NC.
ENVIRONMENTAL CONSIDERATIONS
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN:

#### MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES NO $\underline{X}$ PROTECTION NEEDED
ARE BANKS STABLE? <u>No</u> PROTECTION NEEDED <u>No</u>
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
<u>ALTERNATIVES</u>
RECOMMENDED DESIGN Retain existing 595 ft. twin bridges and construct proposed 595 ft. bridge for proposed ramp.
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO $\underline{X}$ DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:





### PRELIMINARY FLOOD INSURANCE STUDY

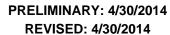
#### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in JOHNSTON COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
JOHNSTON COUNTY	370138
TOWN OF ARCHER LODGE	370138
TOWN OF BENSON	370504
TOWN OF CLAYTON	370139
TOWN OF FOUR OAKS	370502
TOWN OF KENLY	370501
TOWN OF MICRO	370500
TOWN OF PINE LEVEL	370505
TOWN OF PRINCETON	370485
TOWN OF SELMA	370499
TOWN OF SMITHFIELD	370140
TOWN OF WILSON'S MILLS	370262





**Federal Emergency Management Agency** 

State of North Carolina

Flood Insurance Study Number

37101CV000

www.fema.gov and www.ncfloodmaps.com





Table 8 - Flooding Sources Studied by Detailed Methods: Revised or Newly Studied

Source	Table 8 - Flooding Sources Studied by Detailed Methods: Revise  Source Riverine Sources				
	From	То			
Little Creek	The confluence with Swift Creek	The confluence with Swift Creek	Johnston County Town Of Archer Lodge Town Of Clayton		
Little Creek Tributary	The confluence with Little Creek	Approximately 770 feet upstream of U.S. Highway 70	Town Of Clayton		
Little Poplar Creek	The confluence with Poplar Creek	Approximately 260 feet upstream of U.S. Highway 70	Johnston County Town Of Archer Lodge Town Of Smithfield Town Of Wilson's Mills		
Little River	At confluence with Neuse River	Approximately 1.0 mile upstream of the Wayne/Johnston County Boundary	Johnston County Town Of Archer Lodge		
Little River	The Johnston/Wayne County boundary	Approximately 1,600 feet upstream of State Highway 42	Johnston County Town Of Archer Lodge Town Of Kenly Town Of Micro Town Of Princeton		
Little River	The Wake/Johnston County Boundary	Approximately 300 feet upstream of confluence of Perry Creek (Basin 10, Stream 19)	Johnston County Town Of Archer Lodge		
Middle Creek	The confluence with Swift Creek	The Johnston/Wake County boundary	Johnston County Town Of Archer Lodge Town Of Smithfield		
Mill Branch	The confluence with Mill Creek (South)	Approximate 2.4 miles upstream of Harper House Road	Johnston County Town Of Archer Lodge		
Mill Creek (South)	The confluence with Neuse River	Approximate 0.8 mile upstream of confluence of Stone Creek	Johnston County Town Of Archer Lodge		
Moccasin Creek	Approximately 3,425 feet downstream of Buckleberry Road	Approximately 0.4 mile upstream of U.S. Highway 70	Johnston County Town Of Archer Lodge Town Of Princeton		
Moccasin Creek	Approximately 400 feet downstream of U.S. Highway 264A	Approximately 0.7 mile upstream of Henry Baker Road	Johnston County Town Of Archer Lodge		
Moccasin Creek	At confluence with Neuse River	Approximately 3,425 feet downstream of Buckleberry Road	Johnston County Town Of Archer Lodge		
Neuse River	The Johnston/Wayne County boundary	Just downstream of Mial Plantation Road	Johnston County Town Of Archer Lodge Town Of Clayton Town Of Four Oaks Town Of Selma Town Of Smithfield Town Of Wilson's Mills		
Neuse River	Wayne/Lenoir County boundary	Wayne/Johnston County boundary	Johnston County Town Of Archer Lodge Town Of Clayton Town Of Four Oaks Town Of Selma Town Of Smithfield Town Of Wilson's Mills		
Sams Creek	Approximately 0.7 mile upstream of Oneil Street	Approximately 270 feet upstream of City Road	Town Of Clayton		
Spring Branch	The confluence with Neuse River	Collier Street	Town Of Smithfield		
Stone Creek	The confluence with Mill Creek (South)	Approximately 1,640 feet upstream of U.S. Highway 701	Johnston County Town Of Archer Lodge		
Stony Fork	The confluence with Hannah Creek	Approximately 1,550 feet upstream of U.S. Highway 301	Johnston County Town Of Archer Lodge		
Swift Creek	The confluence with Neuse River	The Johnston/Wake County boundary	Johnston County Town Of Archer Lodge Town Of Smithfield		
Unnamed Tributary (#1) to Swift Creek	The confluence with Swift Creek	The Johnston/Wake County boundary	Johnston County Town Of Archer Lodge		
Unnamed ributary (#2) to Swift Creek	The confluence with Swift Creek	Approximately 190 feet upstream of Cornwallis Road	Johnston County Town Of Archer Lodge		
te Oak Creek	The confluence with Swift Creek	The Johnston/Wake County boundary	Johnston County Town Of Archer Lodge Town Of Clayton		

Table 9, "Flooding Sources Studied by Detailed Methods: Redelineated", lists all flooding sources that were studied by detailed methods for the prestatewide FIS and redelineated for previous FISs. These flooding sources were not part of this revision and their effective analyses remain valid.

Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

10010 0 11	couring courses craured	by Botanoa motificaci is	- Caomination
Source	Riverine	Affected Communties	
	From	То	
Buffalo Creek (Basin 9, Stream 1)	The Wake/Johnston County boundary	Robertsons Pond Dam	Johnston County Town Of Archer Lodge

**Table 13 - Summary of Discharges** 

Flooding Source	Table 13 - Summary of Discharges  Flooding Source  Discharges (cfs)							
Location	Drainage Area	10% Annual	2% Annual	1% Annual	0.2% Annual			
	(square miles)	Chance	Chance	Chance	Chance			
Approximately 5,950 feet downstream of Stone Creek Road	11.12	835	1,415	1,708	2,393			
Approximately 1,685 feet downstream of Stone Creek Road	10.24	793	1,346	1,626	2,280			
Approximately 3,300 feet upstream of Stone Creek Road	8.58	711	1,211	1,463	2,056			
At N.C. 96	7.40	649	1,108	1,340	1,886			
Approximately 3,145 feet upstream of N.C. 96	6.13	578	990	1,199	1,692			
Approximately 4,650 feet downstream of Adams Road	5.03	511	879	1,066	1,506			
Approximately 2,350 feet downstream of Adams Road	1.79	271	473	578	826			
Approximately 800 feet downstream of Adams Road	1.24	216	380	464	667			
Approximately 1,750 feet downstream of Interstate 40	1.09	198	351	430	618			
At Interstate 40	0.62	140	250	308	445			
Stone Creek Tributary		I						
Approximately 0.2 mile upstream of the confluence with Stone Creek	2.59	*	*	1,350	*			
Approximately 0.1 mile downstream of Adams Road	1.43	*	*	933	*			
Approximately 0.2 mile upstream of Adams Road	1.33	*	*	889	*			
Approximately 0.5 mile upstream of Adams Road	1.06	*	*	773	*			
Stony Fork				_				
At the mouth at Hannah Creek	9.43	1,589	2,539	2,943	3,963			
At the mouth at Hannah Creek	8.70	*	*	1,920	*			
At Railroad	7.95	1,431	2,293	2,664	3,589			
Approximately 0.5 mile downstream of Raleigh Road	7.68	*	*	2,660	*			
Approximately 0.1 mile upstream of Shade Tree Road	2.78	*	*	1,410	*			
Approximately 0.6 mile upstream of Shade Tree Road	1.87	*	*	1,100	*			
Stony Fork Tributary								
Approximately 0.4 mile upstream of the confluence with Stony Fork	3.78	*	*	1,710	*			
Approximately 0.6 mile downstream of Federal Road	3.39	*	*	1,600	*			
Approximately 0.2 mile downstream of Federal Road	3.12	*	*	1,520	*			
Approximately 0.1 mile upstream of Interstate 40	2.64	*	*	1,370	*			
Swift Creek				•				
At the mouth	286.80	9,523	14,739	17,036	22,489			
Above Middle Creek (at NC 210)	155.22	7,904	12,164	13,961	18,358			
Just upstream of confluence with Swift Creek Tributary 3	153.01	7,894	12,145	13,934	18,318			
Approximately 2.0 miles downstream of Lee Road	120.85	7,424	11,387	13,022	17,083			
Approximately 0.9 mile upstream of Barver Mill Road	109.88	7,070	10,853	12,412	16,290			
Approximately 0.9 mile downstream of Cornwallis Road	89.45	6,195	9,547	10,936	14,389			
Approximately 0.3 mile upstream of NC 42	81.22	6,002	9,243	10,577	13,911			
Swift Creek Tributary 3	12::	1 = 1 = 1	12,-12	1.5,5	1.5,5			
Just upstream of confluence with Swift Creek	1.62	477	904	1,069	1,572			
Approximately 3,225 feet upstream of confluence with Swift Creek	0.57	122	220	271	395			
Approximately 1,150 feet downstream of Market Street	0.40	99	178	220	322			
Approximately 1,750 feet downstream of Market Street  Approximately 1,265 feet upstream of Market Street	0.40	65	119	148	218			
	U.Z.I	100	1113	170	1210			
Unnamed Tributary (#1) to Swift Creek	1,77		4 007	4 000	0.004			
At the confluence with Swift Creek	4.77	1,044	1,687	1,963	2,664			
Approximately 100 feet downstream of New Bethel Church Road	3.98	934	1,513	1,763	2,397			
Approxingately 3,050 feet upstream of New Bethel Road	3.12	804	1,309	1,527	2,082			

**Table 16 - Roughness Coefficients** 

Stream	Channel "n"	Overbank "n"
Mill Branch	0.050	0.030 to 0.150
Mill Creek (Near Clayton)	0.045	0.100
Mill Creek (Near Selma)	0.055	0.150
Mill Creek (South)	0.035 to 0.060	0.040 to 0.160
Mill Creek Tributary 2	0.050	0.150
Mill Creek Tributary 3	0.050	0.150
Mill Creek Tributary 4	0.050	0.150
Mill Creek Tributary 6	0.050	0.150
Mill Swamp Branch	0.050	0.150
Moccasin Creek	0.030 to 0.070	0.030 to 0.220
Moccasin Creek Tributary 1	0.045 to 0.050	0.120 to 0.140
Moccasin Creek Tributary 2	0.046	0.130
Moccasin Swamp	0.048	0.035 to 0.150
Neuse River	0.035 to 0.060	0.055 to 0.250
Neuse River Tributary 1	0.051 to 0.052	0.050 to 0.150
Neuse River Tributary 2	0.048 to 0.052	0.065 to 0.150
Oak Creek	0.050	0.150
Pole Branch	0.045	0.130
Polecat Branch	0.045	0.130
Poplar Creek	0.051	0.055 to 0.150
Quincosin Swamp	0.050	0.150
Reedy Creek	0.045	0.130
Reedy Prong	0.050	0.150
Reedy Prong Tributary	0.050	0.150
Sams Creek	0.035 to 0.055	0.070 to 0.150
Snipes Creek	0.042 to 0.045	0.120 to 0.130
Spring Branch	0.020 to 0.060	0.030 to 0.140
Spring Branch Tributary 1	0.042	0.130
Stone Creek	0.040 to 0.060	0.030 to 0.150
Stone Creek Tributary	0.050	0.150
Stony Fork	0.045 to 0.060	0.030 to 0.150
Stony Fork Tributary	0.050	0.150
Swift Creek	0.040 to 0.072	0.035 to 0.240
Swift Crook Tributary 3	0.055	0.060 to 0.150
Unnamed Tributary (#1) to Swift Creek	0.045 to 0.060	0.050 to 0.150
Unnamed Trou	0.043	0.050 to 0.150
White Oak Creek	0.035 to 0.050	0.035 to 0.150

Site 62

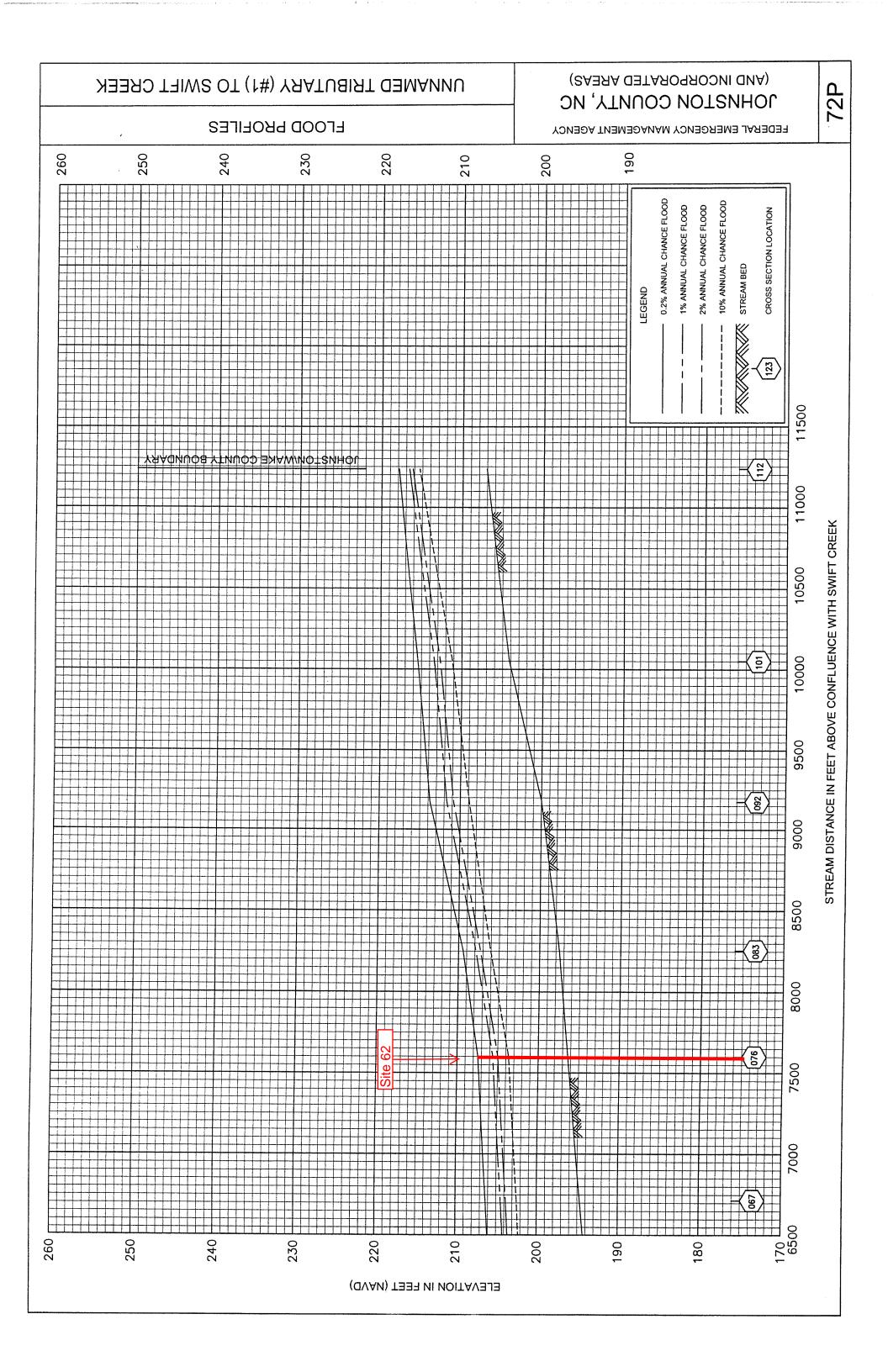
For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained using digital elevation data obtained with LIDAR technology developed as part of the North Carolina Statewide Floodplain Mapping Program. The hydraulic model is prepared using this digital elevation data, without surveying bathymetric or structural data. Where bridge or culvert data are readily available, such as from the North Carolina Department of Transportation, these data have been reflected in the hydraulic model. If these structural data are not readily available, field measurements of these structures were made to approximate their geometry in the hydraulic models. In addition, this method does not include field surveys that determine specifics on channel and floodplain characteristics. A limited detailed study is a "buildable" product that can be upgraded to a fully detailed study at a later date by verifying stream channel characteristics, bridge and culvert opening geometry, and by analyzing multiple recurrence intervals.

The results of the HEC-RAS computations are tabulated for all cross sections (Table 17, "Limited Detailed Flood Hazard Data"). Flood Profiles have not been developed for streams studied by limited detailed methods. Water-surface elevation rasters were developed for steams studied by limited detailed methods. In addition, floodways for streams studied by limited detailed methods are not delineated on the FIRM. However, the 1% annual chance water-surface elevations, flood discharges, and non-encroachment widths from the limited detailed studies for every modeled cross section are given in Table 17. The non-encroachment widths given at modeled cross sections can be used by communities to enforce floodplain management ordinances that meet the requirement defined in 44 CFR 60.3(c)(10).

Between cross sections for streams studied by limited detailed methods, 1% annual chance water-surface elevations can be calculated by mathematical

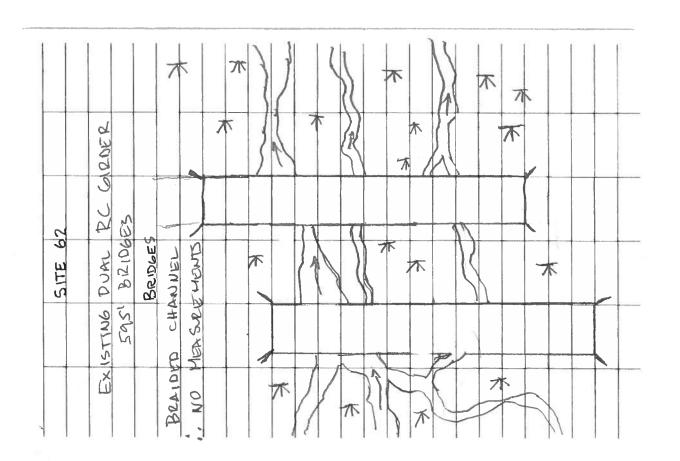
Table 21 - Floodway Data

Floodwa	y Source		Floodway	ole 21 - Fi	oodway D		ter Surface Eleva	tion	
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
037	3,703	184	843	2.3	197.2	*	197.2	198.2	1.0
041	4,106	163	739	2.7	198.2	*	198.2	199.2	1.0
043	4,340	105	525	3.7	198.8	*	198.8	199.8	1.0
051	5,128	206	1,248	1.6	201.4	*	201.4	202.4	1.0
054	5,442	248	1,136	1.6	201.7	*	201.7	202.7	1.0
057	5,699	201	892	2.0	202.0	*	202.0	203.0	1.0
061	6,100	227	869	2.0	202.6	*	202.6	203.6	1.0
064	6,378	353	1,176	1.5	203.2	*	203.2	204.2	0.9
068	6,841	210	771	2.3	204.4	*	204.4	205.2	0.7
071	7,067	140	434	4.1	205.7	*	205.7	206.5	0.8
073	7,332	79	367	4.8	207.4	*	207.4	208.2	0.8
075	7,526	101	516	3.4	208.4	*	208.4	209.3	0.9
077	7,681	198	1,039	1.7	209.0	*	209.0	210.0	1.0
Site 62	7,853	230	1,120	1.6	209.3	*	209.3	210.3	0.9
080	8,041	140	697	2.5	209.7	*	209.7	210.6	1.0
085	8,520	164	793	1.9	210.9	*	210.9	211.8	1.0
089	8,899	173	713	2.1	211.8	*	211.8	212.7	1.0
093	9,340	162	709	2.2	213.0	*	213.0	214.0	1.0
098	9,769	118	420	3.6	214.7	*	214.7	215.7	1.0
100	10,035	48	259	5.9	216.4	*	216.4	217.4	1.0
Unnamed Trib	outary (#2) to S	wift Creek							
005	483	136	325	3.0	174.9 <sup>1</sup>	*	168.4	169.4	1.0
010	958	79	188	5.3	174.9 <sup>1</sup>	*	171.9	172.2	0.3
015	1,500	78	328	3.0	174.9 <sup>1</sup>	*	174.2	175.1	0.9
019	1,897	56	143	6.9	175.7	*	175.7	176.0	0.3
022	2,198	47	183	5.4	177.8	*	177.8	178.7	0.9
025	2,498	46	146	6.8	179.8	*	179.8	180.4	0.6
033	3,251	84	353	2.5	184.4	*	184.4	184.8	0.5
036	3,617	78	280	3.2	185.0	*	185.0	185.9	0.9
039	3,916	40	166	5.4	186.4	*	186.4	187.3	0.8
047	4,726	90	618	1.4	192.5	*	192.5	193.2	0.8
051	5,059	130	393	2.3	192.6	*	192.6	193.3	0.7
055	5,511	60	217	4.1	193.7	*	193.7	194.7	1.0
060	6,037	36	158	5.1	196.7	*	196.7	197.2	0.5
063	6,255	34	113	7.1	197.8	*	197.8	197.9	0.1
066	6,553	52	211	3.8	200.3	*	200.3	200.9	0.6
071	7,074	110	303	2.7	204.0	*	204.0	204.6	0.6
076	7,614	152	404	2.0	206.4	*	206.4	207.3	0.9
080	7,982	45	176	3.6	207.8	*	207.8	208.7	0.8
083	8,252	36	131	4.8	209.9	*	209.9	210.2	0.4
086	8,594	50	209	3.0	211.7	*	211.7	212.2	0.5
091	9,086	48	153	4.1	213.8	*	213.8	214.5	0.7
095	9,524	58	147	4.3	216.9	*	216.9	217.7	0.8
101	10,065	25	116	4.3	219.8	*	219.8	220.8	0.9



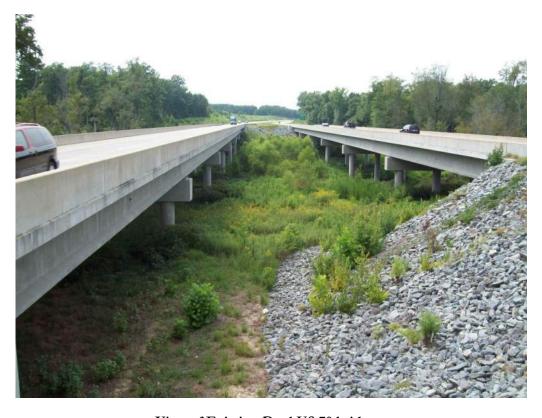
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		Neu	use River Basi
Name	Index Number	Classification	Class Date
Description		Special	Designation
Strouds Creek	27-2-9	C;NSW	12/01/83
From source to Eno River			
Stump Bay	27-148-1-6	SA;HQW,NSW	05/01/88
From source to Long Bay			
Swan Creek	27-144	SA;HQW,NSW	05/01/88
From source to Neuse River		Annual of the second of the se	
Swan Pond	27-52-7	C;NSW	05/01/88
Entire pond and connecting stream to Mill Creek			
Swift Creek	27-97-(6)	SC;Sw,NSW	05/01/88
From mouth of Bear Branch to Neuse River			
Swift Creek	27-97-(0.5)	C;Sw,NSW	05/01/88
From source to mouth of Bear Branch			
Swift Creek	27-43-(8)	C;NSW	05/01/88
From dam at Lake Benson to Neuse River		and the second	
Swift Creek (Lake Benson)	27-43-(5.5)	WS-III;NSW,CA	08/03/92
From a point 0.6 mile upstream of Wake County SR 1006	5 to dam at Lake Benson		
Swift Creek (Lake Wheeler)	27-43-(1)	WS-III;NSW	08/03/92
From source to a point 0.6 mile upstream of Wake Coun	ty SR 1006		
Swindell Bay	27-150-8-(2)	SC;Sw,NSW	05/01/88
From the narrows to Bay River			
Swindell Bay	27-150-8-(1)	SC;Sw,HQW,NSW	08/01/90
From source to the narrows	AND AND SERVICE AND AND AND AND AND AND AND AND AND AND		
Sycamore Creek (Big Lake)	27-33-9	B;NSW	05/01/88
From source to Crabtree Creek			
Tar Creek	27-150-31-4	SA;HQW,NSW	05/01/88
From source to Gale Creek			
Tar Creek	27-141-4	SA;HQW,NSW	05/01/88
From source to Broad Creek			
Tar Kiln Branch	27-54-6	WS-IV;NSW	08/03/92
From source to Falling Creek			
Tar River	27-71-2-2	WS-IV;NSW	08/01/02
From source to Trotters Creek			





Looking Upstream from Existing Crossing of US 70 over Unnamed Trib. No. 1 to Swift Creek.



View of Existing Dual US 70 bridges.



Looking Downstream from Existing Crossing.

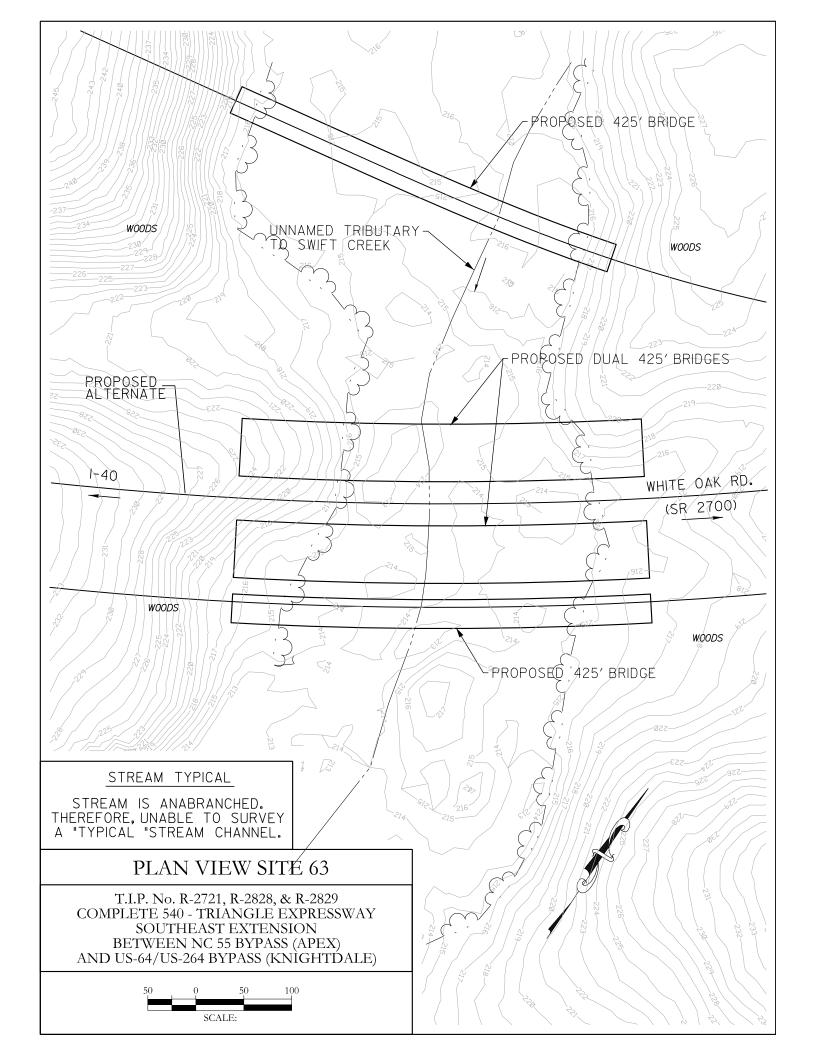


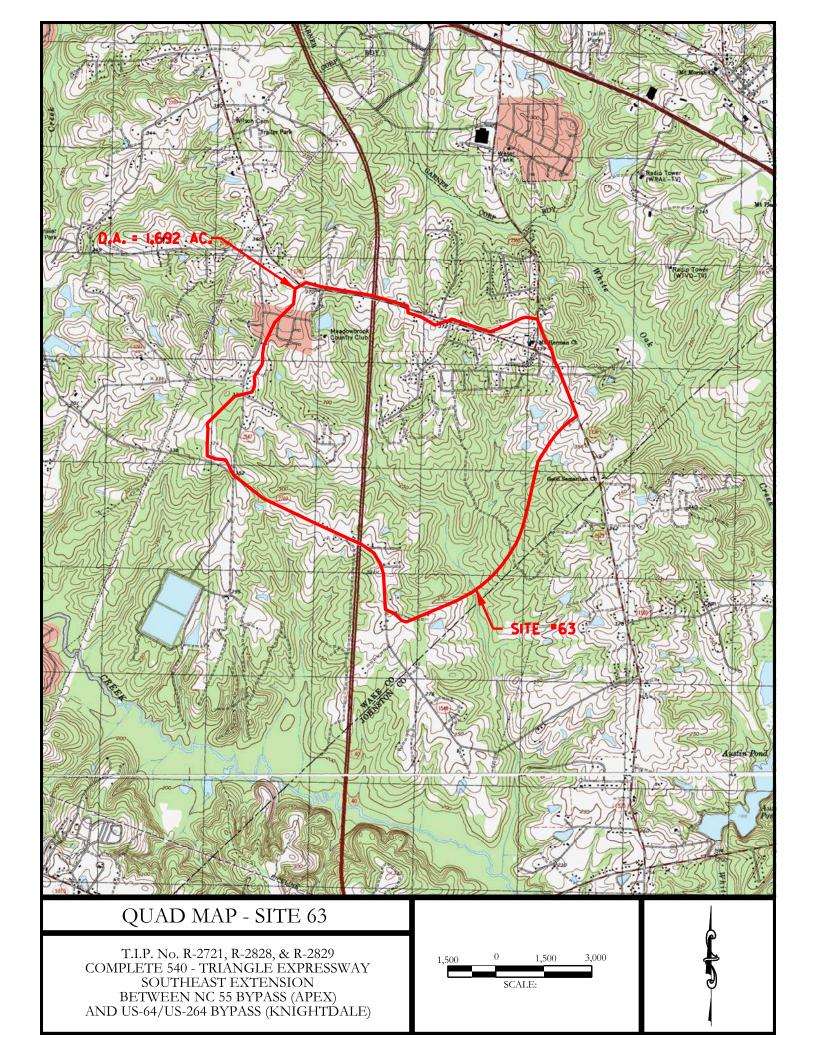
View of Downstream Floodplain.



Shot of Flood Hazard Basin.

#### Site 63





## **North Carolina**

6/20/2014

REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00 STREAM NAME: Unnamed Trib to Swift Creek sq. miles METHOD 2.64 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = ENGLISH

07										
ort 01-42	Sand Hills	(cfs)	28.99	109.61	143.41	192.24	234.70	278.87	330.88	407.94
<b>RURAL EQUATIONS Report 01-4207</b>	Coastal Plain	(cts)	124.35	238.95	341.54	499.71	643.84	810.73	1003.38	1304.44
SAL EQUA	Blue Ridge	(cfs)	266.87	466.92	635.11	890.31	1115.10	1366.65	1651.18	2087.03
RUF	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR
ATIONS (OLD)	ш	(cfs)								
<b>USGS RURAL REGRESSION EQUA</b>	Coastal Plain	(cfs)	128.18	262.16	387.13	606.74	807.05	1057.91	1366.47	1867.12
AL REGRE	Sand Hills	(cfs)	60.51	06.66	132.09	178.70	218.95	264.27	325.41	389.46
<b>USGS RUR</b>	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR

# **USGS URBAN REGRESSION EQUATIONS**

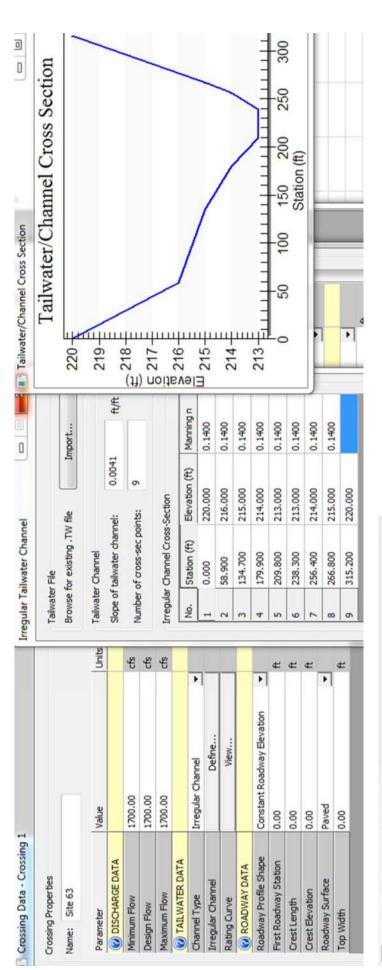
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(These Equations are used only for comparison)

								(Based on 2.80xQ10)	
	_	(cfs)							3709.99
or companison)	Sand Hills Coastal Plain	(cfs)	734.60	958.68	1336.02	1685.61	2155.02	2684.31	3410.58
HIS ALE USEU UIIIS	Sand Hills	(cts)	346.13	409.97	502.48	585.93	691.01	1147.93	943.29
( I liese Eduations	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

00-200
<b>Fact Sheet 007-00</b>
Fact (
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<b>EQUATIONS (% Impervious)</b>
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FEMA	FREQUENCY Disharges			10YR	50YR	100YR	500YR		
								•	
								10)	(10)
	Blue Ridge Discharge Used					1700		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	<b>Blue Ridge</b>	(cts)	847.97	1077.81	1523.29	1739.02	1943.80	3017.86	3944.77
	Coastal Plain	(cts)	714.70	935.32	1341.87	1576.23	1804.23	2618.89	3423.26
20	Sand Hills	(cts)	542.99	682.30	883.02	1033.28	1169.07	1910.45	2497.23
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR



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low (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s) Shear (psf)	Shear (psf)
1700.000	218.858	5.858	1.614	1.499
1700.000	218.858	5.858	1.614	1.499
1700.000	218.858	5.858	1.614	1.499
000.000	218.858	5.858	1.614	1.499
000.000	218.858	5.858	1.614	1.499
700.000	218.858	5.858	1.614	1.499
1700.000	218.858	5.858	1.614	1.499
000.000	218.858	5.858	1.614	1.499
1700.000	218.858	5.858	1.614	1.499
1700.000	218.858	5.858	1.614	1.499
1700.000	218.858	5.858	1.614	1.499

Opted for bridge based upon Floodway defined 400' downstream

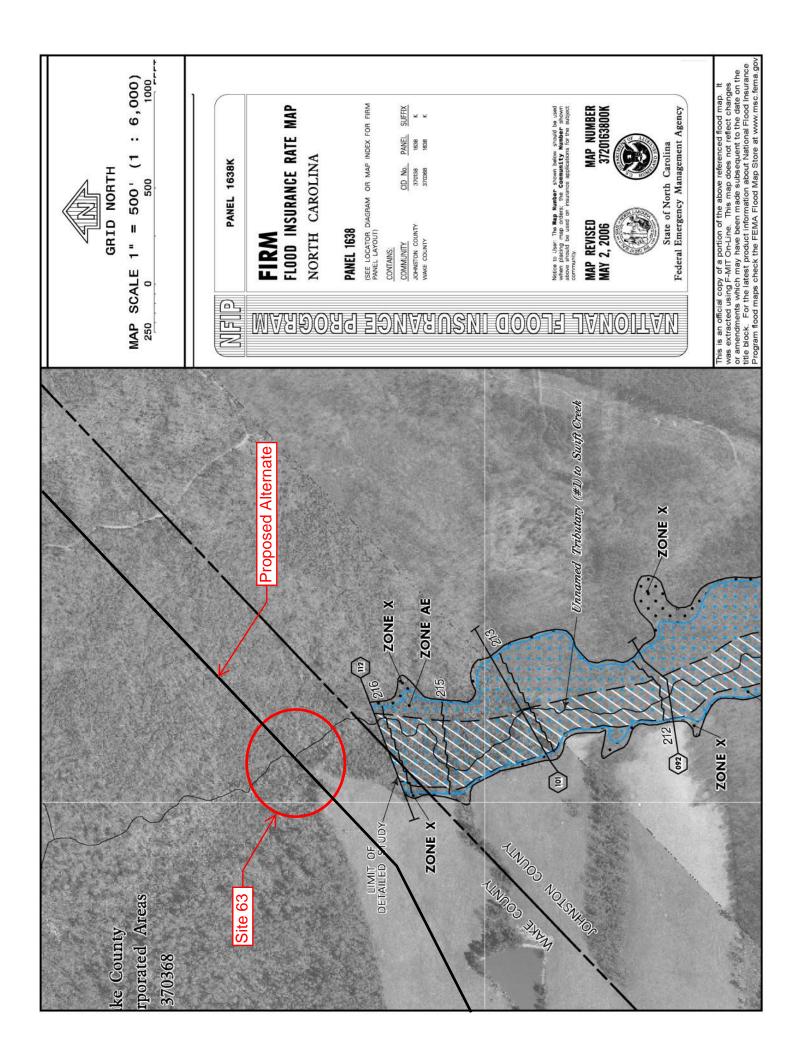
#### PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY: Wake	PROJECT NUMBE	R <u>R-2721, R-28</u>	28 & R-2829
STREAM: <u>Unnamed Tributa</u> (Site 63)	ary to Swift Creek	ROUTE New	Location
ASSESSMENT PREPARED	BY Mulkey, INC. (WBP)	DATE <u>2/7/201</u>	14
	HYDROLOGIC E	VALUATION	
NEAREST GAGING STAT	ON ON THIS STRE.	AM (NC	ONE <u>X</u> )
ARE FLOOD STUDIES AV	AILABLE ON THIS	STREAM: No	
FLOOD DATA:  Q <sub>10</sub> 1,100 CFS EST. BKV Q <sub>50</sub> 1,700 CFS EST. BKV Q <sub>500</sub> 3,900 CFS EST. BKV	VTR. <u>N/A</u> FT. Q <sub>100</sub>	1,500 CFS E 1,900 CFS E	ST. BKWTR. <u>N/A</u> FT. ST. BKWTR. <u>N/A</u> FT.
DRAINAGE AREA: 2.62 Sc	<u>ı. Mi. METHOD USE</u>	ED TO COMPUT	ΓΕ Q: <u>USGS Urban Regression</u>
<u>P</u> 1	ROPERTY RELATE	<u>D EVALUATIO</u>	<u>NS</u>
DAMAGE POTENTIAL: LO	OW MOD	ERATE X	HIGH
COULD THIS BE SI	GNIFICANTLY INC	REASED BY P	ROPOSED
ENCROACHMENT:	YES	NO X	
EXPLANTION: A flo	oodway modification	may be required	at this site.
LIST BUILDINGS IN	N FLOOD PLAIN: <u>N</u>	one LOCA	TION:
UPSTREAM LAND ANTICIPATE ANY		l Residential	
ANY FLOOD ZONII	NG? (FIS STUDIES,	ETC.) YES	NO: <u>X</u>
TYPE OF STUDY: I regulated Zone X.	FEMA – Not in a Spe	cial Flood Hazar	d Zone but listed as non-
REGULATORY FLO	OODWAY WIDTH N	<u> </u>	
COMMENTS:			

#### TRAFFIC RELATED EVALUATIONS

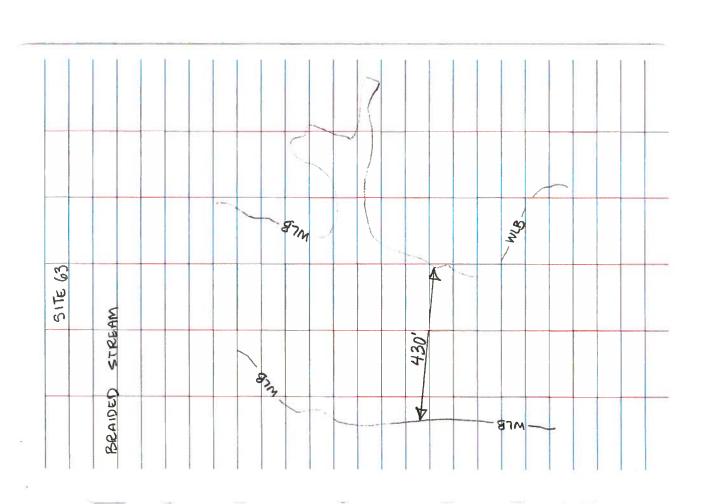
PRESENT YEAR 2012 TRAFFIC COUNT 14,200 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 44,800 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A - New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A - New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? N/A
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS
NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE <u>X</u> ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Weehadkee TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from Web Soil Survey website of Wake County, NC.
ENVIRONMENTAL CONSIDERATIONS
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN:
MISCELLANEOUS COMMENTS
IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED

ARE BANKS STABLE? <u>Yes</u> PROTECTION NEEDED <u>No</u>
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? $\underline{\text{No}}$
COMMENTS:
ALTERNATIVES
RECOMMENDED DESIGN: <u>Dual 425 ft. bridges with two additional 425 ft. bridges along ramps.</u>
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO $\underline{\mathbf{X}}$ DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1) $\underline{X}$ NORMAL PROCESS
(2) NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:



S	ite	63
$\sim$		$\mathbf{c}$

			Ne	use River Basi
Name		Index Number	Classification	Class Date
Description			Special	Designation
Strouds Creek		27-2-9	C;NSW	12/01/83
From source to Eno River				
Stump Bay		27-148-1-6	SA;HQW,NSW	05/01/88
From source to Long Bay				
Swan Creek		27-144	SA;HQW,NSW	05/01/88
From source to Neuse River				
Swan Pond		27-52-7	C;NSW	05/01/88
Entire pond and connecting st	tream to Mill Creek			
Swift Creek		27-97-(6)	SC;Sw,NSW	05/01/88
From mouth of Bear Branch to	o Neuse River			
Swift Creek		27-97-(0.5)	C;Sw,NSW	05/01/88
From source to mouth of Bea	r Branch			
Swift Creek		27-43-(8)	C;NSW	05/01/88
From dam at Lake Benson to I	Neuse River	Market 1917 - 211		
Swift Creek (Lake Benson)		27-43-(5.5)	WS-III;NSW,CA	08/03/92
From a point 0.6 mile upstrea	m of Wake County SR 1006 to	dam at Lake Benson		
Swift Creek (Lake Wheeler)		27-43-(1)	WS-III;NSW	08/03/92
From source to a point 0.6 mi	ile upstream of Wake County Si	R 1006		
Swindell Bay		27-150-8-(2)	SC;Sw,NSW	05/01/88
From the narrows to Bay Rive	er			
Swindell Bay		27-150-8-(1)	SC;Sw,HQW,NSW	08/01/90
From source to the narrows	Andreadon Maria Addition and Andreadon and Andreadon accounts to the proper proper proper proper and the Andreadon Andreadon and Andreadon Andread	And Andrew Committee of the Andrew State Committee of the Andrew Committee of the Andrew Association Committee of the Andrew Association Committee of the Andrew Committee of		
Sycamore Creek (Big Lake)		27-33-9	B;NSW	05/01/88
From source to Crabtree Cree	ek .			
Tar Creek		27-150-31-4	SA;HQW,NSW	05/01/88
From source to Gale Creek				
Tar Creek		27-141-4	SA;HQW,NSW	05/01/88
From source to Broad Creek				
Tar Kiln Branch		27-54-6	WS-IV;NSW	08/03/92
From source to Falling Creek				
Tar River		27-71-2-2	WS-IV;NSW	08/01/02
From source to Trotters Creel	k		-	



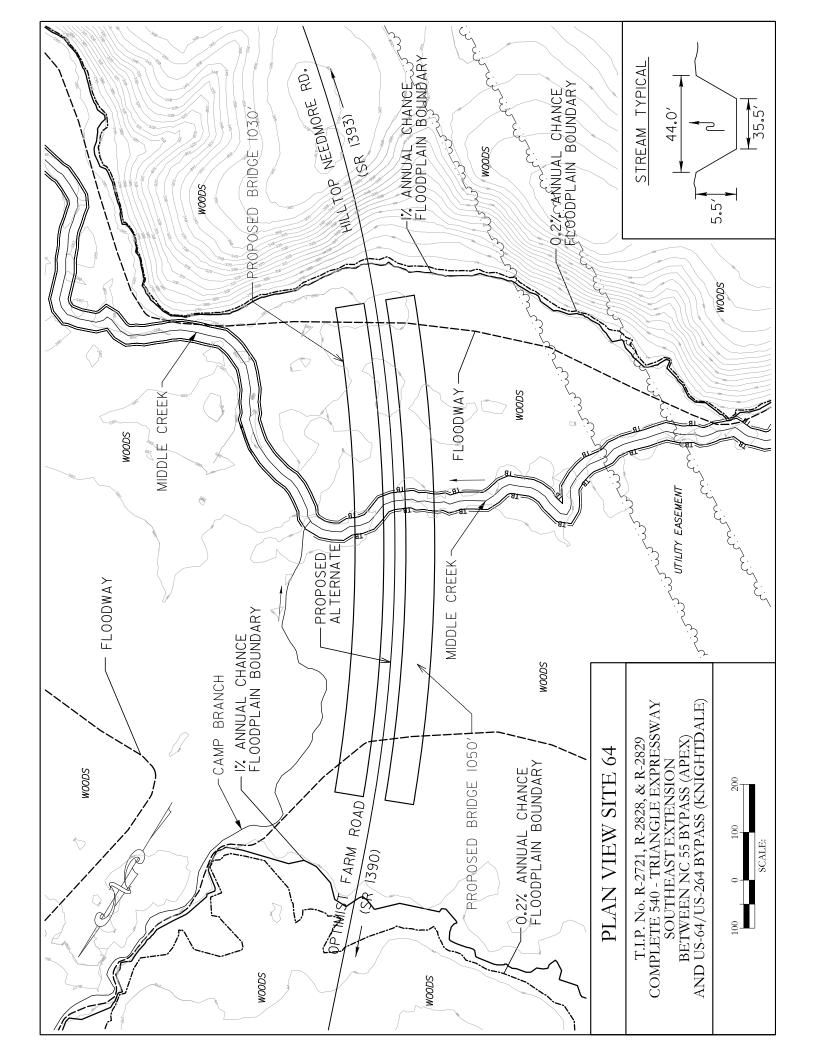


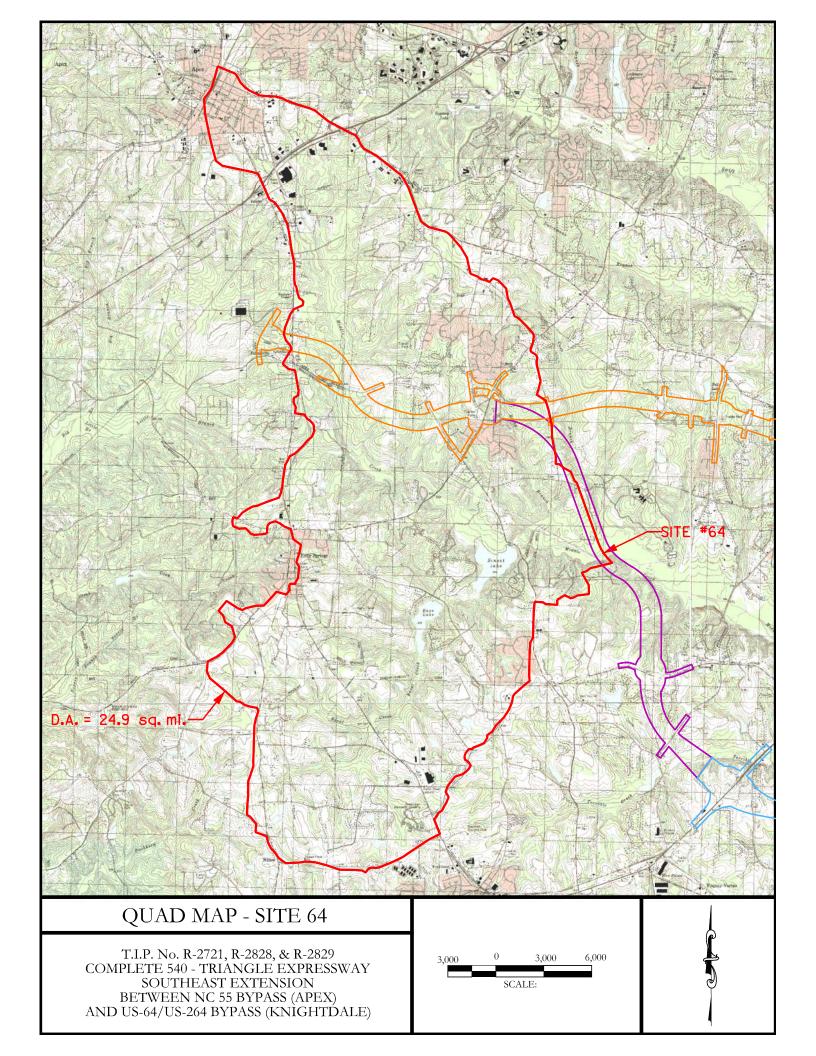
Looking upstream from proposed alternate Site 63 location



Looking downstream from proposed alternate Site 63 location

#### Site 64





Site # 64

REGION: BLUE RIDGE

METHOD USED: Fact Sheet 007-00

4/18/2014

STREAM NAME: Middle Creek sq. miles PROJECT NAME: Triangle Expressway SE Ext.

NGLISH Drainage Area = 24.90 Drainage Area = ENGLISH

<b>USGS RUI</b>	<b>USGS RURAL REGRESSION EQU</b>	SSION EQUA	ION EQUATIONS (OLD)	RUF	<b>RAL EQUA</b>	<b>TIONS Rep</b>	RURAL EQUATIONS Report 01-4207
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cts)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)
2YR	313.45	529.37	1327.81	2YR	1289.63	563.05	330.48
5YR	523.38	967.77	2137.50	5YR	2133.25	993.52	528.48
10YR	695.14	1357.24	2832.82	10YR	2805.63	1357.75	685.30
25YR	963.95	2002.10	3835.55	25YR	3785.78	1890.83	910.41
50YR	1197.05	2557.66	4695.76	50YR	4636.42	2360.83	1106.51
100YR	1464.44	3227.19	5681.79	100YR	5556.24	2887.32	1305.93
200YR	1807.29	4039.53	6787.20	200YR	6578.77	3478.50	1542.56
500YR	2232.00	5289.12	8373.57	500YR	8112.57	4372.51	1893.30

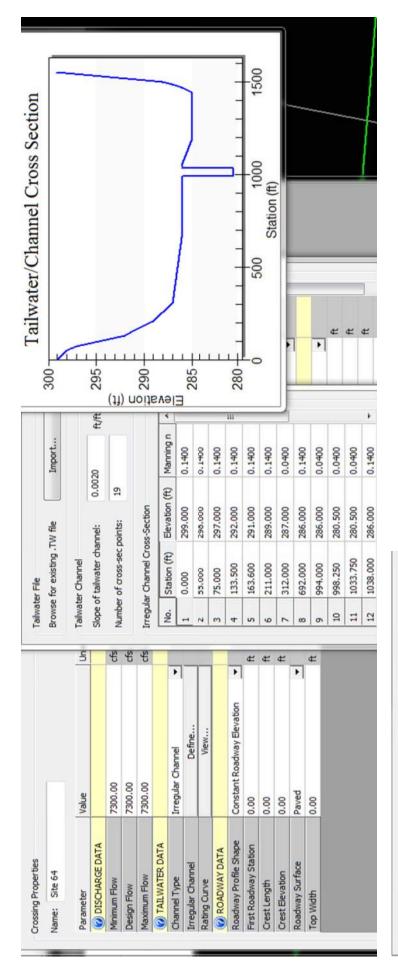
# **USGS URBAN REGRESSION EQUATIONS**

BDF= 11

(These Equations are used only for comparison)

							(Based on 2.80xQ10)	
Blue Ridge	(cfs)	5528.21	6613.85	8178.27	9827.39	11974.81	18518.79	16718.23
Coastal Plain	(cfs)	2979.63	3698.29	4861.71	6007.71	7530.55	10355.22	11470.38
FREQUENCY Sand Hills Coastal Plain	(cfs)	1844.73	2179.92	2709.20	3248.08	3939.50	6103.76	5653.70
FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

00-200
<b>Fact Sheet 007-00</b>
Fact (
<b>USGS Fa</b>
ervious)
% Imp
<b>EQUATIONS (% Impervious)</b>
I EQU
IC REGRESSION EQU
IC REG



Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
7300.000	288.843	8.343	1.924	1.041
7300.000	288.843	8.343	1.924	1.041
7300.000	288.843	8.343	1.924	1.041
7300.000	288.843	8.343	1.924	1.041
7300.000	288.843	8.343	1.924	1.041
7300.000	288.843	8.343	1.924	1.041
7300.000	288.843	8.343	1.924	1.041
7300.000	288.843	8.343	1.924	1.041
7300.000	288.843	8.343	1.924	1.041
7300.000	288.843	8.343	1.924	1.041
7300.000	288.843	8.343	1.924	1.041

#### PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake	PROJECT NUMBER <u>R-2721, R-2828 &amp; R-2829</u>					
STREAM Middle Creek	ROUTE New Location					
(Site 64) ASSESSMENT PREPARED	O BY <u>Mulkey, INC.</u> DATE <u>12/27/2013</u> (WBP)					
	HYDROLOGIC EVALUATION					
NEAREST GAGING STAT	ION ON THIS STREAM (NONE <u>X</u> )					
ARE FLOOD STUDIES AV	AILABLE ON THIS STREAM: Yes					
	VTR. $\underline{N/A}$ FT. $Q_{25}$ $\underline{6,600}$ CFS EST. BKWTR. $\underline{N/A}$ FT. VTR. $\underline{N/A}$ FT. $Q_{100}$ $\underline{8,000}$ CFS EST. BKWTR. $\underline{N/A}$ FT. WTR. $\underline{N/A}$ FT.					
DRAINAGE AREA: 24.9 Sq. Mi. METHOD USED TO COMPUTE Q: USGS Urban Regression						
<u>P</u>	ROPERTY RELATED EVALUATIONS					
DAMAGE POTENTIAL: LO	OW MODERATE X HIGH					
COULD THIS BE SI	GNIFICANTLY INCREASED BY PROPOSED					
ENCROACHMENT:	YES NO <u>X</u>					
EXPLANTION: A flo	oodway modification may be required at this site.					
LIST BUILDINGS IN	N FLOOD PLAIN: None LOCATION:					
UPSTREAM LAND ANTICIPATE ANY						
ANY FLOOD ZONII	NG? (FIA STUDIES, ETC.) YES X NO					
TYPE OF STUDY: 1	FEMA – Special Flood Hazard Zone AE					
REGULATORY FLO	OODWAY WIDTH 750 ft. Section 2181 (AS NOTED IN FIS)					
COMMENTS:						

#### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 14,200 VPD % TRUCKS 12						
DESIGN YEAR 2035 TRAFFIC COUNT 44,800 VPD % TRUCKS 12						
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE						
DETOUR AVAILABLE? N/A - New Location LENGTH OF DETOUR N/A MILES						
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? $N/A$ - New Location						
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? <u>N/A</u>						
COMMENTS:						
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS  NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR						
FREQUENCY.						
LEVEES AGGRADATION/DEGRADATION RESERVOIRS						
DIVERSIONS DRAINAGE DISTRICT NAVIGATION						
BACKWATER FROM ANOTHER SOURCE						
EXPLANATION:						
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION						
EMBANKMENT: SOIL TYPE Chewacla TYPE SLOPE COVER Vegetation						
COMMENTS: Soil Type from Web Soil Survey website of Wake County, NC.						
ENVIRONMENTAL CONSIDERATIONS						
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: Buried culverts 1 foot to allow for fish passage.						
MISCELLANEOUS COMMENTS						
IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED						

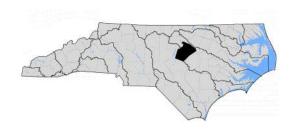
ARE BANKS STABLE? <u>Yes</u> PROTECTION NEEDED <u>No</u>					
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No					
COMMENTS:					
ALTERNATIVES					
RECOMMENDED DESIGN <u>1040 ft. Bridge</u>					
DETOUR STRUCTURE <u>N/A</u>					
BRIDGE WATERWAY OPENING					
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO $\underline{X}$ DISCUSSION:					
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:					
(1)NORMAL PROCESS					
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation					
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:					



### PRELIMINARY FLOOD INSURANCE STUDY

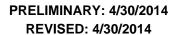
#### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

State of North Carolina

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 9, "Flooding Sources Studied by Detailed Methods: Redelineated", lists all flooding sources that were studied by detailed methods for the prestatewide FIS and redelineated for previous FISs. These flooding sources were not part of this revision and their effective analyses remain valid.

Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	Riverine Sources		Affected Communties	
	From	То		
Basin 10, Stream 2	The confluence with Little River (Basin 10, Stream 1)	Approximately 0.9 mile upstream of confluence with Little River (Basin 10, Stream 1)	Rdu Wake County	
Basin 10, Stream 3	The confluence with Little River (Basin 10, Stream 1)	Moss Road	Rdu Wake County	
Buffalo Branch (Basin 10, Stream 22)	The confluence with Little River (Basin 10, Stream 1)	Morphus Bridge Road	Rdu Town Of Wendell Wake County	
Buffalo Creek (Basin 9, Stream 1)	The Wake/Johnston County boundary	Robertsons Pond Dam	Rdu Town Of Wendell Wake County	
Kit Creek	The Chatham/Wake County Boundary	Approximately 475 feet upstream of Railroad	Rdu Town Of Cary Wake County	
Little Creek (Basin 11, Stream 2)	The Wake/Johnston County boundary	Cemetery Road	Rdu Town Of Zebulon Wake County	
Middle Creek	The confluence with Swift Creek	Approximately 0.7 mile upstream of confluence of Middle Creek Tributary	Rdu Town Of Apex Town Of Cary Town Of Holly Springs Town Of Holly Springs Wake County	
Panther Branch (Basin 22, Stream 2)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.5 mile upstream of Banks Road	Rdu Wake County	
nthe Creek	The Chatham/Wake County Boundary	Approximately 1.0 mile upstream of Green Level to Durham Road	Town Of Cary	
Poplar Creek (Basin 13, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 900 Feet upstream of Fayetteville Street	Rdu Town Of Knightdale Wake County	
Swift Creek	The confluence with the Neuse River	The confluence of Yates Branch (Basin 20, Stream 13)	Rdu Town Of Garner Wake County	
White Oak Creek	The confluence with Swift Creek	Approximately 0.4 mile upstream of Pergo Parkway	Rdu Town Of Clayton Town Of Garner Wake County	

Table 10, "Flooding Sources Studied by Detailed Methods: Limited Detailed", lists all flooding sources within the county that were studied by limited detailed methods for either this FIS or previous FISs.

Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed

Source	Riverine	Sources	Affected Communties
	From	То	
Bachelor Branch (Basin 28, Stream 6)	The confluence with White Oak Creek	Approximately 530 feet upstream of Highway 55	Rdu Town Of Cary Wake County
Basin 11, Stream 7	The Wake/Johnston County boundary	Approximately 0.4 mile upstream of Wake/Johnston County boundary	Rdu Wake County
Basin 14, Stream 2	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.4 mile upstream of Lake Myra Road	Rdu Wake County
Basin 14, Stream 3	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.7 mile upstream of confluence with Marks Creek (Basin 14, Stream 1)	Rdu Town Of Knightdale Town Of Wendell Wake County
Basin 20, Stream 5	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 1.7 miles upstream of confluence with Swift Creek (Basin 20, Stream 1)	Rdu Wake County
Basin 28, Stream 7	The confluence with Basin 28, Stream 8	Approximately 0.4 mile upstream of confluence with Basin 28, Stream 8	Town Of Cary
Beddingfield Creek	Approximately 0.4 mile upstream of the confluence with Neuse River	Approximately 0.2 mile upstream of Shotwell Road	Rdu Town Of Clayton Wake County
Big Branch	The confluence with Harris Reservoir	Approximately 0.9 mile upstream of Highway 1	Rdu Town Of Apex Wake County
Black Creek	Approximately 260 feet upstream of State HWY 210	Approximately 1.0 mile upstream of dam along Black Creek (Basin 23, Stream 1)	Rdu Town Of Fuquay-Varina Wake County

**Table 13 - Summary of Discharges** 

Flooding Source				rges (cfs)	
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annua Chance
Just upstream of Chatham/Wake County boundary	3.80	*	*	2,450	*
Approximately 0.9 mile upstream of Chatham/Wake County boundary	3.30	1,220	1,990	2,320	3,240
Approximately 1,580 feet downstream of New Hill Olive Chapel Road	2.20	986	1,720	2,060	3,060
Approximately 0.4 mile upstream of New Hill Olive Chapel Road	1.40	888	1,380	1,630	2,380
Little Creek (Into Middle Creek)					
Approximately 530 feet downstream of Wake/Johnston County boundary	9.90	*	*	1,710	*
At confluence of Guffy Branch (Basin 21, Stream 4)	5.19	*	*	1,190	*
Approximately 1,580 feet upstream of confluence of Guffy Branch (Basin 21, Stream 4)	5.05	*	*	1,171	*
Approximately 0.9 mile downstream of confluence of Juniper Branch (Basin 21, Stream 2)	4.86	*	*	1,150	*
Approximately 0.5 mile downstream of confluence of Juniper Branch (Basin 21, Stream 2)	4.42	*	*	1,080	*
At confluence of Juniper Branch (Basin 21, Stream 2)	2.27	*	*	744	*
Approximately 0.8 mile downstream of Pagan Road	2.04	*	*	701	*
Approximately 530 feet upstream of Pagan Road	1.52	*	*	594	*
Approximately 0.7 mile upstream of Pagan Road	1.18	*	*	513	*
Little River					
At Wake/Johnston County boundary	69.24	*	*	11,700	*
Marks Creek					
Approximately 0.7 mile downstream of Knightdale Eagle Rock Road	7.90	*	*	3,300	*
Middle Creek	1		<b>'</b>	15,555	
Just upstream of Panther Branch (Basin 22, Stream 2)	56.70	*	*	9,900	*
Just upstream of Terrible Creek (Basin 22, Stream 19)	43.60	*	*	8,600	*
Moccasin Creek					
travillantaly 0.4 mile unatroom of Franklin/Neah County houndary	27.96	*	*	7,470	*
Approximately 0.9 mile upstream of Franklin/Nash County boundary	26.57	*	*	7,230	*
Morris Branch				,	
At Chatham/Wake County boundary	1.40	821	1,380	1,730	2,730
Approximately 0.4 mile upstream of Chatham/Wake County boundary	1.20	707	1,300	1,630	2,490
Just downstream of Green Level to Durham Road	0.80	765	1,080	1,230	1,840
Norris Branch					
Just upstream of confluence with Cary Branch	1.70	*	*	1,038	*
Panther Creek	<u> </u>	•	•	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	•
At Chatham/Wake County boundary	3.60	800	1,600	2,150	4,100
At Yates Store Road	2.50	635	1,330	1,795	3,400
Just upstream of Yates Store Road	2.00	555	1,170	1,590	3,030
Approximately 0.8 mile upstream of Yates Store Road just downstream of tributary	1.40	445	955	1,305	2,525
Approximately 0.8 mile upstream of Yates Store Road just upstream of tributary	0.80	320	695	960	1,800
Poplar Creek (Basin 13, Stream 1)	1				, ,,,,,,
At mouth	9.00	*	*	3,600	*
	10.00			10,000	1
Reedy Branch (Basin 27, Stream 5)	1410	1 520	2.550	2 020	4.420
At confluence with Beaver Creek	4.10	1,520	2,550	3,020	4,430
Terrible Creek (Basin 22, Stream 19)	1	1.	T.		1.
At mouth	12.30	*	*	4,600	*

**Table 16 - Roughness Coefficients** 

Stream	Channel "n"	Overbank "n"
Beaver Creek	0.043 to 0.050	0.100 to 0.200
Beddingfield Creek	0.050	0.130
Big Branch	0.050	0.140
Black Creek	0.025 to 0.060	0.030 to 0.150
Buckhorn Creek	0.040 to 0.048	0.145
Buffalo Creek (Basin 9, Stream 1)	0.030 to 0.070	0.035 to 0.140
Buffalo Creek West	0.045 to 0.052	0.030 to 0.140
Cary Branch	0.040	0.140
Guffy Branch (Basin 21, Stream 4)	0.047	0.130
Jim Branch	0.045	0.145
Juniper Branch (Basin 21, Stream 2)	0.045	0.110 to 0.130
Kit Creek	0.030 to 0.070	0.070 to 0.110
Little Beaver Creek	0.045 to 0.055	0.100 to 0.220
Little Black Creek	0.030 to 0.070	0.070 to 0.130
Little Creek (Basin 11, Stream 2)	0.030 to 0.080	0.070 to 0.150
Little Creek (Into Middle Creek)	0.033 to 0.047	0.095 to 0.140
Little River	0.040 to 0.066	0.070 to 0.240
Marks Creek	0.025 to 0.070	0.070 to 0.130
Middle Creek	0.042 to 0.050	0.030 to 0.140
Mill Branch	0.050	0.030 to 0.150
Mill Creek/(South)	0.035 to 0.060	0.040 to 0.160
4 asin Creek	0.030 to 0.070	0.070 to 0.220
Morris Branch	0.030 to 0.050	0.100 to 0.200
Nancy Branch	0.045 to 0.050	0.120 to 0.150
Neuse River	0.035 to 0.060	0.055 to 0.250
Norris Branch	0.048	0.145
Panther Creek	0.030 to 0.070	0.070 to 0.130
Reedy Branch (Basin 27, Stream 5)	0.045 to 0.050	0.100 to 0.200
Snipes Creek	0.042 to 0.045	0.120 to 0.130
Swift Creek	0.040 to 0.072	0.035 to 0.240
Thomas Creek	0.050	0.145
Thomas oron		
Unnamed Tributary (#1) to Swift Creek	0.045 to 0.060	0.050 to 0.150

For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained using digital elevation data obtained with LIDAR technology developed as part of the North Carolina Statewide Floodplain Mapping Program. The hydraulic model is prepared using this digital elevation data, without surveying bathymetric or structural data. Where bridge or culvert data are readily available, such as from the North Carolina Department of Transportation, these data have been reflected in the hydraulic model. If these structural data are not readily available, field measurements of these structures were made to approximate their geometry in the hydraulic models. In addition, this method does not include field surveys that determine specifics on channel and floodplain characteristics. A limited detailed study is a "buildable" product that can be upgraded to a fully detailed study at a later date by verifying stream channel characteristics, bridge and culvert opening geometry, and by analyzing multiple recurrence intervals.

The results of the HEC-RAS computations are tabulated for all cross sections (Table 17, "Limited Detailed Flood Hazard Data"). Flood Profiles have not been developed for streams studied by limited detailed methods. Water-surface elevation rasters were developed for steams studied by limited detailed methods. In addition, floodways for streams studied by limited detailed methods are not delineated on the FIRM. However, the 1% annual chance water-surface elevations, flood discharges, and non-encroachment widths from the limited detailed studies for every modeled cross section are given in Table 17. The non-encroachment widths given at modeled cross sections can be used by communities to enforce floodplain management ordinances that meet the requirement defined in 44 CFR 60.3(c)(10).

Between cross sections for streams studied by limited detailed methods, 1% annual chance water-surface elevations can be calculated by mathematical interpolation using the distance along the stream centerline. Non-encroachment widths and, therefore, the location of a non-encroachment area boundary between cross sections should be determined based on either 1) mathematical interpolation, or 2) the non-encroachment width at the upstream or downstream cross section, whichever is larger. If the width determined by this second method is wider than the Special Flood Hazard Area (SFHA) or the 1% annual chance floodplain delineated on the FIRM for this location along the stream, the non-encroachment area shall be considered to

#### **FLOOD INSURANCE STUDY**

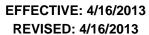
#### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 13 - Sum	mary of Dis	charges			
Flooding Source				ges (cfs)	
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Approximately 575 feet upstream of Glenraven Road	4.09	*	*	3,530	*
At confluence of Millbrook Tributary to Marsh Creek (Basin 18, Stream 19)	2.11	*	*	1,500	*
Approximately 1,060 feet upstream of Millbrook Road	1.60	*	*	1,070	*
Approximately 50 feet downstream of Forest Oak Drive	1.52	*	*	1,630	*
Approximately 350 feet downstream of Quail Ridge Road	1.21	*	*	1,880	*
Medfield Tributary (Basin 18, Stream 39)					
At mouth	1.20	*	*	1,200	*
Approximately 0.6 mile upstream of Old Trinity Road	0.80	*	*	950	*
Middle Creek					
At County boundary	65.30	*	*	10,800	*
Just upstream of Panther Branch (Basin 22, Stream 2)	56.70	*	*	9,900	*
Just upstream of Terrible Creek (Basin 22, Stream 19)	43.60	*	*	8,600	*
At US Route 401	38.70	*	*	7,500	*
At Johnson Pond Road	33.30	*	*	7 000	*
Just upstream of Camp Branch (Basin 22, Stream 7)	24.90	*	*	6,100	*
At State Route 1301	20.40	*	*	5,500	*
64 te Route 1152	8.60	*	*	3,500	*
At State Route 1301	5.60	*	*	2,800	*
Millbrook Tributary to Marsh Creek (Basin 18, Stream 19)					
At mouth	1.00	*	*	1,100	*
At Millbrook Road	0.80	*	*	840	*
Mills Branch (Basin 22, Stream 5)					
At mouth	3.40	*	*	1,850	*
Approximately 1,580 feet downstream of Fayetteville Road	1.43	*	*	574	*
At downstream side of Fayetteville Road	1.34	*	*	552	*
Approximately 1,060 feet upstream of Fayetteville Road	1.21	*	*	521	*
Mine Creek					
At mouth <sup>11</sup>	9.90	*	*	1,500	*
Just downstream of Lynn Road Tributary (Basin 18, Stream 32)	8.30	*	*	3,200	*
Just downstream of NRCS dam <sup>11</sup>	8.30	*	*	175	*
Just downstream of East Fork Mine Creek and West Fork Mine Tributary	6.00	*	*	2,550	*
Mingo Creek (Basin 12, Stream 2)				•	
At confluence of Beaverdam Creek (Basin 12, Stream 1)	0.89	*	*	933	*
Approximately 0.4 mile upstream of Beaverdam Creek (Basin 12, Stream 1)	0.87	*	*	928	*
Approximately 125 feet upstream of Forrestville Road	0.78	*	*	977	*
Approximately 530 feet downstream of N Smithfield Road	0.45	*	*	848	*
Moccasin Creek	1.5.14				
Approximately 0.4 mile upstream of Franklin/Nash County boundary	27.96	*	*	7,470	*
Approximately 0.9 mile upstream of Franklin/Nash County boundary	26.57	*	*	7,230	*
Approximately 1,060 feet upstream of NC 97	25.00	*	*	6,960	*
Approximately 0.8 mile upstream of NC 97	20.10	*	*	6,070	*
Approximately 1,060 feet downstream of US Highway 64	15.49	*	*	5,160	*
Approximately 1,580 feet upstream of US Highway 64	13.95	*	*	4,840	*
Approximately 0.4 mile upstream of Sheppard School Road	12.16	*	*	4,440	*
	1 ***	1	1		

Table 21 - Floodway Data

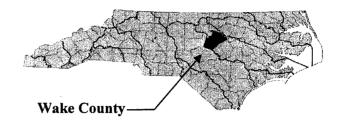
Floodwa	v Source		Floodway	DIE ZI - FI	oodway D		ter Surface Eleva	tion	
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
1661	166,140	1,260	10,323	1.0	233.0	*	233.0	233.8	0.8
1678	167,840	1,230	7,505	1.4	233.5	*	233.5	234.4	0.9
1689	168,860	980	5,981	1.8	234.3	*	234.3	235.0	0.7
1697	169,710	770	5,397	1.9	235.1	*	235.1	235.9	0.8
1702	170,170	670	4,803	2.1	235.6	*	235.6	236.4	0.8
1709	170,850	550	2,751	3.6	236.6	*	236.6	237.2	0.6
1722	172,200	570	5,649	1.8	238.6	*	238.6	239.0	0.4
1732	173,150	420	3,617	2.8	239.0	*	239.0	239.4	0.4
1747	174,660	505	5,716	1.7	240.6	*	240.6	241.0	0.4
1751	175,120	305	2,758	3.6	240.7	*	240.7	241.1	0.4
1757	175,725	550	6,885	1.4	241.7	*	241.7	242.1	0.4
1779	177,900	660	7,072	1.4	242.4	*	242.4	242.9	0.5
1794	179,390	570	5,870	1.5	242.8	*	242.8	243.4	0.6
1801	180,100	875	7,750	1.1	243.0	*	243.0	243.6	0.6
1814	181,400	640	4,667	1.8	243.8	*	243.8	244.4	0.6
1823	182,310	870	6,409	1.3	244.5	*	244.5	245.2	0.7
1833	183,280	870	6,141	1.4	245.0	*	245.0	245.8	0.8
1845	184,465	720	4,090	2.1	247.7	*	247.7	248.0	0.3
1862	186,150	700	4,019	2.1	249.5	*	249.5	250.2	0.7
1882	188,200	500	3,497	2.3	252.9	*	252.9	253.3	0.4
1899	189,940	550	4,575	1.8	254.7	*	254.7	255.2	0.5
1911	191,110	165	2,341	3.5	263.2	*	263.2	263.2	0.0
1924	192,410	550	5,658	1.4	263.7	*	263.7	264.5	0.8
1949	194,930	500	5,414	1.5	264.3	*	264.3	265.2	0.9
1968	196,775	630	6,326	1.3	265.0	*	265.0	266.0	1.0
2001	200,140	1,000	7,921	1.0	265.6	*	265.6	266.5	0.9
2015	201,500	820	4,254	1.9	266.3	*	266.3	267.1	0.8
2035	203,540	670	3,655	2.1	270.0	*	270.0	270.6	0.6
2033	204,130	610	3,484	2.2	271.1	*	271.1	270.6	1.0
					274.1	*			0.3
2050	205,000	740	3,910	1.9		*	274.1	274.4	
2070	207,000	900	3,771	2.0	276.0	*	276.0	276.2	0.2
2094	209,350	840	4,073	1.8	280.1	*	280.1	280.2	0.1
2115	211,450	700	3,437	2.1	282.7	*	282.7	283.4	0.7
2134	213,400	840	5,181	1.4	284.7	*	284.7	285.6	0.9
2145	214,530	830	4,806	1.5	285.6		285.6	286.5	0.9
2156	215,600	780	3,253	2.2	287.0		287.0	288.0	1.0
2161	216,140	730	3,371	2.0	289.2		289.2	289.3	0.1
2181	218,070	750	4,617	1.4	291.1		291.1	291.5	0.4
2198	219,800	800	4,686	1.4	292.1		292.1	292.7	0.6
Site 64	220,375	560	2,480	2.6	292.7	*	292.7	293.3	0.6
	222,125	500	2,602	2.4	297.2	*	297.2	297.2	0.0
2242	224,160	500	3,457	1.8	299.5	*	299.5	300.2	0.7
2258	225,800	238	1,989	2.9	300.9	*	300.9	301.9	1.0
2275	227,500	120	1,383	4.1	304.3	*	304.3	305.0	0.7

#### FLOOD INSURANCE STUDY

A Report of Flood Hazards in

WAKE COUNTY, NORTH CAROLINA

**AND INCORPORATED AREAS** 



#### **VOLUME 5 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





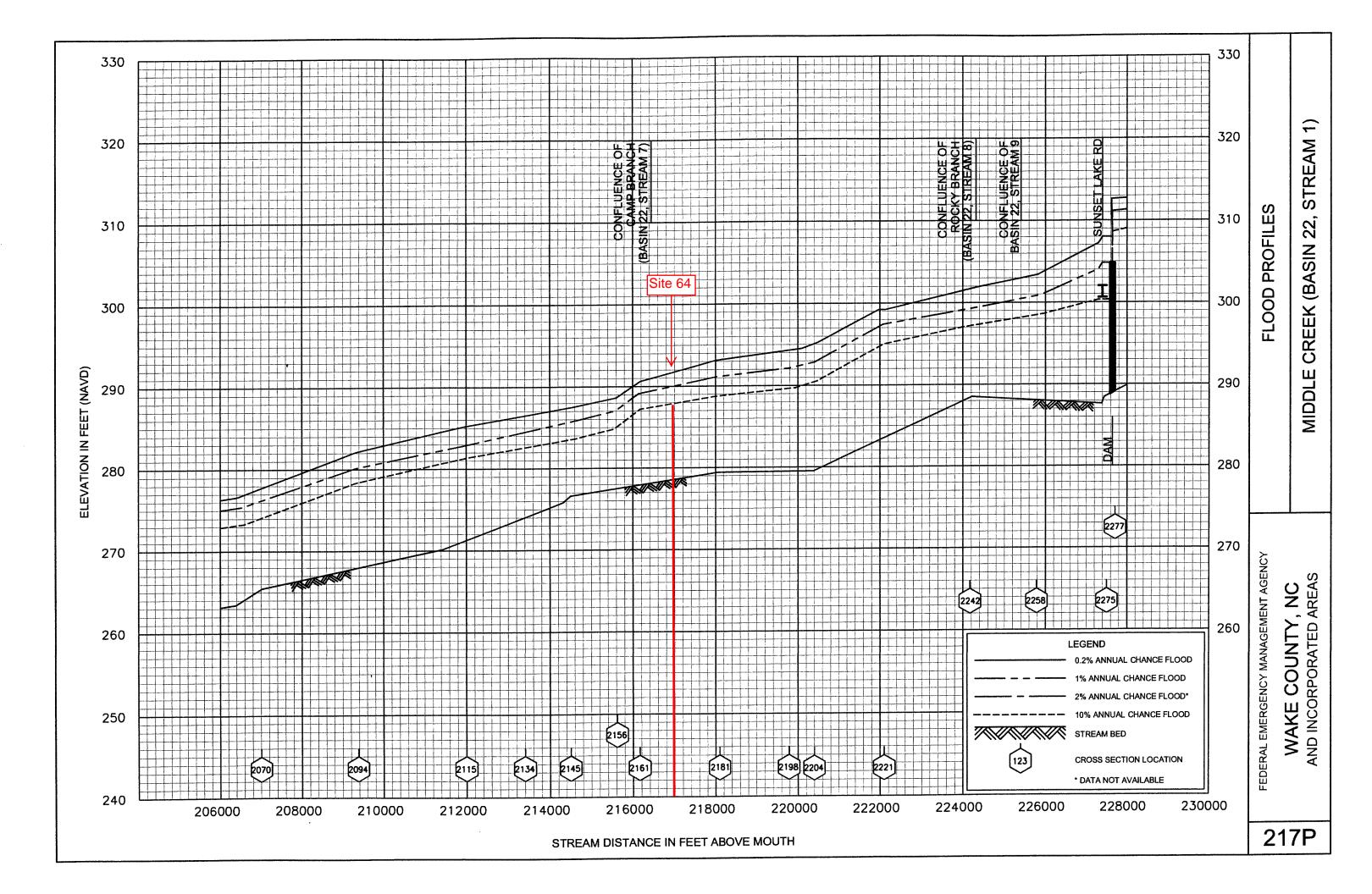
May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV005A







		Neus	se River Basin
Name	Index Number	Classification	Class Date
Description		Special D	esignation
McGowan Creek (Efland Millpond)	27-2-5-(1)	WS-II;HQW,NSW	08/03/92
From source to a point 0.7 mile upstream of mouth			
Meeting House Branch	27-72-3	C;Sw,NSW	05/01/88
From source to Bear Creek			
Merkle Bay	27-148-3	SA;HQW,NSW	05/01/88
From source to West Bay			
Merkle Hammock Creek	27-149-1-2	SA;NSW,ORW	01/01/90
From source to Thorofare Bay			
Mesic Creek	27-150-19	SA;HQW,NSW	05/01/88
From source to Bay River			
Middle Bay	27-154	SA;HQW,NSW	05/01/88
From source to Pamlico Sound			
Middle Canal	27-112-1-1-1	C;Sw,NSW	05/01/88
From source to East Canal			
Middle Creek	27-43-15-(4)	C;NSW	05/01/88
From dam at Sunset Lake to Swift Creek			
Middle Creek	27-43-15-(1)	C;NSW	05/01/88
From source to backwaters of Sunset Lake			
Middle Creek (Sunset Lake)	27-43-15-(2)	B;NSW	05/01/88
From backwaters of Sunset Lake to dam at Sunset Lake			
Middle Swamp	27-86-26-5	C;Sw,NSW	05/01/88
From source to Little Contentnea Creek			
Milburnie Creek (Milburnie Lake)	27-31	C;NSW	05/01/88
From source to Neuse River			
Mill Branch	27-86-5.5	WS-IV;NSW	08/03/92
From source to Contentnea Creek			
Mill Branch	27-72-4	C;Sw,NSW	05/01/88
From source to Bear Creek			
Mill Branch	27-101-9	C;Sw,NSW	05/01/88
From source to Trent River			
Mill Branch	27-80-8	C;Sw,NSW	05/01/88
From source to Southwest Creek			

1
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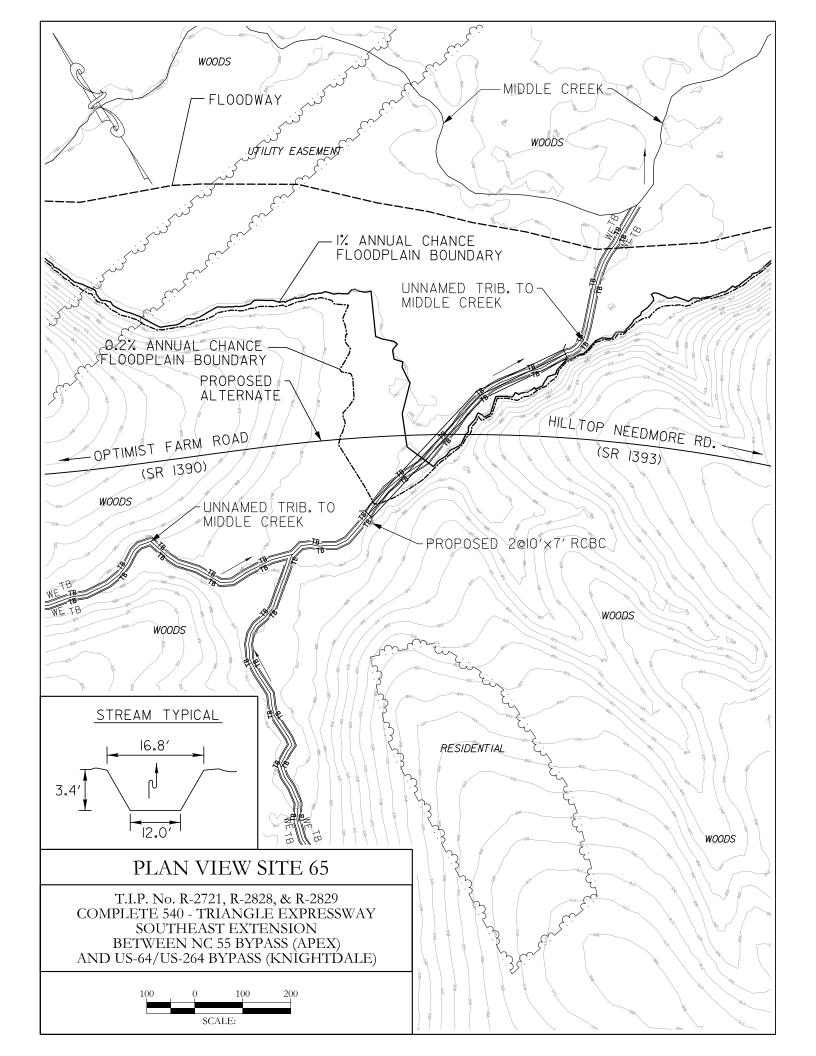


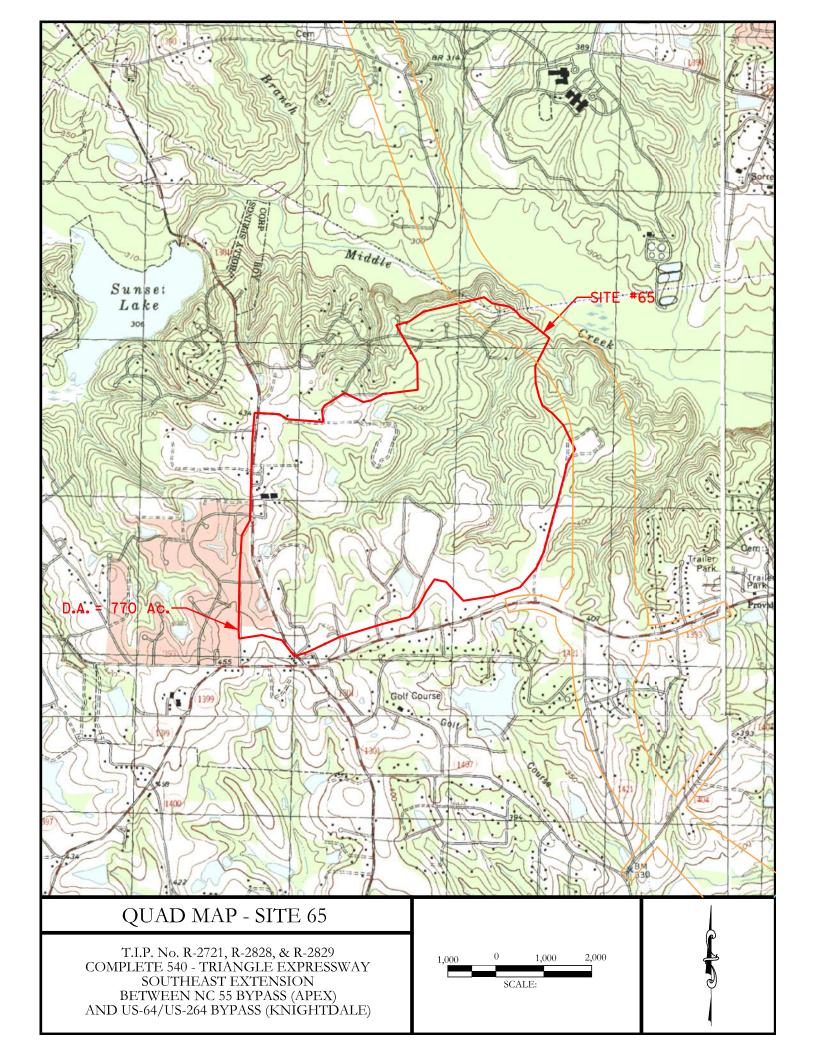
Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

#### Site 65





### **North Carolina**

PROJECT NAME: Triangle Expressway SE Ext. 4/18/2014 ENGLISH

REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00 STREAM NAME: Unnamed Tributary to Middle Creek sq. miles 1.20 Drainage Area =

<b>USGS RUR</b>	<b>ISGS RURAL REGRESSION EQU</b>	SSION EQUA	ATIONS (OLD)	RUF	<b>RURAL EQUAT</b>	<b>TIONS Rep</b>	ort 01-4207
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ri	Coastal Plain	dge Coastal Plain Sand Hills
	(cts)	(cts)	(cfs)		(cfs)	(cts)	(cts)
2YR	33.95	77.88	163.33	2YR	153.43	73.15	38.14
5YR	55.83	165.68	280.22	5YR	273.79	144.83	63.07
10YR	73.70	249.14	377.05	10YR	376.85	210.31	82.78
25YR	98.85	398.87	526.24	25YR	535.40	313.08	111.31
50YR	120.54	538.14	654.10	50YR	675.89	407.86	136.11
100YR	144.81	714.93	808.43	100YR	834.92	518.87	162.11
200YR	178.17	933.71	977.50	200YR	1015.92	648.28	192.65
500YR	210.89	1295.05	1265.93	500YR	1295.28	852.82	237.89

# **USGS URBAN REGRESSION EQUATIONS**

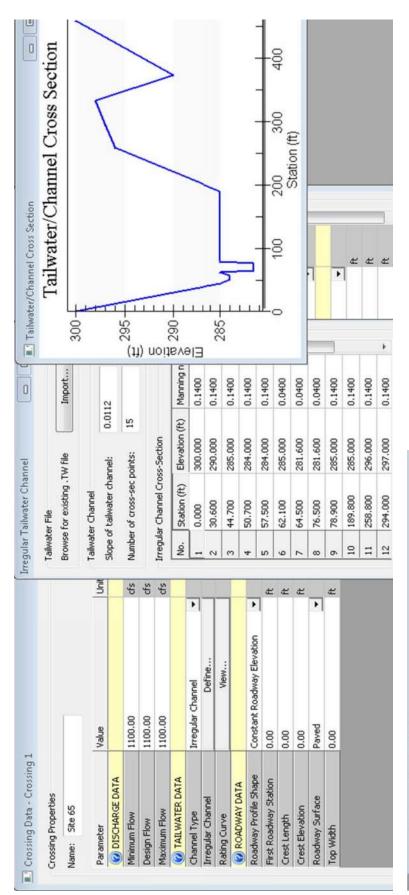
BDF=

(These Equations are used only for comparison)

								(Based on 2.80xQ10)	
		(cfs)						2317.36	2186.03
or companison)	FREQUENCY Sand Hills Coastal Plain	(cts)	449.15	596.58	848.62	1078.52	1388.47	1670.43	2227.18
IIIS AIR USEU UIIIS	Sand Hills	(cfs)	192.27	227.92	277.99	321.01	374.87	638.18	502.81
ל ווופסם בלחמווכ	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

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FEMA	FREQUENCY Disharges			10YR	50YR	100YR	500YR		
	Blue Ridge Discharge Used		7	9	4	35 1100	35	58 (Based on 2.80xQ10)	31 (Based on 3.66xQ10)
		(cfs)		643.06	940.94	9 1081.85	6 1217.85	4 1800.58	5 2353.61
						1015.19			
20	Sand Hills	(cts)	312.68	400.09	531.44	625.31	711.40	1120.25	1464.33
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR



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Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
1100.000	286.648	5.048	3.520	3.528
1100.000	286.648	5.048	3.520	3.528
1100.000	286.648	5.048	3.520	3.528
1100.000	286.648	5.048	3.520	3.528
1100.000	286.648	5.048	3.520	3.528
1100.000	286.648	5.048	3.520	3.528
1100.000	286.648	5.048	3.520	3.528
1100.000	286.648	5.048	3.520	3.528
1100.000	286.648	5.048	3.520	3.528
1100.000	286.648	5.048	3.520	3.528
1100.000	286.648	5.048	3.520	3.528

#### PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake PROJECT NUMBER R-2721, R-2828 & R-2829
STREAM <u>Unnamed Tributary to Middle Creek</u> ROUTE <u>New Location</u> (Site 65)
ASSESSMENT PREPARED BY Mulkey, INC. DATE 5/8/2014 (WBP)
HYDROLOGIC EVALUATION
NEAREST GAGING STATION ON THIS STREAM (NONE $\underline{X}$ )
ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: No
FLOOD DATA: $Q_{10}  \underline{650} \text{ CFS}  \text{EST. BKWTR. } \underline{N/A} \text{ FT.}  Q_{25}  \underline{950} \text{CFS}  \text{EST. BKWTR. } \underline{N/A} \text{ FT.} \\ Q_{50}  \underline{1,100} \text{ CFS}  \text{EST. BKWTR. } \underline{N/A} \text{ FT.}  Q_{100}  \underline{1,200} \text{ CFS}  \text{EST. BKWTR. } \underline{N/A} \text{ FT.} \\ Q_{500}  \underline{2,400} \text{ CFS}  \text{EST. BKWTR. } \underline{N/A} \text{ FT.}$
DRAINAGE AREA <u>1.2 Sq.Mi.</u> METHOD USED TO COMPUTE Q: <u>USGS Urban Regression</u>
PROPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: LOW MODERATE X HIGH
COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: YES NO $\underline{X}$
ENCROACHMENT: YES NO <u>x</u> EXPLANTION: <u>A maximum one foot rise in the natural base flood is allowed, but this rise should not affect any existing insurable structures.</u>
EXPLANTION: A maximum one foot rise in the natural base flood is allowed, but this
EXPLANTION: A maximum one foot rise in the natural base flood is allowed, but this rise should not affect any existing insurable structures.
EXPLANTION: A maximum one foot rise in the natural base flood is allowed, but this rise should not affect any existing insurable structures.  LIST BUILDINGS IN FLOOD PLAIN: None LOCATION:  UPSTREAM LAND USE Under Planning Jurisdiction and Residential
EXPLANTION: A maximum one foot rise in the natural base flood is allowed, but this rise should not affect any existing insurable structures.  LIST BUILDINGS IN FLOOD PLAIN: None LOCATION:  UPSTREAM LAND USE Under Planning Jurisdiction and Residential ANTICIPATE ANY CHANGE? No
EXPLANTION: A maximum one foot rise in the natural base flood is allowed, but this rise should not affect any existing insurable structures.  LIST BUILDINGS IN FLOOD PLAIN: None LOCATION:  UPSTREAM LAND USE Under Planning Jurisdiction and Residential ANTICIPATE ANY CHANGE? No  ANY FLOOD ZONING? (FIA STUDIES, ETC.) YES NO X

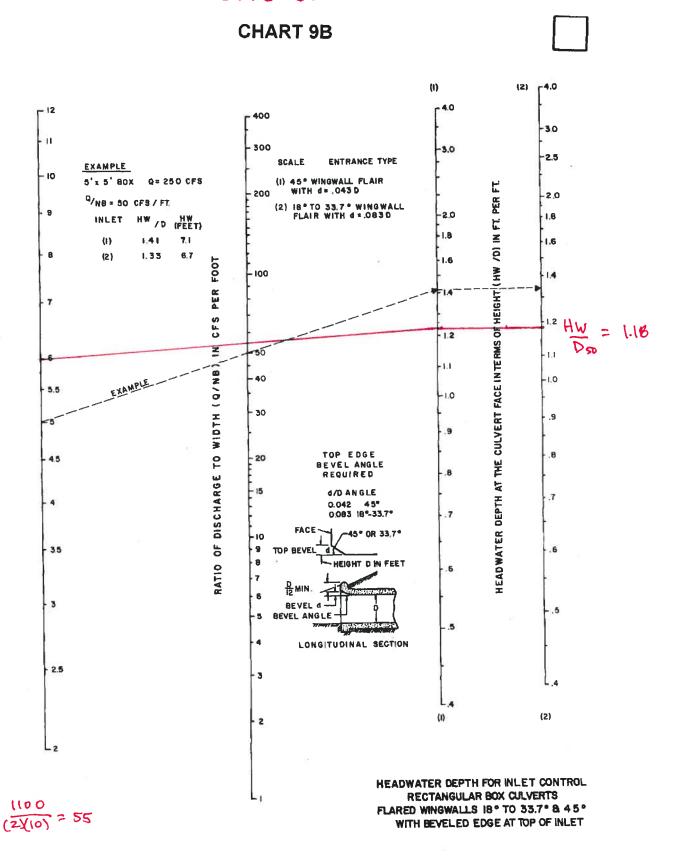
#### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 14,200 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 44,800 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? N/A
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS  NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Appling, Cecil, Chewacla, Pacolet, Wake Wateree, Wehadkee
TYPE SLOPE COVER <u>Vegetation</u>
COMMENTS: Soil Type from Web Soil Survey website of Wake County, NC.
ENVIRONMENTAL CONSIDERATIONS

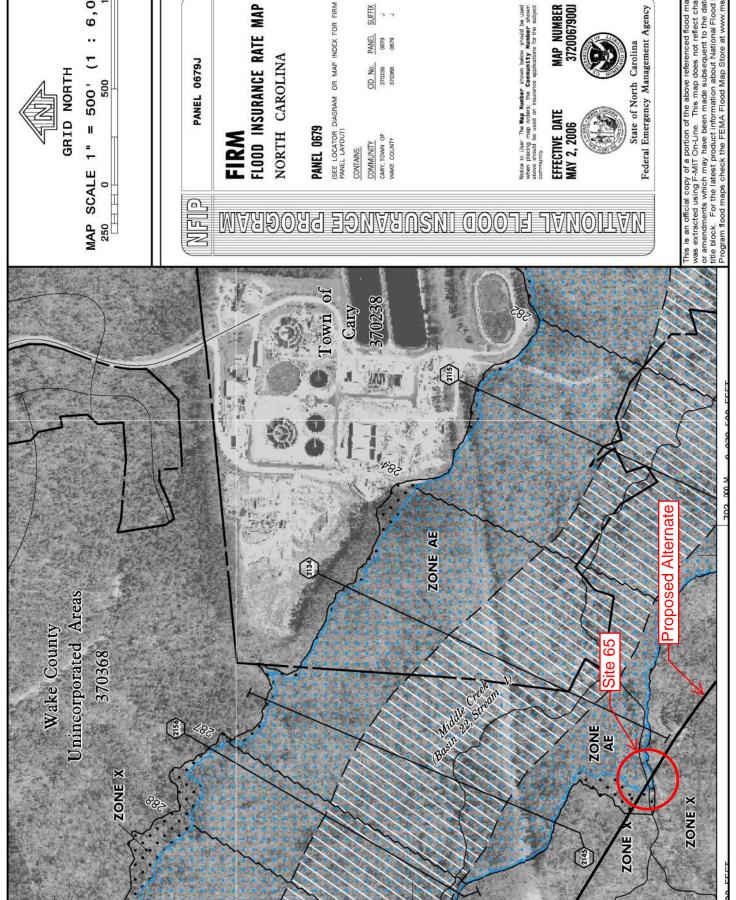
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: <u>Buried culverts 1 foot to allow for fish passage.</u>

#### MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED
ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
<u>ALTERNATIVES</u>
RECOMMENDED DESIGN: <u>2@10'x7' RCBC</u>
DETOUR STRUCTURE N/A
BRIDGE WATERWAY OPENING: 140 sq. ft.
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO X DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood Elevation due to site located in backwater of Middle Creek.
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:



PROPOSED STRUCTURE: 2010'X7' RCBC



SUFFIX

FEET

6,000)

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance

MAP NUMBER 3720067900J

			ise River B
Name	Index Number	Classification	Class D
Description		Special	Designation
McGowan Creek (Efland Millpond)	27-2-5-(1)	WS-II;HQW,NSW	08/03/9
From source to a point 0.7 mile upstream of mouth			
Meeting House Branch	27-72-3	C;Sw,NSW	05/01/8
From source to Bear Creek			
Merkle Bay	27-148-3	SA;HQW,NSW	05/01/8
From source to West Bay			
Merkle Hammock Creek	27-149-1-2	SA;NSW,ORW	01/01/9
From source to Thorofare Bay			
Mesic Creek	27-150-19	SA;HQW,NSW	05/01/8
From source to Bay River			
Middle Bay	27-154	SA;HQW,NSW	05/01/8
From source to Pamlico Sound			
Middle Canal	27-112-1-1-1	C;Sw,NSW	05/01/8
From source to East Canal			
Middle Creek	27-43-15-(4)	C;NSW	05/01/8
From dam at Sunset Lake to Swift Creek			
Middle Creek	27-43-15-(1)	C;NSW	05/01/8
From source to backwaters of Sunset Lake			
Middle Creek (Sunset Lake)	27-43-15-(2)	B;NSW	05/01/8
From backwaters of Sunset Lake to dam at Sunset Lake			
Middle Swamp	27-86-26-5	C;Sw,NSW	05/01/8
From source to Little Contentnea Creek			
Milburnie Creek (Milburnie Lake)	27-31	C;NSW	05/01/8
From source to Neuse River			
Mill Branch	27-86-5.5	WS-IV;NSW	08/03/9
From source to Contentnea Creek			
Mill Branch	27-72-4	C;Sw,NSW	05/01/8
From source to Bear Creek			
Mill Branch	27-101-9	C;Sw,NSW	05/01/8
From source to Trent River			
Mill Branch	27-80-8	C;Sw,NSW	05/01/8
From source to Southwest Creek			

	n=0.12	16.8	7.7		2
	\$0 00 M	18-78 WEWE	MHO		GRAVEL
					SAND / GR
SITE 65			3	<u> </u>	RIAL
			700 n = 20.12	RECENT DRIFT	BED MATERIAL
	1	HU BUI	10 3	Recen	RED

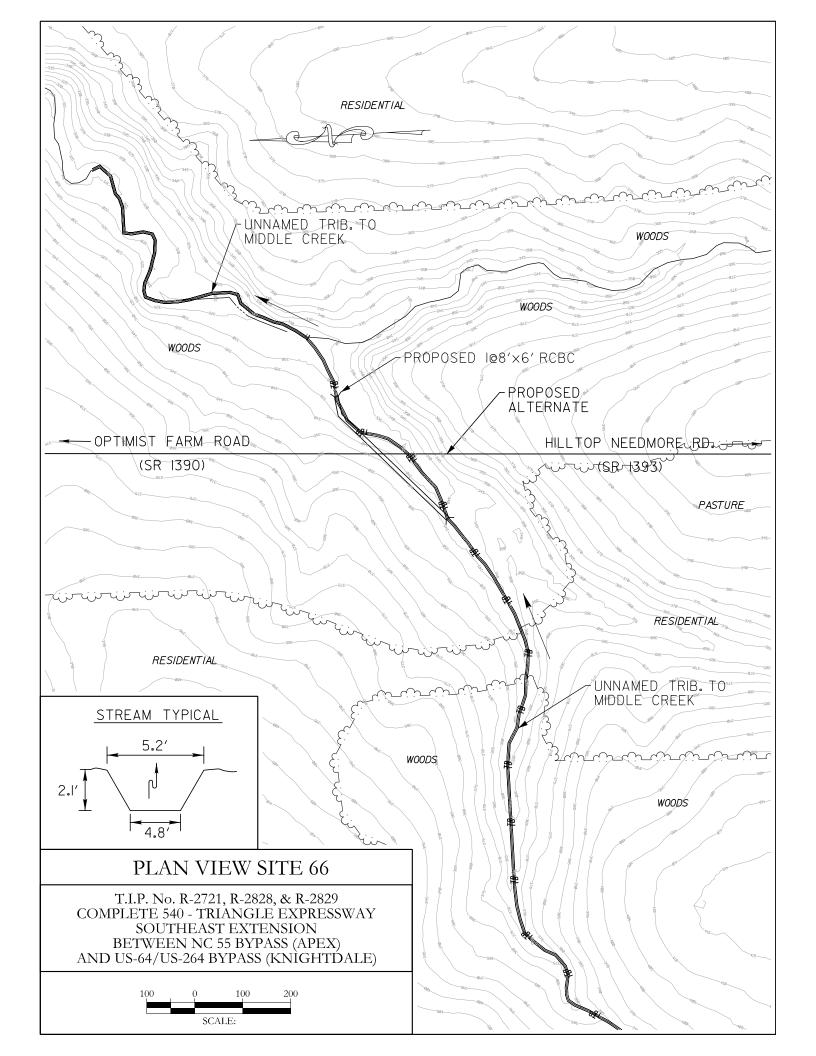


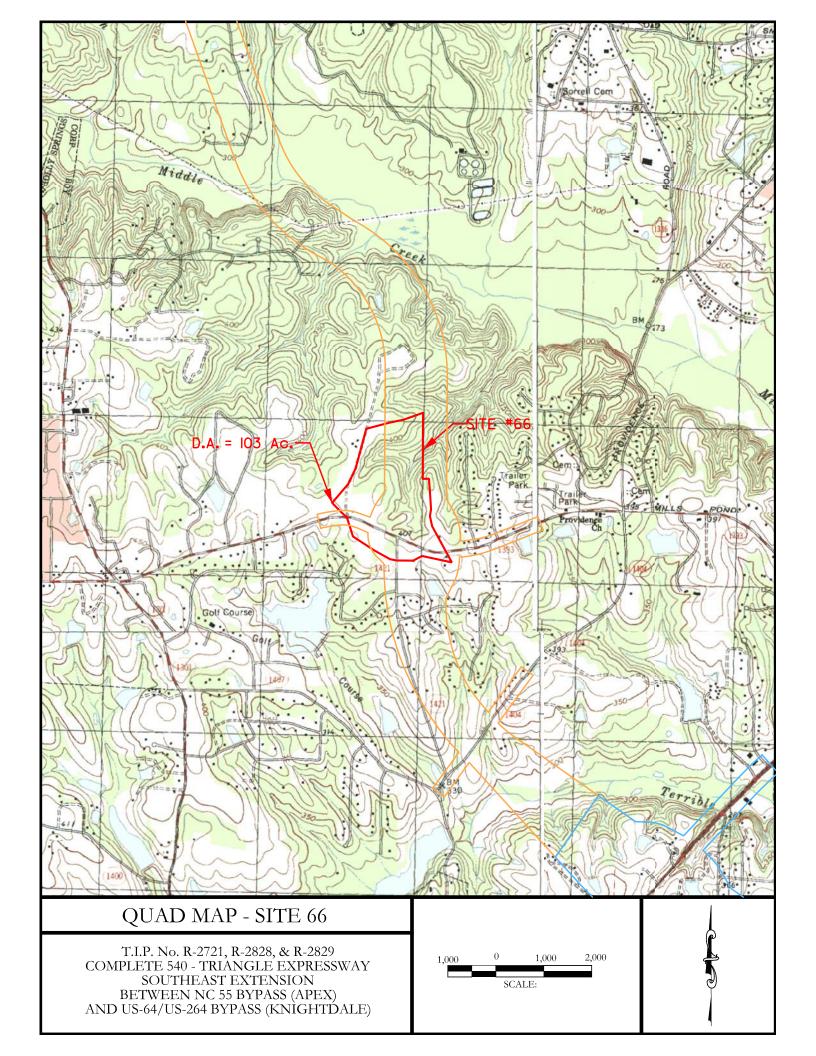
Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

## Site 66





## **North Carolina**

4/18/2014

REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00 STREAM NAME: Unnamed Tributary to Middle Creek sq. miles 0.16 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = ENGLISH

<b>USGS RUR</b>	<b>JSGS RURAL REGRESSION EQU</b>	SSION EQUA	ATIONS (OLD)	RUF	SAL EQUA	<b>ATIONS Rep</b>	RURAL EQUATIONS Report 01-4207
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)
2YR	7.75	21.80	40.59	2YR	37.29	18.85	60.6
5YR	12.62	51.28	72.65	5YR	86.69	40.29	15.36
10YR	16.59	80.78	98.74	10YR	99.28	60.91	20.32
25YR	21.77	136.55	140.61	25YR	145.97	94.79	27.55
50YR	26.22	191.04	176.54	50YR	188.02	127.01	33.82
100YR	31.13	262.64	221.30	100YR	236.99	165.87	40.53
200YR	38.22	352.82	269.74	200YR	293.65	212.31	48.36
500YR	43.98	508.46	360.78	500YR	382.78	287.87	96.69

# **USGS URBAN REGRESSION EQUATIONS**

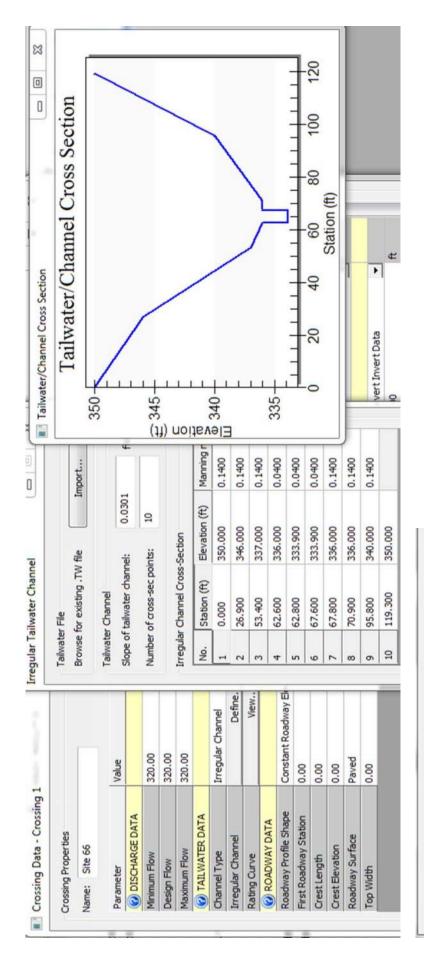
BDF= 11

(These Equations are used only for comparison)

							(Based on 2.80xQ10)	
ш						392.34	582.47	565.73
Coastal Plain	(cfs)	127.76	177.51	266.09	344.55	451.50	497.03	749.55
Sand Hills	(cfs)	42.80	50.84	61.24	86.89	78.55	142.36	100.73
FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR
	ш	ш	ш	ш	ш	FREQUENCY         Sand Hills         Coastal Plain         Blue Ridge           (cfs)         (cfs)         (cfs)         (cfs)           5YR         42.80         127.76         167.63           10YR         50.84         177.51         208.02           25YR         61.24         266.09         272.40           50YR         68.98         344.55         323.22	ш	lain Blue Ridge (cfs) (cfs) 167.63 208.02 272.40 323.22 392.34 582.47 (

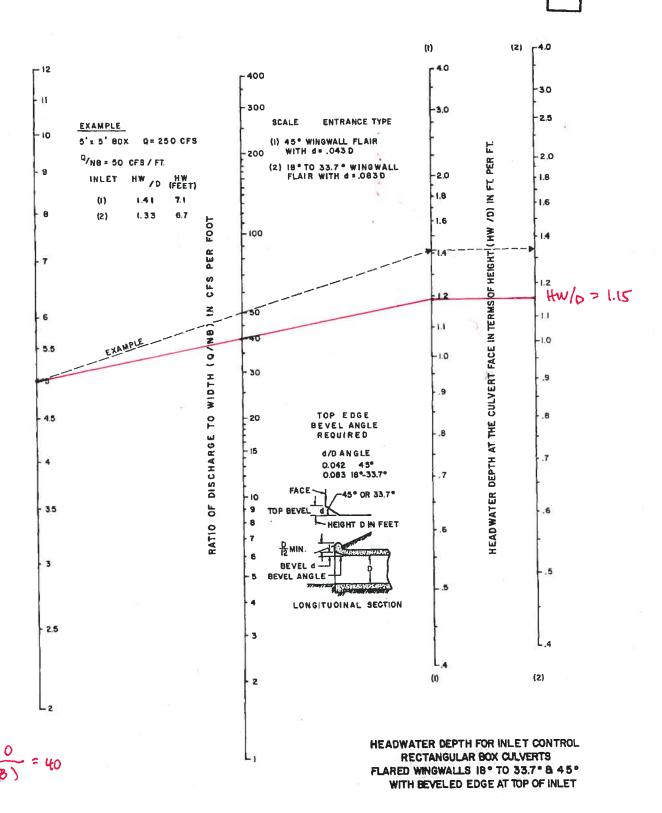
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<b>Fact Sheet 007-00</b>
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<b>EQUATIONS (% Impervious)</b>
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FEMA	FREQUENCY Disharges			10YR	50YR	100YR	500YR		
								10)	10)
	Blue Ridge Discharge Used					320		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	Blue Ridge	(cts)	125.68	171.83	274.73	321.65	368.71	481.11	628.88
	Coastal Plain	(cts)	113.94	162.19	271.48	329.81	389.34	454.14	593.63
20	ωI					173.25			
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

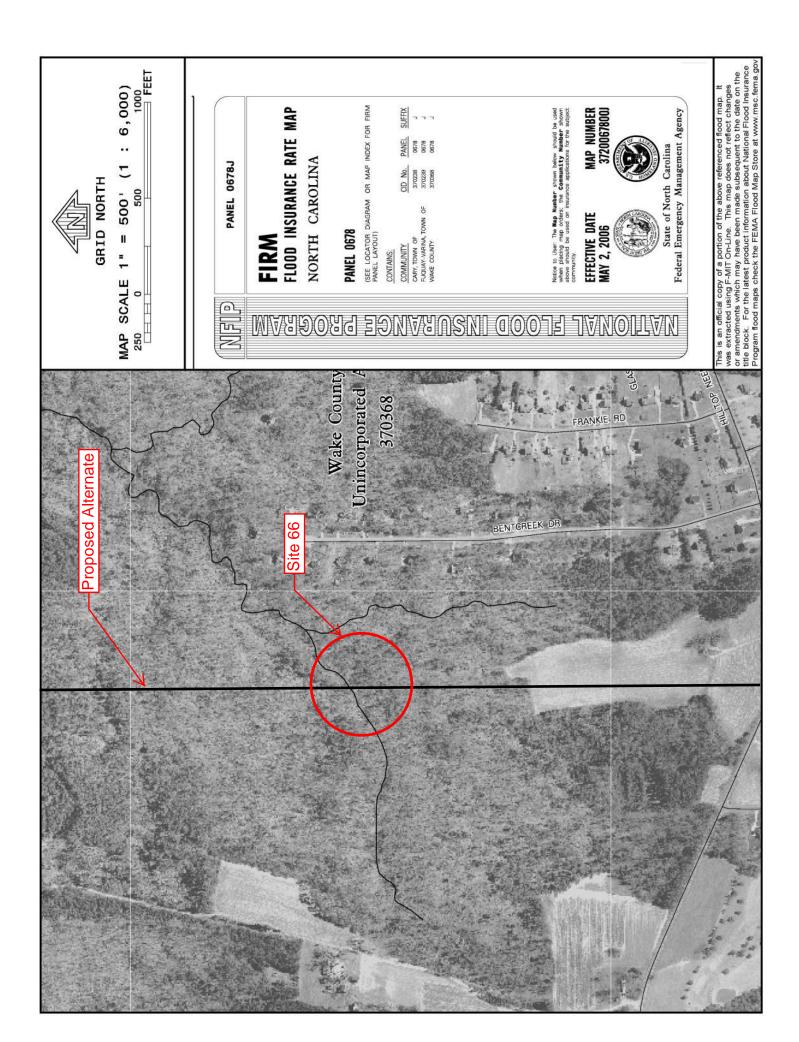


Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
320.000	338.073	4.173	5.589	7.838
320.000	338.073	4.173	5.589	7.838
320.000	338.073	4.173	5.589	7.838
320.000	338.073	4.173	5.589	7.838
320.000	338.073	4.173	5.589	7.838
320.000	338.073	4.173	5.589	7.838
320.000	338.073	4.173	5.589	7.838
320.000	338.073	4.173	5.589	7.838
320.000	338.073	4.173	5.589	7.838
320.000	338.073	4.173	5.589	7.838
320.000	338.073	4.173	5.589	7.838





PROPOSED STRUCTURE:



		Neu	ise River B
Name	Index Number	Classification	Class D
Description		Special I	Designation
McGowan Creek (Efland Millpond)	27-2-5-(1)	WS-II;HQW,NSW	08/03/9
From source to a point 0.7 mile upstream of mouth			
Meeting House Branch	27-72-3	C;Sw,NSW	05/01/8
From source to Bear Creek			
Merkle Bay	27-148-3	SA;HQW,NSW	05/01/8
From source to West Bay			
Merkle Hammock Creek	27-149-1-2	SA;NSW,ORW	01/01/9
From source to Thorofare Bay			
Mesic Creek	27-150-19	SA;HQW,NSW	05/01/8
From source to Bay River			
Middle Bay	27-154	SA;HQW,NSW	05/01/8
From source to Pamlico Sound			
Middle Canal	27-112-1-1-1	C;Sw,NSW	05/01/8
From source to East Canal			
Middle Creek	27-43-15-(4)	C;NSW	05/01/8
From dam at Sunset Lake to Swift Creek			
Middle Creek	27-43-15-(1)	C;NSW	05/01/8
From source to backwaters of Sunset Lake			
Middle Creek (Sunset Lake)	27-43-15-(2)	B;NSW	05/01/8
From backwaters of Sunset Lake to dam at Sunset Lake			
Middle Swamp	27-86-26-5	C;Sw,NSW	05/01/8
From source to Little Contentnea Creek			
Milburnie Creek (Milburnie Lake)	27-31	C;NSW	05/01/8
From source to Neuse River			
Mill Branch	27-86-5.5	WS-IV;NSW	08/03/9
From source to Contentnea Creek			
Mill Branch	27-72-4	C;Sw,NSW	05/01/8
From source to Bear Creek			
Mill Branch	27-101-9	C;Sw,NSW	05/01/8
From source to Trent River			
Mill Branch	27-80-8	C;Sw,NSW	05/01/8
From source to Southwest Creek			

	90	5.5	2.7	20			3	
	WE-WE	91-81	4200	O HIM			MODERATE	
99			*				MODERATE	Ø
SITE 6		2					BED MATERIAL	~
							MATERIAL	RECENT DRIFT
							DEBR	RECEN

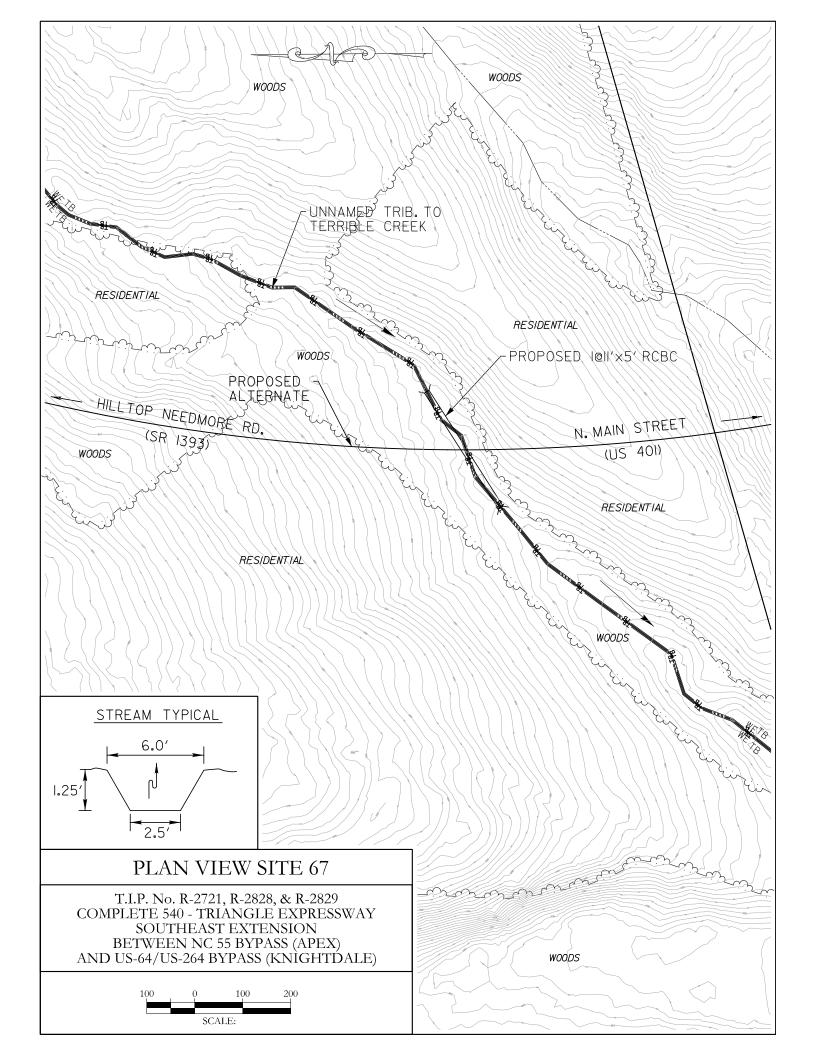


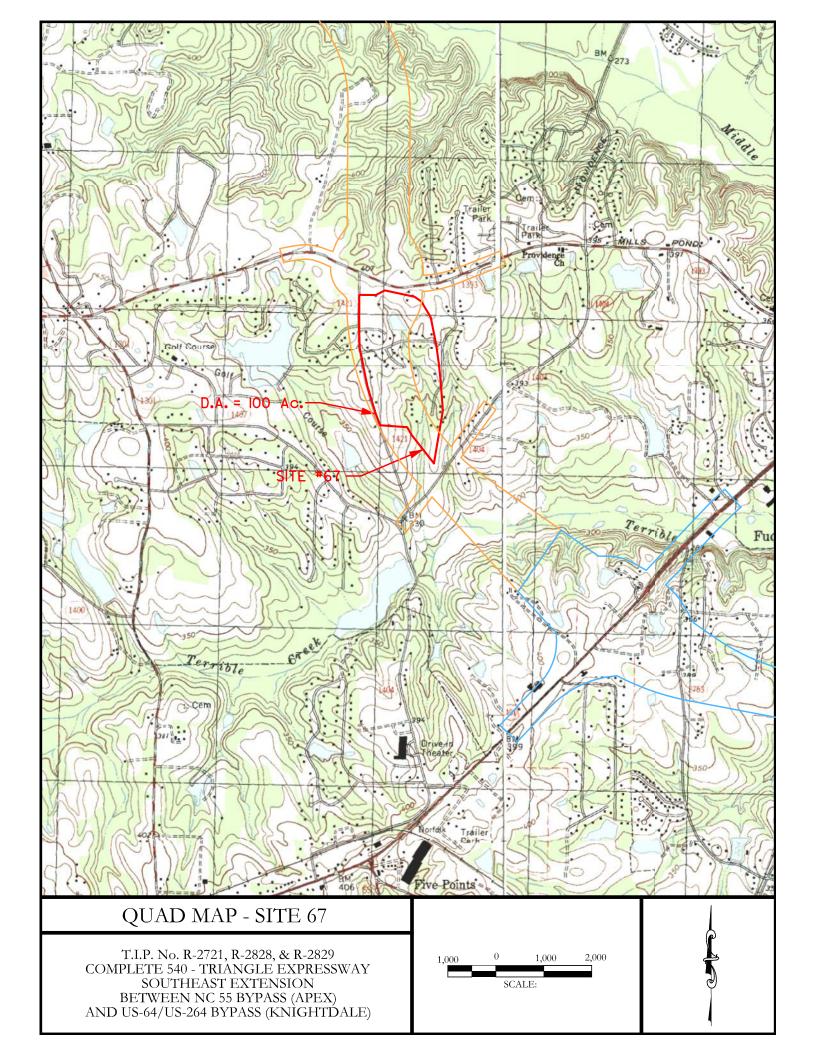
Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

## **Site 67**





## **North Carolina**

4/18/2014

PROJECT NAME: Triangle Expressway SE Ext. STREAM NAME

ENGLISH Drainage Area = 0.16 sq. miles

REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00 STREAM NAME: Unnamed Tributary to Terrible Creek sq. miles 0.16

RURAL EQUATIONS Report 01-4207	ain Sand Hills	(cfs)	60.6	15.36	20.32	27.55	33.82	40.53	48.36	59.96
<b>ATIONS F</b>	Coastal Pl	(cts)	18.85	40.29	60.91	94.79	127.01	165.87	212.31	287.87
SAL EQUI	Blue Ridge	(cts)	37.29	69.98	99.28	145.97	188.02	236.99	293.65	382.78
RUI	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR
ATIONS (OLD)	Ш		40.59	72.65	98.74	140.61	176.54	221.30	269.74	360.78
<b>JSGS RURAL REGRESSION EQUA</b>	Coastal Plain	(cts)	21.80	51.28	80.78	136.55	191.04	262.64	352.82	508.46
<b>SAL REGRE</b>	Sand Hills	(cts)	7.75	12.62	16.59	21.77	26.22	31.13	38.22	43.98
<b>USGS RUF</b>	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR

# **USGS URBAN REGRESSION EQUATIONS**

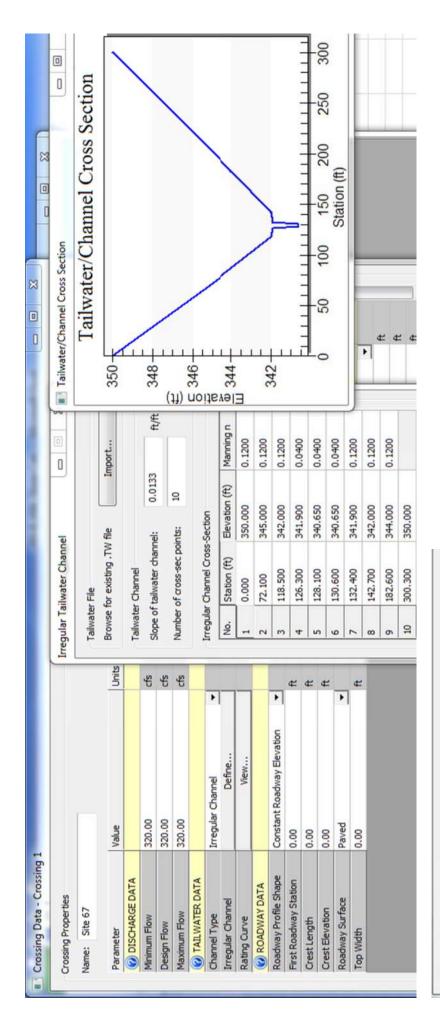
BDF= 11

(These Equations are used only for comparison)

							(Based on 2.80xQ10)	
ш						392.34	582.47	565.73
Coastal Plain	(cfs)	127.76	177.51	266.09	344.55	451.50	497.03	749.55
Sand Hills	(cfs)	42.80	50.84	61.24	86.89	78.55	142.36	100.73
FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR
	ш	ш	ш	ш	ш	FREQUENCY         Sand Hills         Coastal Plain         Blue Ridge           (cfs)         (cfs)         (cfs)         (cfs)           5YR         42.80         127.76         167.63           10YR         50.84         177.51         208.02           25YR         61.24         266.09         272.40           50YR         68.98         344.55         323.22	ш	lain Blue Ridge (cfs) (cfs) 167.63 208.02 272.40 323.22 392.34 582.47 (

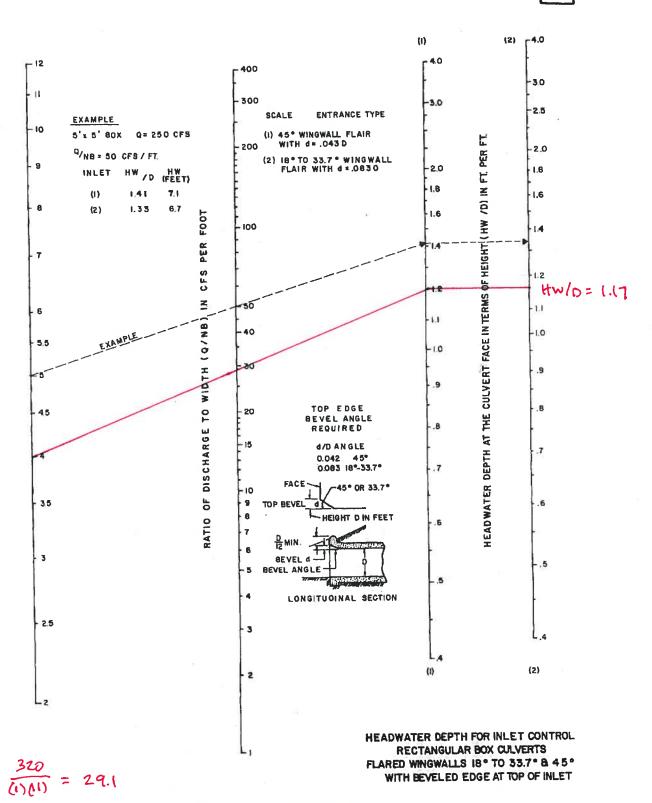
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<b>IC REGRESSION EQUATIONS (% Im</b>

FEMA	FREQUENCY Disharges			10YR	50YR	100YR	500YR		
	Blue Ridge Discharge Used					320		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	Blue Ridge	(cts)	125.68	171.83	274.73	321.65	368.71	481.11	628.88
	Coastal Plain	(cts)	113.94	162.19	271.48	329.81	389.34	454.14	593.63
20	Sand Hills	(cts)	76.31	102.27	145.18	173.25	199.91	286.35	374.30
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

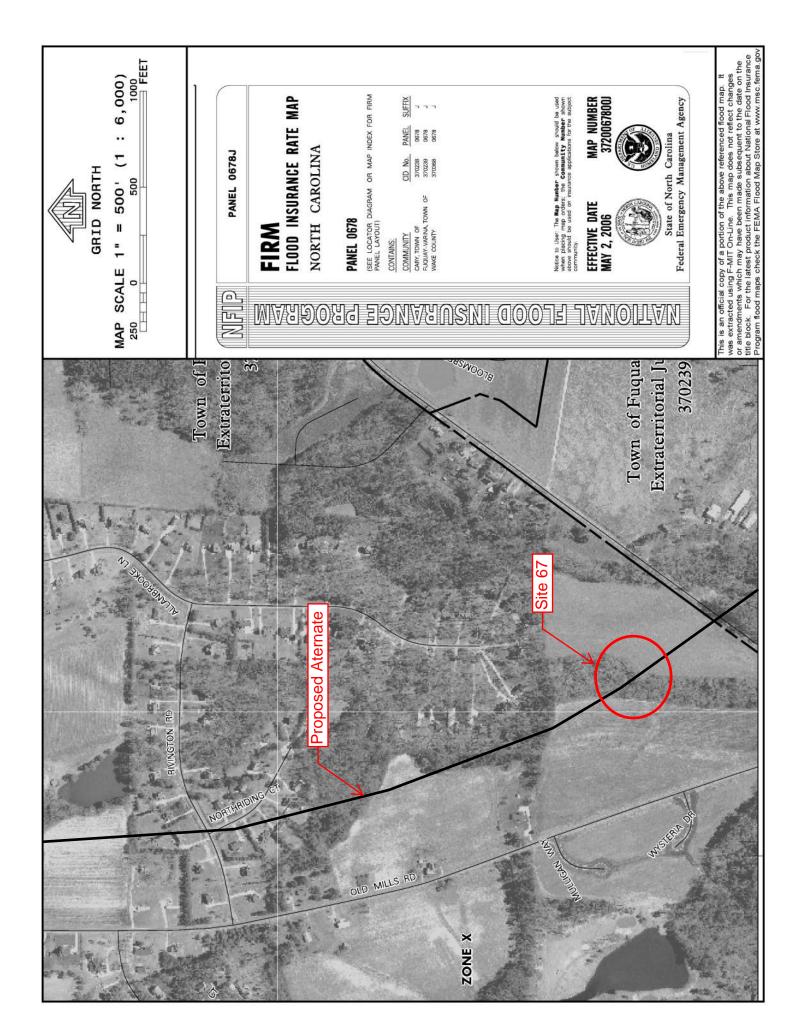


Flow (cfs)	Elevation (ft) Depth (ft)	Depth (ft)	Velocity (ft/s) Shear (psf)	Shear (psf)
320.000	343,985	3.335	2.566	2.768
320.000	343.985	3.335	2.566	2.768
320.000	343.985	3.335	2.566	2.768
320.000	343,985	3.335	2.566	2.768
320.000	343.985	3.335	2.566	2.768
320.000	343.985	3.335	2.566	2.768
320.000	343,985	3.335	2.566	2.768
320.000	343.985	3.335	2.566	2.768
320.000	343.985	3.335	2.566	2.768
320.000	343.985	3.335	2.566	2.768
320.000	343.985	3.335	2.566	2.768

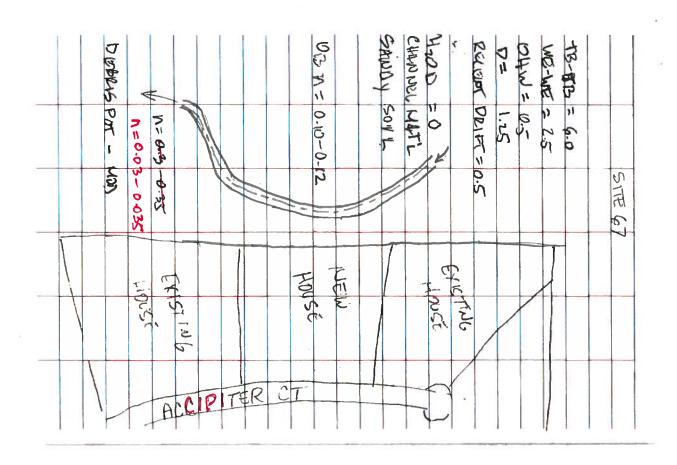
## **CHART 9B**



PROPOSED STRUCTURE:



Name	Index Number	Ne Classification	euse River Basin Class Date
Description		Specia	l Designation
Tarkiln Creek	27-125-7	SC;NSW	05/01/88
From source to Dawson Creek			
Taylor Creek	27-92	C;Sw,NSW	05/01/88
From source to Neuse River			
Taylors Branch	27-81-1-1	C;Sw,NSW	05/01/88
From source to Briery Run			
Tempe Gut	27-150-11	SA;HQW,NSW	07/01/91
From source to Bay River			
Terrible Creek	27-43-15-8-(2)	C;NSW	05/01/88
From dam at Johnsons Pond to Middle Creek			
Terrible Creek (Johnsons Pond)	27-43-15-8-(1)	B;NSW	05/01/88
From source to dam at Johnsons Pond			
The Canal	27-57-21.3	C;NSW	08/03/92
From source to Little River			
The Gut	27-98-3	C;Sw,NSW	05/01/88
From source to Bachelor (Batchelder) Creek			
The Passage	27-149-4-2-6	SA;ORW,NSW	01/01/90
From Pamlico Sound to Back Bay			
The Slough	27-86-14-1	C;Sw,NSW	05/01/88
From source to Nahunta Swamp			
Thomas Creek	27-150-6-3	SC;Sw,NSW	05/01/88
From source to Trent Creek			
Thompson Swamp	27-86-26-1.5	C;Sw,NSW	05/01/88
From source to Little Contentnea Creek			
Thorofare	27-149-1-1	SA;HQW,NSW	05/01/88
From West Thorofare Bay to Thorofare Bay			
Thorofare Bay	27-149-1	SA;ORW,NSW	01/01/90
From source to Core Sound			
Thorofare Swamp	27-97-5-1	C;Sw,NSW	05/01/88
From souce to Clayroot Swamp			
Thoroughfare Swamp	27-54-5-(1.5)	WS-IV;NSW	08/03/92
From a point 0.5 mile upstream of Wayne County SR 1	120 to Falling Creek		





Looking Upstream from Proposed Crossing.

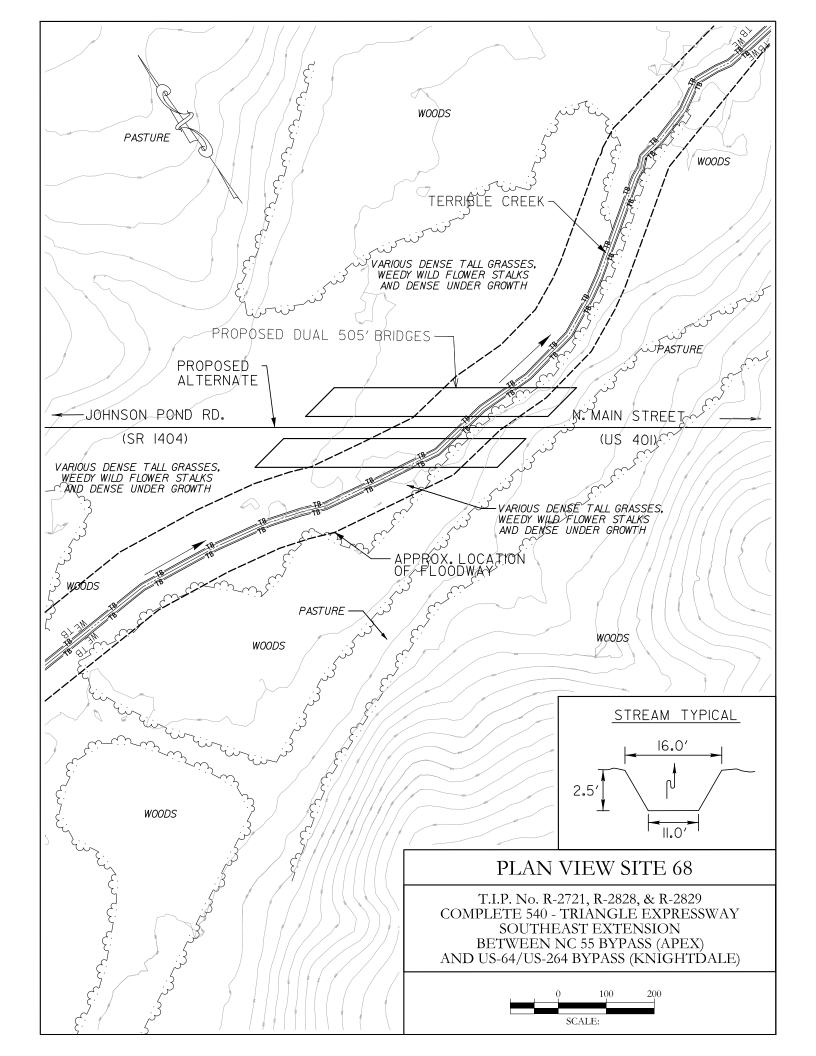


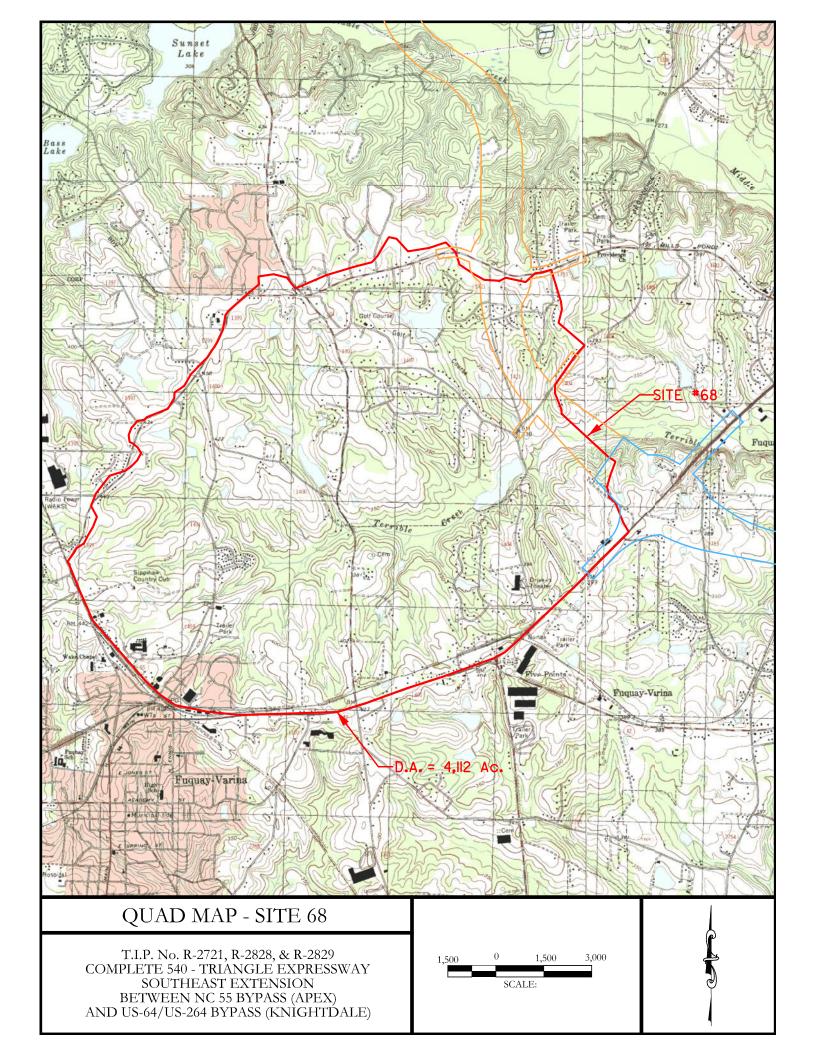
Looking Downstream from Proposed Crossing.



Shot of Top of Bank measurement.

## Site 68





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REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00 STREAM NAME: Terrible Creek sq. miles 6.43 PROJECT NAME: Triangle Expressway SE Ext. ENGLISH Drainage Area = 6.43 Drainage Area =

<b>USGS RUR</b>	AL REGRE	<b>USGS RURAL REGRESSION EQUA</b>	F	RUF	RAL EQUA	TIONS Rep	RURAL EQUATIONS Report 01-4207
FREQUENCY	Sand Hills	Coastal Plain	m	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cfs)	(cfs)			(cts)	(cfs)	(cts)
2YR	116.19	224.98		2YR	498.54	226.38	126.03
5YR	192.70	440.11		5YR	853.05	420.54	204.57
10YR	255.25	636.76		10YR	1144.94	590.48	266.72
25YR	348.72	974.26		25YR	1580.90	847.18	356.25
50YR	429.54	1275.31		50YR	1962.50	1078.00	434.17
100YR	521.24	1646.62		100YR	2383.90	1341.82	514.50
200YR	642.40	2100.55		200YR	2857.22	1643.03	22.609
500YR	778.47	2822.00		500YR	3576.23	2107.68	749.96

# **USGS URBAN REGRESSION EQUATIONS**

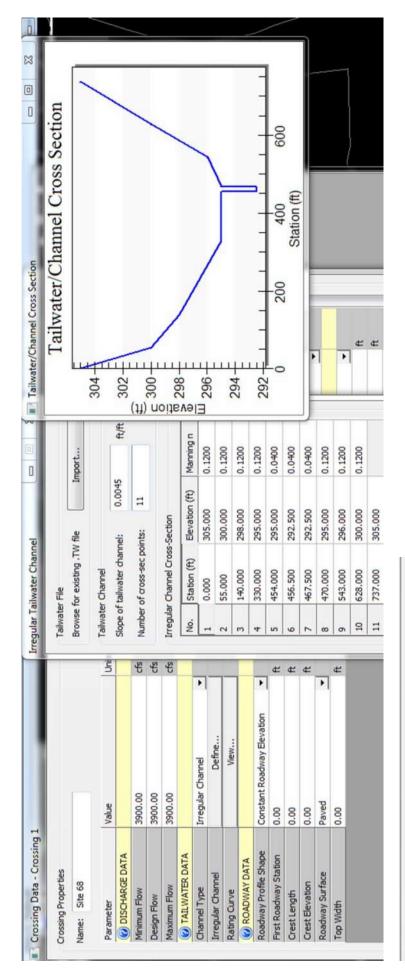
**BDF**= 11

(These Equations are used only for comparison)

								(Based on 2.80xQ10)		
	Blue Ridge	(cfs)	2164.43	2615.03	3283.65	3932.46	4786.83	7322.09	6741.12	
or companison)	Coastal Plain	(cfs)	1280.21	1637.80	2230.19	2790.66	3539.97	4585.85	5518.00	
s are ased or y	Sand Hills	(cfs)	672.21	795.47	980.35	1155.83	1378.36	2227.31	1919.29	
( These Equations are used only for companison)	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR	

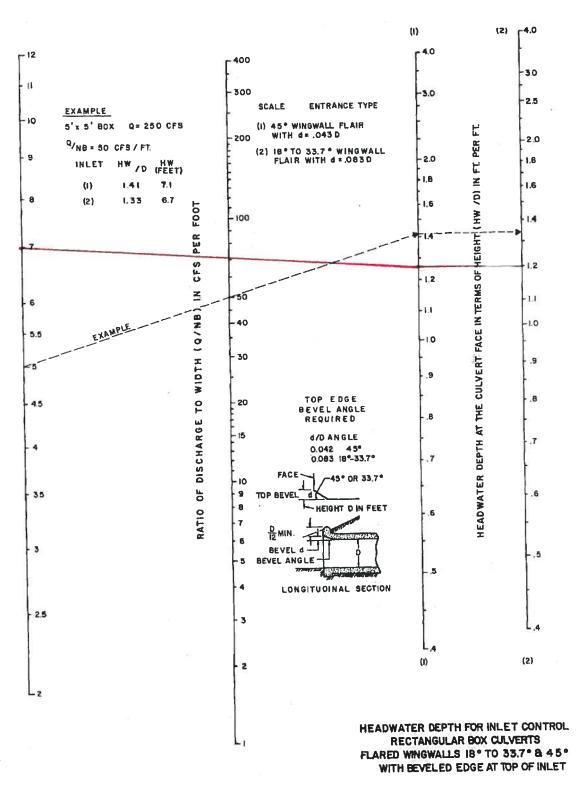
# NC REGRESSION EQUATIONS (% Impervious) USGS Fact Sheet 007-00

% Impervious =	40				FEMA	4
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	lue Ridge Discharge Used	FREQUENCY	Disharges
	(cfs)	(cfs)	(cfs)			
5YR	1505.25	1903.45	2311.25		At Johnson Pond Rd.	Rd.
10YR	1781.32	2331.41	2759.30		10YR	970
25YR	2119.32	3015.26	3550.18		50YR	1,940
50YR	2397.15	3408.44	3910.66	3900	100YR	2,595
100YR	2625.25	3763.01	4223.56		500YR	4,800
200YR	4987.69	6527.96	7726.04	(Based on 2.80xQ10)		
500YR	6519.62	8532.97	10099.04	(Based on 3.66xQ10)		



Flow (cfs)	Elevation (ft) Depth (ft)	Depth (ft)	Velocity (ft/s) Shear (psf)	Shear (psf)
3900.000	299.665	7.165	2.174	2.012
3900.000	299.662	7.165	2.174	2.012
3900.000	299.665	7.165	2.174	2.012
3900.000	299.665	7.165	2.174	2.012
3900.000	299.662	7.165	2.174	2.012
3900.000	299.665	7.165	2.174	2.012
3900.000	299.665	7.165	2.174	2.012
3900.000	299.665	7.165	2.174	2.012
3900.000	299.665	7.165	2.174	2.012
3900.000	299.665	7.165	2.174	2.012
3900.000	299.665	7.165	2.174	2.012

## **CHART 9B**



Q = 70

NB = 3900 = 56.7 : BRIDGE

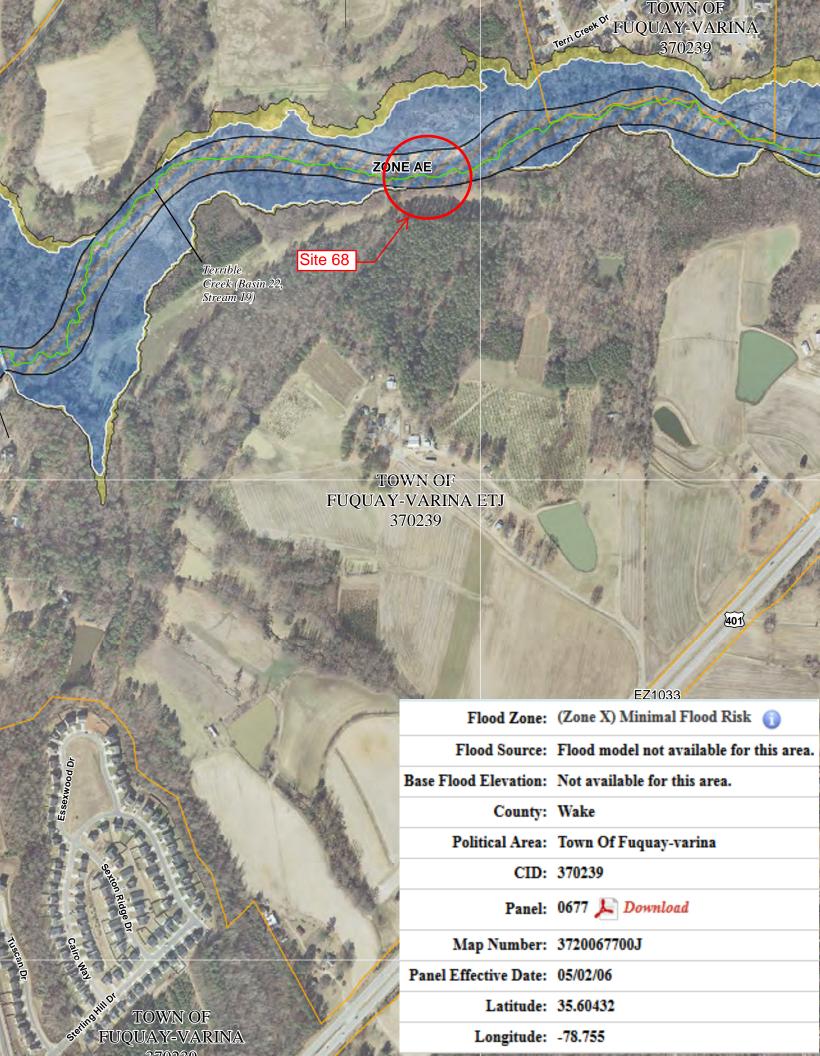
## PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake	PROJECT NUMBER <u>R-2721, R-2828 &amp; R-2829</u>
STREAM Terrible Creek	ROUTE New Location
(Site 68) ASSESSMENT PREPARED	OBY <u>Mulkey, INC.</u> DATE <u>12/27/2013</u> (WBP)
	HYDROLOGIC EVALUATION
NEAREST GAGING STAT	ION ON THIS STREAM (NONE <u>X</u> )
ARE FLOOD STUDIES AV	AILABLE ON THIS STREAM: Yes
FLOOD DATA: Q <sub>10</sub> 2,800 CFS EST. BKV Q <sub>50</sub> 3,900 CFS EST. BKV Q <sub>500</sub> 10,100 CFS EST. BKV	VTR. $\underline{N/A}$ FT. $Q_{25}$ $\underline{3,600}$ CFS EST. BKWTR. $\underline{N/A}$ FT. VTR. $\underline{N/A}$ FT. $Q_{100}$ $\underline{4,200}$ CFS EST. BKWTR. $\underline{N/A}$ FT. VTR. $\underline{N/A}$ FT.
DRAINAGE AREA <u>6.43 Sq</u>	. Mi. METHOD USED TO COMPUTE Q: USGS Urban Regression
<u>P</u>	ROPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: LO	OW MODERATE X HIGH
COULD THIS BE SI	GNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT:	YES NO <u>X</u>
EXPLANTION: A flo	oodway modification may be required at this site.
LIST BUILDINGS II	N FLOOD PLAIN: None LOCATION:
UPSTREAM LAND ANTICIPATE ANY	
ANY FLOOD ZONII	NG? (FIA STUDIES, ETC.) YES X NO
TYPE OF STUDY:	FEMA – Special Flood Hazard Zone AE
REGULATORY FLO	OODWAY WIDTH 662 ft. Section 221 (AS NOTED IN FIS)
COMMENTS:	

## TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 14,200 VPD % TRUCKS 12						
DESIGN YEAR 2035 TRAFFIC COUNT 44,800 VPD % TRUCKS 12						
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE						
DETOUR AVAILABLE? N/A - New Location LENGTH OF DETOUR N/A MILES						
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A - New Location						
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? N/A						
COMMENTS:						
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS						
NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.						
LEVEES AGGRADATION/DEGRADATION RESERVOIRS						
DIVERSIONS DRAINAGE DISTRICT NAVIGATION						
BACKWATER FROM ANOTHER SOURCE						
EXPLANATION:						
ROADWAY OVERFLOW SECTION (NONE <u>X</u> ) LENGTH ELEVATION						
EMBANKMENT: SOIL TYPE Roanoke TYPE SLOPE COVER Vegetation						
COMMENTS: Soil Type from Web Soil Survey website of Wake County, NC.						
ENVIRONMENTAL CONSIDERATIONS						
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN:						
MISCELLANEOUS COMMENTS						
IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED						

ARE BANKS STABLE? <u>Yes</u> PROTECTION NEEDED <u>No</u>						
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No						
COMMENTS:						
<u>ALTERNATIVES</u>						
RECOMMENDED DESIGN 470 ft. bridge						
DETOUR STRUCTURE <u>N/A</u>						
BRIDGE WATERWAY OPENING						
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO <u>X</u> DISCUSSION:						
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:						
(1)NORMAL PROCESS						
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation						
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:						



## **FLOOD INSURANCE STUDY**

## FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	Riverine	Sources	Affected Communties
	From	То	
Southwest Prong Beaverdam Creek (Basin 18, Stream 29)	The confluence with Beaverdam Creek (Basin 18, Stream 28)	Wade Avenue	City Of Raleigh
Spring Branch (Basin 6, Stream 6)	The confluence with Dunn Creek (Basin 6, Stream 5)	Approximately 875 feet upstream of Franklin Street	Town Of Wake Forest
Stirrup Iron Creek	The confluence with Brier Creek (Basin 18, Stream 14)	The Wake/Durham County boundary	Rdu Town Of Cary Town Of Morrisville Wake County
Straight Branch (Basin 20, Stream 23)	The confluence with Lens Branch (Basin 20, Stream 22)	Approximately 1,000 feet upstream of US Route 164	Town Of Cary
Swift Creek	The confluence with the Neuse River	The confluence of Yates Branch (Basin 20, Stream 13)	Rdu Town Of Garner Wake County
Swift Creek Tributary No. 7 (Basin 20, Stream 24)	The confluence with Swift Creek (Basin 20, Stream 1)	Maynard Road	Town Of Cary
Swift Creek Tributary No. 7A (Basin 20, Stream 25)	The confluence with Swift Creek Tributary No. 7 (Basin 20, Stream 24)	Approximately 0.5 mile upstream of confluence with Swift Creek Tributary No. 7 (Basin 20, Stream 24)	Town Of Cary
Sycamore Creek (Basin 18, Stream 6)	Approximately 0.9 mile downstream of Basin 18, Stream 8	Approximately 0.5 mile upstream of A.C.C. Boulevard	City Of Raleigh Rdu Wake County
Terrible Creek (Basin 22, Stream 19)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 1.0 mile upstream of Sunset Lake Road	Rdu Town Of Fuquay-Varina Wake County
Toms (treek (Basin 7, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 0.9 mile upstream of Forestville Road	Rdu Town Of Rolesville Town Of Wake Forest Wake County
Tributary to Big Branch Tributary No. 1 (Basin 30, Stream 8)	The confluence with Big Branch Tributary No. 1 (Basin 30, Stream 6)	Approximately 0.5 mile upstream of confluence with Big Branch Tributary No. 1 (Basin 30, Stream 6)	Town Of Garner
Turkey Creek (Basin 18, Stream 23)	The confluence with Crabtree Creek (Basin 18, Stream 9)	Approximately 1,200 feet upstream of High House Road	Town Of Cary
Turkey Creek (Basin 18, Stream 5)	Approximately 1,160 feet upstream of Sendero Drive	Glenwood Avenue	City Of Raleigh
Unnamed Stream	The confluence with Basin 19, Stream 3	Railroad	Rdu Town Of Garner Wake County
Unnamed Tributary (#1) to Swift Creek	The confluence with Swift Creek	The Johnston/Wake County boundary	Rdu Wake County
Upper Barton Creek (Basin 16, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Victory Church Road	Rdu Wake County
West Fork Mine Creek (Basin 18, Stream 33)	The confluence with Mine Creek (Basin 18, Stream 31)	Approximately 0.4 mile upstream of confluence of Mine Creek (Basin 18, Stream 31)	City Of Raleigh
Wheelers Creek (Basin 10, Stream 25)	The confluence with Little River (Basin 10, Stream 1)	Worth Hinton Road	Town Of Zebulon
White Oak Creek	The confluence with Swift Creek	Approximately 0.4 mile upstream of Pergo Parkway	Rdu Town Of Clayton Town Of Garner Wake County
Wildcat Branch (Basin 30, Stream 4)	The confluence with Walnut Creek (Basin 30, Stream 1)	Approximately 1,000 feet upstream of Rush Street	City Of Raleigh
Yates Branch (Basin 20, Stream 13)	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 3.6 miles upstream of Lake Wheeler Road	City Of Raleigh Rdu Town Of Garner Wake County

Table 10, "Flooding Sources Studied by Detailed Methods: Limited Detailed", lists all flooding sources within the county that were studied by limited detailed methods for either this FIS or previous FISs.

Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed

1 4 5 1 6 1 6 1 6	ourrig Sources Studied	by Detailed Methods. Li	iliteu Detalleu
Source	Riverine	Sources	Affected Communties
	From	То	
Adams Branch (Basin 30, Stream 9)	Corwin Road	Approximately 0.2 mile upstream of Meadowbrook Drive	Town Of Garner
Angier Creek (Basin 24, Stream 4)	Railroad	Approximately 0.7 mile upstream of Old Baron Drive	Town Of Fuquay-Varina
Armory Tributary (Basin 18, Stream 38)	The confluence with Richland Creek (Basin 18, Stream 3)	Approximately 0.5 mile upstream of confluence with Richland Creek (Basin 18, Stream 3)	City Of Raleigh
Bachelor Branch (Basin 28, Stream 6)	The confluence with White Oak Creek	Approximately 530 feet upstream of Highway 55	Rdu Town Of Cary Wake County

Table 21 - Floodway Data

Table 21 - Floodway Data  Floodway Source Floodway Water Surface Elevation											
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase		
Terrible Creel	k (Basin 22, St	ream 19)									
025	2,450	600	2,376	1.9	244.0	*	244.0	245.0	1.0		
100	10,005	240	1,148	4.0	259.4	*	259.4	260.2	0.8		
109	10,945	195	1,141	4.0	265.6	*	265.6	265.9	0.3		
149	14.865	70	621	5.6	281.4	*	281.4	282.0	0.6		
221	22,100	662	8,269	0.3	323.4	*	323.4	324.4	1.0		
243 1	24,260	482	2,379	1.0	323.4	*	323.4	324.4	1.0		
8	24,900	280	933	2.6	324.3	*	324.3	324.9	0.6		
254	25,420	210	705	3.4	327.1	*	327.1	327.3	0.2		
273	27,300	180	789	3.0	335.4	*	335.4	336.4	1.0		
286	28,600	200	975	2.1	342.6	*	342.6	343.1	0.5		
296	29,600	100	429	3.3	344.8	*	344.8	345.7	0.9		
303	30,330	100	374	3.3	348.3	*	348.3	348.9	0.6		
309	30,920	80	306	1.6	350.6	*	350.6	350.9	0.3		
313	31,300	75	150	3.3	351.2	*	351.2	351.7	0.5		
316	31,570	75	175	2.9	354.0	*	354.0	354.0	0.0		
322	32,150	75	112	4.5	360.5	*	360.5	360.6	0.1		
331	33,100	75	184	2.7	372.6	*	372.6	373.1	0.5		
340	34,000	75	121	3.7	383.6	*	383.6	383.8	0.2		
	Basin 7, Strea		121	J 3.1	303.0		303.0	303.0	0.2		
012	1,170	165	451	5.5	198.9 <sup>1</sup>	*	186.6	187.6	1.0		
039	3,880	105	657	3.8	202.5	*	202.5	203.3	0.8		
070	7,000	90	420	6.0	216.1	*	216.1	216.1	0.0		
090	9,025	410	3,688	0.4	234.6	*	234.6	235.6	1.0		
118	11,800	255	1,337	1.0	249.4	*	249.4	249.6	0.2		
149	14,930	165	339	4.1	260.5	*	260.5	260.5	0.0		
164	16,350	50	110	8.6	275.5	*	275.5	275.5	0.0		
	ig Branch Trib	•		•	215.5		275.5	275.5	[0.0		
003	280	70	214	4.2	229.9	*	229.9	230.6	0.7		
029	2,880	100	160	5.5	259.1	*	259.1	259.1	0.0		
	(Basin 18, Str	•	11.55	1.5.5	1			1	1.5.5		
025	2,520	130	455	2.3	310.1	*	310.1	311.1	1.0		
041	4,125	90	327	5.9	317.6	*	317.6	318.2	0.6		
Turkey Creek	(Basin 18, Str	eam 5)	1	1	1	1		1			
083	8,270	185	1,118	1.3	280.4	*	280.4	281.4	1.0		
096	9,630	190	374	3.8	282.4	*	282.4	282.4	0.0		
126	12,570	740	14,859	0.1	338.5	*	338.5	338.5	0.0		
144	14,440	60	653	2.2	338.5	*	338.5	338.6	0.1		
158	15,780	40 10	275	5.1	340.2	*	340.2	340.2	0.0		
Unnamed Trib	outary (#1) to S	Swift Creek	1			1		1			
112	11,235	400	958	3.6	216.6	*	216.6	217.6	1.0		
Upper Barton	Creek (Basin	16, Stream 1)	1	I	1	I		1	I		
196	19,620	280	1,382	2.4	264.4	*	264.4	265.4	1.0		
230	23,020	255	446	6.6	272.3	*	272.3	272.3	0.0		
250	25,020	125	992	3.0	286.8	*	286.8	287.5	0.7		

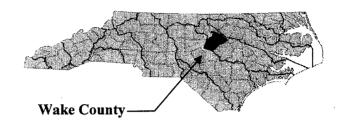
**Table 13 - Summary of Discharges** 

Table 13 - Summ					
Flooding Source Location	Drainage Area	10% Annual	Discharges (cfs)  10% Annual 2% Annual 1% Annual 0.2		
	(square miles)	Chance	Chance	Chance	Chance
Just downstream of MacGregor Downs Lake 15	4.30	*	*	2,100	*
Just upstream of MacGregor Downs Lake	4.30	*	*	2,400	*
At Queensferry Road	2.60	*	*	1,900	*
Swift Creek Tributary No. 7A (Basin 20, Stream 25)		T	1		
At Queensferry Road	0.80	*	*	920	*
Sycamore Creek (Basin 18, Stream 6)					
At confluence with Crabtree Creek (Basin 18, Stream 9)	15.95	*	*	4,210	*
At confluence of Turkey Creek (Basin 18, Stream 5)	11.33	*	*	3,400	*
Approximately 1.5 miles upstream of confluence of Turkey Creek (Basin 18, Stream 5)	10.74	*	*	3,290	*
Approximately 1.6 miles downstream of confluence of Basin 18, Stream 7	9.74	*	*	3,090	*
At confluence of Basin 18, Stream 7	7.22	*	*	2,940	*
Approximately 1,580 feet upstream of confluence from Basin 18, Stream 7	6.82	*	*	2,840	*
Approximately 1.1 miles upstream of confluence of Basin 18, Stream 7	5.83	*	*	2,730	*
Just downstream of Basin 18, Stream 8	5.00	*	*	2,600	*
Just upstream of Basin 18, Stream 8	2.70	*	*	1,900	*
Approximately 0.4 mile downstream of Leesville Road	1.66	*	*	1,300	*
Approximately 1,060 feet upstream of Leesville Road	1.00	*	*	1,070	*
Terrible Creek (Basin 22, Stream 19)					
At mouth	12.30	*	*	4,600	*
Just upstream of Basin 22, Stream 20	8.30	*	*	3,500	*
At Johnson Pond Road	4.90	*	*	2,595	*
At Sunset Lake Road	3.20	*	*	2,040	*
At Sunset Vake Road	2.30	*	*	1,675	*
hyimetaly 0.6 mile downstroom of Stowart Bood	1.20	*	*	1,190	*
A Dainjately 0.6 mile downstream of Stewart Road	0.20	*	*	450	*
Thomas Creek		ı	I		
Approximately 1.0 mile downstream of Highway 1	1.60	*	*	992	*
Approximately 0.7 mile downstream of Highway 1	0.80	*	*	649	*
Approximately 0.4 mile downstream of Highway 1	0.70	*	*	606	*
Toms Creek (Basin 7, Stream 1)					
At mouth	4.70	*	*	2,500	*
Approximately 0.4 mile upstream of mouth	3.30	*	*	2,080	*
Approximately 0.6 mile downstream of Forestville Road	2.50	*	*	1,770	*
Approximately 0.8 mile upstream of Forestville Road	0.80	*	*	950	*
Tributary to Big Branch Tributary No. 1 (Basin 30, Stream 8)					
At mouth	0.70	*	*	900	*
Just downstream of fork	0.50	*	*	875	*
Turkey Creek (Basin 18, Stream 23)	•		•	•	•
At mouth	1.70	*	*	1,450	*
Approximately 1,000 feet downstream of High House Road	0.40	*	*	700	*
Turkey Creek (Basin 18, Stream 5)	13	l 	1	1.00	
	4.60	*		1.020	*
At confluence with Sycamore Creek (Basin 18, Stream 6)	4.60			1,930	
Approximately 0.7 mile downstream of confluence of Basin 18, Stream 8	4.36	*	*	1,870	*

A Report of Flood Hazards in

## WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 1 OF 7**

Community Name	<b>Community Number</b>	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV001A





### **Section 5.0 - Engineering Methods**

**Table 10-Roughness Coefficients** 

Stream	Channel "n"	Overbank "n"
Rocky Branch (Basin 22, Stream 8)	0.030 - 0.070	0.070 - 0.110
Rocky Branch (Basin 30, Stream 5) (upstream)	0.030 - 0.070	0.070 - 0.110
Rocky Ford Branch (Basin 24, Stream 5)	0.030 - 0.070	0.070 - 0.110
Sanford Creek (Basin 6, Stream 7)	0.030 - 0.070	0.070 - 0.110
Smith Creek (Basin 6, Stream 1)	0.030 - 0.070	0.070 - 0.110
Snipes Creek	0.042 - 0.045	0.120 - 0.130
Southeast Prong Beaverdam Creek (Basin 18, Stream 30)	0.030 - 0.070	0.070 - 0.110
Southwest Prong Beaverdam Creek (Basin 18, Stream 29)	0.030 - 0.060	0.050 - 0.090
Spring Branch (Basin 6, Stream 6)	0.030 - 0.070	0.070 - 0.110
Stirrup Iron Creek (Basin 18, Stream 12)	0.030 - 0.070	0.070 - 0.110
Straight Branch (Basin 20, Stream 23)	0.030 - 0.070	0.070 - 0.110
Swift Creek (Basin 20, Stream 1)	0.040 - 0.072	0.070 - 0.240
Swift Creek Tributary No. 7 (Basin 20, Stream 24)	0.030 - 0.070	0.070 - 0.110
Swift Creek Tributary No. 7A (Basin 20, Stream 25)	0.030 - 0.070	0.070 - 0.110
Sycamore Creek (Basin 18, Stream 6)	0.030 - 0.070	0.070 - 0.130
Terrible Creek (Basin 22, Stream 19)	0.030 - 0.070	0.070 - 0.110
Thomas Creek	0.050	0.145
Toms Creek (Basin 7, Stream 1)	0.030 - 0.070	0.070 - 0.110
Tributary to Big Branch Tributary No. 1 (Basin 30,	0.030 - 0.070	0.070 - 0.110
Stream 8)	0.030 - 0.070	0.070 - 0.110
Turkey Creek (Basin 18, Stream 5)	0.030 - 0.070	0.070 - 0.150
Turkey Creek (Basin 18, Stream 23)	0.030 - 0.070	0.070 - 0.110
Turkey Creek Tributary	0.046	0.100-0.150
Upper Barton Creek (Basin 16, Stream 1)	0.030 - 0.070	0.070 - 0.110
Unnamed Tributary to Swift Creek	0.040 - 0.043	0.105 - 0.133
Utley Creek	0.050	0.147
Walnut Creek (Basin 30, Stream 1)	0.038 - 0.050	0.100 - 0.200
West Fork Mine Creek (Basin 18, Stream 33)	0.030 - 0.070	0.070 - 0.110
Wheelers Creek (Basin 10, Stream 25)	0.030 - 0.070	0.070 - 0.110
White Oak Creek (Basin 19, Stream 1)	0.030 - 0.070	0.070 - 0.110
White Oak Creek (Basin 26, Stream 1)	0.050	0.150
White Oak Creek (Basin 28, Stream 1)	0.045 - 0.050	0.100 - 0.150
Wildcat Branch (Basin 30, Stream 4)	0.030 - 0.070	0.070 - 0.110
Yates Branch (Basin 20, Stream 13)	0.030 - 0.070	0.070 - 0.110

Does not include ineffective flow areas where n = 1.0 or 10.0

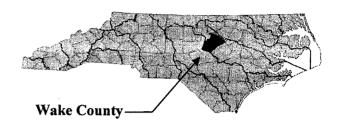
For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained

Site 68

A Report of Flood Hazards in

## WAKE COUNTY, NORTH CAROLINA

**AND INCORPORATED AREAS** 



### **VOLUME 7 OF 7**

Community Name	<b>Community Number</b>	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse



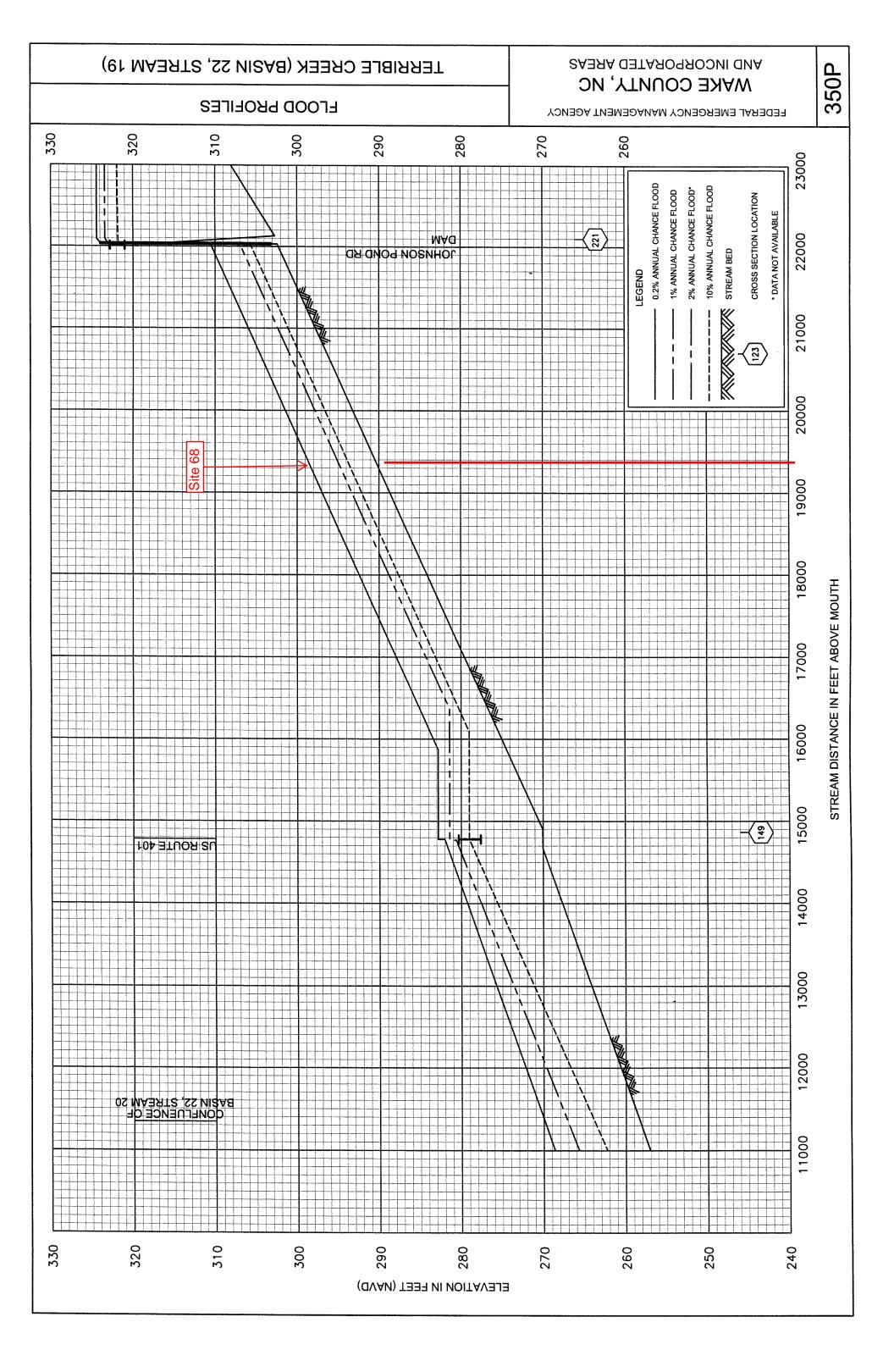


May 2, 2006

Federal Emergency Management Agency State of North Carolina

> Flood Insurance Study Number 37183CV007A





Name	Index Number	Classification	leuse River Bas Class Date
Description		Spe	cial Designation
Tarkiln Creek	27-125-7	SC;NSW	05/01/88
From source to Dawson Creek			
Taylor Creek	27-92	C;Sw,NSW	05/01/88
From source to Neuse River			
Taylors Branch	27-81-1-1	C;Sw,NSW	05/01/88
From source to Briery Run			
Tempe Gut	27-150-11	SA;HQW,NSW	07/01/91
From source to Bay River			
Terrible Creek	27-43-15-8-(2)	C;NSW	05/01/88
From dam at Johnsons Pond to Middle Creek			03, 02, 03
Terrible Creek (Johnsons Pond)	27-43-15-8-(1)	B;NSW	05/01/88
From source to dam at Johnsons Pond			
The Canal	27-57-21.3	C;NSW	08/03/92
From source to Little River			
The Gut	27-98-3	C;Sw,NSW	05/01/88
From source to Bachelor (Batchelder) Creek			
The Passage	27-149-4-2-6	SA;ORW,NSW	01/01/90
From Pamlico Sound to Back Bay			
The Slough	27-86-14-1	C;Sw,NSW	05/01/88
From source to Nahunta Swamp			
Thomas Creek	27-150-6-3	SC;Sw,NSW	05/01/88
From source to Trent Creek			
Thompson Swamp	27-86-26-1.5	C;Sw,NSW	05/01/88
From source to Little Contentnea Creek		. ,	· ·
Thorofare	27-149-1-1	SA;HQW,NSW	05/01/88
From West Thorofare Bay to Thorofare Bay			
Thorofare Bay	27-149-1	SA;ORW,NSW	01/01/90
From source to Core Sound			
Thorofare Swamp	27-97-5-1	C;Sw,NSW	05/01/88
From souce to Clayroot Swamp			
Thoroughfare Swamp	27-54-5-(1.5)	WS-IV;NSW	08/03/92

	Spoom				15 = 16"	WE - 11	0 = 2.5	Di JILON	- MHO	( HAD D = 0.5	SAND	CH. HAT'L = CLAVEL	Der Tre Die Bald	3.3	activity and the second		
SITE 68	'	OKASS,	WILLD PLINNIES	S HRUSBERDY							10.0. VX	1	\(\frac{\text{\rm }}{\text{\rm }} \\ \frac{\text{\rm }}{\text{\rm }} \\ \text{\r		J		
7				W0005	Anny frewse	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	(TAW 6008 111	WILD FLOURSING W	21/542	0.12							

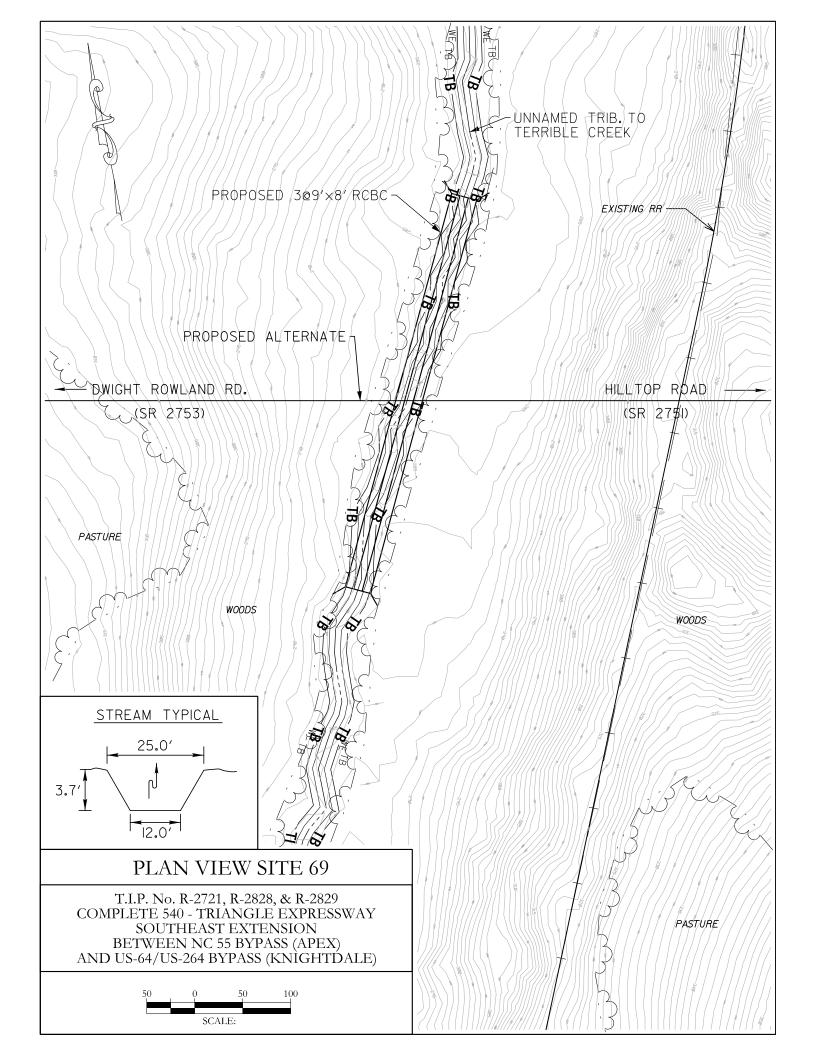


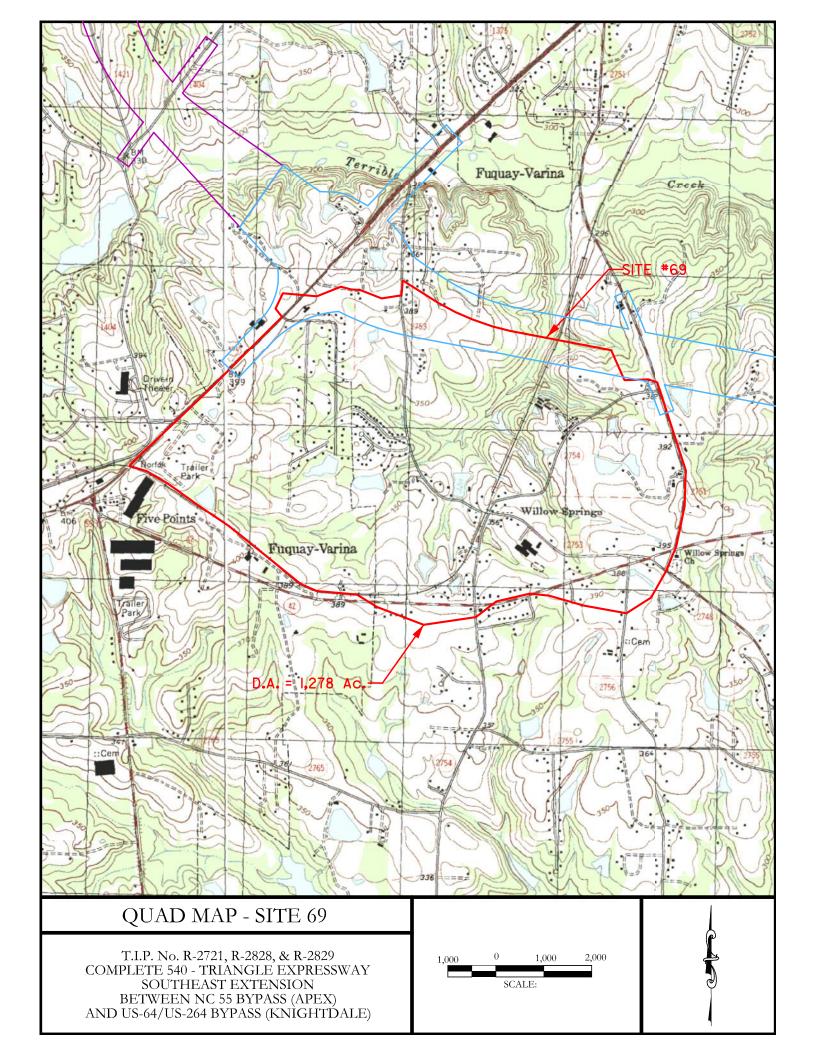
Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

# Site 69





# **North Carolina**

REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00 STREAM NAME: Unnamed Trib to Terrible Creek sq. miles METH PROJECT NAME: Triangle Expressway SE Ext. Drainage Area =

4/18/2014

ENGLISH

Site #69

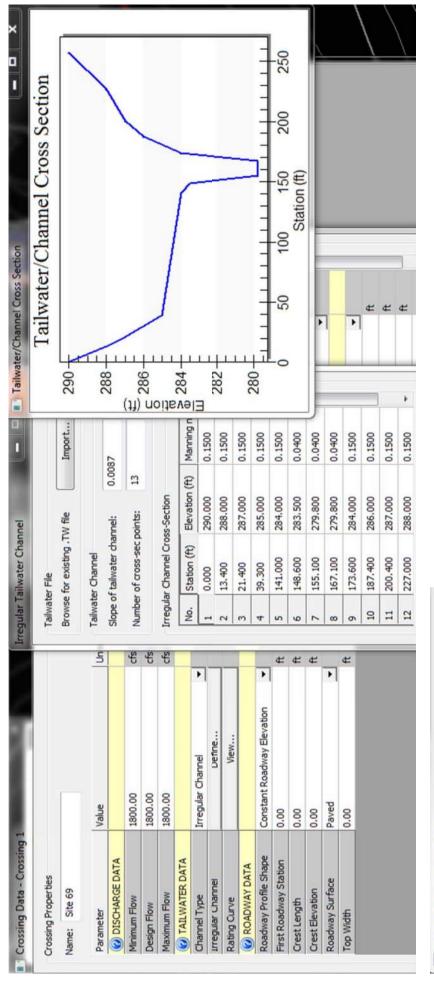
-4207	Hills	<b>(3</b>	88	72	18	59	73	38	50	38
ort 01	Sand	(cfs	54.8	90.3	118.	158.	193.	230.	273.	337.
<b>ATIONS Report 01-4207</b>	Coastal Plain	(cfs)	103.16	200.33	287.93	423.85	548.23	692.83	860.34	1123.14
<b>RURAL EQUAT</b>	Blue Ridge	(cts)	219.61	386.91	528.48	744.34	934.87	1148.95	1391.62	1764.34
RUE	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR
ATIONS (OLD)	Blue Ridge	(cts)	232.47	394.59	529.58	735.35	911.69	1122.77	1354.81	1740.28
<b>USGS RURAL REGRESSION EQUA</b>	Coastal Plain	(cts)	107.55	223.04	331.48	523.43	699.72	921.56	1194.99	1641.44
AL REGRE	Sand Hills	(cts)	49.36	81.39	107.56	145.07	177.45	213.82	263.22	313.80
<b>USGS RUR</b>	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR

# **USGS URBAN REGRESSION EQUATIONS**

BDF=	11			
( These Equation	These Equations are used only for comparison)	for comparison)		
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	
	(cts)	(cfs)	(cfs)	
5YR	281.40	617.76	963.98	
10YR	333.41	811.22	1174.57	
25YR	407.93	1138.70	1494.57	
50YR	474.05	1440.36	1784.66	
100YR	557.14	1845.98	2170.47	
200YR	933.54	2271.41	3288.81	(Bas
500YR	755.84	2935.36	3079.53	

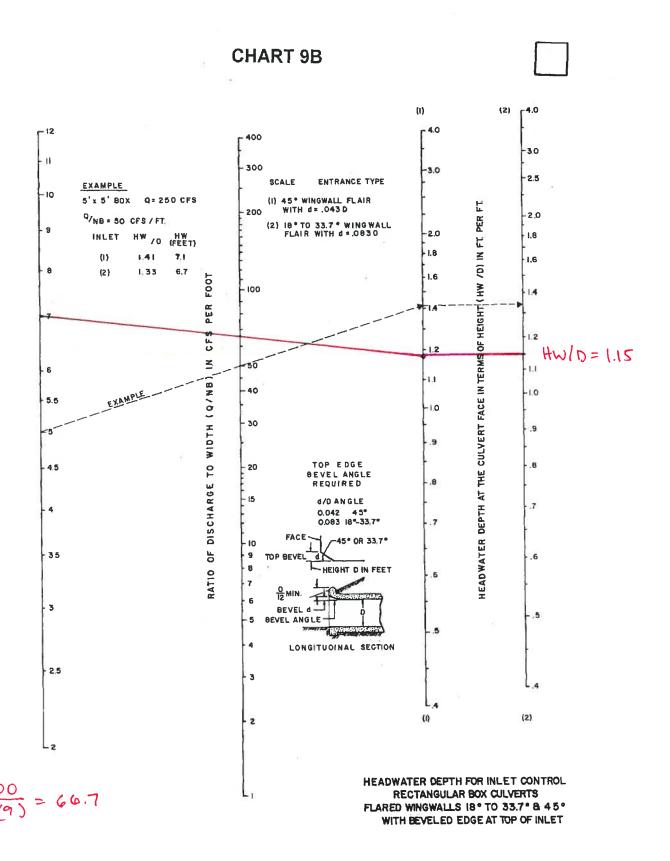
(Based on 2.80xQ10)

MC REGRESSION EQUATIONS (%)           % Impervious = REQUENCY         35         Coastal Plain           FREQUENCY         Sand Hills         Coastal Plain           (cfs)         (cfs)         (cfs)           5YR         615.76         820.67           10YR         754.25         1048.98           25YR         942.51         1462.00           50YR         1199.18         1893.85	35 Sand Hills (cfs) (cfs) 615.76 754.25 942.51 1080.58		Blue Ridge (cfs) 966.69 1198.75 1640.88 1836.38	Impervious   USGS Fact Sheet 007-00	FREQUENCY 10YR 50YR 100YR	FEMA  CY Disharges  600  1,200  1,650  R 1,650
	111.89	2937.13	3356.51	(Based on 2.80xQ10)	500YR	3,200
500YR 27	760.55	3839.25	4387.43	(Based on 3.66xQ10)		



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1800.000 1800.000 1800.000	Elevation (ft) 286.456 286.456 286.456 286.456	6.656 6.656 6.656 6.656 6.656	velocity (ft/s) 4.602 4.602 4.602 4.602	Shear (psf) 3.613 3.613 3.613 3.613
1800.000	286.456	959.9	4.602	
1800.000	286.456	959.9	4.602	3.613
1800.000	286.456	959.9	4.602	3.613
1800.000	286.456	959.9	4.602	3.613
1800.000	286.456	959.9	4.602	3.613
1800.000	286.456	959.9	4.602	3.613
1800.000	286.456	6.656	4.602	3.613



PROPOSED STEUCTURE:

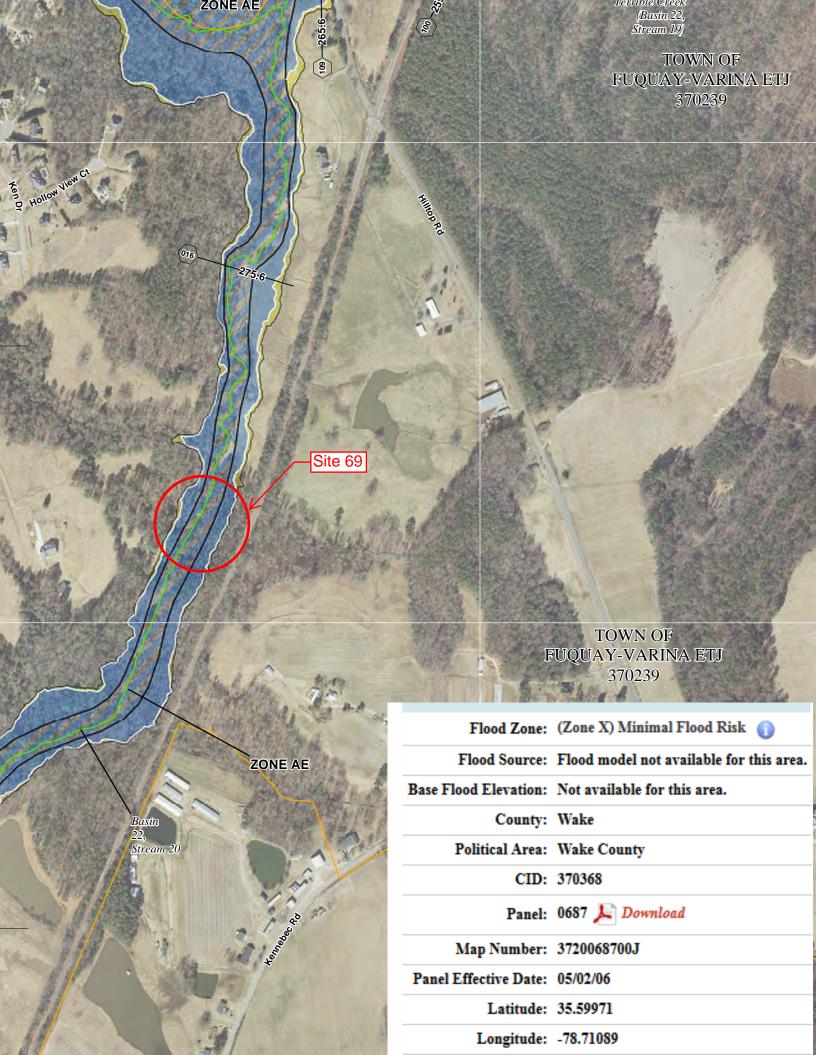
# PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake F	PROJECT NUMBER <u>R-2721, R-2828 &amp; R-2829</u>
STREAM <u>Terrible Creek</u> F (Site 69)	
ASSESSMENT PREPARED E	BY <u>Mulkey, INC.</u> DATE <u>12/27/2013</u> (WBP)
	HYDROLOGIC EVALUATION
NEAREST GAGING STATIO	ON ON THIS STREAM (NONE <u>X</u> )
ARE FLOOD STUDIES AVA	ILABLE ON THIS STREAM: Yes
FLOOD DATA: Q <sub>10</sub> 1,200 CFS EST. BKWT Q <sub>50</sub> 1,800 CFS EST. BKWT Q <sub>500</sub> 4,400 CFS EST. BKWT	FR. $N/A$ FT. $Q_{25}$ 1,600CFS EST. BKWTR. $N/A$ FT. FR. $N/A$ FT. $Q_{100}$ 2,000 CFS EST. BKWTR. $N/A$ FT. FR. $N/A$ FT.
DRAINAGE AREA <u>2.0 Sq.Mi</u>	. METHOD USED TO COMPUTE Q: USGS Urban Regression
PRO	OPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: LOV	W MODERATE X HIGH
COULD THIS BE SIG	NIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: Y	YES NO <u>X</u>
EXPLANTION: A floo	dway modification may be required at this site.
LIST BUILDINGS IN	FLOOD PLAIN: None LOCATION:
UPSTREAM LAND U ANTICIPATE ANY CI	SE <u>Under Planning Jurisdiction and Residential</u> HANGE? <u>No</u>
ANY FLOOD ZONING	G? (FIA STUDIES, ETC.) YES X NO
TYPE OF STUDY: FE	EMA – Special Flood Hazard Zone AE
REGULATORY FLOC	DDWAY WIDTH 150 ft. Section 016 (AS NOTED IN FIS)
COMMENTS:	

### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 14,200 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 44,800 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? N/A
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS
NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE <u>X</u> ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE Wehadkee TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from Web Soil Survey website of Wake County, NC.
ENVIRONMENTAL CONSIDERATIONS
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: Buried culverts 1 foot to allow for fish passage.
MISCELLANEOUS COMMENTS
IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED

ARE BANKS STABLE? <u>Yes</u> PROTECTION NEEDED <u>No</u>
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
<u>ALTERNATIVES</u>
RECOMMENDED DESIGN 3@9'x8' RCBC
DETOUR STRUCTURE <u>N/A</u>
BRIDGE WATERWAY OPENING 189 sq. ft.
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO <u>X</u> DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:



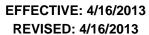
### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

**State of North Carolina** 

Flood Insurance Study Number

37183CV000





Table 9, "Flooding Sources Studied by Detailed Methods: Redelineated", lists all flooding sources that were studied by detailed methods for the prestatewide FIS and redelineated for previous FISs. These flooding sources were not part of this revision and their effective analyses remain valid.

Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	Riverine	Sources	Affected Communities
Course	From	То	7 incoled Communics
Adams Branch (Basin 30, Stream 9)	The confluence with Big Branch Tributary No. 1 (Basin 30, Stream 6)	Corwin Road	Town Of Garner
Angier Creek (Basin 24, Stream 4)	The confluence with Kenneth Creek (Basin 24, Stream 2)	Railroad	Town Of Fuquay-Varina
Armory Tributary (Basin 18, Stream 38)	The confluence with Richland Creek (Basin 18, Stream 3)	Approximately 0.5 mile upstream of confluence with Richland Creek (Basin 18, Stream 3)	City Of Raleigh
Austin Creek (Basin 6, Stream 10)	The confluence with Smith Creek (Basin 6, Stream 1)	Approximately 350 feet upstream of Averette Road	Rdu Town Of Wake Forest Wake County
Bagwell Branch (Basin 20, Stream 10)	The confluence with Swift Creek (Basin 20, Stream 1)	NC Route 50	Town Of Garner
Basal Creek (Basin 22, Stream 16)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.8 mile upstream of State Road 55	Rdu Town Of Fuquay-Varina Town Of Holly Springs Wake County
Basin 10, Stream 10	The confluence with Little River (Basin 10, Stream 1)	Highway 96/Zebulon Road	Rdu Wake County
Basin 10, Stream 2	The confluence with Little River (Basin 10, Stream 1)	Approximately 0.9 mile upstream of confluence with Little River (Basin 10, Stream 1)	Rdu Wake County
Basin 10, Stream 3	The confluence with Little River (Basin 10, Stream 1)	Moss Road	Rdu Wake County
Basin 10, Stream 5	The confluence with Little River (Basin 10, Stream 1)	Lizard Lick Rd	Rdu Wake County
Basin 10, Stream 6	The confluence with Little River (Basin 10, Stream 1)	Lizard Lick Rd	Rdu Wake County
Basin 10, Stream 9	The confluence with Little River (Basin 10, Stream 1)	Zebulon Road	Rdu Wake County
Basin 12, Stream 3	The confluence with Beaverdam Creek (Basin 12, Stream 1)	Old Crews Road	Town Of Knightdale
Basin 15, Stream 22	The confluence with Neuse River (Basin 15, Stream 1)	Forestville Road	City Of Raleigh
Basin 15, Stream 25	The confluence with Neuse River (Basin 15, Stream 1)	The intersection between Forestville Rd and Mitchell Mill Road	City Of Raleigh
Basin 15, Stream 28	The confluence with Perry Creek (Basin 15, stream 26)	Approximately 0.7 mile upstream of Berkshire Downs Drive	City Of Raleigh
Basin 15, Stream 32	The confluence with Falls Lake	Just upstream of Raven Ridge Road	Rdu Wake County
Basin 15, Stream 33	The confluence with Honeycutt Creek (Basin 15, Stream 31)	Approximately 0.3 mile upstream of Honeycutt Road	Rdu Wake County
Basin 15, Stream 7	The confluence with Neuse River (Basin 15, Stream 1)	Clifton Road	Rdu Town Of Knightdale Wake County
Basin 15, Stream 8	The confluence with Basin 15, Stream 7	Grasshopper Road	Rdu Wake County
Basin 15, Stream 9	The confluence with Neuse River (Basin 15, Stream 1)	Battle Ridge Road	Rdu Wake County
Basin 16, Stream 2	The confluence with Upper Barton Creek (Basin 16, Stream 1)	State Route 50	Rdu Wake County
Basin 16, Stream 5	The confluence with Upper Barton Creek (Basin 16, Stream 1)	Approximately 0.2 mile upstream of State Route 50	Rdu Wake County
Basin 17, Stream 4	The confluence with Lower Barton Creek (Basin 17, Stream 1)	Old Creedmoor Road	Rdu Wake County
Basin 18, Stream 13	The confluence with Stirrup Iron Creek (Basin 18, Stream 12)	Sorrell Grove Church Road	Town Of Morrisville
Basin 18, Stream 4	The confluence with Turkey Creek (Basin 18, Stream 5)	Approximately 0.3 mile upstream of Lynn Road	City Of Raleigh
Basin 18, Stream 8	The confluence with Sycamore Creek (Basin 18, Stream 6)	Approximately 0.6 mile upstream of West Gate Road	City Of Raleigh
Basin 19, Stream 3	The confluence with White Oak Creek (Basin 19, Stream 1)	Railroad	Rdu Town Of Garner Wake County
Basin 20, Stream 20	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 0.8 mile upstream of confluence with Swift Creek (Basin 20, Stream 1)	Rdu Wake County
Basin 20, Stream 7	The confluence with Mahlers Creek (Basin 20, Stream 6)	Bryan Road	Town Of Garner
Basin 20, Stream 8	The confluence with Basin 20, Stream 7	Bryan Road	Town Of Garner
Basin 22, Stream 20	The confluence with Terrible Creek (Basin 22, Stream 19)	Approximately 1.0 mile upstream of confluence with Terrible Creek (Basin 22, Stream 19)	Town Of Fuquay-Varina

**Table 13 - Summary of Discharges** 

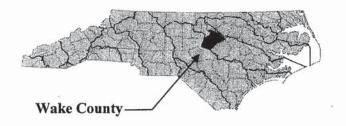
Decision   Process   20% Annual   20% Annual   20% Annual   Charce   Char	Table 13 - Sumr	nary of Dis	cnarges	Discha	rges (cfs)	
As Old Creedmoor Road  Basin 18, Stream 13  An condr 2 20	<u> </u>	Drainage Area		2% Annual	1% Annual	0.2% Annual Chance
At moute 2 2,30	At Old Creedmoor Road		*	*		*
At moute 2 2,30	Basin 18, Stream 13	<u>.</u>				
Approximately 530 feet upstream of Airport Boulevand 2.27		2.30	*	*	520	*
Approximately 1,000 feet upstream of Airport Boulevand 2,00			*	*		*
Approximately 0.8 mile upstream of confluence of Basin 18, Stream 13 Tributary  Approximately 0.5 mile upstream of confluence with Basin 18, Stream 13	Approximately 1,060 feet upstream of Airport Boulevard	2.02	*	*	1,150	*
Approximately 0.8 mile upstream of confluence of Basin 18, Stream 13 Tributary	At confluence of Basin 18, Stream 13 Tributary		*	*		*
Sasin 18, Stream 13 Tributary	Approximately 0.8 mile upstream of confluence of Basin 18, Stream 13 Tributary		*	*		*
Approximately 0.5 mile upstream of confluence with Basin 18, Stream 13  Alf mouth  Approximately 1.580 feet upstream of Lynn Road  Alf Cleinwood Avenuer US Highway 70  Alf Cleinwood Mit Sycamore Creek  Basin 18, Stream 8  Alf mouth  Alf Cleinwood Avenuer US Highway 70				•	•	
Al mouth		0.67	*	*	582	*
At mouth 2,000 - 1,550		1 2 2	•		1	•
Approximately 1,580 feet upstream of Lynn Road 1,20		2.00	*	*	1 550	*
At Glerwood Avenue/ US Highway 70			*	*	,	*
Approximately 0.8 mile upstream of Lynn Road 0.55			*	*		*
Basin 18, Stream 7			*	*		*
At confluence with Sycamore Creek  Basin 18, Stream 8  At mouth  2,30  1,700  1,700  2,4pproximately 0.4 mile upstream of West Gate Road 1,10  1,000  2,900  2,900  3,900  3,900  3,900  3,900  4,900  4,900  5,900  4,900  5,900  6,900  6,900  7,900		10.55			1031	
Basin 18, Stream 8		4.05			4 000	
At mouth 2.30	·	1.05		<u> </u>	1,020	<u> </u>
Approximately 0.4 mile upstream of West Gate Road					1	Ī.
Approximately 0.4 mile upstream of West Gate Road just upstream of tributary 0.70			*	*		*
Basin 19, Stream 3  At mouth				*		
At mouth 2.40		0.70	*	*	900	*
1.80	Basin 19, Stream 3					
Ust upstream of Basin 19, Stream 4	At mouth	2.40	*	*	1,795	*
At US Route 70 0.40 * * * 710 * * 710 * * 8asin 19, Stream 4  At mouth 1.00 * * 1,155 * * 1,155 * * * * * * * * * * * * * * * * * *	Just upstream of first tributary	1.80	*	*	1,520	*
Basin 19, Stream 4	Just upstream of Basin 19, Stream 4	0.50	*	*	785	*
At mouth 1.00	At US Route 70	0.40	*	*	710	*
Basin 20, Stream 20	Basin 19, Stream 4					
At mouth 1.20	At mouth	1.00	*	*	1,155	*
At Woodys Lake 0.80 * 93	Basin 20, Stream 20					
Basin 20, Stream 5	At mouth	1.20	*	*	1,200	*
Approximately 600 feet downstream of Wake/Johnston County boundary  Approximately 1.0 mile upstream of Wake/Johnston County boundary  Basin 20, Stream 7  At mouth  1.51  * * * * * * * * * * * * * * * * * *	At Woodys Lake	0.80	*	*	930	*
Approximately 1.0 mile upstream of Wake/Johnston County boundary    Basin 20, Stream 7	Basin 20, Stream 5					
Stream 7	Approximately 600 feet downstream of Wake/Johnston County boundary	0.87	*	*	433	*
At mouth	Approximately 1.0 mile upstream of Wake/Johnston County boundary	0.61	*	*	353	*
At mouth 0.70 * * 870 * Approximately 0.5 mile upstream of Bryan Road 0.50 * * 760 * * Approximately 0.5 mile upstream of Bryan Road 0.50 * * 1,650 * * 4 * 1,650 * * 4 * 4 * 4 * 4 * 4 * 4 * 4 * 4 * 4	Basin 20, Stream 7					
At mouth 0.70 * * 870 * Approximately 0.5 mile upstream of Bryan Road 0.50 * * 760 * * 760 * * * 760 * * * * 760 * * * * * * 1,650 * * * * * * * * * * * * * * * * * * *	At mouth	1.51	*	*	1,330	*
At mouth 0.70 * * 870 * Approximately 0.5 mile upstream of Bryan Road 0.50 * * 760 * * 760 * * * 760 * * * * 760 * * * * * * 1,650 * * * * * * * * * * * * * * * * * * *	Basin 20. Stream 8					
Approximately 0.5 mile upstream of Bryan Road  Basin 22, Stream 20  At mouth  2.20  * * * 1,650  * 1,650  * tributary  1,200 feet downstream of State Route 2753 just downstream of tributary  1.10  * * 1,250  * * 1,250  * * 1,250	·	0.70	*	*	870	*
At mouth			*	*		*
At mouth 2.20 * * 1,650 *  Approximately 1,200 feet downstream of State Route 2753 just downstream of tributary in 22, Stream 6						
Approximately 1,200 feet downstream of State Route 2753 just downstream of tributary  1.10 * 1,250 * 1,250   1		2 20	*	*	1 650	*
in 22, Stream 6			*	*		*
In 22, Stream 6	<u>tribu</u> tary	1.10			1,200	
	a 🗁					
	·	2.00	*	*	1.590	*

Table 21 - Floodway Data									
	y Source	147 HI (F 1)	Floodway		D 11		ter Surface Eleva		
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
109	10,865	100	400	2.8	427.1	*	427.1	428.1	1.0
Basin 19, Stre	am 3	ı	1		T				T
021	2,100	225	471	3.2	248.8	*	248.8	249.8	1.0
059	5,890	65	204	3.2	277.3	*	277.3	278.1	0.8
063	6,320	280	4,731	0.1	294.4	*	294.4	295.1	0.7
Basin 19, Stre	am 4		T		T				T
016	1,600	50	143	3.1	268.7	*	268.7	269.2	0.5
033	3,325	65	169	2.7	285.3	*	285.3	286.1	0.8
Basin 20, Stre	am 20	ı	1		T				T
013	1,300	80	280	4.3	305.0	*	305.0	306.0	1.0
044	4,430	130	357	3.4	317.3	*	317.3	318.3	1.0
Basin 20, Stre	am 7				1				
015	1,460	55	294	4.5	240.0	*	240.0	241.0	1.0
023	2,320	90	339	3.9	245.0	*	245.0	246.0	1.0
Basin 20, Stre	am 8		I			1			ı
010	950	75	239	3.7	254.8	*	254.8	255.8	1.0
Basin 22, Stre	am 20		I		Ī			I	T .
016	1,600	150	436	3.8	275.6	*	275.6	276.6	1.0
055	5,490	85	344	4.5	310.7	*	310.7	311.7	1.0
Basin 22, Stre	am 6		I						
008	760	160	570	2.8	271.1 <sup>2</sup>	*	268.2	269.2	1.0
Site 6	9 35	85	381	4.1	276.8 <sup>2</sup>	*	276.8	277.3	0.5
030	3,000	75	308	4.9	281.8	*	281.8	282.2	0.4
041	4,120	110	565	2.7	289.1	*	289.1	289.6	0.5
050	4,960	110	562	2.7	294.4	*	294.4	294.9	0.5
058	5,790	110	488	2.9	297.5	*	297.5	298.1	0.6
063	6,300	120	524	2.7	299.9	*	299.9	300.8	0.9
070	7,040	110	420	3.3	304.5	*	304.5	304.9	0.4
075	7,480	130	494	2.7	306.3	*	306.3	306.9	0.6
085	8,530	80	251	2.9	313.7	*	313.7	313.9	0.2
091	9,060	80	301	2.5	319.6	*	319.6	320.1	0.5
097	9,700	60	215	3.4	327.1	*	327.1	327.6	0.5
107	10,720	50	156	4.3	338.8	*	338.8	339.3	0.5
113	11,280	50	151	4.4	347.1	*	347.1	347.3	0.2
Basin 22, Stre		ı <del>- `</del>			, <del>-</del>		1 =	, 5	, - · <del>-</del>
026	2,630	120	316	3.9	314.3	*	314.3	314.4	0.1
045	4,530	105	588	2.1	331.5	*	331.5	332.4	0.9
080	8,030	129	183	4.8	354.4	*	354.4	354.4	0.0
Basin 27, Stre		120	1.00	1 1.0	1007.7		1007.7	1007.7	10.0
010	1,025	105	384	3.7	287.6	*	287.6	288.6	1.0
Basin 28, Stre	•								
008	835	241	932	1.8	261.9 <sup>1</sup>	*	260.8	261.8	1.0
021	2,082	135	859	1.9	266.2	*	266.2	267.2	1.0
026	2,646	110	470	3.5	267.6	*	267.6	268.5	1.0
031	3,074	165	693	2.4	269.7	*	269.7	270.7	1.0
035			690	2.4	271.0	*	271.0		1.0
UJO	3,530	190	บลด	4.4	Z / 1.U	I	Z/ 1.U	272.0	I.U

A Report of Flood Hazards in

WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 1 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





May 2, 2006

Federal Emergency Management Agency State of North Carolina

> Flood Insurance Study Number 37183CV001A



### Section 5.0 - Engineering Methods

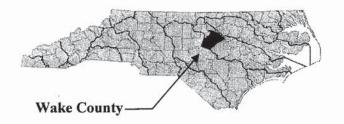
Table 10-Roughness Coefficients

Stream	Channel "n"	Overbank "n"
Basin 22, Stream 6	0.030 - 0.070	0.070 - 0.110
Basin 22, Stream 9	0.030 - 0.070	0.070 - 0.110
Basin 22, Stream 20	0.030 - 0.070	0.070 - 0.110
Basin 23, Stream 2	0.050	0.140
Basin 23, Stream 2 Tributary	0.050	0.150
Basin 23, Stream 3	0.048	0.140
Basin 23, Stream 4	0.050	0.150
Basin 23, Stream 5	0.050	0.150
Basin 27, Stream 4	0.030 - 0.070	0.070 - 0.110
Basin 28, Stream 7	0.050 - 0.055	0.150 - 0.155
Basin 28, Stream 8	0.047 - 0.050	0.100 - 0.200
Basin 30, Stream 3	0.030 - 0.070	0.070 - 0.110
Beaver Creek (Basin 27, Stream 2)	0.043 - 0.050	0.100 - 0.200
Beaverdam Creek (Basin 11, Stream 3)	0.030 - 0.070	0.070 - 0.130
Beaverdam Creek (Basin 12, Stream 1)	0.024 - 0.070	0.070 - 0.130
Beaverdam Creek (Basin 15, Stream 21)	0.018 - 0.070	0.070 - 0.130
Beaverdam Creek (Basin 18, Stream 28)	0.040 - 0.055	0.090 - 0.200
Beaver Creek Tributary (Basin 27, Stream 3)	0.030 - 0.070	0.070 - 0.110
Big Branch	0.050	0.140
Big Branch (Basin 10, Stream 8)	0.030 - 0.070	0.070 - 0.130
Big Branch (Basin 18, Stream 21)	0.035 - 0.055	0.090 - 0.200
Big Branch (Basin 26, Stream 5)	0.050	0.140
Big Branch (Basin 30, Stream 2)	0.030 - 0.070	0.070 - 0.110
Big Branch Tributary No. 1 (Basin 30, Stream 6)	0.030 - 0.070	0.070 - 0.120
Adams Branch (Basin 30, Stream 9)	0.030 - 0.070	0.070 - 0.110
Black Creek (Basin 23, Stream 1)	0.045	0.150
Black Creek Tributary A (Basin 18, Stream 11)	0.030 - 0.070	0.070 - 0.110
Bradley Creek (Basin 24, Stream 3)	0.030 - 0.070	0.070 - 0.110
Bridges Branch	0.050	0.130
Brier Creek (Basin 18, Stream 14)	0.024 - 0.040	0.100 - 0.200
Buck Branch (Basin 20, Stream 12)	0.030 - 0.070	0.070 - 0.011
Buckhorn Branch (Basin 3, Stream 9)	0.030 - 0.070	0.070 - 0.011
Buckhorn Creek	0.040 - 0.048	0.145
Buffalo Branch (Basin 10, Stream 22)	0.030 - 0.070	0.070 - 0.110
Buffalo Creek (Basin 9, Stream 1)	0.030 - 0.070	0.070 - 0.130
Camp Branch (Basin 22, Stream 7)	0.030 - 0.070	0.070 - 0.110
Cary Branch	0.040	0.140
Cedar Creek (Basin 15, Stream 34)	0.030 - 0.070	0.070 - 0.110
Cedar Fork (Basin 10, Stream 15)	0.042	0.130
Clark Branch (Basin 28, Stream 3)	0.050	0.150
Coles Branch (Basin 18, Stream 24)	0.030 - 0.070	0.070 - 0.200

A Report of Flood Hazards in

WAKE COUNTY, NORTH CAROLINA

AND INCORPORATED AREAS



### **VOLUME 3 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse



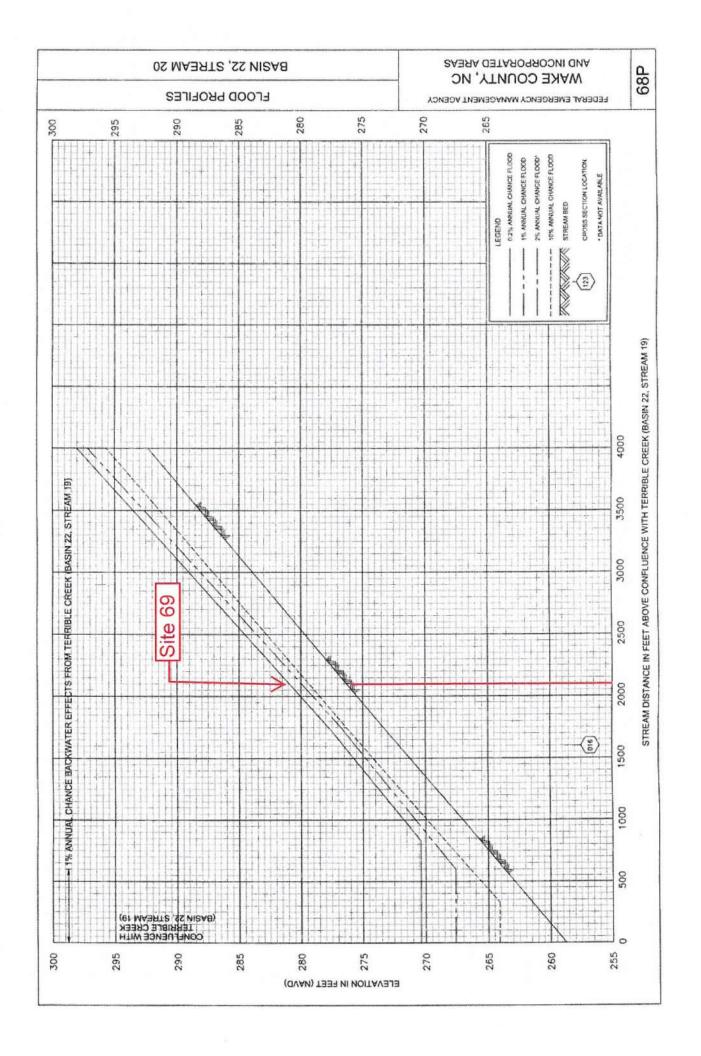


May 2, 2006

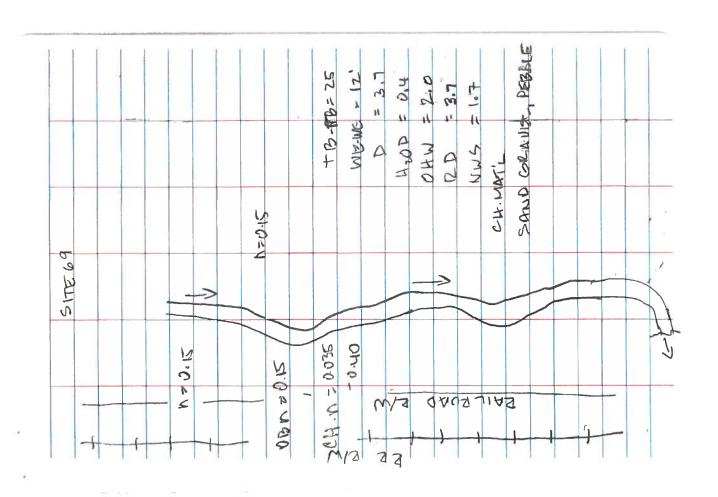
Federal Emergency Management Agency State of North Carolina

> Flood Insurance Study Number 37183CV003A





Name	Index Number	Classification	Neuse River Basin Class Date
Description		Sr	pecial Designation
Tarkiln Creek	27-125-7	SC;NSW	05/01/88
From source to Dawson Creek			
Taylor Creek	27-92	C;Sw,NSW	05/01/88
From source to Neuse River			
Taylors Branch	27-81-1-1	C;Sw,NSW	05/01/88
From source to Briery Run			
Tempe Gut	27-150-11	SA;HQW,NSW	07/01/91
From source to Bay River			
Terrible Creek	27-43-15-8-(2)	C;NSW	05/01/88
From dam at Johnsons Pond to Middle Creek			
Terrible Creek (Johnsons Pond)	27-43-15-8-(1)	B;NSW	05/01/88
From source to dam at Johnsons Pond			
The Canal	27-57-21.3	C;NSW	08/03/92
From source to Little River			
The Gut	27-98-3	C;Sw,NSW	05/01/88
From source to Bachelor (Batchelder) Creek			
The Passage	27-149-4-2-6	SA;ORW,NSW	01/01/90
From Pamlico Sound to Back Bay			
The Slough	27-86-14-1	C;Sw,NSW	05/01/88
From source to Nahunta Swamp			
Thomas Creek	27-150-6-3	SC;Sw,NSW	05/01/88
From source to Trent Creek			
Thompson Swamp	27-86-26-1.5	C;Sw,NSW	05/01/88
From source to Little Contentnea Creek			
Thorofare	27-149-1-1	SA;HQW,NSW	05/01/88
From West Thorofare Bay to Thorofare Bay			
Thorofare Bay	27-149-1	SA;ORW,NSW	01/01/90
From source to Core Sound			
Thorofare Swamp	27-97-5-1	C;Sw,NSW	05/01/88
From souce to Clayroot Swamp			
Thoroughfare Swamp	27-54-5-(1.5)	WS-IV;NSW	08/03/92
From a point 0.5 mile upstream of Wayne County SR 1	120 to Falling Creek		



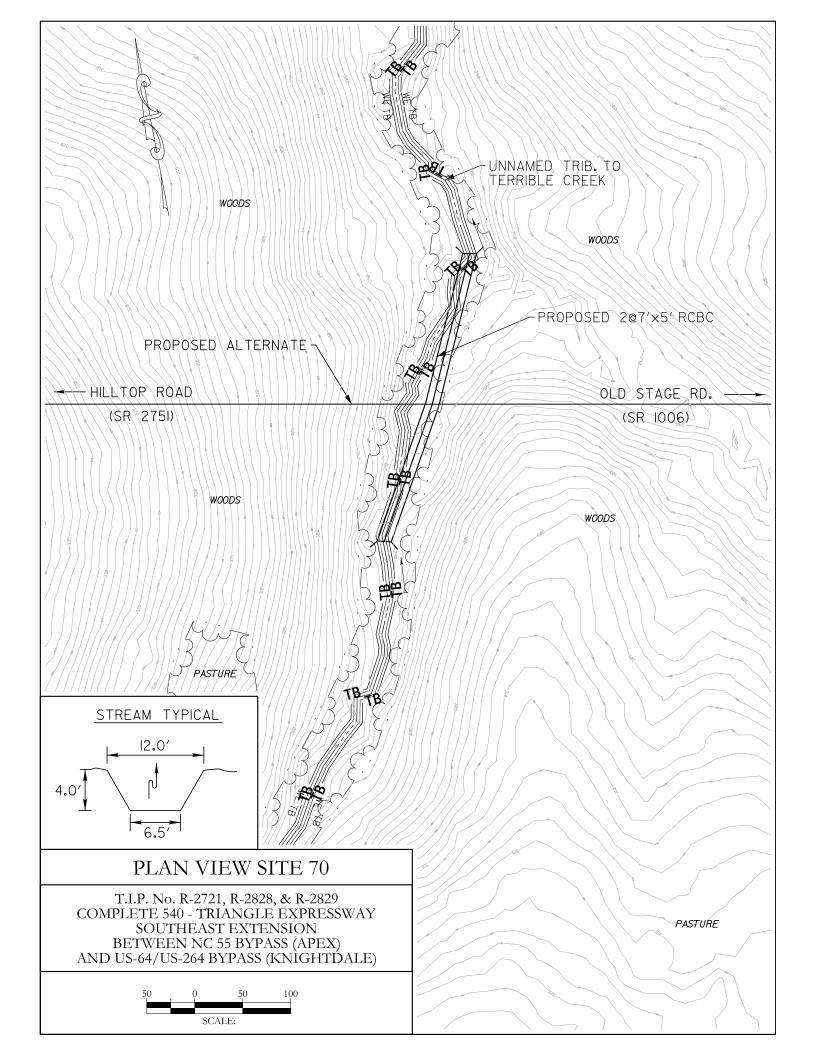


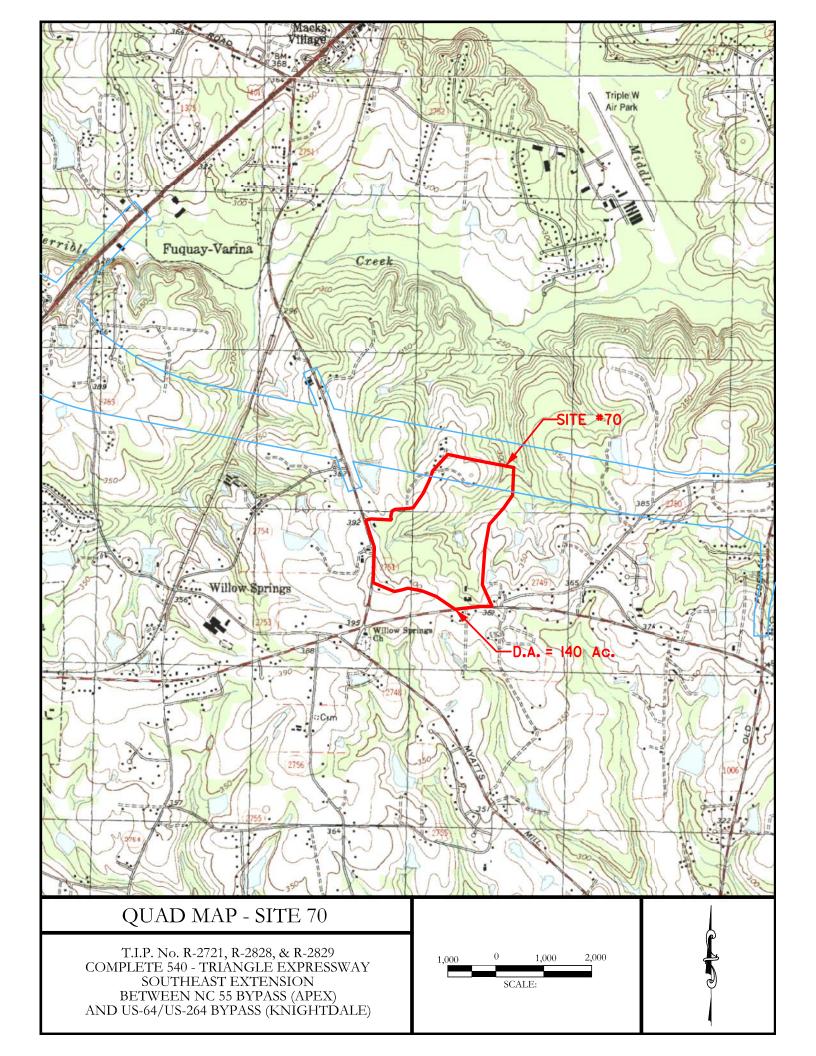
Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

# **Site 70**





# **North Carolina**

Site #70

4/18/2014

REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00 STREAM NAME: Unnamed Trib to Terrible Creek sq. miles METH 0.22 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = ENGLISH

2										
ort 01-420	Sand Hills	(cfs)	11.40	19.20	25.37	34.35	42.15	50.46	60.17	74.55
RURAL EQUATIONS Report 01-4207	Coastal Plain	(cfs)	23.35	49.32	74.09	114.49	152.73	198.64	253.28	341.78
<b>SAL EQUA</b>	Blue Ridge	(cfs)	46.64	86.82	122.58	179.25	230.16	289.18	357.29	464.11
RUI	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR
<u> </u>										
$\vdash$	m	(cfs)								439.95
SSION EQUA	Coastal Plain	(cfs)	26.65	61.73	96.52	161.76	225.01	307.68	411.49	589.43
<b>USGS RURAL REGRESSION EQUA</b>	Sand Hills	(cfs)	9.79	15.96	21.00	27.65	33.37	39.69	48.75	56.35
RUR	VCY				~	~	~	~	200YR	œ

# **USGS URBAN REGRESSION EQUATIONS**

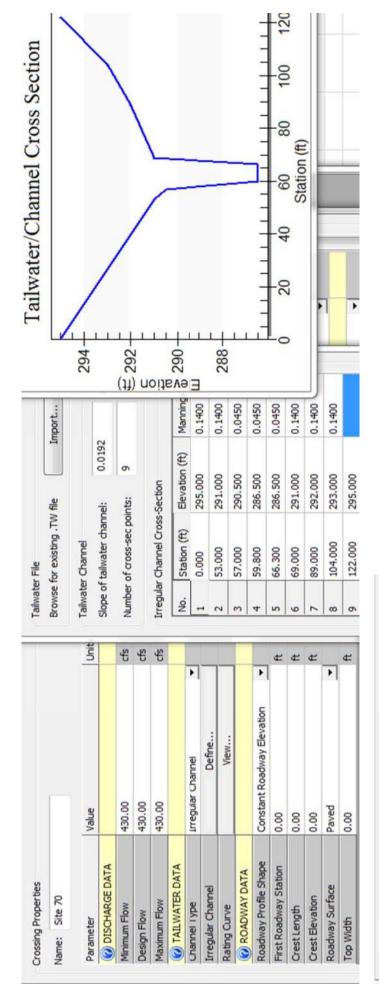
(These Equations are used only for comparison) BDF=

		(	i
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge
	(cfs)	(cts)	(cts)
5YR	54.27	155.84	209.00
10YR	64.45	215.00	258.76
25YR	77.78	319.62	337.61
50YR	87.95	412.64	400.92
100YR	100.56	539.22	486.77
200YR	180.45	601.99	724.53
500YR	129.87	890.33	700.48

) USGS Fact Sheet 007-00	
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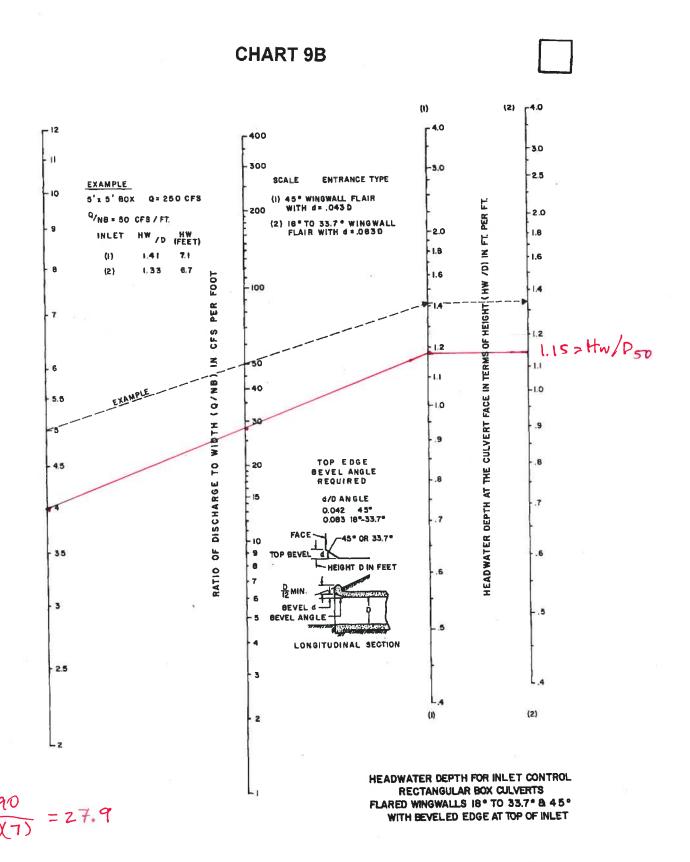
(Based on 2.80xQ10)

% Impervious =	20				FEMA	<b>₽</b>
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	Blue Ridge Discharge Used	FREQUENCY	Disharges
	(cts)	(cts)	(cts)			
5YR	92.36	140.37	156.12			
10YR	126.87	197.91	211.68		10YR	
25YR	178.23	325.52	333.74		50YR	
50YR	212.22	393.95	389.62	390	100YR	
100YR	244.32	463.43	445.35		100YR	
200YR	355.25	554.15	592.70	(Based on 2.80xQ10)	500YR	
500YR	464.36	724.36	774.74	(Based on 3.66xQ10)		ı

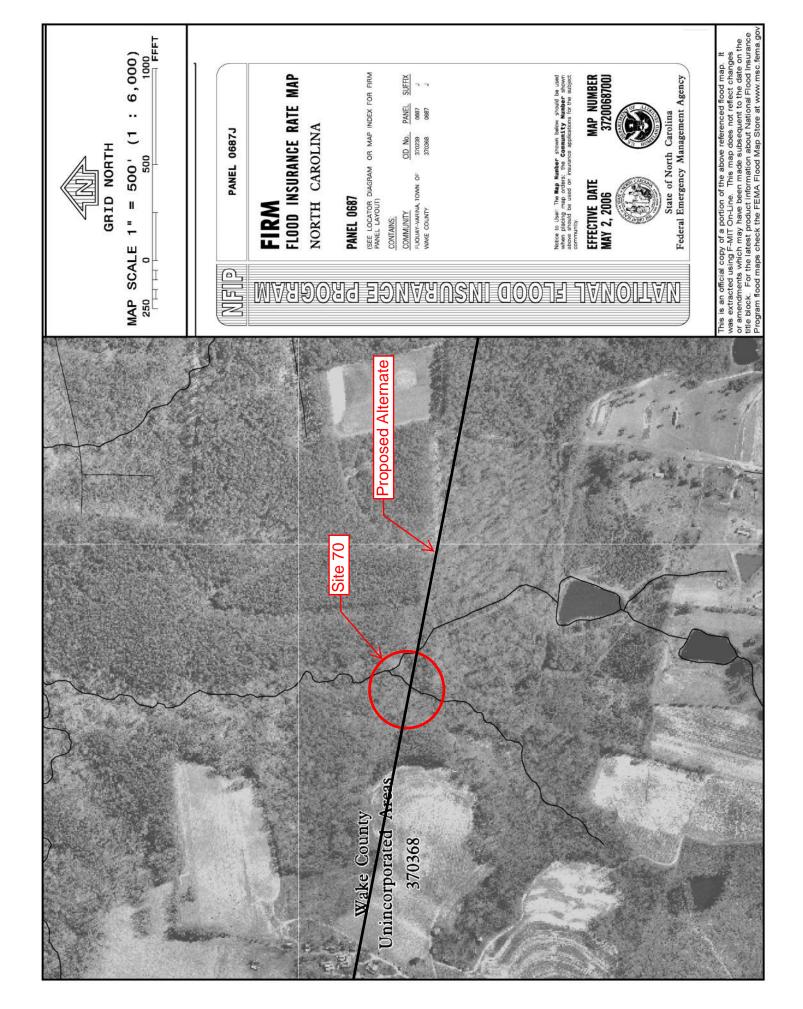


-low (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
430.000	291.372	4.872	8.336	5.837
430.000	291.372	4.872	8.336	5.837
130.000	291.372	4.872	8.336	5.837
130.000	291.372	4.872	8.336	5.837
430.000	291.372	4.872	8.336	5.837
130.000	291.372	4.872	8.336	5.837
130.000	291.372	4.872	8.336	5.837
130.000	291.372	4.872	8.336	5.837
130.000	291.372	4.872	8.336	5.837
130.000	291.372	4.872	8.336	5.837
130.000	291.372	4.872	8.336	5.837

Site 70 SIZE= 2071x5'RCBC



Proposed Structure: 2@7'x5'



			Neuse River Basin
Name	Index Number	Classification	Class Date
Description		Sp	pecial Designation
Tarkiln Creek	27-125-7	SC;NSW	05/01/88
From source to Dawson Creek			
Taylor Creek	27-92	C;Sw,NSW	05/01/88
From source to Neuse River			
Taylors Branch	27-81-1-1	C;Sw,NSW	05/01/88
From source to Briery Run			
Tempe Gut	27-150-11	SA;HQW,NSW	07/01/91
From source to Bay River			
Terrible Creek	27-43-15-8-(2)	C;NSW	05/01/88
rom dam at Johnsons Pond to Middle Creek			
Terrible Creek (Johnsons Pond)	27-43-15-8-(1)	B;NSW	05/01/88
From source to dam at Johnsons Pond			
The Canal	27-57-21.3	C;NSW	08/03/92
From source to Little River			
The Gut	27-98-3	C;Sw,NSW	05/01/88
From source to Bachelor (Batchelder) Creek			
The Passage	27-149-4-2-6	SA;ORW,NSW	01/01/90
From Pamlico Sound to Back Bay			
The Slough	27-86-14-1	C;Sw,NSW	05/01/88
From source to Nahunta Swamp			
Thomas Creek	27-150-6-3	SC;Sw,NSW	05/01/88
From source to Trent Creek			
Thompson Swamp	27-86-26-1.5	C;Sw,NSW	05/01/88
From source to Little Contentnea Creek			
Thorofare	27-149-1-1	SA;HQW,NSW	05/01/88
From West Thorofare Bay to Thorofare Bay			
Thorofare Bay	27-149-1	SA;ORW,NSW	01/01/90
From source to Core Sound			
Thorofare Swamp	27-97-5-1	C;Sw,NSW	05/01/88
From souce to Clayroot Swamp			
Thoroughfare Swamp	27-54-5-(1.5)	WS-IV;NSW	08/03/92
From a point 0.5 mile upstream of Wayne County SR 1120	to Falling Creek		

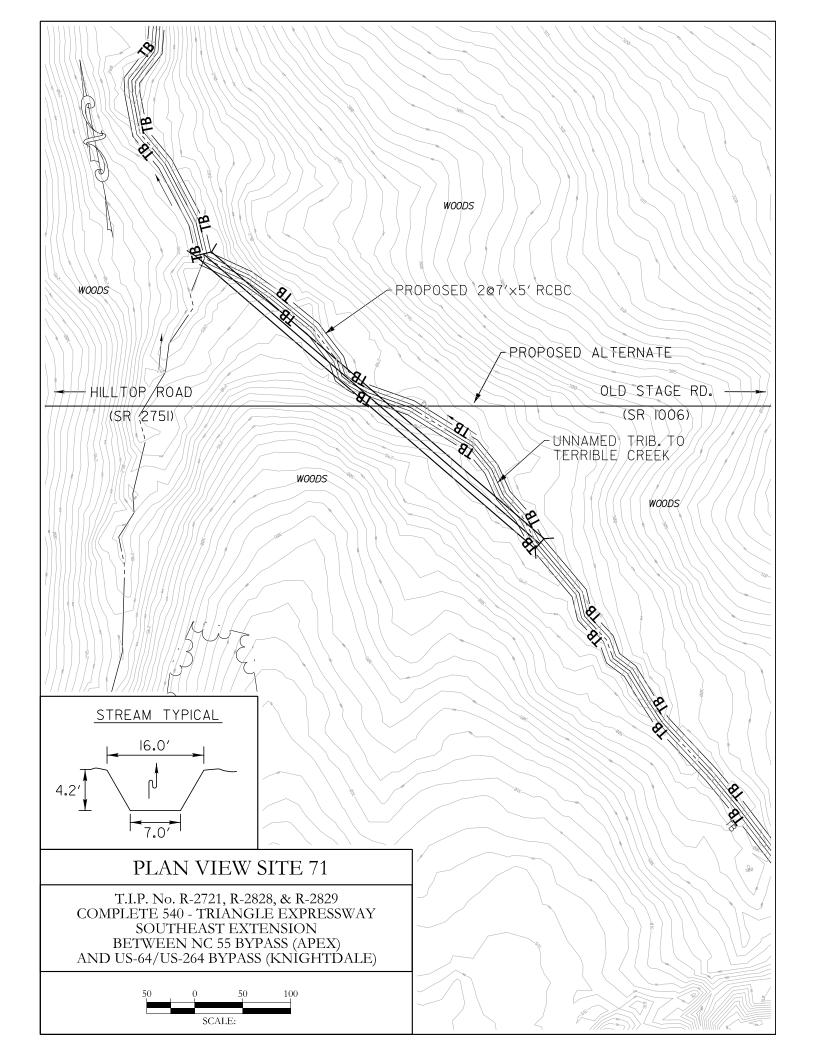
anadigation en			1 5 1	11	1878= 16	1 - 4.2	12 Pec=117=3,3 DRIFT=3,3	
	SINT 70 \$71.	# 10 TATES	LZO DEOTH	CV PECENT		) S N . N . N . N . N . N . N . N . N . N	22.5	
	(V)	5			SAND-BED	N N O O C	Site 71	

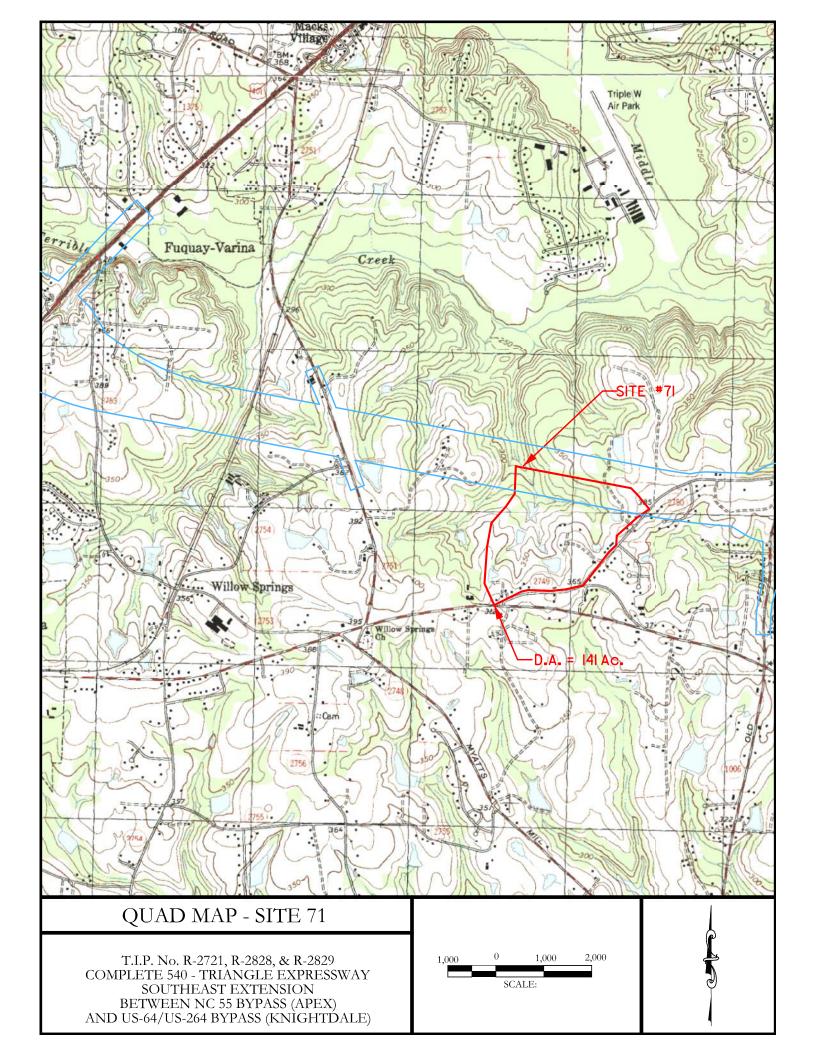


Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.





Site #71

4/18/2014

REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00 STREAM NAME: Unnamed Trib to Terrible Creek sq. miles METH 0.22 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = ENGLISH

<b>USGS RUR</b>	AL REGRE	<b>JSGS RURAL REGRESSION EQUA</b>	ATIONS (OLD)	RUF	<b>SAL EQUA</b>	<b>ATIONS Rep</b>	RURAL EQUATIONS Report 01-4207
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cts)	(cts)	(cfs)		(cfs)	(cfs)	(cfs)
2YR	9.79	26.65	50.58	2YR	46.64	23.35	11.40
5YR	15.96	61.73	89.92	5YR	86.82	49.32	19.20
10YR	21.00	96.52	122.03	10YR	122.58	74.09	25.37
25YR	27.65	161.76	173.22	25YR	179.25	114.49	34.35
50YR	33.37	225.01	217.15	50YR	230.16	152.73	42.15
100YR	39.69	307.68	271.59	100YR	289.18	198.64	50.46
200YR	48.75	411.49	330.62	200YR	357.29	253.28	60.17
500YR	56.35	589.43	439.95	500YR	464.11	341.78	74.55

# **USGS URBAN REGRESSION EQUATIONS**

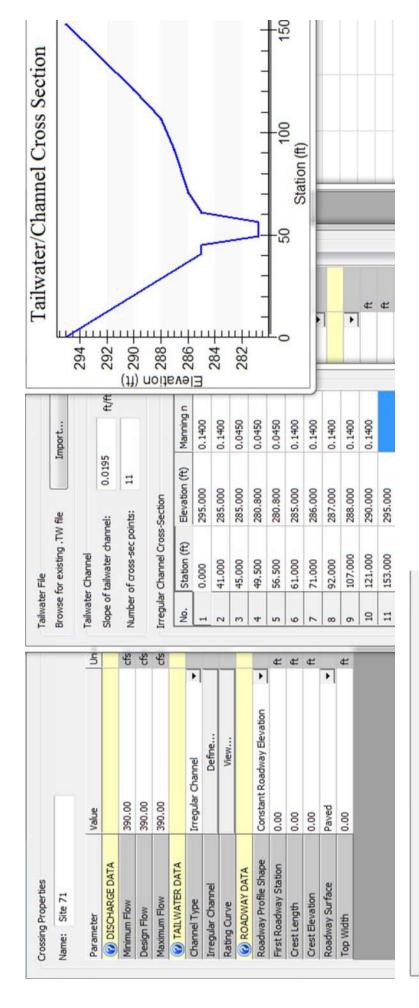
BDF=

(These Equations are used only for comparison)

								(Based on 2.80xQ10)	
	ш	(cts)							
ioi compansoni)	Coastal Plain	(cfs) (cfs)	155.84	215.00	319.62	412.64	539.22	601.99	890.33
nis ale used only	Sand Hills	(cts)	54.27	64.45	77.78	87.95	100.56	180.45	129.87
	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

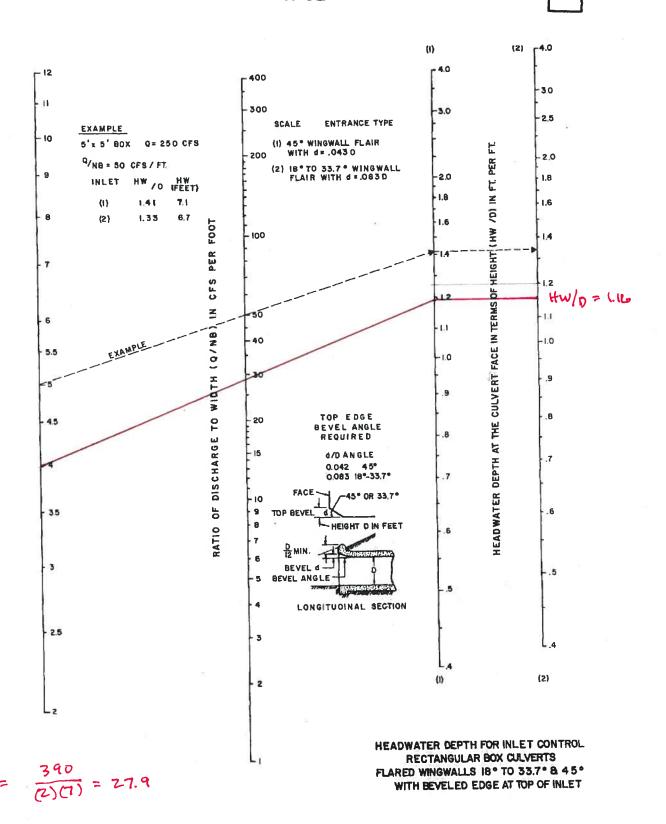
t 007-00
Fact Sheet
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USGS
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% Imp
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FEMA	FREQUENCY Disharges			10YR	50YR	100YR	100YR	500YR	
	Blue Ridge Discharge Used					390		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	Blue Ridge	(cts)	156.12	211.68	333.74	389.62	445.35	592.70	774.74
	Coastal Plain	(cts)	140.37	197.91	325.52	393.95	463.43	554.15	724.36
20	Sand Hills	(cts)	92.36	126.87	178.23	212.22	244.32	355.25	464.36
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR



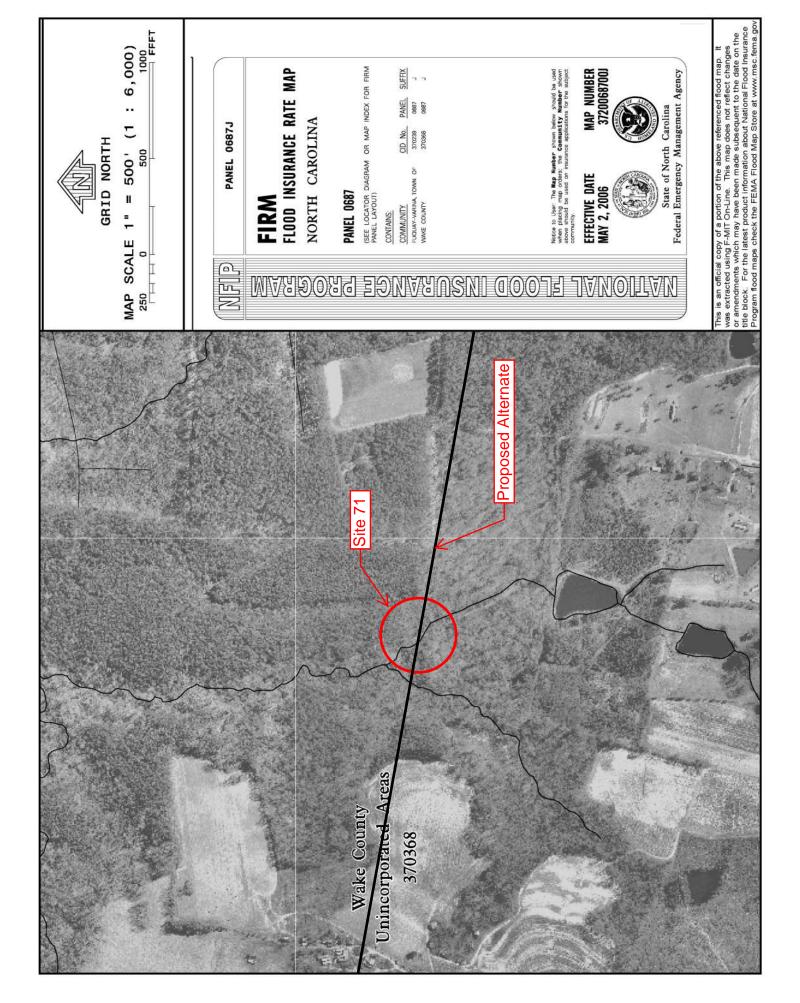
(Jsd											
Shear (	4.975	4.975	4.975	4.975	4.975	4.975	4.975	4.975	4.975	4.975	4.975
Velocity (ft/s) Shear (psf)	8.382	8.382	8.382	8.382	8.382	8.382	8.382	8.382	8.382	8.382	8.382
Depth (ft)	4.088	4.088	4.088	4.088	4.088	4.088	4.088	4.088	4.088	4.088	4.088
Elevation (ft)	284.888	284.888	284.888	284.888	284.888	284.888	284.888	284.888	284.888	284.888	284.888
Flow (cfs)	390.000	390.000	390.000	390.000	390.000	390.000	390.000	390.000	390.000	390.000	390.000

### **CHART 9B**



PROPOSED STRUCTURE:

2 0 7' x5' RCBC



			Neuse River Basin
Name	Index Number	Classification	Class Date
Description		Sn	ecial Designation
Tarkiln Creek	27-125-7	SC;NSW	05/01/88
From source to Dawson Creek			
Taylor Creek	27-92	C;Sw,NSW	05/01/88
From source to Neuse River			
Taylors Branch	27-81-1-1	C;Sw,NSW	05/01/88
From source to Briery Run			
Tempe Gut	27-150-11	SA;HQW,NSW	07/01/91
From source to Bay River			
Terrible Creek	27-43-15-8-(2)	C;NSW	05/01/88
From dam at Johnsons Pond to Middle Creek			
Terrible Creek (Johnsons Pond)	27-43-15-8-(1)	B;NSW	05/01/88
From source to dam at Johnsons Pond			
The Canal	27-57-21.3	C;NSW	08/03/92
From source to Little River			
The Gut	27-98-3	C;Sw,NSW	05/01/88
From source to Bachelor (Batchelder) Creek			
The Passage	27-149-4-2-6	SA;ORW,NSW	01/01/90
From Pamlico Sound to Back Bay			
The Slough	27-86-14-1	C;Sw,NSW	05/01/88
From source to Nahunta Swamp			
Thomas Creek	27-150-6-3	SC;Sw,NSW	05/01/88
From source to Trent Creek			
Thompson Swamp	27-86-26-1.5	C;Sw,NSW	05/01/88
From source to Little Contentnea Creek			
Thorofare	27-149-1-1	SA;HQW,NSW	05/01/88
From West Thorofare Bay to Thorofare Bay			
Thorofare Bay	27-149-1	SA;ORW,NSW	01/01/90
From source to Core Sound			
Thorofare Swamp	27-97-5-1	C;Sw,NSW	05/01/88
From souce to Clayroot Swamp			
Thoroughfare Swamp	27-54-5-(1.5)	WS-IV;NSW	08/03/92
From a point 0.5 mile upstream of Wayne County SR 1120	0 to Falling Creek		

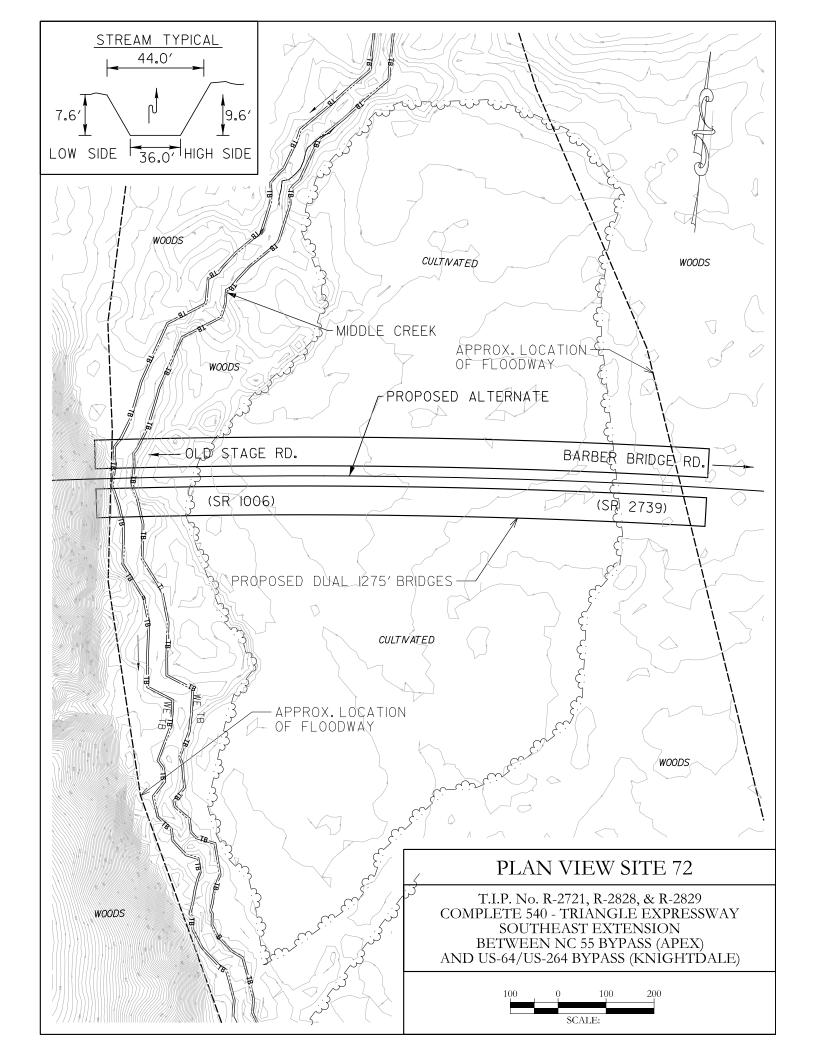
	TBTB-121	L20 D=07H - 0.3 NW = 1,7!	DECENT - 4.51	16-B= 16-	1 (1) = 0 = 4.2 (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	PECE-17-3,3	
12301 2415	Tre 70; We	1,6 7,7 N	(B)		10 P L L. A.		
	3, 1			SAND-BED		Site 71	

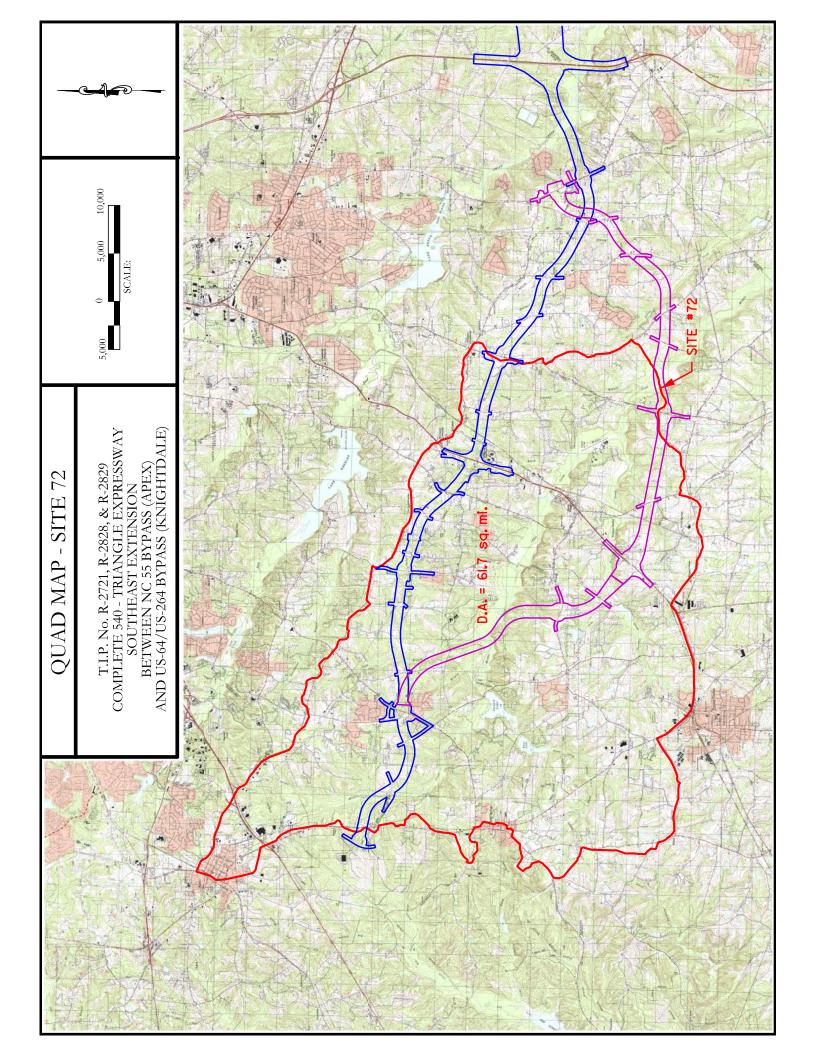


Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.





This spreadsheet computes the 50, 20, 10, 4, 2, 1, 0,5, and 0.2-percent chance exceedance flows for an ungaged site in Georgia, South Carolina, and North Carolina. The spreasheet also includes the 95-percent prediction intervals, the minus and plus standard error of prediction intervals, and the average standard error of prediction. To use the spreadsheet, enter requested information in the yellow cells below.

Enter a site-description name:

Site 72 - Middle Creek

### Enter the explanatory variables:

Drainage area, in square miles	61.7
Percent of basin in Hydrologic Region 1	0
Percent of basin in Hydrologic Region 2	100
Percent of basin in Hydrologic Region 3	0
Percent of basin in Hydrologic Region 4	0
Percent of basin in Hydrologic Region 5	0

Sum of region percentages

Applicable range of draingage area is 1 to 9,000 square miles.

Hydrologic Region 1 corresponds to the USEPA Level III Ridge and Valley and Piedmont ecoregions

Hydrologic Region 2 corresponds to the USEPA Level III Blue Ridge accoragion

Hydrologic Region 3 corresponds to the USEPA Level IV Sand Hills ecoregion

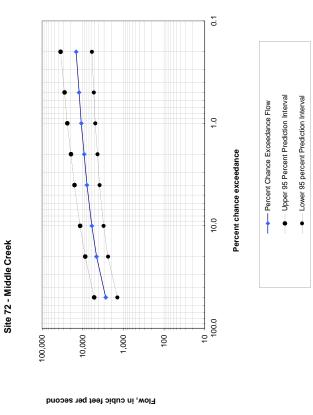
Hydrologic Region 4 corresponds to the USEPA Level III Southasstem, Middle Atlantic Coastal, and Southern Coastal Plain ecoregions

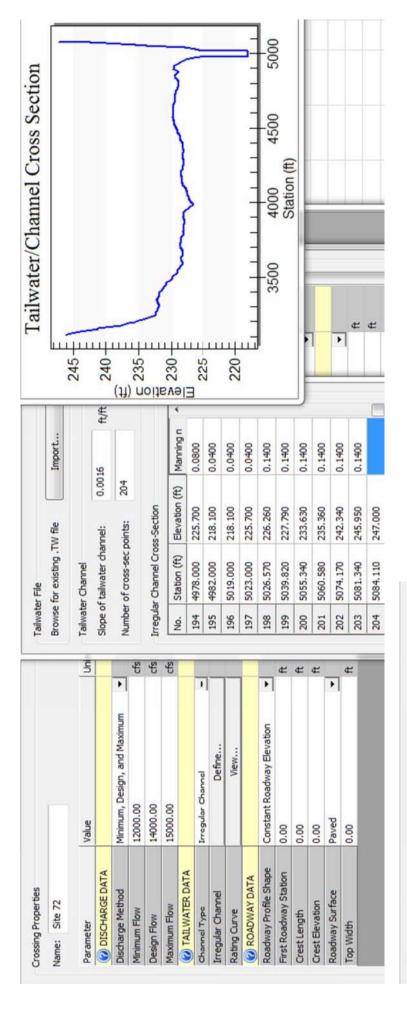
Hydrologic Region 5 corresponds to the lower portion of the USEPA Level IV Tifton Uplands ecoregion.

Drainage area check DRAINAGE AREA WITHIN APPLICABLE LIMITS.

		Lower 95	Upper 95			
	Percent	percent	percent			
	chance	prediction	prediction			Average
	exceedance	interval flow,	interval flow,	-S <sub>P,1</sub>	+S <sub>P,i</sub>	S
Percent chance exceedance	flow, in ft3/s in ft3/s	in ft³/s	in ft³/s	(percent) (percent)	(percent)	(percent)
20	2,720	1,410	5,240	-28.4	39.8	34.4
20	4,580	2,400	8,760	-28.2	39.2	34.0
10	2,990		11,700	-28.9	40.6	35.1
4	1,870	3,870	16,000	-30.4	43.7	37.5
	2 9,230	4,360	19,500	-31.8	46.5	39.6
	10,900	4,950	24,000	-33.1	49.6	42.0
0.5	12,300	5,360	28,200	-34.6	52.8	44.4
0.2	14.500	5.960	35,300	-36.5	57.4	47.8

MA	Disharges	4,700	8,500	10,800		18,000
田田	REQUENCY	10YR	SOVR	100VR	100YR	SOOVE





Flow (cfs)	Elevation (ft) Depth (ft)	Depth (ft)	Velocity (ft/s) Shear (psf)	Shear (psf)	
12000.000	231.793	13.693	2.175	1.367	
12300.000	231.861	13.761	2,185	1.374	
12600.000	231.941	13.841	2.186	1.382	
12900.000	232.015	13,915	2.190	1.389	
13200.000	232.086	13.986	2.196	1.396	
13500.000	232.164	14.064	2.196	1.404	
13800,000	222,233	14,133	2,202	1.411	
14000.000	232.279	14.179	2.205	1.416	$\triangle$
14400.000	732.337	14.257	2:219	1.423	
14700.000	232.425	14.325	2.224	1.430	
15000.000	232.482	14.382	2.234	1.436	Š
					1

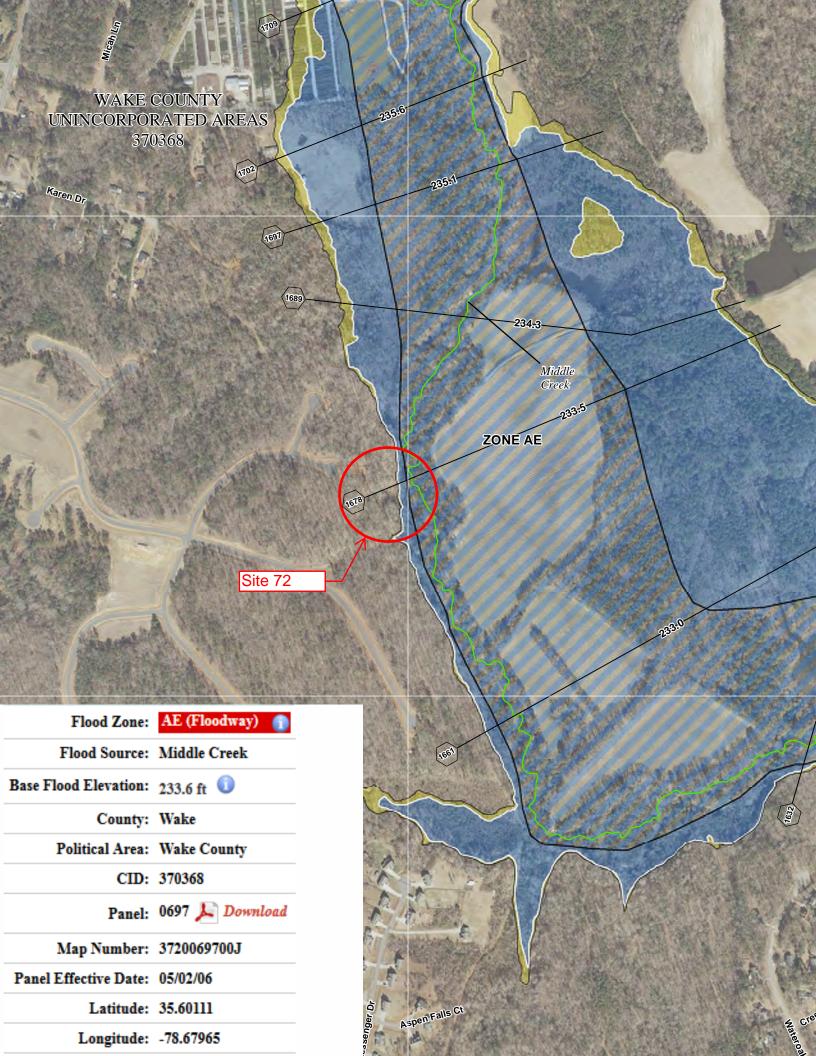
Depth is in excess of 14'. Therefore, go with a bridge.

### PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake PROJECT NUMBER R-2721, R-2828 & R-2829 STREAM Middle Creek **ROUTE New Location** (Site 72) ASSESSMENT PREPARED BY Mulkey, INC. DATE 12/27/2013 (WBP) **HYDROLOGIC EVALUATION** NEAREST GAGING STATION ON THIS STREAM \_\_\_\_\_ (NONE X) ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: Yes FLOOD DATA:  $Q_{10}$  6,000 CFS EST. BKWTR. N/A FT.  $Q_{25}$  7,900 CFS EST. BKWTR. N/A FT. Q<sub>50</sub> <u>9,200</u> CFS EST. BKWTR. N/A FT. Q<sub>100</sub> <u>10,900</u> CFS EST. BKWTR. <u>N/A</u> FT. Q<sub>500</sub> 14,500 CFS EST. BKWTR. N/A FT. DRAINAGE AREA 61.7 Sq.Mi. METHOD USED TO COMPUTE Q: USGS Rural Regression PROPERTY RELATED EVALUATIONS DAMAGE POTENTIAL: LOW \_\_\_\_\_ MODERATE X HIGH COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED ENCROACHMENT: YES NO X EXPLANTION: A floodway modification may be required at this site. LOCATION: LIST BUILDINGS IN FLOOD PLAIN: None **UPSTREAM LAND USE Residential** ANTICIPATE ANY CHANGE? No ANY FLOOD ZONING? (FIA STUDIES, ETC.) YES X NO TYPE OF STUDY: FEMA – Special Flood Hazard Zone AE REGULATORY FLOODWAY WIDTH 980 ft. Section 1689 (AS NOTED IN FIS) COMMENTS: \_\_\_\_\_

PRESENT YEAR 2012 TRAFFIC COUNT 14,200 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 44,800 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? <u>N/A New Location</u>
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? $\underline{\text{N/A}}$
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS
NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE <u>X</u> ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE <u>Wedowee and Wehadkee</u> TYPE SLOPE COVER <u>Vegetation</u>
COMMENTS: Soil Type from Web Soil Survey website of Wake County, NC.
ENVIRONMENTAL CONSIDERATIONS
LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN:
MISCELLANEOUS COMMENTS
IS THERE UNUSUAL SCOUR POTENTIAL? YES NO $\underline{\mathbf{x}}$ PROTECTION NEEDED
ARE BANKS STABLE? Yes PROTECTION NEEDED No

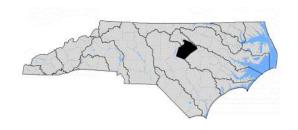
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
<u>ALTERNATIVES</u>
RECOMMENDED DESIGN <u>1270 ft. bridge</u>
DETOUR STRUCTURE <u>N/A</u>
BRIDGE WATERWAY OPENING
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YESNO $\underline{X}$ DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood and Floodway Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:



### PRELIMINARY FLOOD INSURANCE STUDY

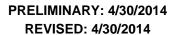
### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

State of North Carolina

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 9, "Flooding Sources Studied by Detailed Methods: Redelineated", lists all flooding sources that were studied by detailed methods for the prestatewide FIS and redelineated for previous FISs. These flooding sources were not part of this revision and their effective analyses remain valid.

Table 9 - Flooding Sources Studied by Detailed Methods: Redelineated

Source	Riverine	Sources	Affected Communities
	From	То	
Basin 10, Stream 2	The confluence with Little River (Basin 10, Stream 1)	Approximately 0.9 mile upstream of confluence with Little River (Basin 10, Stream 1)	Rdu Wake County
Basin 10, Stream 3	The confluence with Little River (Basin 10, Stream 1)	Moss Road	Rdu Wake County
Buffalo Branch (Basin 10, Stream 22)	The confluence with Little River (Basin 10, Stream 1)	Morphus Bridge Road	Rdu Town Of Wendell Wake County
Buffalo Creek (Basin 9, Stream 1)	The Wake/Johnston County boundary	Robertsons Pond Dam	Rdu Town Of Wendell Wake County
Kit Creek	The Chatham/Wake County Boundary	Approximately 475 feet upstream of Railroad	Rdu Town Of Cary Wake County
Little Creek (Basin 11, Stream 2)	The Wake/Johnston County boundary	Cemetery Road	Rdu Town Of Zebulon Wake County
Middle Creek	The confluence with Swift Creek	Approximately 0.7 mile upstream of confluence of Middle Creek Tributary	Rdu Town Of Apex Town Of Cary Town Of Fuquay-Varina Town Of Holly Springs Wake County
Panther Banch (Basin 22, Stream 2)	The confluence with Middle Creek (Basin 22, Stream 1)	Approximately 0.5 mile upstream of Banks Road	Rdu Wake County
nthe Creek	The Chatham/Wake County Boundary	Approximately 1.0 mile upstream of Green Level to Durham Road	Town Of Cary
Poplar Creek (Basin 13, Stream 1)	The confluence with Neuse River (Basin 15, Stream 1)	Approximately 900 Feet upstream of Fayetteville Street	Rdu Town Of Knightdale Wake County
Swift Creek	The confluence with the Neuse River	The confluence of Yates Branch (Basin 20, Stream 13)	Rdu Town Of Garner Wake County
White Oak Creek	The confluence with Swift Creek	Approximately 0.4 mile upstream of Pergo Parkway	Rdu Town Of Clayton Town Of Garner Wake County

Table 10, "Flooding Sources Studied by Detailed Methods: Limited Detailed", lists all flooding sources within the county that were studied by limited detailed methods for either this FIS or previous FISs.

Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed

Source	Riverine	Sources	Affected Communties
	From	То	
Bachelor Branch (Basin 28, Stream 6)	The confluence with White Oak Creek	Approximately 530 feet upstream of Highway 55	Rdu Town Of Cary Wake County
Basin 11, Stream 7	The Wake/Johnston County boundary	Approximately 0.4 mile upstream of Wake/Johnston County boundary	Rdu Wake County
Basin 14, Stream 2	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.4 mile upstream of Lake Myra Road	Rdu Wake County
Basin 14, Stream 3	The confluence with Marks Creek (Basin 14, Stream 1)	Approximately 0.7 mile upstream of confluence with Marks Creek (Basin 14, Stream 1)	Rdu Town Of Knightdale Town Of Wendell Wake County
Basin 20, Stream 5	The confluence with Swift Creek (Basin 20, Stream 1)	Approximately 1.7 miles upstream of confluence with Swift Creek (Basin 20, Stream 1)	Rdu Wake County
Basin 28, Stream 7	The confluence with Basin 28, Stream 8	Approximately 0.4 mile upstream of confluence with Basin 28, Stream 8	Town Of Cary
Beddingfield Creek	Approximately 0.4 mile upstream of the confluence with Neuse River	Approximately 0.2 mile upstream of Shotwell Road	Rdu Town Of Clayton Wake County
Big Branch	The confluence with Harris Reservoir	Approximately 0.9 mile upstream of Highway 1	Rdu Town Of Apex Wake County
Black Creek	Approximately 260 feet upstream of State HWY 210	Approximately 1.0 mile upstream of dam along Black Creek (Basin 23, Stream 1)	Rdu Town Of Fuquay-Varina Wake County

**Table 13 - Summary of Discharges** 

Table 13 - Summ			Discha	rges (cfs)	
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Just upstream of Chatham/Wake County boundary	3.80	*	*	2,450	*
Approximately 0.9 mile upstream of Chatham/Wake County boundary	3.30	1,220	1,990	2,320	3,240
Approximately 1,580 feet downstream of New Hill Olive Chapel Road	2.20	986	1,720	2,060	3,060
Approximately 0.4 mile upstream of New Hill Olive Chapel Road	1.40	888	1,380	1,630	2,380
Little Creek (Into Middle Creek)				•	•
Approximately 530 feet downstream of Wake/Johnston County boundary	9.90	*	*	1,710	*
At confluence of Guffy Branch (Basin 21, Stream 4)	5.19	*	*	1,190	*
Approximately 1,580 feet upstream of confluence of Guffy Branch (Basin 21, Stream 4)	5.05	*	*	1,171	*
Approximately 0.9 mile downstream of confluence of Juniper Branch (Basin 21, Stream 2)	4.86	*	*	1,150	*
Approximately 0.5 mile downstream of confluence of Juniper Branch (Basin 21, Stream 2)	4.42	*	*	1,080	*
At confluence of Juniper Branch (Basin 21, Stream 2)	2.27	*	*	744	*
Approximately 0.8 mile downstream of Pagan Road	2.04	*	*	701	*
Approximately 530 feet upstream of Pagan Road	1.52	*	*	594	*
Approximately 0.7 mile upstream of Pagan Road	1.18	*	*	513	*
Little River					
At Wake/Johnston County boundary	69.24	*	*	11,700	*
Marks Creek	•		-		
Approximately 0.7 mile downstream of Knightdale Eagle Rock Road	7.90	*	*	3,300	*
Middle Creek				1 - /	•
Just upstream of Panther Branch (Basin 22, Stream 2)	56.70	*	*	9,900	*
Just upstream of Terrible Creek (Basin 22, Stream 19)	43.60	*	*	8,600	*
Moccasin Creek	1.5.55	l		10,000	<b>1</b>
Approximately 0.4 mile upstream of Franklin/Nash County boundary	27.96	*	*	7,470	*
Approximately 0.9 mile upstream of Franklin/Nash County boundary	26.57	*	*	7,230	*
Morris Branch	20.07			1,200	
At Chatham/Wake County boundary	1.40	821	1,380	1,730	2,730
Approximately 0.4 mile upstream of Chatham/Wake County boundary	1.20	707	1,300	1,630	2,490
Just downstream of Green Level to Durham Road	0.80	765	1,080	1,230	1,840
Norris Branch	1		, , , , , ,	,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
Just upstream of confluence with Cary Branch	1.70	*	*	1,038	*
Panther Creek	10			1,000	
At Chatham/Wake County boundary	3.60	800	1,600	2,150	4,100
At Yates Store Road	2.50	635	1,330	1,795	3,400
Just upstream of Yates Store Road	2.00	555	1,170	1,590	3,030
Approximately 0.8 mile upstream of Yates Store Road just downstream of tributary	1.40	445	955	1,305	2,525
Approximately 0.8 mile upstream of Yates Store Road just downstream of tributary	0.80	320	695	960	1,800
Poplar Creek (Basin 13, Stream 1)		1920			1,000
· · · · · · · · · · · · · · · · · · ·	9.00	*	*	3 600	*
At mouth	J 3.00			3,600	
Reedy Branch (Basin 27, Stream 5)	140	4.500	0.550	0.000	1,400
At confluence with Beaver Creek	4.10	1,520	2,550	3,020	4,430
Terrible Creek (Basin 22, Stream 19)					
At mouth	12.30	*	*	4,600	*

**Table 16 - Roughness Coefficients** 

Stream	Channel "n"	Overbank "n"
Beaver Creek	0.043 to 0.050	0.100 to 0.200
Beddingfield Creek	0.050	0.130
Big Branch	0.050	0.140
Black Creek	0.025 to 0.060	0.030 to 0.150
Buckhorn Creek	0.040 to 0.048	0.145
Buffalo Creek (Basin 9, Stream 1)	0.030 to 0.070	0.035 to 0.140
Buffalo Creek West	0.045 to 0.052	0.030 to 0.140
Cary Branch	0.040	0.140
Guffy Branch (Basin 21, Stream 4)	0.047	0.130
Jim Branch	0.045	0.145
Juniper Branch (Basin 21, Stream 2)	0.045	0.110 to 0.130
Kit Creek	0.030 to 0.070	0.070 to 0.110
Little Beaver Creek	0.045 to 0.055	0.100 to 0.220
Little Black Creek	0.030 to 0.070	0.070 to 0.130
Little Creek (Basin 11, Stream 2)	0.030 to 0.080	0.070 to 0.150
Little Creek (Into Middle Creek)	0.033 to 0.047	0.095 to 0.140
Little River	0.040 to 0.066	0.070 to 0.240
Marks Crook	0.025 to 0.070	0.070 to 0.130
Middle Creek	0.042 to 0.050	0.030 to 0.140
Mill Branch	0.050	0.030 to 0.150
reek (South)	0.035 to 0.060	0.040 to 0.160
2 asin Creek	0.030 to 0.070	0.070 to 0.220
Morris Branch	0.030 to 0.050	0.100 to 0.200
Nancy Branch	0.045 to 0.050	0.120 to 0.150
Neuse River	0.035 to 0.060	0.055 to 0.250
Norris Branch	0.048	0.145
Panther Creek	0.030 to 0.070	0.070 to 0.130
Reedy Branch (Basin 27, Stream 5)	0.045 to 0.050	0.100 to 0.200
Snipes Creek	0.042 to 0.045	0.120 to 0.130
Swift Creek	0.040 to 0.072	0.035 to 0.240
Thomas Creek	0.050	0.145
Unnamed Tributary (#1) to Swift Creek	0.045 to 0.060	0.050 to 0.150
White Oak Creek	0.035 to 0.050	0.035 to 0.150

For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained using digital elevation data obtained with LIDAR technology developed as part of the North Carolina Statewide Floodplain Mapping Program. The hydraulic model is prepared using this digital elevation data, without surveying bathymetric or structural data. Where bridge or culvert data are readily available, such as from the North Carolina Department of Transportation, these data have been reflected in the hydraulic model. If these structural data are not readily available, field measurements of these structures were made to approximate their geometry in the hydraulic models. In addition, this method does not include field surveys that determine specifics on channel and floodplain characteristics. A limited detailed study is a "buildable" product that can be upgraded to a fully detailed study at a later date by verifying stream channel characteristics, bridge and culvert opening geometry, and by analyzing multiple recurrence intervals.

The results of the HEC-RAS computations are tabulated for all cross sections (Table 17, "Limited Detailed Flood Hazard Data"). Flood Profiles have not been developed for streams studied by limited detailed methods. Water-surface elevation rasters were developed for steams studied by limited detailed methods. In addition, floodways for streams studied by limited detailed methods are not delineated on the FIRM. However, the 1% annual chance water-surface elevations, flood discharges, and non-encroachment widths from the limited detailed studies for every modeled cross section are given in Table 17. The non-encroachment widths given at modeled cross sections can be used by communities to enforce floodplain management ordinances that meet the requirement defined in 44 CFR 60.3(c)(10).

Between cross sections for streams studied by limited detailed methods, 1% annual chance water-surface elevations can be calculated by mathematical interpolation using the distance along the stream centerline. Non-encroachment widths and, therefore, the location of a non-encroachment area boundary between cross sections should be determined based on either 1) mathematical interpolation, or 2) the non-encroachment width at the upstream or downstream cross section, whichever is larger. If the width determined by this second method is wider than the Special Flood Hazard Area (SFHA) or the 1% annual chance floodplain delineated on the FIRM for this location along the stream, the non-encroachment area shall be considered to

Table 21 - Floodway Data

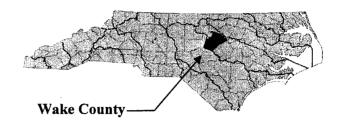
Floodwa	y Source		Floodway	ole 21 - Fl	oodway D		iter Surface Eleva	ation	
Cross Section	Distance (Feet	Width (Feet)	Section Area	Mean Velocity	Regulatory	1% Annual	Without	With Floodway	Increase
	Above Mouth)	( ,	(Square Feet)	(Feet Per Second)		Chance Future Water-Surface Elevation	Floodway	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
092	9,189	240	940	2.6	238.5	*	238.5	239.3	0.8
100	9,971	180	965	2.5	241.4	*	241.4	242.4	1.0
108	10,800	270	1,635	1.4	242.9	*	242.9	243.9	1.0
123	12,310	325	1,894	1.2	246.5	*	246.5	247.5	1.0
129	12,915	250	788	3.0	247.4	*	247.4	248.2	0.8
135	13,536	330	1,298	1.8	249.6	*	249.6	250.5	0.9
139	13,918	300	1,298	1.8	250.2	*	250.2	251.1	1.0
146	14,626	250	990	2.1	251.3	*	251.3	252.3	1.0
155	15,471	175	588	3.5	254.3	*	254.3	254.9	0.6
163	16,263	225	870	2.4	256.9	*	256.9	257.6	0.7
177	17,728	130	749	2.8	260.3	*	260.3	261.3	0.9
186	18,564	170	798	2.6	262.9	*	262.9	263.7	0.8
193	19,252	120	549	3.0	264.9	*	264.9	265.9	1.0
	Basin 11, Strea	•	10.0	10.0	120		120	1200.0	1.10
056	5,630	515	3,987	0.6	227.8	*	227.8	227.9	0.1
067	6,730	320	1,719	1.4	227.9	*	227.9	228.0	0.1
119	11,900	265	1,221	1.2	238.8	*	238.8	239.8	1.0
Little River	,			<u> </u>		<u> </u>			-
3451	345,141	670	7,458	1.4	216.2	217.7	216.2	217.1	0.9
3461	346,136	630	6,234	1.7	216.6	218.0	216.6	217.5	0.9
3470	346,975	410	4,260	2.4	217.0	218.3	217.0	217.9	0.9
3480	347,953	330	3,856	2.7	217.7	218.9	217.7	218.4	0.8
Middle Creek									
1415	141,500	800	6,211	1.7	213.3	*	213.3	213.9	0.6
1430	143,000	685	4,794	2.2	214.2	*	214.2	215.2	1.0
1447	144,650	800	5,510	2.0	216.3	*	216.3	217.1	0.8
1469	146,910	915	5,948	1.8	218.0	*	218.0	218.6	0.6
1486	148,620	1,030	6,581	1.6	219.2	*	219.2	220.0	0.8
1504	150,390	700	4,749	2.3	220.5	*	220.5	221.4	0.9
1512	151,150	600	4,538	2.4	221.5	*	221.5	222.4	0.9
1529	152,890	530	4,236	2.5	224.5	*	224.5	225.2	0.7
1545	154,530	525	5,212	2.1	225.8	*	225.8	226.5	0.7
1551	155,085	600	4,469	2.4	226.2	*	226.2	226.9	0.7
1559	155,930	620	5,330	2.0	227.0	*	227.0	227.5	0.5
1576	157,630	620	5,913	1.8	227.8	*	227.8	228.5	0.7
1582	158,165	500	3,745	2.9	228.1	*	228.1	228.9	0.8
1597	159,720	568	6,722	1.6	231.0	*	231.0	231.5	0.5
1607	160,655	660	5,171	2.0	231.3	*	231.3	232.0	0.7
1620	161,950	850	7,140	1.5	232.2	*	232.2	233.0	0.8
1632	163,190	950	9,795	1.1	232.6	*	232.6	233.4	0.8
1661	166 140	1 260	10 323	1.0	233.0	*	232.0	233.4	0.8
	,	,	,			*			
1678	167,840	1,230	7,505	1.4	233.5		233.5	234.4	0.9
1689 <b>/</b>	168,860	980	5,981	1.8	234.3		234.3	235.0	0.7
	169,710	770	5,397	1.9	235.1		235.1	235.9	0.8
1702	170,170	670	4,803	2.1	235.6	*	235.6	236.4	0.8

### FLOOD INSURANCE STUDY

A Report of Flood Hazards in

WAKE COUNTY, NORTH CAROLINA

**AND INCORPORATED AREAS** 



### **VOLUME 5 OF 7**

Community Name	Community Number	River Basin
Apex, Town of	370467	Cape Fear/Neuse
Cary, Town of	370238	Cape Fear/Neuse
Fuquay-Varina, Town of	370239	Cape Fear
Garner, Town of	370240	Neuse
Holly Springs, Town of	370403	Cape Fear/Neuse
Knightdale, Town of	370241	Neuse
Morrisville, Town of	370242	Cape Fear/Neuse
Raleigh, City of	370243	Neuse
Rolesville, Town of	370468	Neuse
Wake County (Unincorporated Areas)	370368	Cape Fear/Neuse
Wake Forest, Town of	370244	Neuse
Wendell, Town of	370245	Neuse
Zebulon, Town of	370246	Neuse





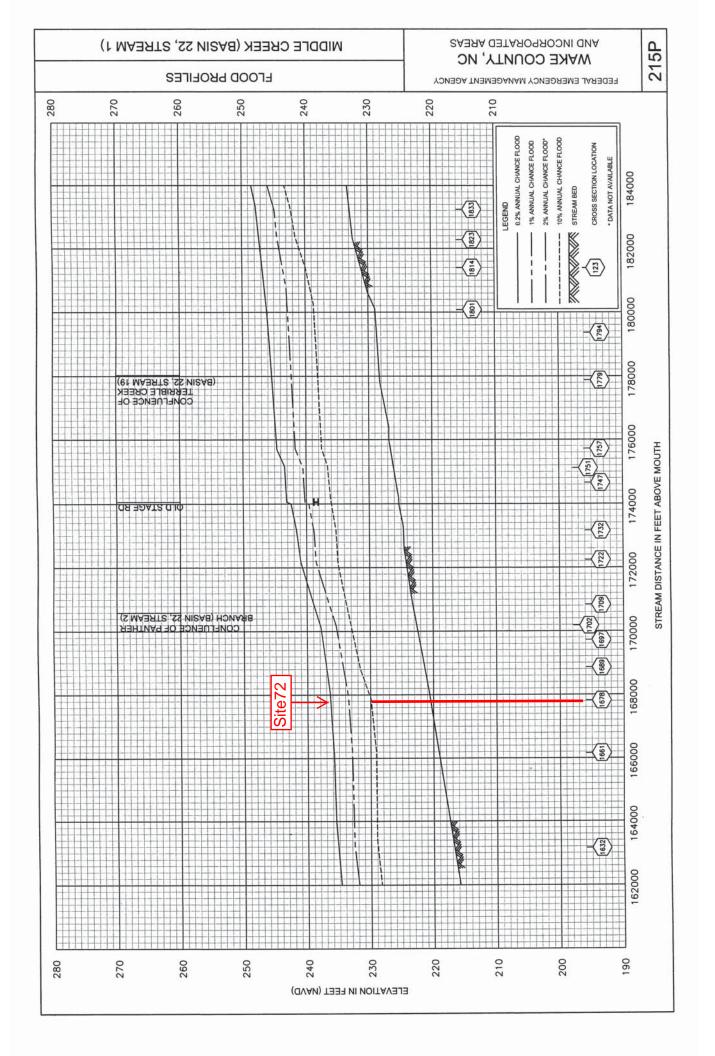
May 2, 2006

Federal Emergency Management Agency State of North Carolina

Flood Insurance Study Number 37183CV005A

www.fema.gov and www.ncfloodmaps.com





		Nei	use River Basin
Name	Index Number	Classification	Class Date
Description		Special	Designation
McGowan Creek (Efland Millpond)	27-2-5-(1)	WS-II;HQW,NSW	08/03/92
From source to a point 0.7 mile upstream of mouth			
Meeting House Branch	27-72-3	C;Sw,NSW	05/01/88
From source to Bear Creek			
Merkle Bay	27-148-3	SA;HQW,NSW	05/01/88
From source to West Bay			
Merkle Hammock Creek	27-149-1-2	SA;NSW,ORW	01/01/90
From source to Thorofare Bay			
Mesic Creek	27-150-19	SA;HQW,NSW	05/01/88
From source to Bay River			
Middle Bay	27-154	SA;HQW,NSW	05/01/88
From source to Pamlico Sound			
Middle Canal	27-112-1-1-1	C;Sw,NSW	05/01/88
From source to East Canal			
Middle Creek	27-43-15-(4)	C;NSW	05/01/88
From dam at Sunset Lake to Swift Creek			
Middle Creek	27-43-15-(1)	C;NSW	05/01/88
From source to backwaters of Sunset Lake			
Middle Creek (Sunset Lake)	27-43-15-(2)	B;NSW	05/01/88
From backwaters of Sunset Lake to dam at Sunset Lake			
Middle Swamp	27-86-26-5	C;Sw,NSW	05/01/88
From source to Little Contentnea Creek			
Milburnie Creek (Milburnie Lake)	27-31	C;NSW	05/01/88
From source to Neuse River			
Mill Branch	27-86-5.5	WS-IV;NSW	08/03/92
From source to Contentnea Creek			
Mill Branch	27-72-4	C;Sw,NSW	05/01/88
From source to Bear Creek			
Mill Branch	27-101-9	C;Sw,NSW	05/01/88
From source to Trent River			
Mill Branch	27-80-8	C;Sw,NSW	05/01/88
From source to Southwest Creek			

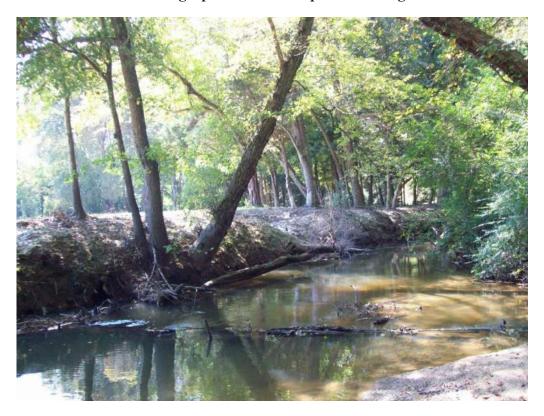
### 2012 North Carolina 303(d) List-Category 5

Neuse	Neuse River Basin	asin		10-digi	10-digit Watershed	0302020108			Crabtree Creek	reek
AU N	AU Number	Name		Description			Length or Area	a Units	Classification	Category
	Category	/ Rating	Use		Reason for Rating	Parameter			Year	
> 27-33	27-33-4-1	Little Brier Creek		From source to Brier	to Brier Creek		5.3	FW Miles	C;NSW	55
	.C	Impaired	Fish Consumption	tion	Standard Violation	PCB			2008	
> 27-33-5	3-5	Black Creek		From source	From source to Crabtree Lake, Crabtree Cr.	ő	3.6	FW Miles	C;NSW	55
	2	Impaired	Aquatic Life		Fair Bioclassification	Ecological/biological Integrity Benthos	tegrity Bentho	SC	1998	
Neuse	Neuse River Basin	asin		10-dig	10-digit Watershed	0302020109			Middle Creek	reek
				12-d	12-digit Subwatershed	030202010902			Middle Middle Creel	Creel
> 27-4	27-43-15-8-(2)	Terrible Creek		From dam at	From dam at Johnsons Pond to Middle Creek	reek	7.8	FW Miles	C;NSW	R
	2	Impaired	Aquatic Life		Fair Bioclassification	Ecological/biological Integrity Benthos	tegrity Bentho	SC	2012	
				12-d	12-digit Subwatershed	030202010901			UpperMiddle Creek	Creek
> 27-4	27-43-15-(1)b1	Middle Creek		From 0.8 mil	es south of US 1 to ut on we	From 0.8 miles south of US 1 to ut on west of creek 3.0 miles downstream	3.0	FW Miles	C;NSW	r.
	Ŋ	Impaired	Aquatic Life		Fair Bioclassification	Ecological/biological Integrity Benthos	tegrity Bentho	sc	2008	
> 27-48	27-43-15-(1)b2	Middle Creek		From ut on w Sunset Lake	vest isde of creek 3.0 miles d	From ut on west isde of creek 3.0 miles downstream to backwaters of Sunset Lake	1.6	FW Miles	C;NSW	rv.
	2	Impaired	Aquatic Life		Standard Violation	Turbidity			2012	
	Ŋ	Impaired	Aquatic Life		Fair Bioclassification	Ecological/biological Integrity Benthos	tegrity Bentho	SC	2012	
> 27-43	27-43-15-(1)but3	t3 UT to Middle Creek		source to Middle Creek	ddle Creek		2.6	FW Miles		r.
	2	Impaired	Aquatic Life		Standard Violation	Turbidity			2012	
> 27-4	27-43-15-(4)a1	Middle Creek		From dam at Sunset	Sunset Lake to small impou	Lake to small impoundment upstream of US 401	4.5	FW Miles	C;NSW	ıs
	2	Impaired	Aquatic Life		Standard Violation	Turbidity			2010	
Neuse	Neuse River Basin	asin		10-di	10-digit Watershed	0302020110			Swift Creek	reek
				12-d	12-digit Subwatershed	030202011002			Lake Benson-Swift Creel	t Creel

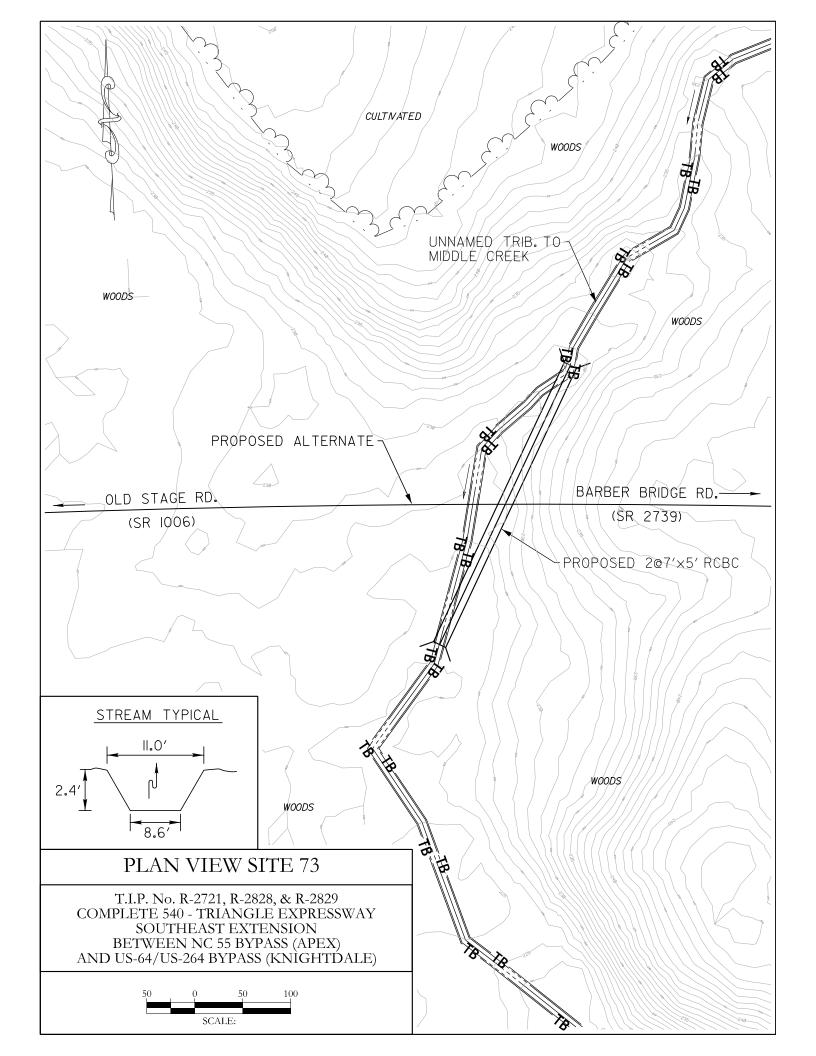
	CLEARED ACRICULT.	80.0 = 0.08	TPS=44 WE=36 D=7.6/9.6	4200=25 OHW:	PDERICA ONT. 11 AND DERICA ON THE PARTY OF T	CH.MATIL = SILT &
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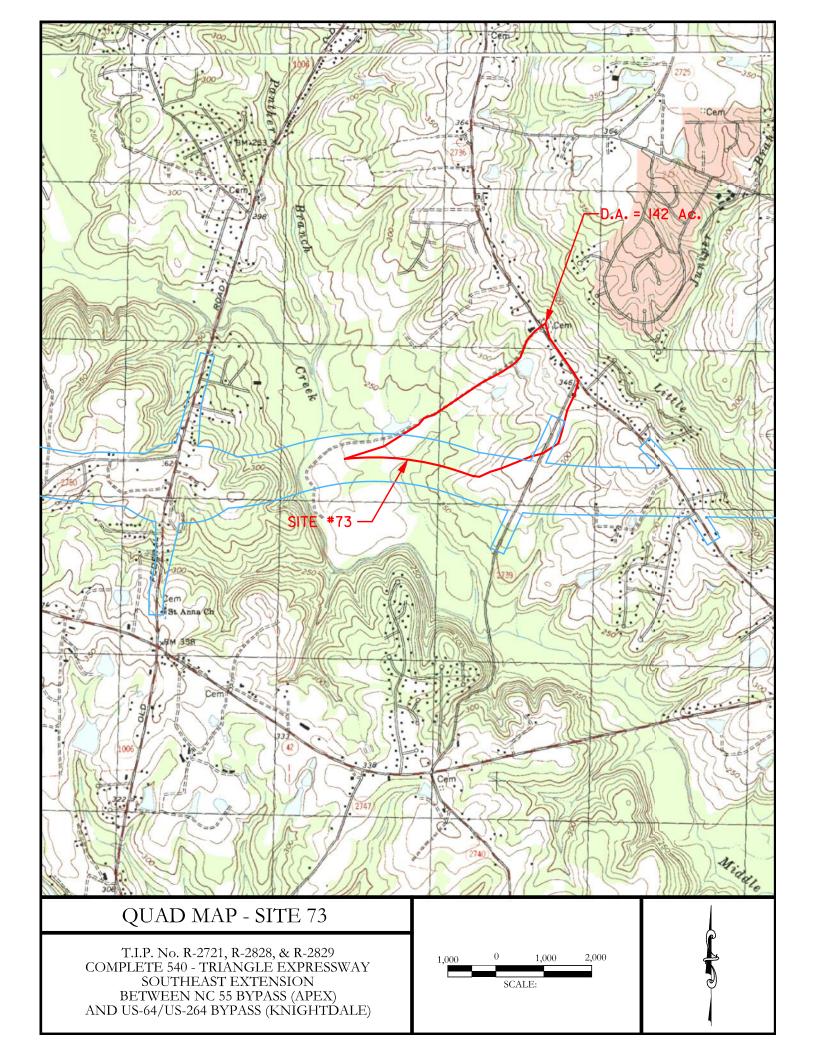


Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.





Site #73

4/18/2014

STREAM NAME: Unnamed Trib to Middle Creek sq. miles METI 0.22 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = ENGLISH

REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00

USGS RUF	RAL REGRE	USGS RURAL REGRESSION EQUAT	ATIONS (OLD) Blue Ridge	RUE	RAL EQUA	Coastal Plain	RURAL EQUATIONS Report 01-4207  UENCY Blue Ridge Coastal Plain Sand Hills	
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)	
2YR	9.79	26.65	50.58	2YR	46.64	23.35	11.40	
5YR	15.96	61.73	89.92	5YR	86.82	49.32	19.20	
10YR	21.00	96.52	122.03	10YR	122.58	74.09	25.37	
25YR	27.65	161.76	173.22	25YR	179.25	114.49	34.35	
50YR	33.37	225.01	217.15	50YR	230.16	152.73	42.15	
100YR	39.69	307.68	271.59	100YR	289.18	198.64	50.46	
200YR	48.75	411.49	330.62	200YR	357.29	253.28	60.17	
500YR	56.35	589.43	439.95	500YR	464.11	341.78	74.55	

# **USGS URBAN REGRESSION EQUATIONS**

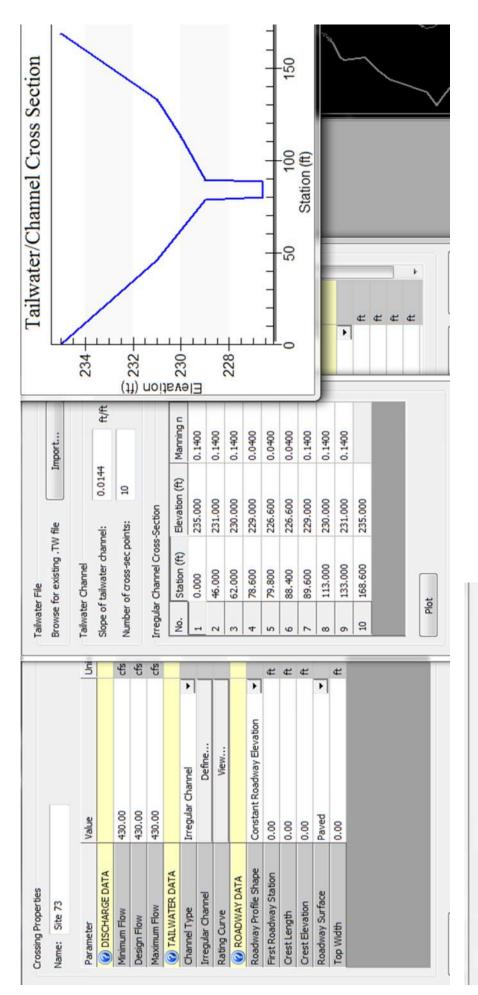
BDF=

(These Equations are used only for comparison)

								(Based on 2.80xQ10)	
		(cfs)						724.53	
dis ale used of ily for compalisorily	FREQUENCY Sand Hills Coastal Plain	(cts)	155.84	215.00	319.62	412.64	539.22	601.99	890.33
	Sand Hills	(cfs)	54.27	64.45	77.78	87.95	100.56	180.45	129.87
( Hese Edualic	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

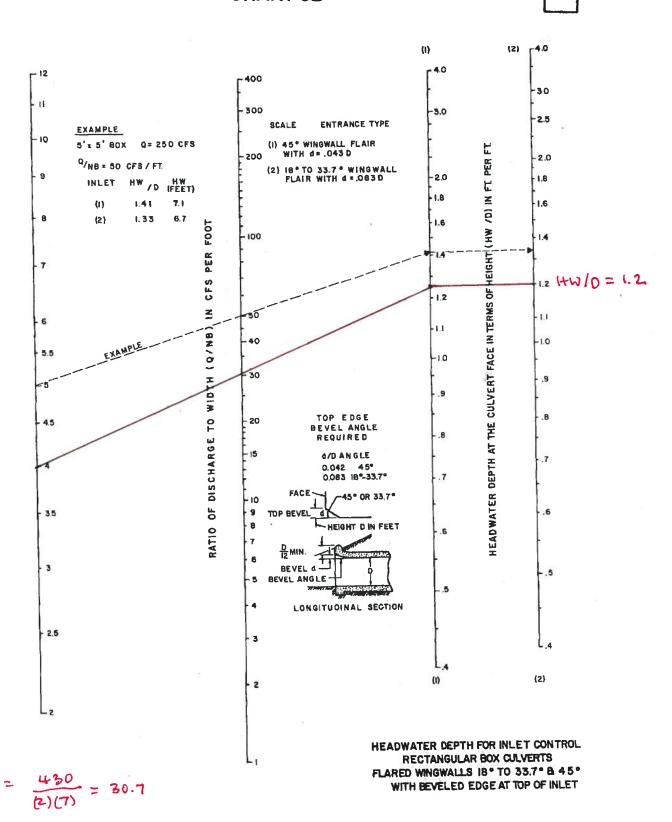
et 007-00
<b>USGS Fact Sheet 00</b>
Fact
USGS
Impervious) USG
<b>"</b> %
<b>I EQUATIONS (% Im</b>
C REGRESSION
S

FEMA	Disharges								
Œ	FREQUENCY			10YR	50YR	100YR	100YR	500YR	
									<u> </u>
	Blue Ridge Discharge Used					430		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	Blue Ridge	(cts)	177.37	237.46	367.84	425.61	482.38	664.88	869.09
	Coastal Plain	(cts)	159.48	222.01	358.78	430.34	501.97	621.64	812.57
25	Sand Hills	(cts)	108.34	142.32	196.44	231.82	264.64	398.51	520.91
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

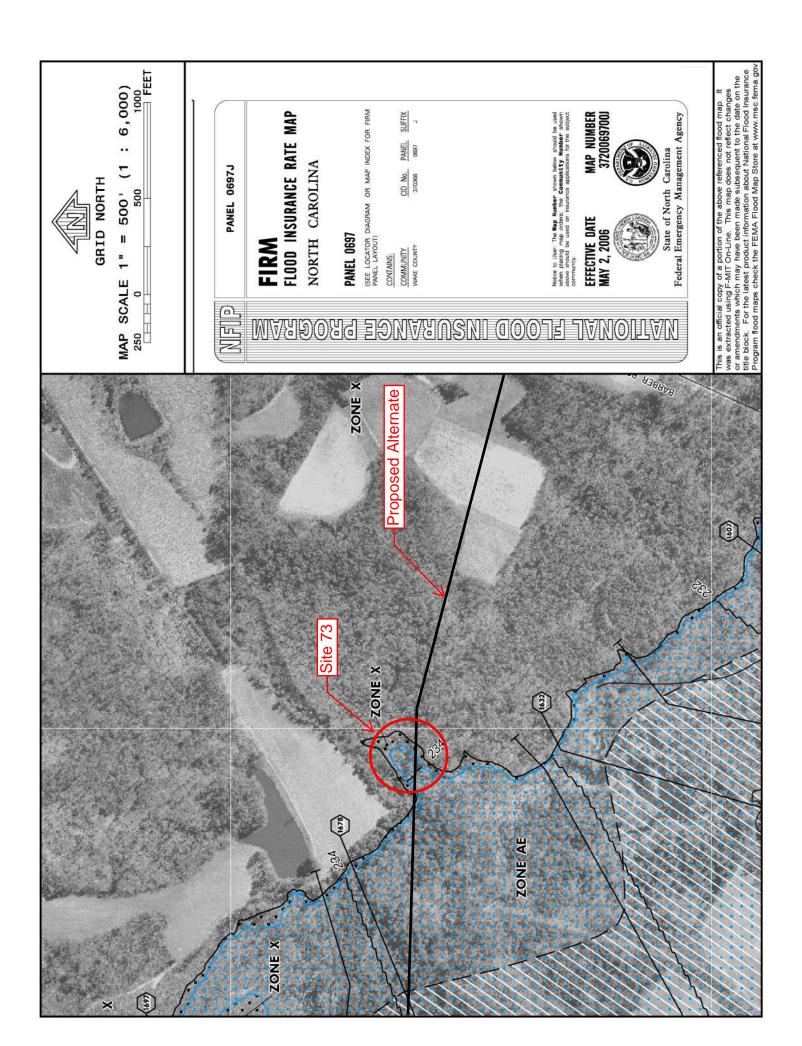


Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s) Shear (psf)	Shear (psf)
430.000	230.589	3.989	4.735	3.584
430.000	230.589	3.989	4.735	3.584
430.000	230.589	3.989	4.735	3.584
430.000	230.589	3.989	4.735	3.584
430.000	230.589	3.989	4.735	3.584
430.000	230.589	3.989	4.735	3.584
430.000	230.589	3.989	4.735	3.584
430.000	230.589	3.989	4.735	3.584
430.000	230.589	3.989	4.735	3.584
430.000	230.589	3.989	4.735	3.584
430.000	230.589	3.989	4.735	3.584

### **CHART 9B**



PROPOSED STEVENUE:



Name	Index Number	Ne Classification	cuse River Basin Class Date
Description		Specia	l Designation
McGowan Creek (Efland Millpond)	27-2-5-(1)	WS-II;HQW,NSW	08/03/92
From source to a point 0.7 mile upstream of mouth			
Meeting House Branch	27-72-3	C;Sw,NSW	05/01/88
From source to Bear Creek			
Merkle Bay	27-148-3	SA;HQW,NSW	05/01/88
From source to West Bay			
Merkle Hammock Creek	27-149-1-2	SA;NSW,ORW	01/01/90
From source to Thorofare Bay			
Mesic Creek	27-150-19	SA;HQW,NSW	05/01/88
From source to Bay River			
Middle Bay	27-154	SA;HQW,NSW	05/01/88
From source to Pamlico Sound			
Middle Canal	27-112-1-1-1	C;Sw,NSW	05/01/88
From source to East Canal			
Middle Creek	27-43-15-(4)	C;NSW	05/01/88
From dam at Sunset Lake to Swift Creek			
Middle Creek	27-43-15-(1)	C;NSW	05/01/88
From source to backwaters of Sunset Lake			
Middle Creek (Sunset Lake)	27-43-15-(2)	B;NSW	05/01/88
From backwaters of Sunset Lake to dam at Sunset Lake			
Middle Swamp	27-86-26-5	C;Sw,NSW	05/01/88
From source to Little Contentnea Creek			
Milburnie Creek (Milburnie Lake)	27-31	C;NSW	05/01/88
From source to Neuse River			
Mill Branch	27-86-5.5	WS-IV;NSW	08/03/92
From source to Contentnea Creek			
Mill Branch	27-72-4	C;Sw,NSW	05/01/88
From source to Bear Creek			
Mill Branch	27-101-9	C;Sw,NSW	05/01/88
From source to Trent River			
Mill Branch	27-80-8	C;Sw,NSW	05/01/88
From source to Southwest Creek			

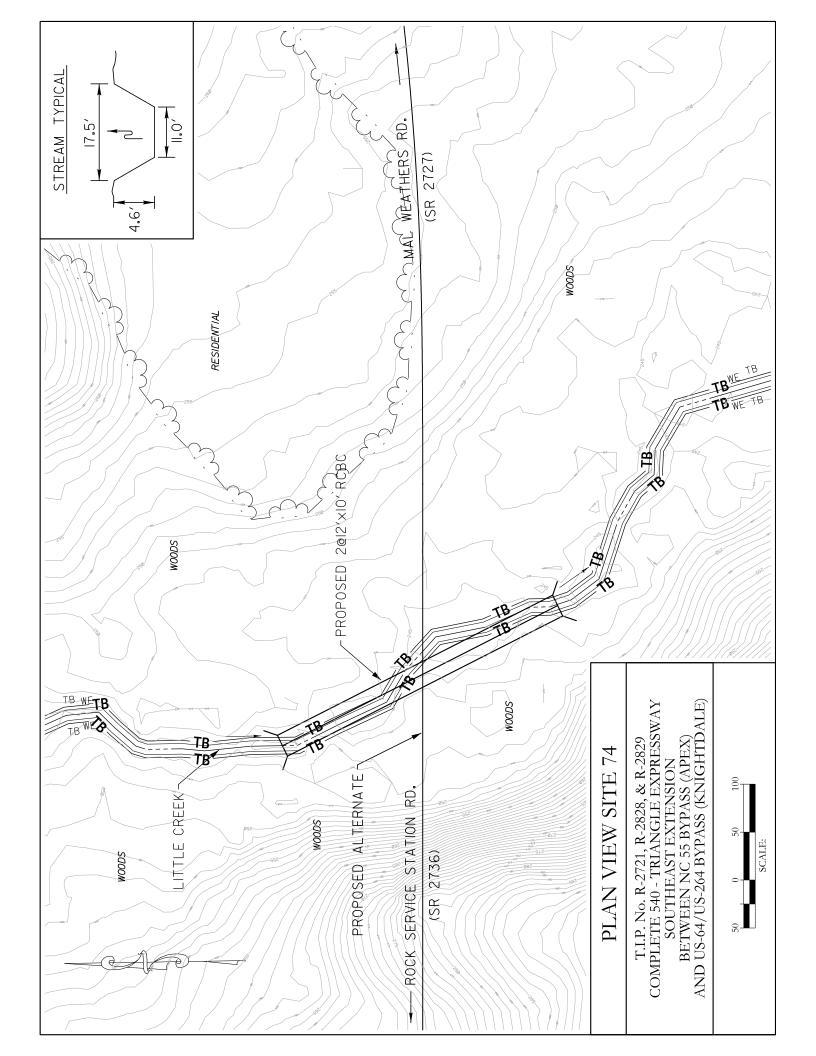
3 1 2 2		MOODS 11=0.14	TB-TB 11.0		ATE STATES
	21 2115				MATTORIL KAND LOBANEL

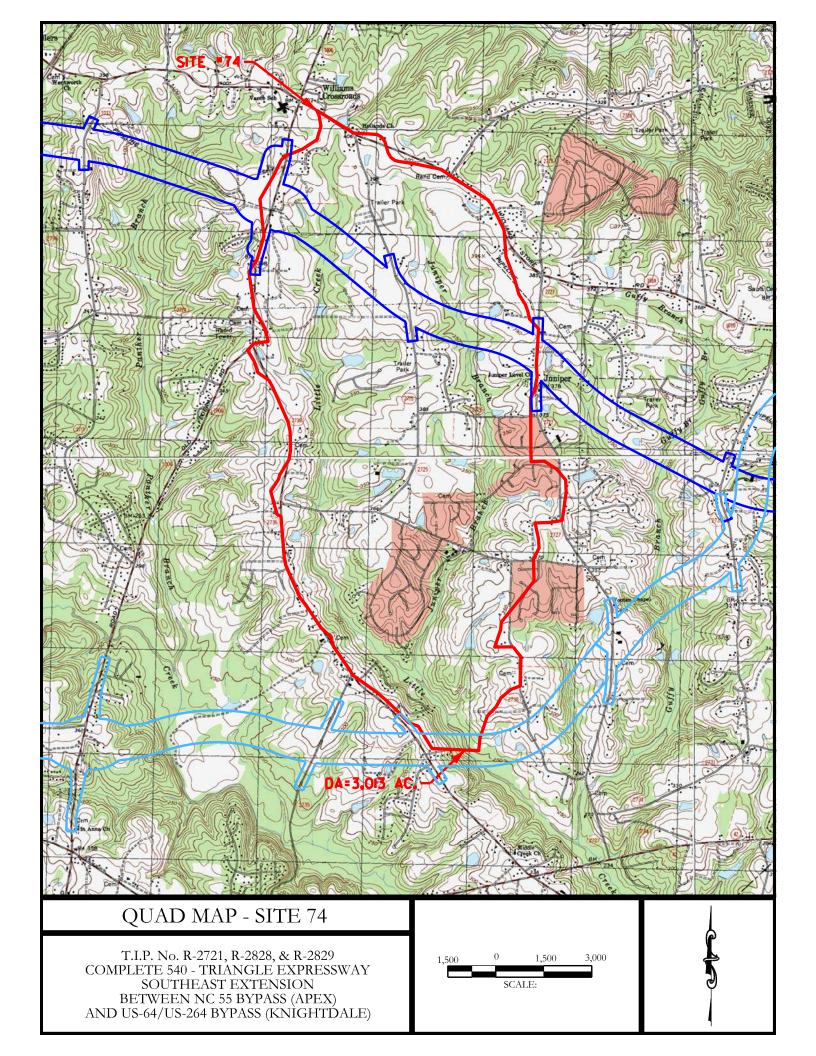


Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.





# **North Carolina**

REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00 STREAM NAME: Little Creek sq. miles PROJECT NAME: Triangle Expressway SE Ext. 4.7 Drainage Area = 4/18/2014 ENGLISH

ort 01-4207	Sand Hills	(cts)	100.83	164.22	214.38	286.70	349.62	414.71	491.48	605.25
RURAL EQUATIONS Report 01-4207	Coastal Plain	(cts)	183.33	344.64	486.97	703.49	899.11	1123.71	1381.15	1780.08
RAL EQUA	Blue Ridge	(cfs)	400.08	96.689	930.41	1291.55	1608.34	1959.83	2355.58	2958.54
RUF	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR
ATIONS (OLD)	ш			699.45						2963.44
<b>USGS RURAL REGRESSION EQUA</b>	Coastal Plain	(cfs)	184.55	366.73	534.42	824.64	1085.56	1409.11	1805.47	2440.06
AL REGRE	Sand Hills	(cts)	92.34	152.91	202.41	275.58	338.82	410.38	505.61	610.02
<b>USGS RUR</b>	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR

# **USGS URBAN REGRESSION EQUATIONS**

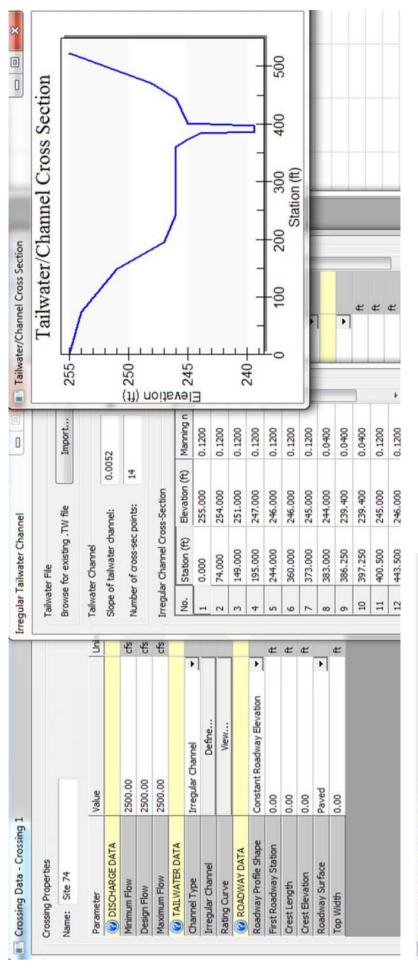
BDF= 11

(These Equations are used only for comparison)

								(Based on 2.80xQ10)		
	Blue Ridge	(cfs)	1742.09	2109.56	2658.38	3181.14	3871.36	5906.77	5462.85	
These Equations are used only for companison)	Coastal Plain	(cfs)	1052.81	1356.36	1862.07	2336.80	2972.43	3797.81	4658.17	
is air asca offiy		(cts)				909.94	1080.90	1763.73	1494.61	
ל וווכפת בלתמוות	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR	

# NC REGRESSION EQUATIONS (% Impervious) USGS Fact Sheet 007-00

% Impervious =	20				FEMA	4
FREQUENCY	Sand Hills (cfs)	Coastal Plain (cfs)	Blue Ridge (cfs)	Blue Ridge Discharge Used (cfs)	FREQUENCY	Disharges
5YR		1042.79	1255.93			
10YR		1341.28	1572.59		10YR	
25YR		1864.19	2166.88		50YR	
50YR		2174.69	2460.95	2500	100YR	1,150
100YR		2473.51	2736.49		100YR (future)	2,730
200YR		3755.57	4403.24	(Based on 2.80xQ10)	500YR	
500YR		4909.07	5755.66	(Based on 3.66xQ10)		



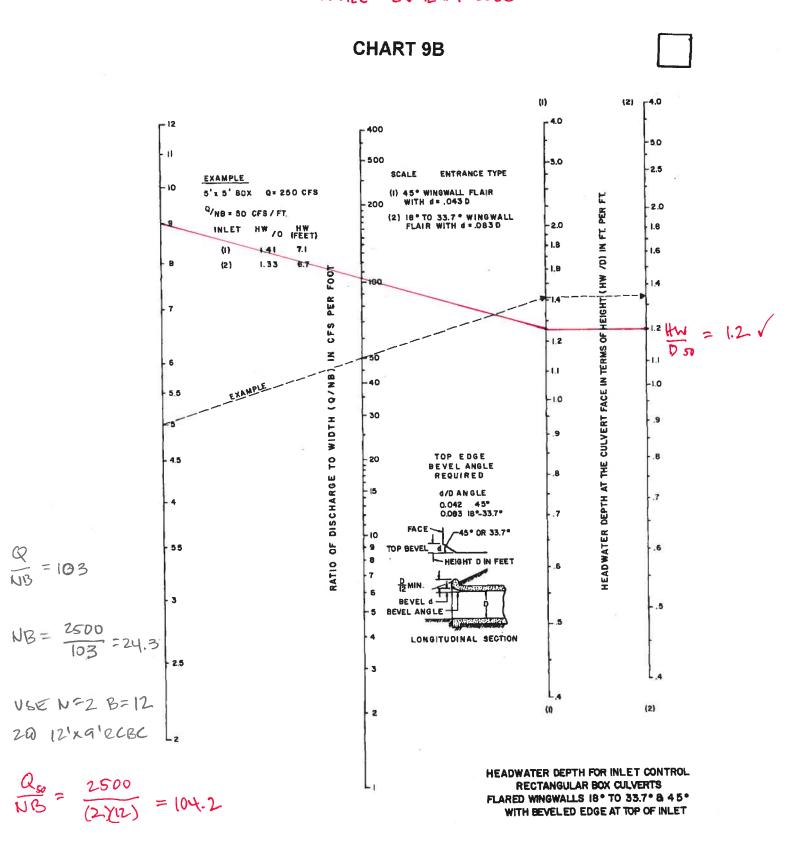
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Elevation (ft) Depth (ft) Velocity (ft/s) Shear (psf)	248.700 9.300 2.933 3.018	248.700 9.300 2.933 3.018	248.700 9.300 2.933 3.018	248.700 9.300 2.933 3.018	248.700 9.300 2.933 3.018	248.700 9.300 2.933 3.018	248.700 9.300 2.933 3.018	248.700 9.300 2.933 3.018	248.700 9.300 2.933 3.018	248.700 9.300 2.933 3.018	
Flow (cfs)	2500.000	2500.000	2500.000	2500.000	2500.000	2500.000	2500.000	2500.000	2500.000	2500.000	

Site 74

512E = 20 12'x 10' 2CBC

EFF. SIZE = 20 12'x 9' 2CBC



# PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY <u>Wake</u>	PROJECT NUMBER <u>R-2721</u> , <u>R-2828</u> & <u>R-2829</u>
STREAM Little Creek	· · · · · · · · · · · · · · · · · · ·
(Site 74) ASSESSMENT PREPARED	O BY Mulkey, INC. DATE 12/27/2013 (WBP)
	HYDROLOGIC EVALUATION
NEAREST GAGING STAT	ION ON THIS STREAM (NONE <u>X</u> )
ARE FLOOD STUDIES AV	AILABLE ON THIS STREAM: Yes
FLOOD DATA: Q <sub>10</sub> <u>1,600</u> CFS EST. BKV Q <sub>50</sub> <u>2,500</u> CFS EST. BKV Q <sub>500</sub> <u>5,800</u> CFS EST. BKV	WTR. $\underline{N/A}$ FT. $Q_{25}$ $\underline{2,200}$ CFS EST. BKWTR. $\underline{N/A}$ FT. WTR. $\underline{N/A}$ FT. $Q_{100}$ $\underline{2,700}$ CFS EST. BKWTR. $\underline{N/A}$ FT. WTR. $\underline{N/A}$ FT.
DRAINAGE AREA <u>4.7 Sq. :</u>	Mi. METHOD USED TO COMPUTE Q: USGS Urban Regression
<u>P</u>	ROPERTY RELATED EVALUATIONS
DAMAGE POTENTIAL: LO	OW MODERATE X HIGH
COULD THIS BE SI	IGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT:	: YES NO <u>X</u>
EXPLANTION: No f	floodway designated at this site.
LIST BUILDINGS I	N FLOOD PLAIN: None LOCATION:
UPSTREAM LAND ANTICIPATE ANY	
ANY FLOOD ZONII	NG? (FIS STUDIES, ETC.) YES X NO
TYPE OF STUDY: 1	FEMA – Special Flood Hazard Zone AE
REGULATORY FLO	OODWAY WIDTH 167 ft. Section 225 (AS NOTED IN FIS)
COMMENTS:	

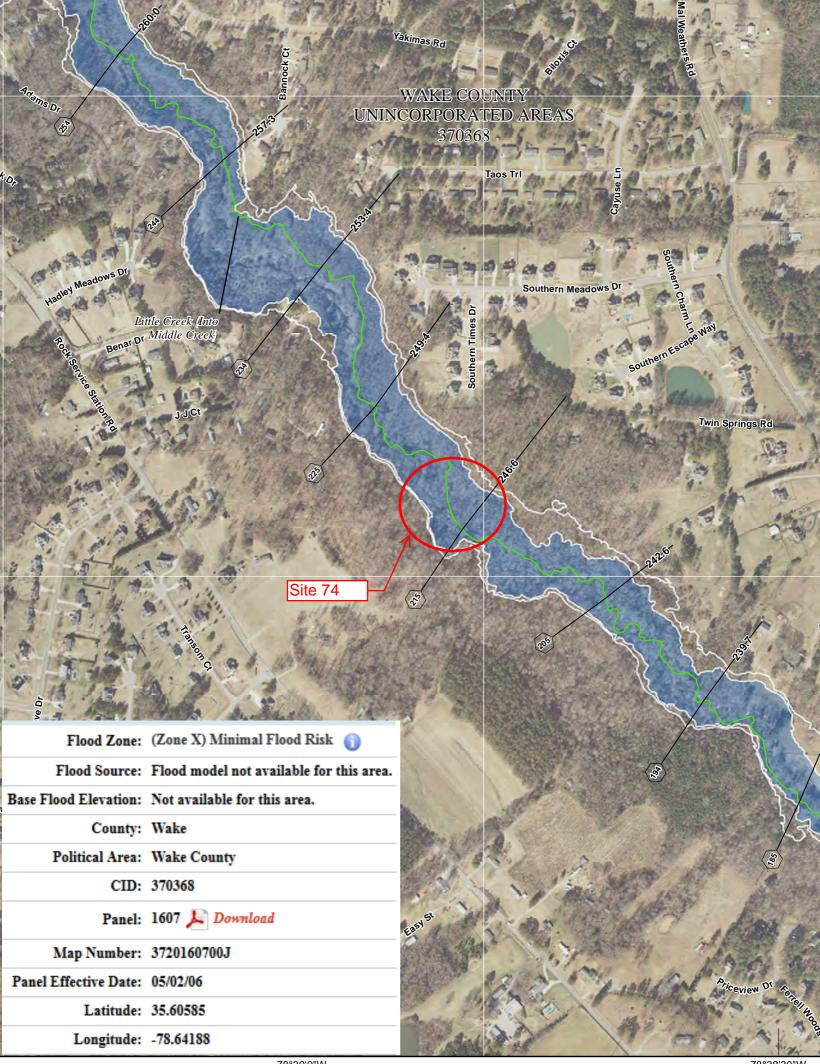
# TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 14,200 VPD % TRUCKS 12								
DESIGN YEAR 2035 TRAFFIC COUNT 44,800 VPD % TRUCKS 12								
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE								
DETOUR AVAILABLE? <u>N/A New Location</u> LENGTH OF DETOUR <u>N/A</u> MILES								
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location								
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? N/A								
COMMENTS:								
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS  NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.  LEVEES AGGRADATION/DEGRADATION RESERVOIRS								
DIVERSIONS DRAINAGE DISTRICT NAVIGATION								
BACKWATER FROM ANOTHER SOURCE  EXPLANATION:								
ROADWAY OVERFLOW SECTION (NONE X ) LENGTH ELEVATION								
EMBANKMENT: SOIL TYPE Wehadkee TYPE SLOPE COVER Vegetation								
COMMENTS: Soil Type from Web Soil Survey website of Wake County, NC.								
ENVIRONMENTAL CONSIDERATIONS								

LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: <u>Buried culverts 1 foot to allow for fish passage.</u>

## MISCELLANEOUS COMMENTS

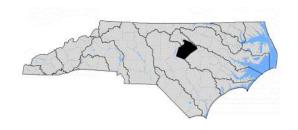
IS THERE UNUSUAL SCOUR POTENTIAL? YES NO X PROTECTION NEEDED								
ARE BANKS STABLE? Yes PROTECTION NEEDED No								
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No								
COMMENTS:								
<u>ALTERNATIVES</u>								
RECOMMENDED DESIGN: 2@12'x10' RCBC								
DETOUR STRUCTURE N/A								
BRIDGE WATERWAY OPENING: 240 sq. ft.								
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO $\underline{X}$ DISCUSSION:								
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:								
(1)NORMAL PROCESS								
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood Elevation								
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:								



# PRELIMINARY FLOOD INSURANCE STUDY

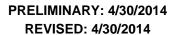
# FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

State of North Carolina

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed

Source	Riverin	e Sources	Affected Communities		
	From	То			
Buckhorn Creek	The confluence with Harris Reservoir	Approximately 0.5 mile upstream of Honeycutt Road	Rdu Town Of Holly Springs Wake County		
Buffalo Creek (Basin 9, Stream 1)	State Highway 42	The Johnston/Wake County boundary	Rdu Wake County		
Cary Branch	The confluence with Harris Reservoir	Approximately 2.5 miles upstream of Rex Road	Rdu Town Of Holly Springs Wake County		
Guffy Branch (Basin 21, Stream 4)	The confluence with Little Creek (Basin 21, Stream 1)	Approximately 4.3 miles upstream of confluence with Little Creek (Basin 21, Stream 1)	Rdu Wake County		
Harris Reservoir	Entire shoreline within Chatham County	Entire shoreline within Chatham County	Rdu Wake County		
Jim Branch	The confluence with Harris Reservoir	Approximately 0.5 mile upstream of confluence with Harris Reservoir	Rdu Wake County		
Juniper Branch (Basin 21, Stream 2)	The confluence with Little Creek (Basin 21, Stream 1)	Approximately 0.8 mile upstream of Pagen Road	Rdu Wake County		
Little Black Creek	The confluence with Black Creek	Approximately 0.6 mile upstream of Walter Myatt Road	Rdu Wake County		
Little Creek (Into Middle Creek)	The confluence with Middle Creek	Approximately 2.3 miles upstream of the confluence of Juniper Branch	Rdu Wake County		
Marks Creek	The confluence with the Neuse River	Approximately 0.8 mile downstream of Knightdale Eagle Rock Road	Rdu Town Of Clayton Town Of Wendell Wake County		
Nancy Branch	Approximately 0.4 mile upstream of confluence with Panther Creek	Approximately 0.1 miles upstream of Del Webb Avenue	Town Of Cary		
Norris Branch	The confluence with Cary Branch	Approximately 500 feet upstream of Avent Ferry Road	Rdu Town Of Holly Springs Wake County		
Snipes Creek	The confluence with the Little River	Approximately 0.6 mile upstream of State Highway 96	Rdu Town Of Zebulon Wake County		
Thomas Creek	The confluence with Harris Reservoir	Approximately 100 feet downstream of Highway 1	Rdu Wake County		

Table 11, "Stream Name Changes" is not applicable in Wake County.

This FIS also incorporates the determinations of letters issued by FEMA resulting in map changes (Letters of Map Revision [LOMRs]), as shown in Table 12, "Letters of Map Revision".

**Table 12 - Letters of Map Revision** 

Case Number	Date Issued	Flooding Source/Description	Communities
06-04-C341P	12/3/2007	Marks Creek / 06-04-C341P	Rdu
06-04-C341P	12/3/2007	Marks Creek / 06-04-C341P	Town Of Wendell
07-04-2076P	4/13/2007	Panther Creek / 07-04-2076P	Town Of Cary

# 5.0 Engineering Methods

For the flooding sources in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded at least once on the average during any 10-, 25-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2% annual chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedance) during the term of a 30-year mortgage is approximately 26 percent (about 3 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

**Table 13 - Summary of Discharges** 

Table 13 - Summ		Discharges (cfs)				
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance	
Just upstream of Chatham/Wake County boundary	3.80	*	*	2,450	*	
Approximately 0.9 mile upstream of Chatham/Wake County boundary	3.30	1,220	1,990	2,320	3,240	
Approximately 1,580 feet downstream of New Hill Olive Chapel Road	2.20	986	1,720	2,060	3,060	
Approximately 0.4 mile upstream of New Hill Olive Chapel Road	1.40	888	1,380	1,630	2,380	
Little Creek (Into Middle Creek)					•	
Approximately 530 feet downstream of Wake/Johnston County boundary	9.90	*	*	1,710	*	
At confluence of Guffy Branch (Basin 21, Stream 4)	5.19	*	*	1,190	*	
Approximately 1,580 feet upstream of confluence of Guffy Branch (Basin 21, Stream 4)	5.05	*	*	1,171	*	
Approximately 0.9 mile downstream of confluence of Juniper Branch (Basin 21, Stream 2)	4.86	*	*	1,150	*	
Approximately 0.5 mile downstream of confluence of Juniper Branch (Basin 21,	4.42	*	*	1,080	*	
4 ————————————————————————————————————	2.27	*	*	744	*	
Approximately 0.8 mile downstream of Pagan Road	2.04	*	*	701	*	
Approximately 530 feet upstream of Pagan Road	1.52	*	*	594	*	
Approximately 0.7 mile upstream of Pagan Road	1.18	*	*	513	*	
Little River						
At Wake/Johnston County boundary	69.24	*	*	11,700	*	
Marks Creek						
Approximately 0.7 mile downstream of Knightdale Eagle Rock Road	7.90	*	*	3,300	*	
Middle Creek						
Just upstream of Panther Branch (Basin 22, Stream 2)	56.70	*	*	9,900	*	
Just upstream of Terrible Creek (Basin 22, Stream 19)	43.60	*	*	8,600	*	
Moccasin Creek						
Approximately 0.4 mile upstream of Franklin/Nash County boundary	27.96	*	*	7,470	*	
Approximately 0.9 mile upstream of Franklin/Nash County boundary	26.57	*	*	7,230	*	
Morris Branch				,		
At Chatham/Wake County boundary	1.40	821	1,380	1,730	2,730	
Approximately 0.4 mile upstream of Chatham/Wake County boundary	1.20	707	1,300	1,630	2,490	
Just downstream of Green Level to Durham Road	0.80	765	1,080	1,230	1,840	
Norris Branch	•		,			
Just upstream of confluence with Cary Branch	1.70	*	*	1,038	*	
Panther Creek		•	•	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
At Chatham/Wake County boundary	3.60	800	1,600	2,150	4,100	
At Yates Store Road	2.50	635	1,330	1,795	3,400	
Just upstream of Yates Store Road	2.00	555	1,170	1,590	3,030	
Approximately 0.8 mile upstream of Yates Store Road just downstream of tributary	1.40	445	955	1,305	2,525	
Approximately 0.8 mile upstream of Yates Store Road just upstream of tributary	0.80	320	695	960	1,800	
Poplar Creek (Basin 13, Stream 1)					1 /***	
At mouth	9.00	*	*	3,600	*	
				10,000		
Reedy Branch (Basin 27, Stream 5)	4 10	1 520	2 550	3 020	4.430	
At confluence with Beaver Creek	4.10	1,520	2,550	3,020	4,430	
Terrible Creek (Basin 22, Stream 19)	1,000			1,00-	1.	
At mouth	12.30	*	*	4,600		

**Table 16 - Roughness Coefficients** 

Stream	Channel "n"	Overbank "n"
Beaver Creek	0.043 to 0.050	0.100 to 0.200
Beddingfield Creek	0.050	0.130
Big Branch	0.050	0.140
Black Creek	0.025 to 0.060	0.030 to 0.150
Buckhorn Creek	0.040 to 0.048	0.145
Buffalo Creek (Basin 9, Stream 1)	0.030 to 0.070	0.035 to 0.140
Buffalo Creek West	0.045 to 0.052	0.030 to 0.140
Cary Branch	0.040	0.140
Guffy Branch (Basin 21, Stream 4)	0.047	0.130
Jim Branch	0.045	0.145
Juniper Branch (Basin 21, Stream 2)	0.045	0.110 to 0.130
Kit Creek	0.030 to 0.070	0.070 to 0.110
Little Beaver Creek	0.045 to 0.055	0.100 to 0.220
Little Black Creek	0.030 to 0.070	0.070 to 0.130
Little Creek (Basin 11 Stream 2)	0.030 to 0.080	0.070 to 0.150
Little Creek (Into Middle Creek)	0.033 to 0.047	0.095 to 0.140
Little River	0.040 to 0.066	0.070 to 0.240
1 arks Creek	0.025 to 0.070	0.070 to 0.130
Middle Creek	0.042 to 0.050	0.030 to 0.140
Mill Branch	0.050	0.030 to 0.150
Mill Creek (South)	0.035 to 0.060	0.040 to 0.160
Moccasin Creek	0.030 to 0.070	0.070 to 0.220
Morris Branch	0.030 to 0.050	0.100 to 0.200
Nancy Branch	0.045 to 0.050	0.120 to 0.150
Neuse River	0.035 to 0.060	0.055 to 0.250
Norris Branch	0.048	0.145
Panther Creek	0.030 to 0.070	0.070 to 0.130
Reedy Branch (Basin 27, Stream 5)	0.045 to 0.050	0.100 to 0.200
Snipes Creek	0.042 to 0.045	0.120 to 0.130
Swift Creek	0.040 to 0.072	0.035 to 0.240
Thomas Creek	0.050	0.145
Unnamed Tributary (#1) to Swift Creek	0.045 to 0.060	0.050 to 0.150
White Oak Creek	0.035 to 0.050	0.035 to 0.150

For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained using digital elevation data obtained with LIDAR technology developed as part of the North Carolina Statewide Floodplain Mapping Program. The hydraulic model is prepared using this digital elevation data, without surveying bathymetric or structural data. Where bridge or culvert data are readily available, such as from the North Carolina Department of Transportation, these data have been reflected in the hydraulic model. If these structural data are not readily available, field measurements of these structures were made to approximate their geometry in the hydraulic models. In addition, this method does not include field surveys that determine specifics on channel and floodplain characteristics. A limited detailed study is a "buildable" product that can be upgraded to a fully detailed study at a later date by verifying stream channel characteristics, bridge and culvert opening geometry, and by analyzing multiple recurrence intervals.

The results of the HEC-RAS computations are tabulated for all cross sections (Table 17, "Limited Detailed Flood Hazard Data"). Flood Profiles have not been developed for streams studied by limited detailed methods. Water-surface elevation rasters were developed for steams studied by limited detailed methods. In addition, floodways for streams studied by limited detailed methods are not delineated on the FIRM. However, the 1% annual chance water-surface elevations, flood discharges, and non-encroachment widths from the limited detailed studies for every modeled cross section are given in Table 17. The non-encroachment widths given at modeled cross sections can be used by communities to enforce floodplain management ordinances that meet the requirement defined in 44 CFR 60.3(c)(10).

Between cross sections for streams studied by limited detailed methods, 1% annual chance water-surface elevations can be calculated by mathematical interpolation using the distance along the stream centerline. Non-encroachment widths and, therefore, the location of a non-encroachment area boundary between cross sections should be determined based on either 1) mathematical interpolation, or 2) the non-encroachment width at the upstream or downstream cross section, whichever is larger. If the width determined by this second method is wider than the Special Flood Hazard Area (SFHA) or the 1% annual chance floodplain delineated on the FIRM for this location along the stream, the non-encroachment area shall be considered to

Table 17 - Limited Detailed Flood Hazard Data

	Table 17 - Lir	nited Detailed Floo	d Hazard Data	
Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water- Surface Elevation (feet NAVD 88)	Non-Encroachment Width (feet) Left/Right from Stream Centerline
141	14,062	1,711	226.0	93 / 160
145	14,514	1,711	226.7	82 / 182
150	15,014	1,711	227.5	156 / 169
155	15,534	1,711	228.6	20 / 116
156	15,625	1,711	230.2	-9,999 / -9,999
157	15,653	1,711	230.2	-9,999 / -9,999
161	16,094	1,711	230.9	218 / 20
164	16,441	1,711	231.2	20 / 119
170	17,015	1,189	232.2	155 / 17
175	17,509	1,189	232.9	28 / 17
180	17,976	1,189	234.5	40 / 25
185	18,475	1,189	236.5	64 / 16
190	18,961	1,171	238.2	86 / 13
194	19,395	1,171	239.7	50 / 28
		1,171		
199	19,948	1,171	241.3	61 / 33
205	20,461	1,171	242.6	90 / 58
210	20,961	1,145	243.9	17 / 67
215	21,461	1,145	246.6	125 / 65
220	21,961	<u> </u>	248.6	45 / 151
225	22,461	1,145	249.4	90 / 77
Site 74	23,014	1,145	250.9	17 / 79
23 Offe 74	23,441	1,145	253.4	54 / 77
239	23,941	1,085	255.9	16 / 250
244	24,369	1,085	257.3	32 / 94
249	24,869	1,085	259.0	68 / 45
254	25,411	1,085	260.0	59 / 132
258	25,843	1,085	260.8	32 / 82
264	26,436	744	263.0	58 / 50
269	26,895	744	265.6	27 / 20
274	27,383	744	269.1	52 / 13
279	27,877	744	272.7	13 / 44
284	28,377	744	275.7	102 / 49
289	28,886	744	278.5	13 / 102
294	29,374	744	281.8	13 / 49
299	29,874	701	284.1	30 / 84
304	30,374	701	286.3	62 / 28
309	30,874	701	289.4	18 / 76
314	31,420	701	293.9	40 / 20
318	31,824	701	295.9	13 / 86
		701		
322	32,162	701	296.9	16/92
327	32,701	701	299.5	37 / 58
332	33,186	701	302.0	17 / 88
336	33,555	701	303.3	79 / 13
338	33,785	701	306.6	-9,999 / -9,999
338	33,826	701	306.6	-9,999 / -9,999

Table 11—Limited Detailed Flood Hazard Data

Cross Section <sup>1</sup>	Stream Station <sup>2</sup>	Existing Flood Discharge (cfs)	Future Flood Discharge (cfs)	1% Annual Chance Existing Water-Surface Elevation (feet NAVD 88)	1% Annual Chance Future Water-Surface Elevation <sup>3</sup> (feet NAVD 88)	Non- Encroachment Width <sup>4</sup> (feet)
			2) (continued)			
249	24,869	756	1,510	312.1	314.3	28 / 13
	CONTRACTOR OF THE PARTY OF THE	21, STREAM				20/13
115	11,523	1,711	4,010	220.4	222.2	136 / 129
120	12,023	1,711	4,010	221.5	223.6	10 / 178
125	12,507	1,711	4,010	222.7	225.0	10 / 265
130	13,021	1,711	4,010	224.2	226.3	233 / 16
135	13,514	1,711	4,010	225.3	227.4	147 / 113
141	14,062	1,711	4,010	226.1	228.3	93 / 160
145	14,514	1,711	4,010	226.7	229.0	82 / 182
150	15,014	1,711	4,010	227.5	229.8	156 / 169
155	15,534	1,711	4,010	228.6	230.9	16 / 121
161	16,094	1,711	4,010	230.9	235.8	222 / 18
164	16,441	1,711	4,010	231.2	235.9	10 / 142
170	17,015	1,189	2,890	232.2	236.2	160 / 12
175	17,509	1,189	2,890	232.9	236.5	72 / 7
180	17,976	1,189	2,890	234.5	237.5	40 / 25
185	18,475	1,189	2,890	236.5	239.1	100 / 12
190	18,961	1,171	2,840	238.2	240.4	130 / 12
194	19,395	1,171	2,840	239.7	242.0	50 / 28
199	19,948	1,171	2,840	241.3	243.7	61 / 33
205	20,461	1,171	2,840	242.6	245.2	90 / 58
210	20,961	1,171	2,840	243.9	246.3	15 / 71
215	21,461	1,145	2,730	246.6	248.1	180 / 50
220	21,961	1,145	2,730	248.6	250.3	45 / 151
225	22,461	1,145	2,730	249.4	251.4	90 / 77
230	23,014	1,145	2,730	251.0	253.0	16 / 80
234	23,441	1,145	2,730	253.4	255.1	54 / 77
239	23,941	1,085	2,580	255.9	257.4	6 / 252
244	24,369	1,085	2,580	257.3	259.1	32 / 94
249	24,869	1,085	2,580	259.0	261.1	68 / 45
254	25,411	1,085	2,580	260.0	262.2	59 / 132
258	25,843	1,085	2,580	260.8	263.0	32 / 82
264	26,436	744	1,650	263.1	264.8	58 / 50
269	26,895	744	1,650	265.6	266.7	27 / 20
274	27,383	744	1,650	269.1	270.7	64 / 8
279	27,877	744	1,650	272.7	274.1	13 / 45
284	28,377	744	1,650	275.7	277.2	102 / 49
289	28,886	744	1,650	278.5	279.9	3 / 109
294	29,374	744	1,650	281.9	283.5	9 / 56
299	29,874	701	1,550	284.2	285.8	30 / 84
304	30,374	701	1,550	286.3	287.8	62 / 28
309	30,874	701	1,550	289.4	290.8	18 / 76
314	31,420	701	1,550	293.9	295.4	40 / 20
318	31,824	701	1,550	295.9	297.5	11 / 90

Name	Index Number	Classification	Neuse River Basin Class Date
Description		Spe	ecial Designation
Little Buffalo Creek	27-57-17	C;NSW	05/01/88
From source to Little River			
Little Chinquapin Branch	27-101-11	C;Sw,NSW	05/01/88
From source to Trent River			
Little Contentnea Creek	27-86-26	C;Sw,NSW	05/01/88
From source to Contentnea Creek			
Little Creek	27-57-19	C;NSW	05/01/88
From source to Little River			
Little Creek	27-43-12	C;NSW	05/01/88
From source to Swift Creek			
Little Creek	27-135-11	SA;HQW,NSW	05/01/88
From source to South River			
Little Creek	27-139	SA;HQW,NSW	05/01/88
From source to Neuse River			
Little Creek	27-43-15-10	C;NSW	05/01/88
74 From source to Middle Creek			
Little Creek	27-86-3.7	C;NSW	08/03/92
From source to Buckhorn Reservoir, Contentnea Creek			
Little Creek	27-2-11	WS-IV;NSW	08/03/92
From source to Eno River			
Little Creek (East Side)	27-86-2-5	C;NSW	05/01/88
From source to Moccasin Creek			
Little Creek (West Side)	27-86-2-4	C;NSW	05/01/88
From source to Moccasin Creek			
Little Drum Creek	27-152-9	SA;HQW,NSW	05/01/88
From source to Jones Bay			
Little Eve Creek	27-152-8	SA;HQW,NSW	05/01/88
From source to Jones Bay			
Little Hell Creek	27-101-24	C;Sw,NSW	05/01/88
From source to Trent River			
Little John Creek	27-115-6	SC;Sw,NSW	05/01/88
From source to Hancock Creek			

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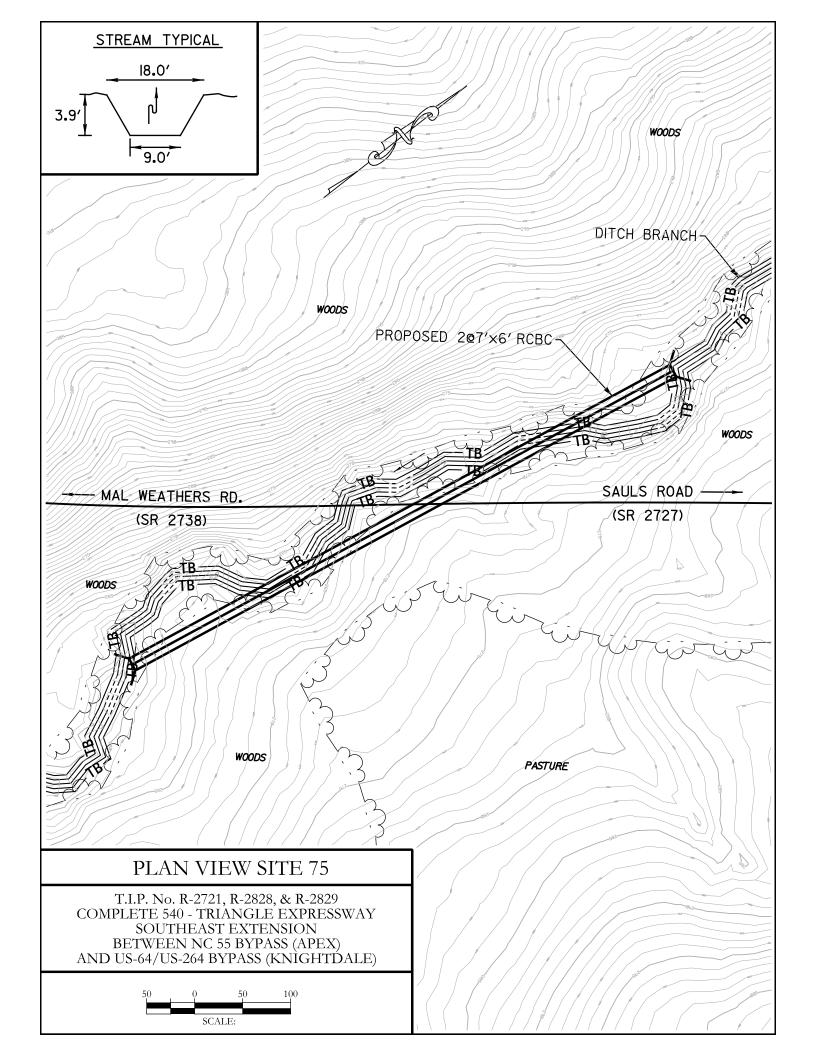
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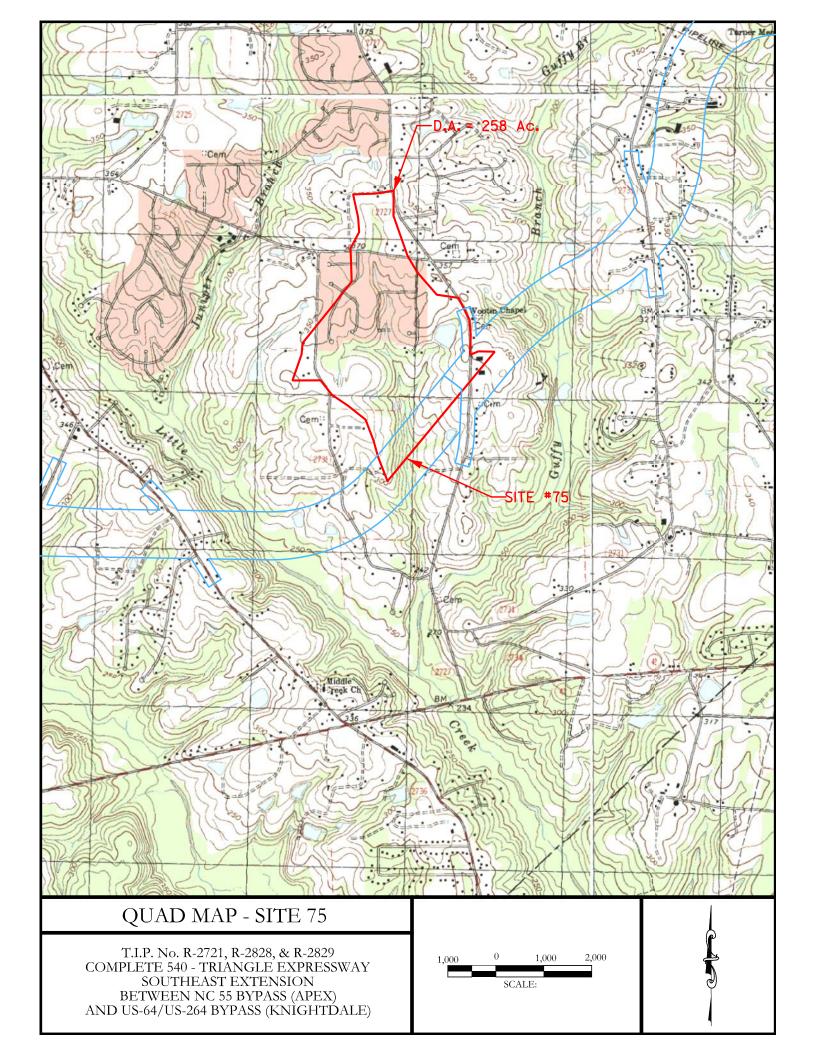


Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.





# **North Carolina**

Site #75

4/18/2014

REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00 STREAM NAME: Unnamed Trib to Guffy Branch sq. miles 0.4 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = ENGLISH

<b>USGS RUR</b>	AL REGRE	<b>ISGS RURAL REGRESSION EQU</b>	ATIONS (OLD)	RUI	RAL EQUA	<b>ATIONS Rep</b>	RURAL EQUATIONS Report 01-4207	
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills	
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)	
2YR	15.17	38.89	76.45	2YR	70.95	34.92	17.45	
5YR	24.82	87.41	134.22	5YR	130.14	72.09	29.20	
10YR	32.69	134.81	181.60	10YR	182.10	107.01	38.49	
25YR	43.32	222.33	256.25	25YR	263.59	163.20	51.99	
50YR	52.47	305.95	320.27	50YR	336.44	215.90	63.71	
100YR	62.62	414.13	398.89	100YR	420.19	278.62	76.13	
200YR	76.97	549.24	484.44	200YR	516.36	352.73	29.06	
500YR	89.71	777.86	638.50	500YR	666.35	471.73	112.21	

# **USGS URBAN REGRESSION EQUATIONS**

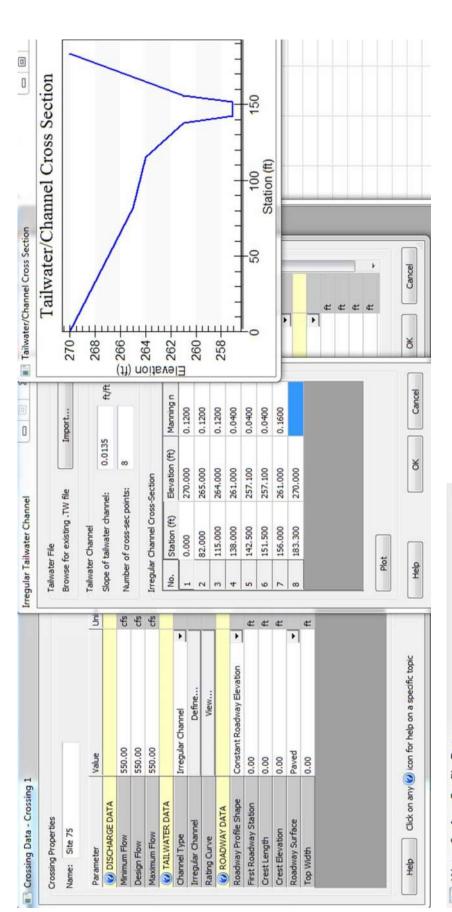
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(These Equations are used only for comparison)

							(Based on 2.80xQ10)	
ш							1091.44	1046.10
Coastal Plain	(cfs)	226.30	308.06	450.90	578.92	752.53	862.56	1229.93
Sand Hills	(cfs)	84.75	100.58	121.84	138.80	159.88	281.63	209.26
FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR
	ш	ш	ш	ш	ш	ш	ICY         Sand Hills         Coastal Plain         BI           (cfs)         (cfs)         (cfs)           84.75         226.30         100.58         308.06           121.84         450.90         138.80         578.92           159.88         752.53         752.53	(cfs) 316.20 3316.20 389.80 505.14 600.76 729.74

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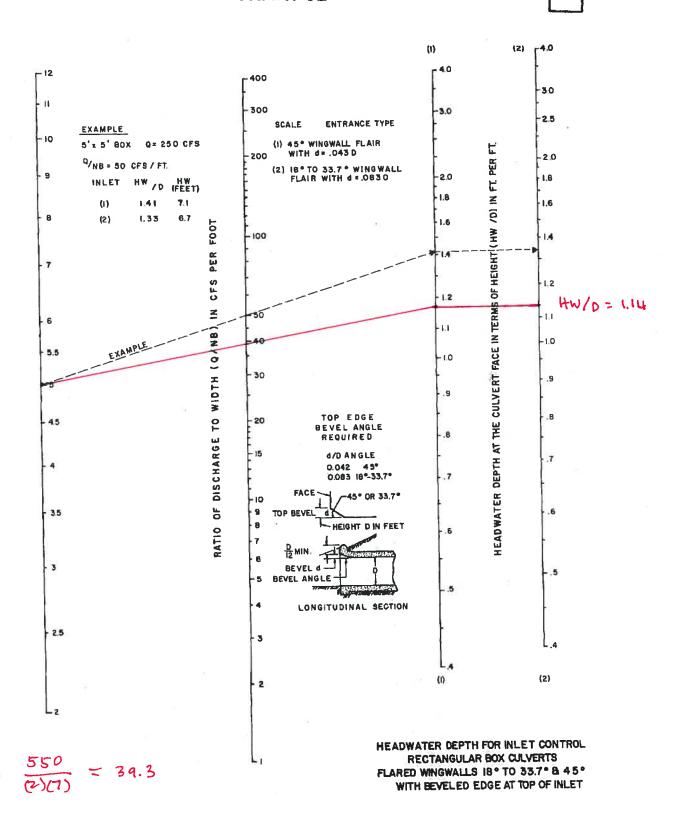
FEMA	<b>FREQUENCY</b> Disharges			10YR	50YR	100YR	100YR	500YR	
	Blue Ridge Discharge Used					550		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	Blue Ridge	(cts)	234.57	313.14	480.89	558.39	634.84	876.79	1146.10
	Coastal Plain	(cts)	207.65	287.57	457.69	549.94	642.69	805.20	1052.51
20	Sand Hills	(cts)	144.91	190.17	261.93	310.58	356.06	532.48	696.03
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR



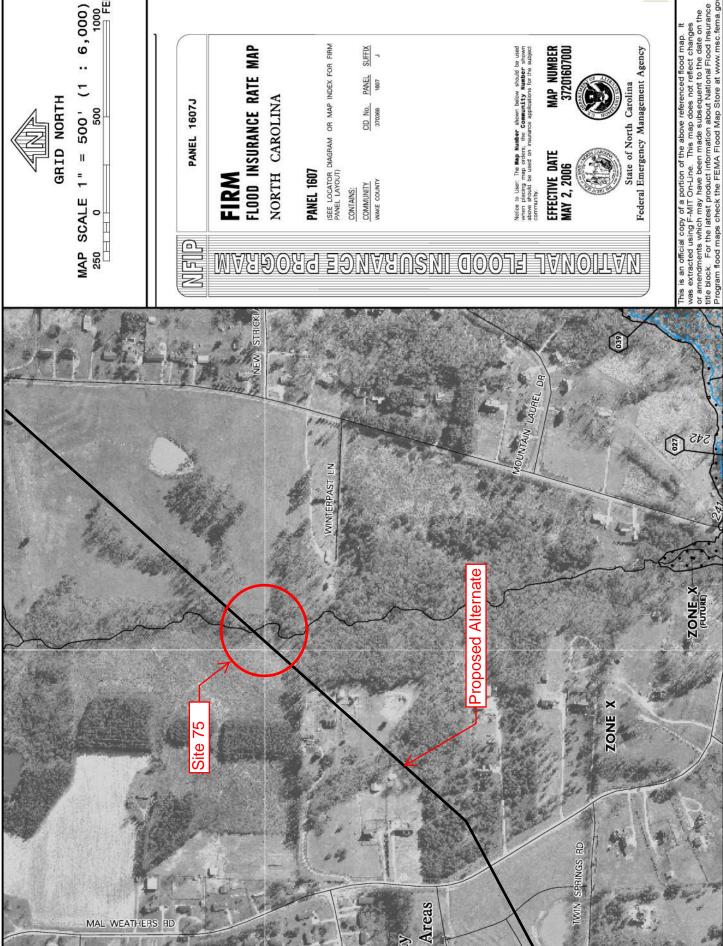
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Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
550.000	261.508	4.408	8.706	3.713
550.000	261.508	4.408	8.706	3.713
550.000	261.508	4.408	8.706	3.713
550.000	261.508	4.408	8.706	3.713
550.000	261.508	4.408	8.706	3.713
550.000	261.508	4.408	8.706	3.713
550.000	261.508	4.408	8.706	3.713
550.000	261.508	4.408	8.706	3.713
550.000	261.508	4.408	8.706	3.713
550.000	261.508	4.408	8.706	3.713
550.000	261.508	4.408	8.706	3.713

### **CHART 9B**



PROPOSED STEVETURE:



1000

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT Orbitine. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance

Name	Index Number	N Classification	euse River Ba Class Da
Description		Spec	ial Designation
Little Buffalo Creek	27-57-17	C;NSW	05/01/8
From source to Little River			
Little Chinquapin Branch	27-101-11	C;Sw,NSW	05/01/8
From source to Trent River			
Little Contentnea Creek	27-86-26	C;Sw,NSW	05/01/8
From source to Contentnea Creek			
Little Creek	27-57-19	C;NSW	05/01/8
From source to Little River			
Little Creek	27-43-12	C;NSW	05/01/8
From source to Swift Creek			
Little Creek	27-135-11	SA;HQW,NSW	05/01/8
From source to South River			
Little Creek	27-139	SA;HQW,NSW	05/01/8
From source to Neuse River			
Little Creek	27-43-15-10	C;NSW	05/01/8
From source to Middle Creek			
Little Creek	27-86-3.7	C;NSW	08/03/9
From source to Buckhorn Reservoir, Contentnea Creek			
Little Creek	27-2-11	WS-IV;NSW	08/03/9
From source to Eno River			
Little Creek (East Side)	27-86-2-5	C;NSW	05/01/8
From source to Moccasin Creek			
Little Creek (West Side)	27-86-2-4	C;NSW	05/01/8
From source to Moccasin Creek			
Little Drum Creek	27-152-9	SA;HQW,NSW	05/01/8
From source to Jones Bay			
Little Eve Creek	27-152-8	SA;HQW,NSW	05/01/8
From source to Jones Bay			
Little Hell Creek	27-101-24	C;Sw,NSW	05/01/8
From source to Trent River			
Little John Creek	27-115-6	SC;Sw,NSW	05/01/8
From source to Hancock Creek			

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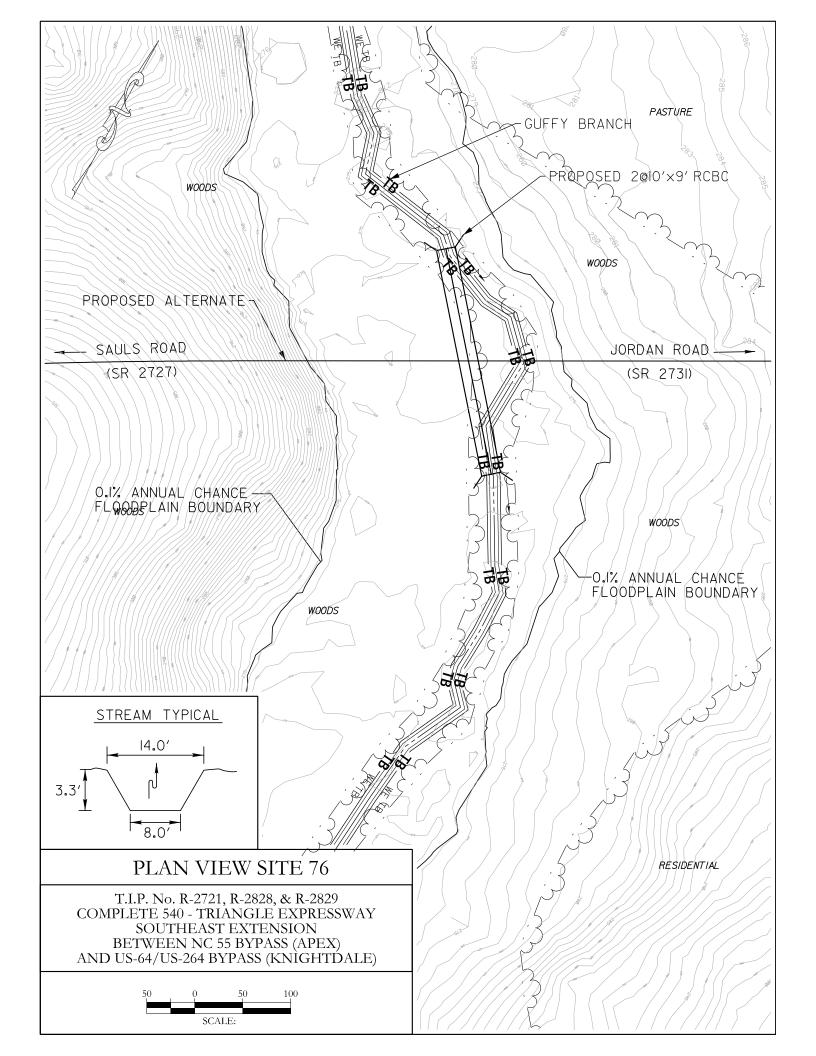
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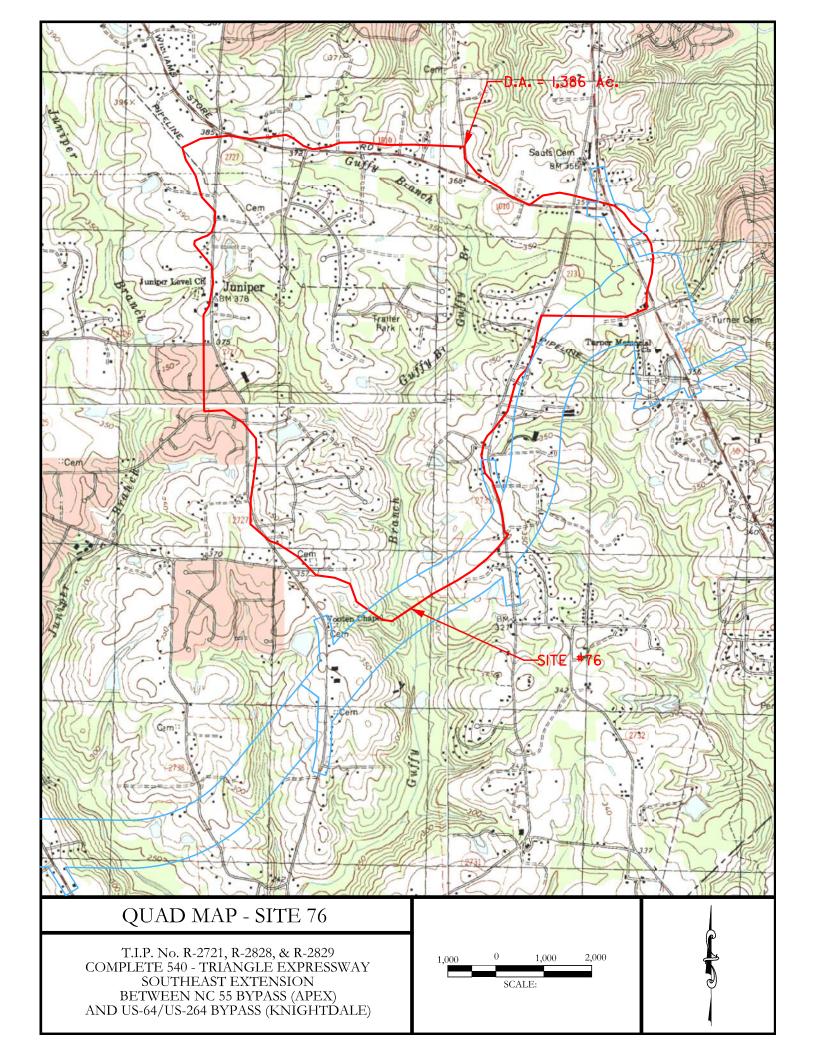


Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.





### **North Carolina**

REGION: BLUE RIDGE METHOD USED: Fact Sheet 007-00 STREAM NAME: Guffy Branch sq. miles 2.2 PROJECT NAME: Triangle Expressway SE Ext. Drainage Area = 4/18/2014 ENGLISH

Site #76

RURAL EQUATIONS Report 01-4207	Blue Ridge Coastal Plain Sand Hills	(cfs) (cfs) (cfs)	234.81 109.99 58.73	412.70 212.83 96.46	562.90 305.31 126.30	791.53 448.50 169.42	993.20 579.33 206.92	1219.47 731.24 245.99	1475.77 906.98 291.98	1869.06 1182.35 360.11
RUF	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR
(OLD)	Blue Ridge	(cfs)							1439.88	1846.75
<b>USGS RURAL REGRESSION EQUAT</b>	Coastal Plain	(cts)	114.23	235.76	349.62	59.055	734.85	966.27	1251.29	1715.66
AL REGRE	Sand Hills	(cts)	52.94	87.32	115.42	155.84	190.72	229.95	283.10	337.95
<b>USGS RUR</b>	FREQUENCY		2YR	5YR	10YR	25YR	50YR	100YR	200YR	500YR

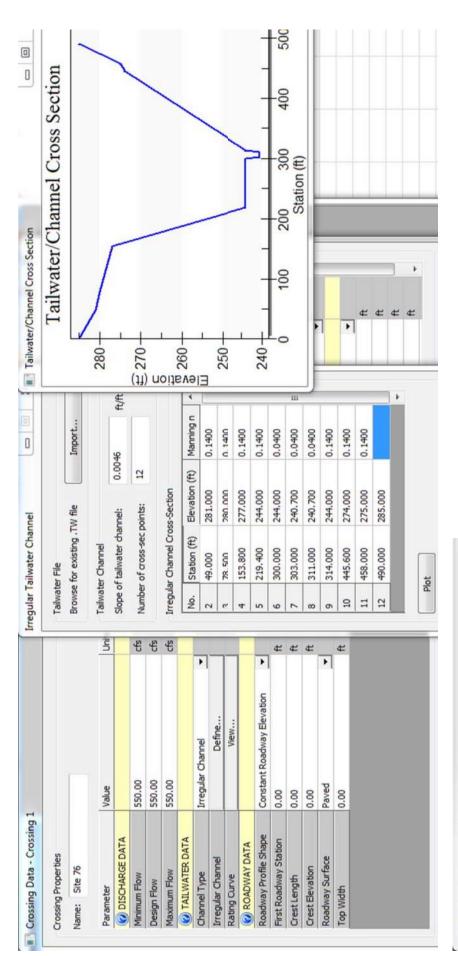
# **USGS URBAN REGRESSION EQUATIONS**

	ly for comparison)	Coastal Plain	(cts)	655 61
	are used onl	Sand Hills	(cfs)	302 13
BDF= 11	(These Equations are used only for comparison)	FREQUENCY		A > A

FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	
	(cfs)	(cfs)	(cfs)	
5YR	302.13	655.61	1029.77	
10YR	357.93	859.09	1253.86	
25YR	438.19	1202.91	1593.73	
50YR	509.82	1520.24	1903.52	
100YR	599.89	1946.72	2315.20	
200YR	1002.20	2405.45	3510.81	(Based on 2.80xQ10)
500YR	815.57	3090.53	3282.87	

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) USGS Fact Sheet 007
% Impervious)
% Im
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EQUAT
IC REGRESSION EQUATIONS (% Impervious

FEMA	Disharges				764	1,460		
뿐	FREQUENCY		10YR	50YR	100YR	100YR (future)	500YR	
	Blue Ridge Discharge Used				1700		Based on 2.80xQ10)	Based on 3.66xQ10)
	Blue Ridge [	850.92	1072.97	1501.96	1702.21	1889.69	3004.30	3927.05
	Coastal Plain	720.60	936.22	1333.00	1555.30	1768.78	2621.43	3426.58
25	Sand Hills	543.00	676.52	865.43	1004.98	1128.88	1894.26	2476.07
% Impervious =	FREQUENCY	5YR	10YR	25YR	50YR	100YR	200YR	500YR



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Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
1700.000	248.723	8.023	3.067	2.303
1700.000	248.723	8.023	3.067	2.303
1700.000	248.723	8.023	3.067	2.303
1700.000	248.723	8.023	3.067	2.303
1700.000	248.723	8.023	3.067	2.303
1700.000	248.723	8.023	3.067	2.303
1700.000	248.723	8.023	3.067	2.303
1700.000	248.723	8.023	3.067	2.303
1700.000	248.723	8.023	3.067	2.303
1700.000	248.723	8.023	3.067	2.303
1700.000	248.723	8.023	3.067	2.303

### PRELIMINARY DESIGN AND ASSESSMENT OF STREAM CROSSINGS AND ENCROACHMENTS

COUNTY Wake	PROJECT NUMBER R-2	721, R-2828 & R-2829
STREAM Guffy Branch (Site 76)	ROUTE New Location	
` ,	O BY Mulkey, INC. DAT (WBP)	TE <u>5/8/2014</u>
	HYDROLOGIC EVALU	<u>JATION</u>
NEAREST GAGING STAT	TION ON THIS STREAM	(NONE <u>X</u> )
ARE FLOOD STUDIES AV	/AILABLE ON THIS STRE.	AM: Yes
FLOOD DATA: Q <sub>10</sub> 1,100 CFS EST. BI Q <sub>50</sub> 1,700 CFS EST. BI Q <sub>500</sub> 3,900 CFS EST. BK	KWTR. <u>N/A</u> FT. Q <sub>100</sub> <u>1,900</u>	CFS EST. BKWTR. <u>N/A</u> FT. CFS EST. BKWTR. <u>N/A</u> FT.
DRAINAGE AREA 2.20 Sq	<u>ı.Mi. METHOD USED TO C</u>	COMPUTE Q: <u>USGS Urban Regression</u>
<u>P</u>	PROPERTY RELATED EVA	<u>ALUATIONS</u>
DAMAGE POTENTIAL: L	OW MODERAT	TE <u>X</u> HIGH
COULD THIS BE S	IGNIFICANTLY INCREAS	ED BY PROPOSED
ENCROACHMENT	: YES	NO <u>X</u>
EXPLANTION: A maximum should not affect any existing		base flood is allowed, but this rise
LIST BUILDINGS I	N FLOOD PLAIN: None	LOCATION:
UPSTREAM LAND ANTICIPATE ANY		
ANY FLOOD ZONI	NG? (FIA STUDIES, ETC.)	YES <u>X</u> NO
TYPE OF STUDY:	FEMA	
REGULATORY FLO	OODWAY WIDTH <u>N/A (Li</u>	mited Detail)
COMMENTS:		

### TRAFFIC RELATED EVALUATIONS

PRESENT YEAR 2012 TRAFFIC COUNT 14,200 VPD % TRUCKS 12
DESIGN YEAR 2035 TRAFFIC COUNT 44,800 VPD % TRUCKS 12
EMERGENCY ROUTE SCHOOL BUS ROUTE MAIL ROUTE
DETOUR AVAILABLE? N/A, New Location LENGTH OF DETOUR N/A MILES
DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? N/A New Location
IS THE TRAFFIC VOLUME, TYPE, USAGE SUCH TO WARRANT CONSIDERATION FOR VARIANCE FROM STANDARDS OR EXISTING LEVEL OF INTERRUPTION? N/A
COMMENTS:
HIGHWAY AND BRIDGE (CULVERT) RELATED EVALUATIONS
NOTE ANY OUTSIDE FEATURES WHICH MIGHT AFFECT STAGE, DISCHARGE OR FREQUENCY.
LEVEES AGGRADATION/DEGRADATION RESERVOIRS
DIVERSIONS DRAINAGE DISTRICT NAVIGATION
BACKWATER FROM ANOTHER SOURCE
EXPLANATION:
ROADWAY OVERFLOW SECTION (NONE <u>X</u> ) LENGTH ELEVATION
EMBANKMENT: SOIL TYPE: Wehadkee, Bibb and Appling TYPE SLOPE COVER Vegetation
COMMENTS: Soil Type from Web Soil Survey website of Wake County, NC.

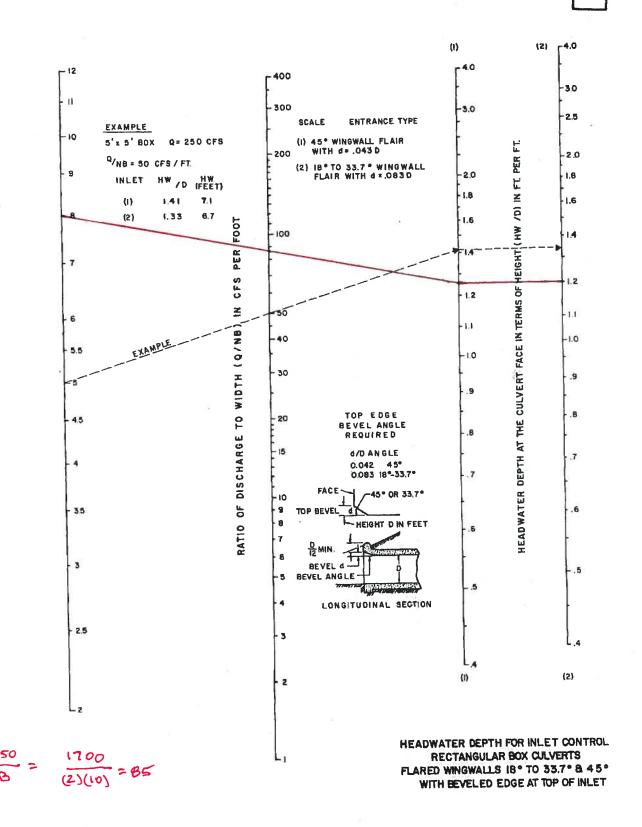
**ENVIRONMENTAL CONSIDERATIONS** 

LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN: <u>Buried culverts 1 foot to allow for fish passage.</u>

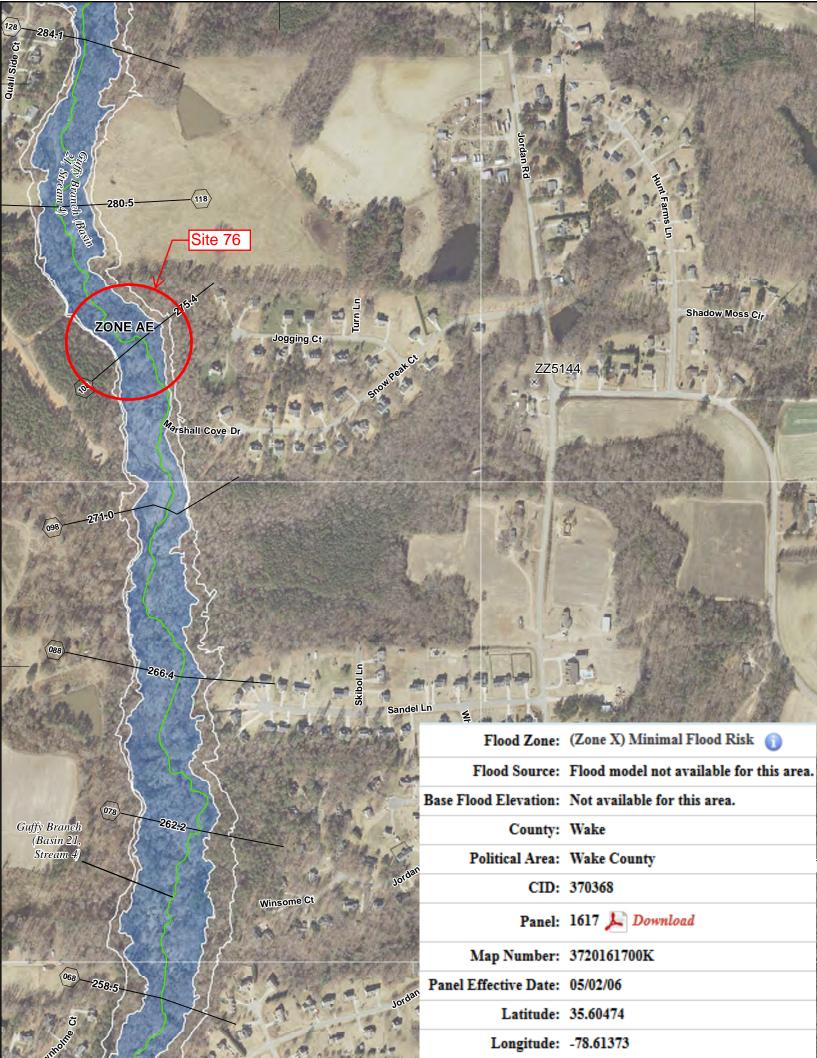
### MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES $\_\_$ NO $\underline{X}$ PROTECTION NEEDED $\_\_$
ARE BANKS STABLE? Yes PROTECTION NEEDED No
DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No
COMMENTS:
<u>ALTERNATIVES</u>
RECOMMENDED DESIGN: <u>2@10'x9' RCBC</u>
DETOUR STRUCTURE N/A
BRIDGE/CULVERT WATERWAY OPENING: 180 sq. ft.
WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES NO <u>X</u> DISCUSSION:
THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:
(1)NORMAL PROCESS
(2) X NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR 100 year Base Flood Elevation
(3) SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION ADDRESSING:

### **CHART 9B**



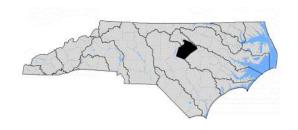
PROPOSED STRUCTURE:



### PRELIMINARY FLOOD INSURANCE STUDY

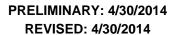
### FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in WAKE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF RALEIGH	370243
TOWN OF APEX	370467
TOWN OF CARY	370238
TOWN OF FUQUAY-VARINA	370239
TOWN OF GARNER	370240
TOWN OF HOLLY SPRINGS	370403
TOWN OF KNIGHTDALE	370241
TOWN OF MORRISVILLE	370242
TOWN OF ROLESVILLE	370468
TOWN OF WAKE FOREST	370244
TOWN OF WENDELL	370245
TOWN OF ZEBULON	370246
WAKE COUNTY	370368





**Federal Emergency Management Agency** 

State of North Carolina

Flood Insurance Study Number

37183CV000

www.fema.gov and www.ncfloodmaps.com





Table 10 - Flooding Sources Studied by Detailed Methods: Limited Detailed

Source	Riverin	e Sources	Affected Communities	
	From	То		
Buckhorn Creek	The confluence with Harris Reservoir	Approximately 0.5 mile upstream of Honeycutt Road	Rdu Town Of Holly Springs Wake County	
Buffalo Creek (Basin 9, Stream 1)	State Highway 42	The Johnston/Wake County boundary	Rdu Wake County	
Cary Branch	The confluence with Harris Reservoir	Approximately 2.5 miles upstream of Rex Road	Rdu Town Of Holly Springs Wake County	
Guffy Branch (Basin 21, Stream 4)	The confluence with Little Creek (Basin 21, Stream 1)	Approximately 4.3 miles upstream of confluence with Little Creek (Basin 21, Stream 1)	Rdu Wake County	
Harris Reservoir	Entire shoreline within Chatham County	Entire shoreline within Chatham County	Rdu Wake County	
76 Branch	The confluence with Harris Reservoir	Approximately 0.5 mile upstream of confluence with Harris Reservoir	Rdu Wake County	
Juniper Branch (Basin 21, Stream 2)	The confluence with Little Creek (Basin 21, Stream 1)	Approximately 0.8 mile upstream of Pagen Road	Rdu Wake County	
Little Black Creek	The confluence with Black Creek	Approximately 0.6 mile upstream of Walter Myatt Road	Rdu Wake County	
Little Creek (Into Middle Creek)	The confluence with Middle Creek	Approximately 2.3 miles upstream of the confluence of Juniper Branch	Rdu Wake County	
Marks Creek	The confluence with the Neuse River	Approximately 0.8 mile downstream of Knightdale Eagle Rock Road	Rdu Town Of Clayton Town Of Wendell Wake County	
Nancy Branch	Approximately 0.4 mile upstream of confluence with Panther Creek	Approximately 0.1 miles upstream of Del Webb Avenue	Town Of Cary	
Norris Branch	The confluence with Cary Branch	Approximately 500 feet upstream of Avent Ferry Road	Rdu Town Of Holly Springs Wake County	
Snipes Creek	The confluence with the Little River	Approximately 0.6 mile upstream of State Highway 96	Rdu Town Of Zebulon Wake County	
Thomas Creek	The confluence with Harris Reservoir	Approximately 100 feet downstream of Highway 1	Rdu Wake County	

Table 11, "Stream Name Changes" is not applicable in Wake County.

This FIS also incorporates the determinations of letters issued by FEMA resulting in map changes (Letters of Map Revision [LOMRs]), as shown in Table 12, "Letters of Map Revision".

Table 12 - Letters of Man Revision

Case Number	Date Issued	Flooding Source/Description	Communities
06-04-C341P	12/3/2007	Marks Creek / 06-04-C341P	Rdu
06-04-C341P	12/3/2007	Marks Creek / 06-04-C341P	Town Of Wendell
07-04-2076P	4/13/2007	Panther Creek / 07-04-2076P	Town Of Cary

### 5.0 Engineering Methods

For the flooding sources in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded at least once on the average during any 10-, 25-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2% annual chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedance) during the term of a 30-year mortgage is approximately 26 percent (about 3 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

**Table 13 - Summary of Discharges** 

Flooding Source	Droinage Area	100/ Appual		arges (cfs)	0.2% Anr
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Ani Chanc
Approximately 0.8 mile upstream of Highway 1	0.10	*	*	198	*
Black Creek					
Approximately 0.6 mile downstream of Wake/Johnston County boundary	14.50	*	*	2,130	*
Buckhorn Creek					
Approximately 250 feet upstream of Cass Holt Road	11.40	*	*	3,395	*
Approximately 1,580 feet downstream of Sweet Springs Road	10.20	*	*	3,176	*
Just downstream of Sweet Springs Road	8.70	*	*	2,887	*
Approximately 0.6 mile upstream of Sweet Springs Road	8.50	*	*	2,842	*
Approximately 1.6 miles upstream of Sweet Springs Road	7.90	*	*	2,704	*
Approximately 1.2 miles downstream of Buckhorn Duncan Road	5.90	*	*	2,268	*
Approximately 0.8 mile downstream of Buckhorn Duncan Road	5.60	*	*	2,180	*
Approximately 0.4 mile downstream of Buckhorn Duncan Road	5.30	*	*	2,105	*
Approximately 180 feet downstream of Buckhorn Duncan Road	3.10	*	*	1,508	*
Approximately 1,060 feet upstream of Buckhorn Duncan Road	2.80	*	*	1,429	*
Approximately 0.4 mile upstream of Buckhorn Duncan Road	2.70	*	*	1,396	*
Buffalo Branch (Basin 10, Stream 22)					
At Morphus Bridge Road	0.40	*	*	600	*
Buffalo Creek (Basin 9, Stream 1)					
At County boundary	18.40	*	*	5,300	*
Buffalo Creek West					
At Johnston-Wake County Boundary	1.81	251	442	542	778
Cary Branch	·				
Approximately 0.8 mile downstream of Rex Road	4.50	*	*	1,904	*
Approximately 1,060 feet downstream of Rex Road	4.20	*	*	1,822	*
Just upstream of confluence with Cary Branch Tributary	2.10	*	*	1,188	*
Approximately 1,580 feet upstream of confluence with Cary Branch Tributary	1.70	*	*	1,028	*
Guffy Branch (Basin 21, Stream 4)	·				•
At confluence with Little Creek (Basin 21, Stream 1)	4.02	*	*	1,029	*
At downstream side of Sauls Road	3.32	*	*	923	*
Approximately 0.7 mile upstream of Sauls Road	2.80	*	*	853	*
Approximately 1.3 miles upstream of Sauls Road	2.38	*	*	764	*
Approximately 2.1 miles upstream of Sauls Road	1.84	*	*	660	*
Branch					
Approximately 0.4 mile upstream of confluence with Buckhorn Creek	1.80	*	*	1,082	*
Approximately 0.8 mile upstream of confluence with Buckhorn Creek	1.60	*	*	1,011	*
Approximately 1.2 miles upstream of confluence with Buckhorn Creek	1.20	*	*	816	*
Juniper Branch (Basin 21, Stream 2)					
At confluence with Little Creek (Basin 21, Stream 1)	2.03	*	*	700	*
Approximately 530 feet downstream of Pagan Road	1.59	*	*	607	*
Approximately 1,580 feet upstream of Pagan Road	1.36	*	*	557	*
Approximately 530 feet downstream of Lakefield Drive	1.08	*	*	489	*
Kit Creek	•				
MIL CIECK					

**Table 16 - Roughness Coefficients** 

Stream	Channel "n"	Overbank "n"
Beaver Creek	0.043 to 0.050	0.100 to 0.200
Beddingfield Creek	0.050	0.130
Big Branch	0.050	0.140
Black Creek	0.025 to 0.060	0.030 to 0.150
Buckhorn Creek	0.040 to 0.048	0.145
Buffalo Creek (Basin 9, Stream 1)	0.030 to 0.070	0.035 to 0.140
Buffalo Creek West	0.045 to 0.052	0.030 to 0.140
Cary Branch	0.040	0.140
Guffy Branch (Basin 21, Stream 4)	0.047	0.130
Jim Branch	0.045	0.145
Juniper Branch (Basin 21, Stream 2)	0.045	0.110 to 0.130
<del>Cre</del> ék	0.030 to 0.070	0.070 to 0.110
Little Beaver Creek	0.045 to 0.055	0.100 to 0.220
Little Black Creek	0.030 to 0.070	0.070 to 0.130
Little Creek (Basin 11, Stream 2)	0.030 to 0.080	0.070 to 0.150
Little Creek (Into Middle Creek)	0.033 to 0.047	0.095 to 0.140
Little River	0.040 to 0.066	0.070 to 0.240
Marks Creek	0.025 to 0.070	0.070 to 0.130
Middle Creek	0.042 to 0.050	0.030 to 0.140
Mill Branch	0.050	0.030 to 0.150
Mill Creek (South)	0.035 to 0.060	0.040 to 0.160
Moccasin Creek	0.030 to 0.070	0.070 to 0.220
Morris Branch	0.030 to 0.050	0.100 to 0.200
Nancy Branch	0.045 to 0.050	0.120 to 0.150
Neuse River	0.035 to 0.060	0.055 to 0.250
Norris Branch	0.048	0.145
Panther Creek	0.030 to 0.070	0.070 to 0.130
Reedy Branch (Basin 27, Stream 5)	0.045 to 0.050	0.100 to 0.200
Snipes Creek	0.042 to 0.045	0.120 to 0.130
Swift Creek	0.040 to 0.072	0.035 to 0.240
Thomas Creek	0.050	0.145
Unnamed Tributary (#1) to Swift Creek	0.045 to 0.060	0.050 to 0.150
White Oak Creek	0.035 to 0.050	0.035 to 0.150

For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained using digital elevation data obtained with LIDAR technology developed as part of the North Carolina Statewide Floodplain Mapping Program. The hydraulic model is prepared using this digital elevation data, without surveying bathymetric or structural data. Where bridge or culvert data are readily available, such as from the North Carolina Department of Transportation, these data have been reflected in the hydraulic model. If these structural data are not readily available, field measurements of these structures were made to approximate their geometry in the hydraulic models. In addition, this method does not include field surveys that determine specifics on channel and floodplain characteristics. A limited detailed study is a "buildable" product that can be upgraded to a fully detailed study at a later date by verifying stream channel characteristics, bridge and culvert opening geometry, and by analyzing multiple recurrence intervals.

The results of the HEC-RAS computations are tabulated for all cross sections (Table 17, "Limited Detailed Flood Hazard Data"). Flood Profiles have not been developed for streams studied by limited detailed methods. Water-surface elevation rasters were developed for steams studied by limited detailed methods. In addition, floodways for streams studied by limited detailed methods are not delineated on the FIRM. However, the 1% annual chance water-surface elevations, flood discharges, and non-encroachment widths from the limited detailed studies for every modeled cross section are given in Table 17. The non-encroachment widths given at modeled cross sections can be used by communities to enforce floodplain management ordinances that meet the requirement defined in 44 CFR 60.3(c)(10).

Between cross sections for streams studied by limited detailed methods, 1% annual chance water-surface elevations can be calculated by mathematical interpolation using the distance along the stream centerline. Non-encroachment widths and, therefore, the location of a non-encroachment area boundary between cross sections should be determined based on either 1) mathematical interpolation, or 2) the non-encroachment width at the upstream or downstream cross section, whichever is larger. If the width determined by this second method is wider than the Special Flood Hazard Area (SFHA) or the 1% annual chance floodplain delineated on the FIRM for this location along the stream, the non-encroachment area shall be considered to

**Table 17 - Limited Detailed Flood Hazard Data** 

	Table 17 - 1	Limited Detailed Floo	od Hazard Data	
Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance Water- Surface Elevation (feet NAVD 88)	Non-Encroachment Width (feet) Left/Right from Stream Centerline
046	4,623	1,822	238.7	80 / 197
050	4,961	1,822	239.0	150 / 94
052	5,250	1,188	239.4	33 / 100
057	5,677	1,188	240.2	14 / 53
060	5,969	1,188	241.9	14 / 57
063	6,327	1,188	243.3	14 / 24
069	6,851	1,028	246.3	92 / 14
073	7,303	1,028	248.2	65 / 13
078	7,812	1,028	251.1	13 / 14
Guffy Branch (Basin 21, S				
005	500	1,029	231.3 <sup>1</sup>	121 / 97
010	1,028	1,029	233.3	16 / 109
015	1,500	1,029	235.6	23 / 32
021	2,140	923	238.4	-9,999 / -9,999
022	2,175	923	238.4	-9,999 / -9,999
027	2,749	923	241.8	22 / 44
033	3,290	923	246.1	53 / 33
039	3,855	923	247.6	37 / 158
044	4,374	923	249.1	5 / 175
049	4,860	923	250.9	31 / 53
053	5,340	923	252.5	94 / 16
058	5,775	923	253.9	12 / 22
		853		
063	6,275	853	256.4	28 / 8
068	6,775	853	258.5	60 / 15
073	7,275	853	260.2	41 / 74
078	7,775	853	262.2	4 / 159
083	8,275	853	264.0	40 / 103
088	8,775	853	266.4	38 / 80
092	9,228	764	268.9	77 / 34
098	9,793	764	271.0	70 / 110
103	10,342	764	212.0	3/110
108	10,801		275.4	45 / 99
113	11,314	764	278.1	35 / 76
6	11,821	764	280.5	111 / 6
<u> </u>	12,321	764	282.3	66 / 34
128	12,801	764	284.2	81 / 7
143	14,269	660	291.3	93 / 11
148	14,769	517	293.7	40 / 31
153	15,269	517	296.7	2 / 108
221	22,065	287	350.5	6 / 4
226	22,633	287	354.7	25 / 45
Jim Branch		1	T	T
002	227	1,082	232.21	13 / 147
006	568	1,082	232.21	13 / 80
009	871	1,082	232.21	44 / 20
012	1,221	1,082	232.21	21 / 45

		ol ::: .:	
Name	Index Number	Classification	Class I
Description		Specia	Designation
Groundnut Creek	27-77-2-2	C;Sw,NSW	05/01,
From source to Mosely Creek			
Guffy Branch	27-43-15-10-2	C;NSW	05/01,
From source to Little Creek			
Gulden Creek	27-123-3	SA;HQW,NSW	05/01/
From source to Clubfoot Creek			
Gum Branch	27-117	SC;Sw,NSW	05/01/
From source to Neuse River			
Gum Swamp	27-97-1	C;Sw,NSW	05/01/
From source to Swift Creek			
Gum Swamp	27-45-11	C;NSW	05/01/
From source to Black Creek			
Gum Swamp	27-84-1-1	C;Sw,NSW	05/01,
From source to Tracey Swamp			
Gum Swamp (Long Lake)	27-101-40-2-1	C;Sw,NSW	05/01/
From source to Brice Creek			
Gum Swamp Creek	27-77-3	C;Sw,NSW	05/01
From source to Falling Creek			
Gum Tricket Creek	27-140	SA;HQW,NSW	05/01/
From source to Neuse River			
Haleys Branch	27-33-7	C;NSW	05/01/
From source to Crabtree Creek			
Halfmile Branch	27-54.5	WS-IV;NSW	08/03/
From source to Neuse River			
Halfmoon Creek	27-88	C;Sw,NSW	05/01/
From source to Neuse River			
Hallam Branch	27-86-24-1	C;Sw,NSW	05/01/
From source to Wheat Swamp Creek			
Hams Prong	27-86-14-3-1	C;Sw,NSW	05/01,
From source to Button Branch			
Hancock Creek	27-115	SC;Sw,NSW	05/01/
From source to Neuse River			

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	SURVEYED	BEAVERDAM			MOODS	hj.c=u								DERPIC PATENTIAL	

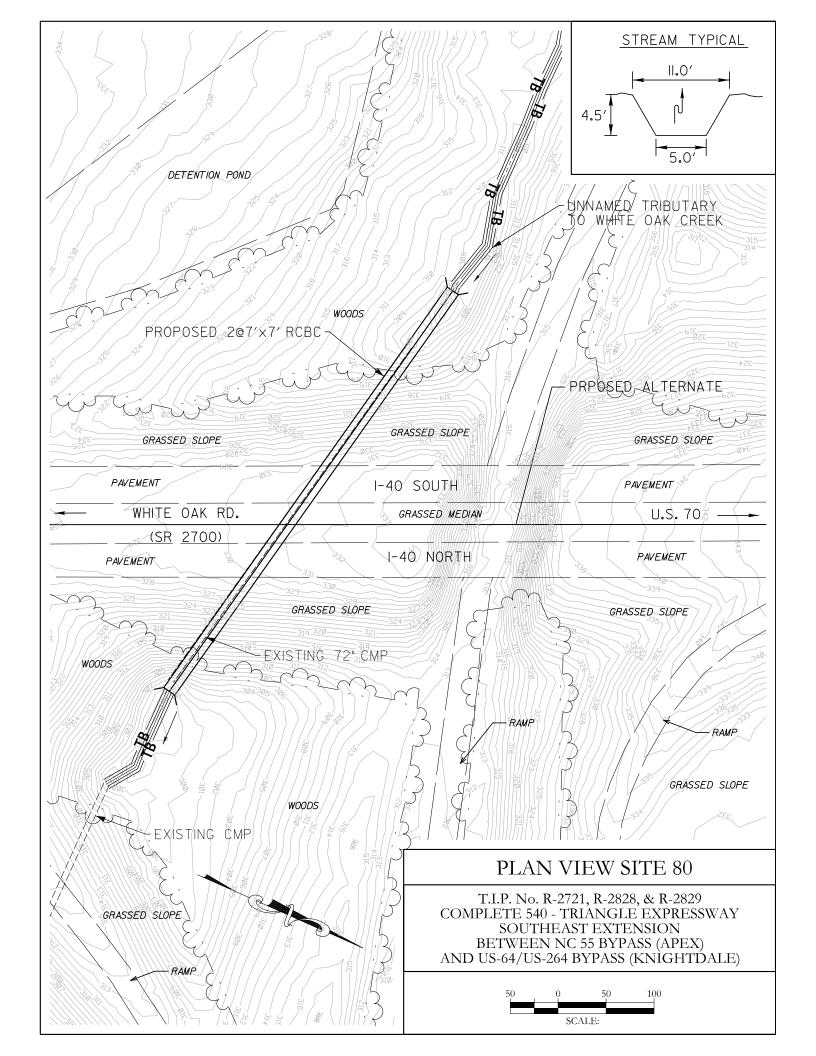


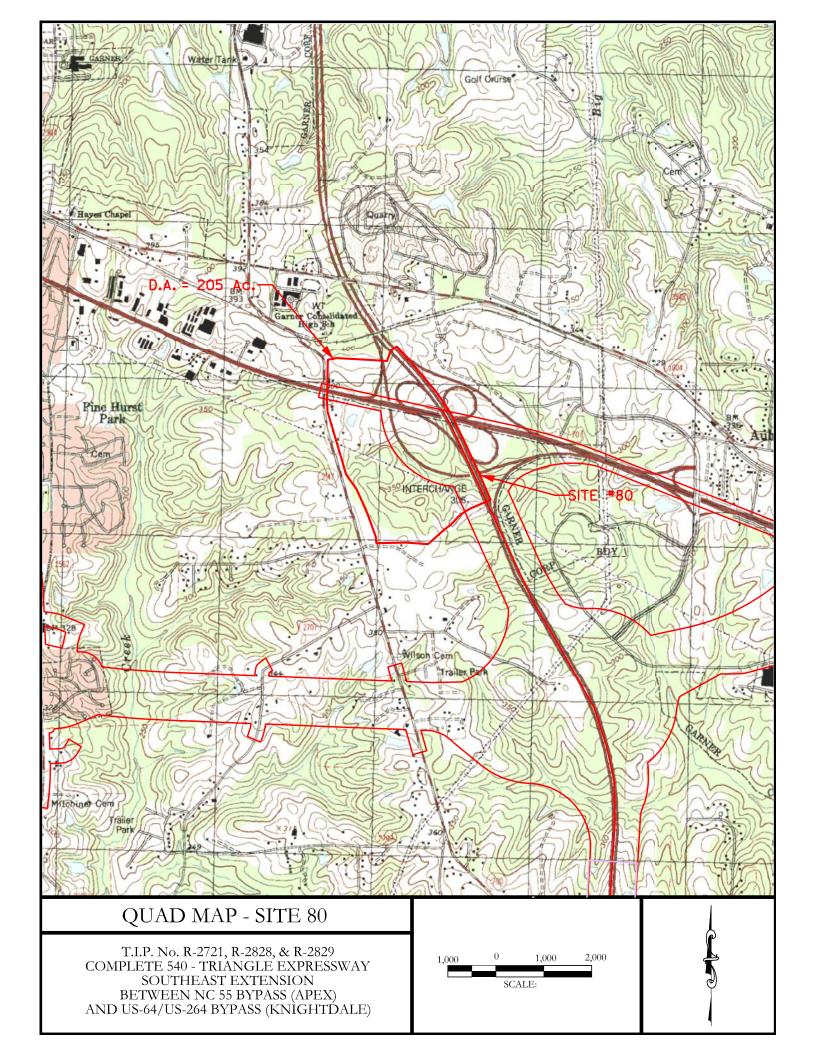
Looking Upstream from Proposed Crossing.



Looking Downstream from Proposed Crossing.

### Site 80





REGION: BLUE RIDGE

### **North Carolina**

4/18/2014 PROJECT NAME: Triangle Expressway SE Ext.

ENGLISH

sq. miles 0.32 Drainage Area =

STREAM NAME: Unnamed Trib. to White Oak Creek

METHOD USED: Fact Sheet 007-00

<b>USGS RUI</b>	<b>REGRE</b>	<b>USGS RURAL REGRESSION EQUA</b>	ATIONS (OLD)	RUF	SAL EQUA	<b>ATIONS Rep</b>	RURAL EQUATIONS Report 01-4207	
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills	
	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)	(cfs)	
2YR	12.88	33.78		2YR	60.67	30.05	14.88	
5YR	21.05	76.77		5YR	111.89	62.57	24.97	
10YR	27.71	119.00		10YR	157.09	93.29	32.95	
25YR	36.63	197.45		25YR	228.26	142.98	44.54	
50YR	44.32	272.80		50YR	291.99	189.74	54.61	
100YR	52.82	370.66		100YR	365.49	245.56	65.29	
200YR	64.90	493.12		200YR	450.05	311.71	77.80	
500YR	75.42	701.35	555.63	500YR	582.20	418.27	96.33	

# **USGS URBAN REGRESSION EQUATIONS**

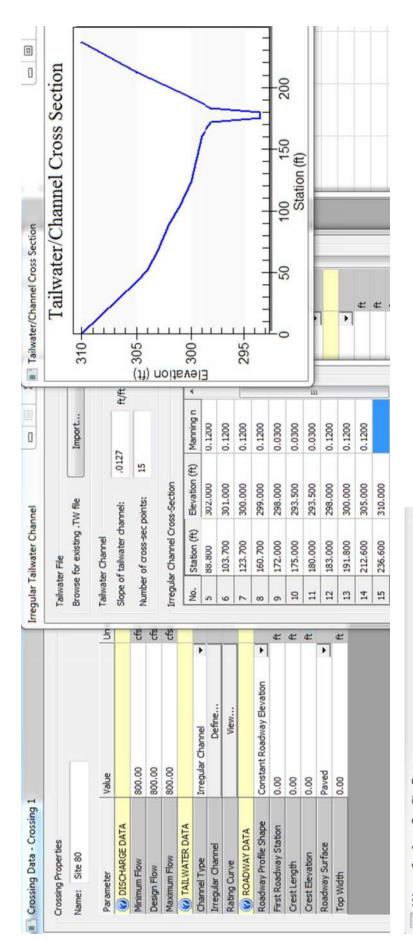
BDF=

(These Equations are used only for comparison)

								(Based on 2.80xQ10)	
	ш	(cts)						936.66	99.006
ioi compansoni)	Coastal Plain	(cfs) (cfs)	196.89	269.36	396.55	510.19	664.49	754.20	1090.19
ils ale used oilly	Sand Hills	(cfs)	71.76	85.19	103.05	117.07	134.47	238.52	175.13
( Illese Edualious	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

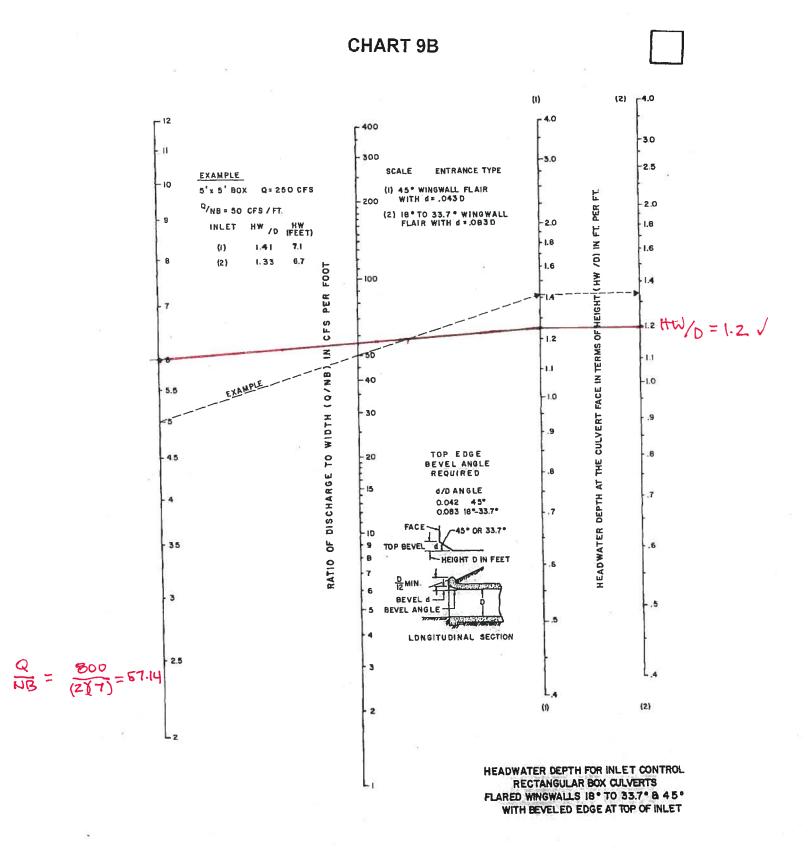
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<b>IC REGRESSION EQUATIONS (% Imp</b>

FEMA	FREQUENCY Disharges			10YR	50YR	100YR	500YR		
	Blue Ridge Discharge Used		43	46	47	800	01	09 (Based on 2.80xQ10)	04 (Based on 3.66xQ10)
			395.43			778.58	848.10	5 1390.09	7 1817.04
	Coastal F	(cts)	352.08	458.98	673.77	774.36	867.45	1285.1	1679.87
65	Sand Hills	(cts)	243.26	300.03	379.28	429.68	471.77	840.07	1098.09
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR



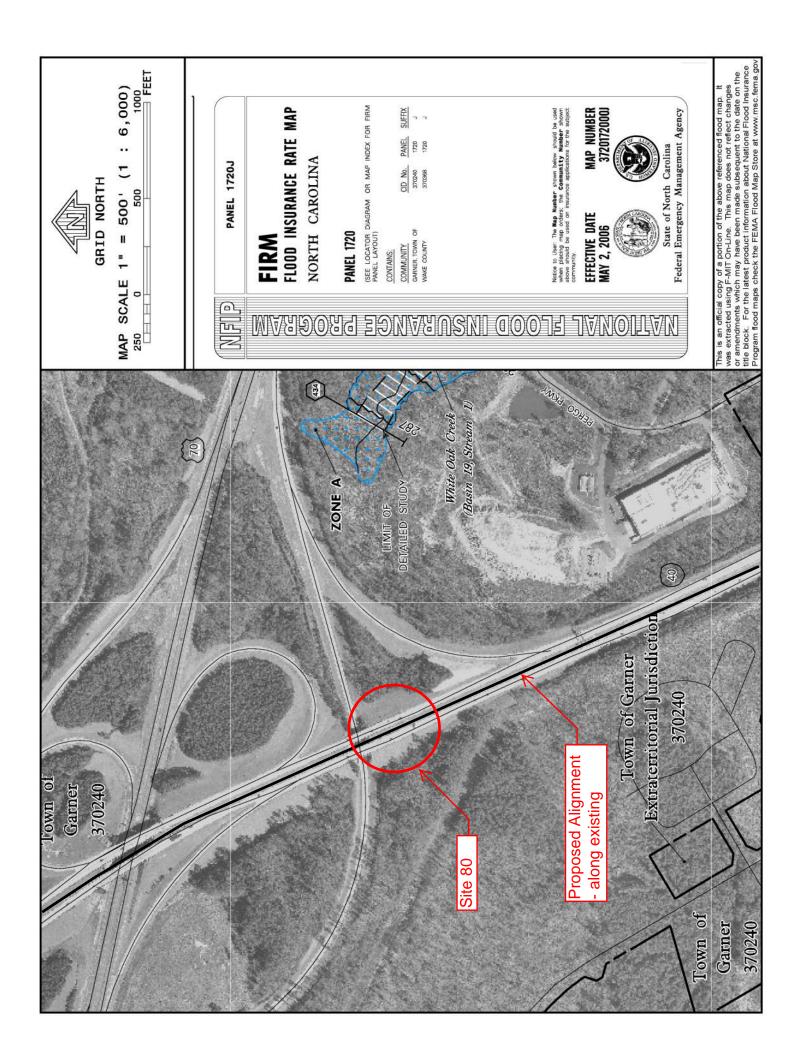
## Water Surface Profile Data

Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
800.000	299.932	6.432	8.188	5.097
800.000	299.932	6.432	8, 188	2:097
800.000	299.932	6.432	8, 188	5.097
300.000	299.932	6.432	8.188	2:097
800.000	299.932	6.432	8.188	5.097
800.000	299.932	6.432	8, 188	5.097
800.000	299.932	6.432	8, 188	2.097
800.000	299.932	6.432	8.188	5.097
800.000	299.932	6.432	8.188	5.097
800.000	299.932	6.432	8, 188	2:097
800.000	299.932	6.432	8.188	5.097

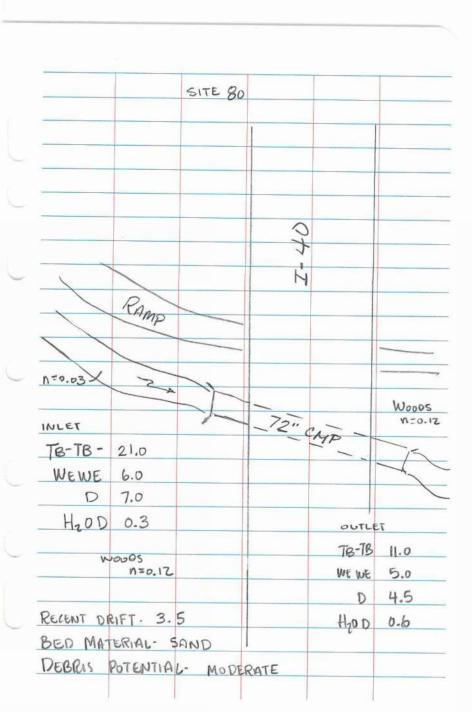


PROPOSED STRUCTURE:

A.



Name	Index Number	Classification	cuse River Basi Class Date
Description Whealton Creek	27-150-31-3	SA;HQW,NSW	Designation 05/01/88
From source to Gale Creek	27-130-31-3	SA,FIQVV,IVSVV	03/01/88
	27.00.04		07/04/00
Wheat Swamp Creek	27-86-24	C;Sw,NSW	05/01/88
From source to Contentnea Creek			
Wheeler Gut	27-125-3	SC;NSW	05/01/88
From source to Dawson Creek			
Whitaker Branch	27-12-1-2	WS-IV;NSW	08/03/92
From source to Robertson Creek			
White Mash Run	27-77-2.5	C;Sw,NSW	05/01/88
From source to Falling Creek			
White Oak Branch	27-52-5-2	C;NSW	05/01/88
From source to Stone Creek			
White Oak Creek (Austin Pond)	27-43-11	C;NSW	05/01/88
From source to Swift Creek			
White Oak Swamp	27-86-9-3-1-2	C;Sw,NSW	05/01/88
From source to Juniper Swamp			
Whitehurst Creek	27-150-7-1	SC;Sw,HQW,NSW	08/01/90
From source to Chapel Creek			
Whiteoak Swamp	27-86-11-2	WS-III;NSW	08/03/92
From source to Toisnot Swamp			
Whiteoak Swamp	27-86-11-7	C;Sw,NSW	05/01/88
From source to Toisnot Swamp			
Whitleys Creek (Whitelace Creek)	27-76	C;Sw,NSW	05/01/88
From source to Neuse River			
Whittaker Creek	27-130	SA;HQW,NSW	05/01/88
From source to Neuse River			
Wildcat Branch	27-34-7	C;NSW	05/01/88
From source to Walnut Creek			
Williams Creek	27-43-2	WS-III;NSW	08/03/92
From source to Swift Creek			· •
Williamson Branch	27-33-18-1	C;NSW	05/01/88
From source to Pigeon House Branch			





Looking at inlet of existing 72-inch CMP crossing at I-40



Looking upstream from inlet of existing 72-inch CMP

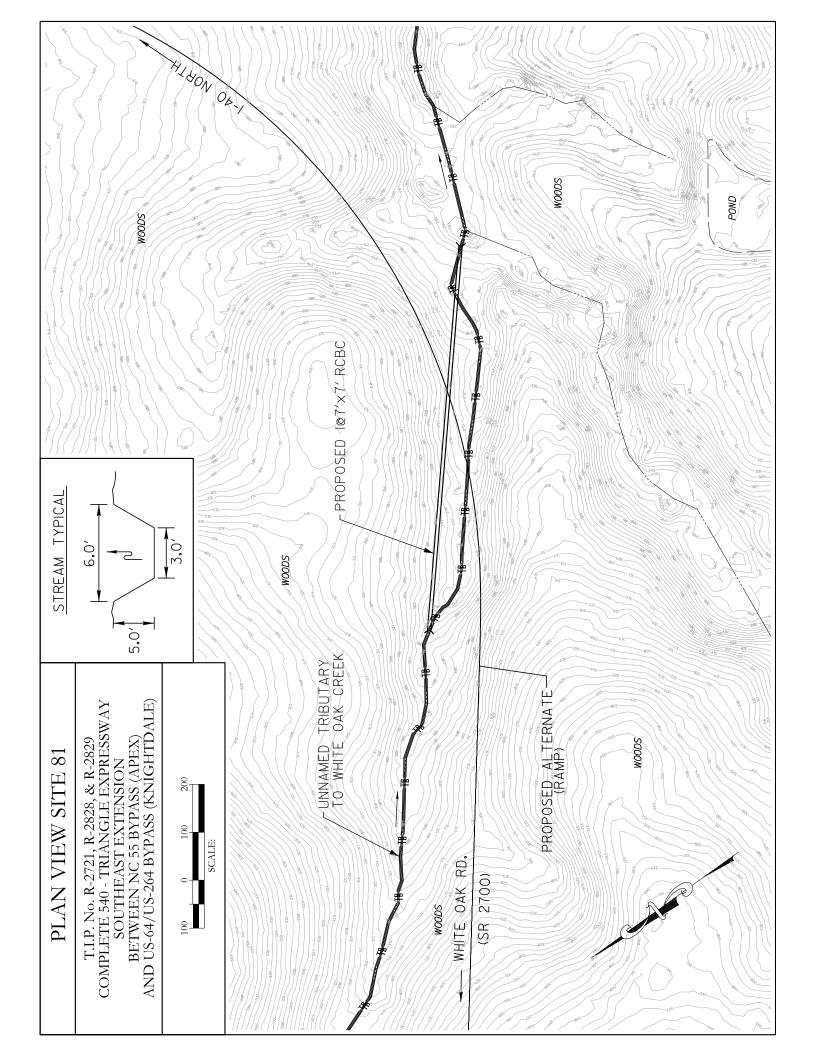


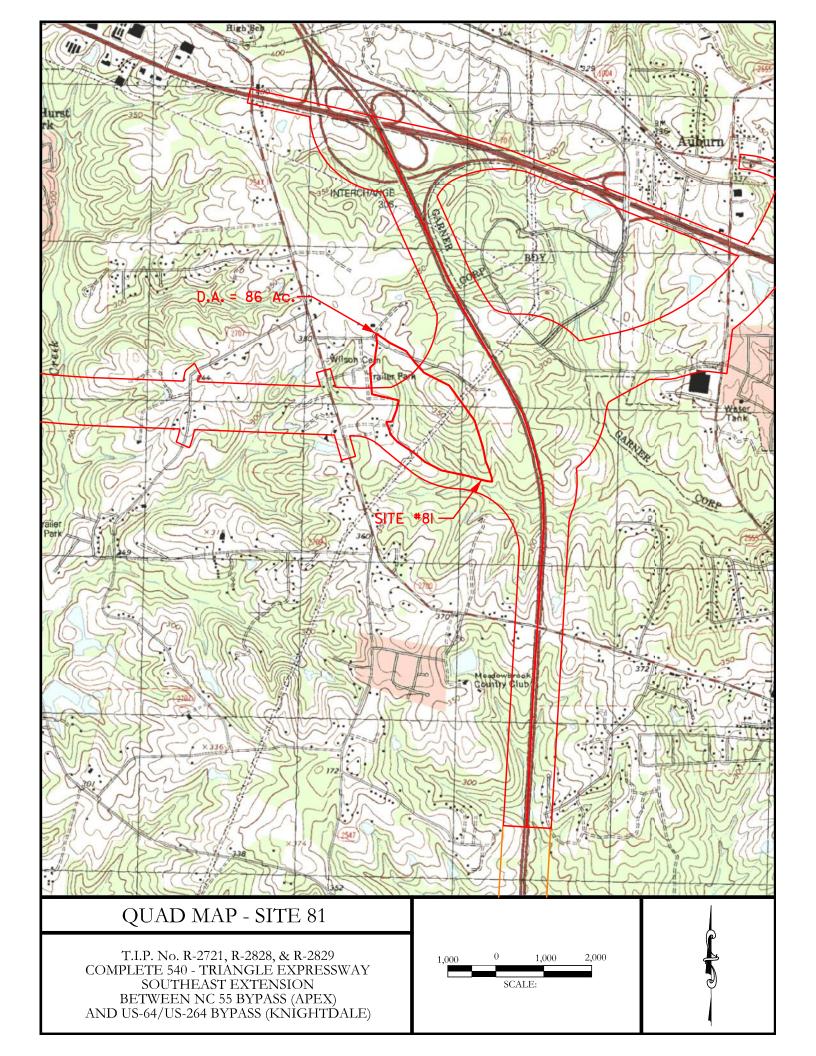
Looking at outlet of existing 72-inch CMP crossing at I-40



Looking downstream from outlet of existing 72-inch CMP

### Site 81





### **North Carolina**

PROJECT NAME: Triangle Expressway SE Ext.

4/18/2014

ENGLISH

0.13 Drainage Area =

sq. miles

REGION: BLUE RIDGE STREAM NAME: Unnamed Trib. to White Oak Creek

METHOD USED: Fact Sheet 007-00

<b>USGS RUR</b>	AL REGRE	<b>JSGS RURAL REGRESSION EQU</b>	ATIONS (OLD)	RUF	RAL EQUA	TIONS Rep	RURAL EQUATIONS Report 01-4207
FREQUENCY	Sand Hills	Coastal Plain	Blue Ridge	FREQUENCY	Blue Ridge	Coastal Plain	Sand Hills
	(cts)	(cts)	(cfs)		(cfs)	(cts)	(cfs)
2YR	6.81	19.48	35.91	2YR	32.93	16.73	8.01
5YR	11.07	46.26	64.51	5YR	62.07	36.00	13.56
10YR	14.55	73.15	87.75	10YR	88.29	54.62	17.96
25YR	19.05	124.26	125.19	25YR	130.19	85.33	24.36
50YR	22.93	174.39	157.32	50YR	168.00	114.62	29.92
100YR	27.19	240.48	197.45	100YR	212.13	150.03	35.87
200YR	33.38	323.86	240.85	200YR	263.26	192.45	42.82
500YR	38.31	468.30	323.05	500YR	343.84	261.63	53.11

# **USGS URBAN REGRESSION EQUATIONS**

BDF=

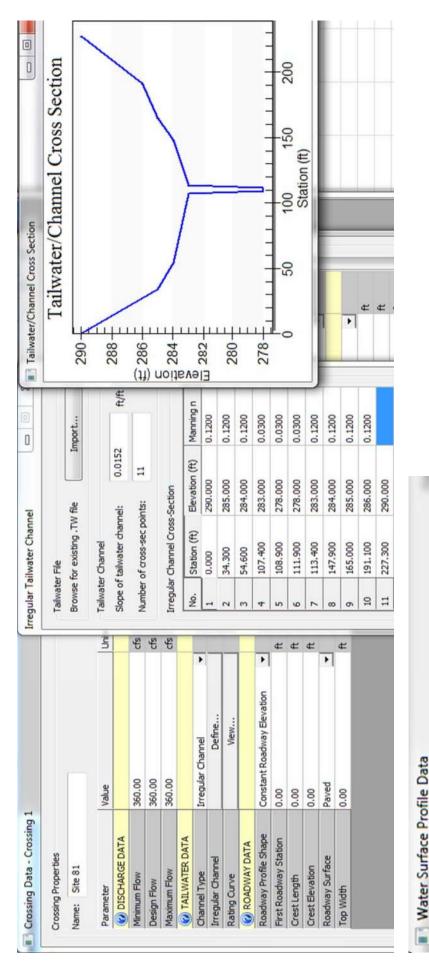
(These Equations are used only for comparison)

	4							_	
	Blue Ridge	(cts)	148.25	184.22	241.71	286.68	347.94	515.81	502.28
or companson)	Coastal Plain	(cts)	114.38	159.55	240.27	311.62	408.99	446.73	681.05
These Equations are used only for companson)	Sand Hills	(cts)	37.50	44.55	53.61	60.25	68.45	124.75	87.44
( Illese Edualic	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

) USGS Fact Sheet 007-00
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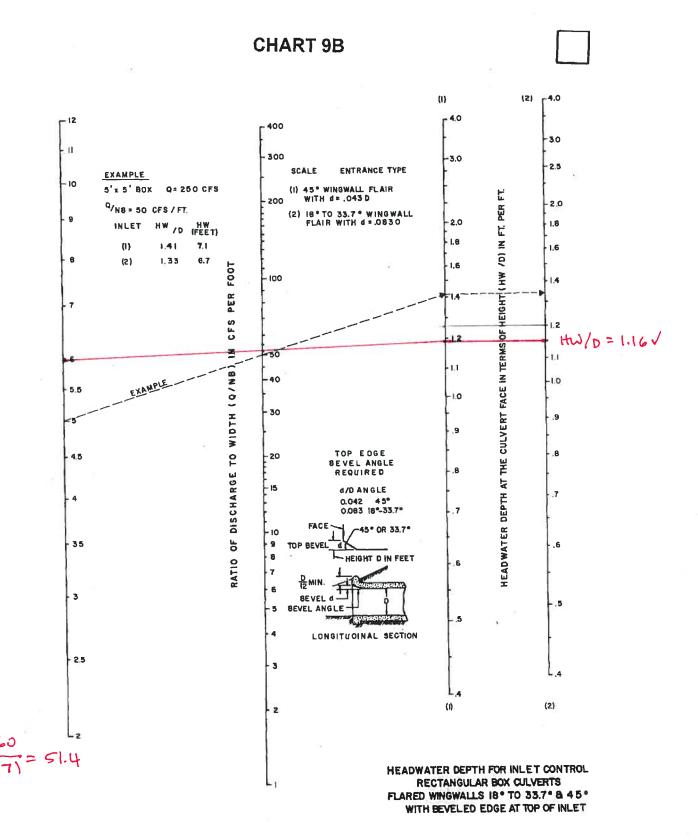
(Based on 2.80xQ10)

FEMA	REQUENCY Disharges			10YR	50YR	100YR	500YR		
	Blue Ridge Discharge Used					360		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	Blue Ridge	(cts)	153.41	204.08	314.64	360.79	405.53	571.43	746.95
	Coastal Plain	(cts)	139.72	193.67	313.19	372.85	431.73	542.28	708.83
35	Sand Hills	(cts)	92.82	120.99	165.30	193.14	218.43	338.79	442.84
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

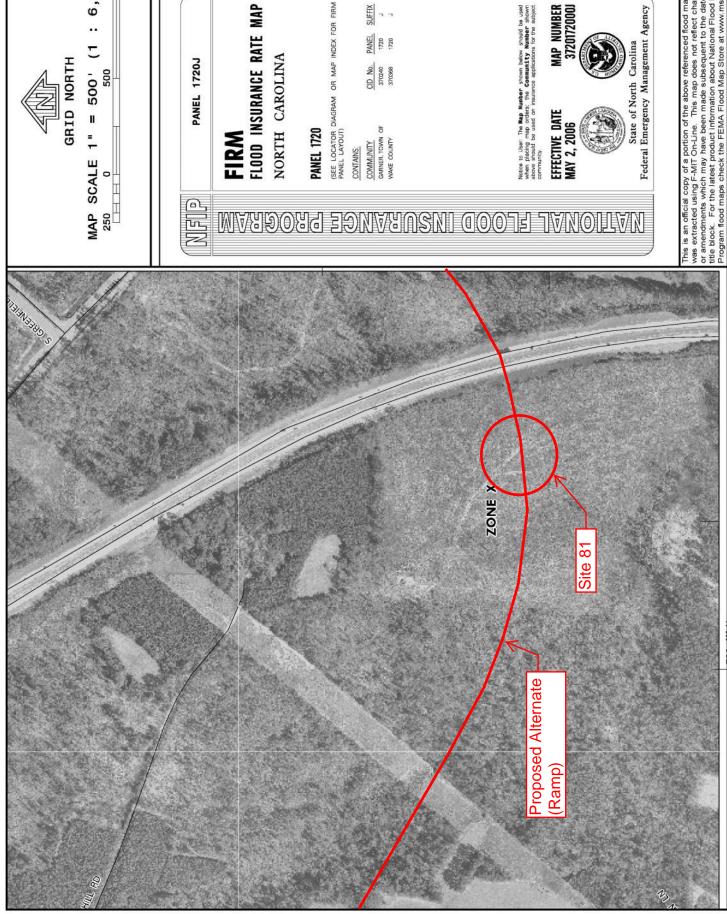


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Flow (cfs)	Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
360.000	284.128	6.128	4.267	5.812
360.000	284.128	6.128	4.267	5.812
360.000	284.128	6.128	4.267	5.812
360.000	284.128	6.128	4.267	5.812
360.000	284.128	6.128	4.267	5.812
360.000	284.128	6.128	4.267	5.812
360.000	284.128	6.128	4.267	5.812
360.000	284.128	6.128	4.267	5.812
360.000	284.128	6.128	4.267	5.812
360.000	284.128	6.128	4.267	5.812
360.000	284.128	6.128	4.267	5.812



PROPOSED STRUCTURE:



SUFFIX

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Federal Emergency Management Agency State of North Carolina

MAP NUMBER 3720172000J

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance

Name	Index Number	No Classification	euse River Basin Class Date
Description		Speci	al Designation
Whealton Creek	27-150-31-3	SA;HQW,NSW	05/01/88
From source to Gale Creek			
Wheat Swamp Creek	27-86-24	C;Sw,NSW	05/01/88
From source to Contentnea Creek			
Wheeler Gut	27-125-3	SC;NSW	05/01/88
From source to Dawson Creek			
Whitaker Branch	27-12-1-2	WS-IV;NSW	08/03/92
From source to Robertson Creek			
White Mash Run	27-77-2.5	C;Sw,NSW	05/01/88
From source to Falling Creek			
White Oak Branch	27-52-5-2	C;NSW	05/01/88
From source to Stone Creek			
White Oak Creek (Austin Pond)	27-43-11	C;NSW	05/01/88
From source to Swift Creek			
White Oak Swamp	27-86-9-3-1-2	C;Sw,NSW	05/01/88
From source to Juniper Swamp			
Whitehurst Creek	27-150-7-1	SC;Sw,HQW,NSW	08/01/90
From source to Chapel Creek			
Whiteoak Swamp	27-86-11-2	WS-III;NSW	08/03/92
From source to Toisnot Swamp			
Whiteoak Swamp	27-86-11-7	C;Sw,NSW	05/01/88
From source to Toisnot Swamp			
Whitleys Creek (Whitelace Creek)	27-76	C;Sw,NSW	05/01/88
From source to Neuse River			
Whittaker Creek	27-130	SA;HQW,NSW	05/01/88
From source to Neuse River			
Wildcat Branch	27-34-7	C;NSW	05/01/88
From source to Walnut Creek			
Williams Creek	27-43-2	WS-III;NSW	08/03/92
From source to Swift Creek			
Williamson Branch	27-33-18-1	C;NSW	05/01/88
From source to Pigeon House Branch			

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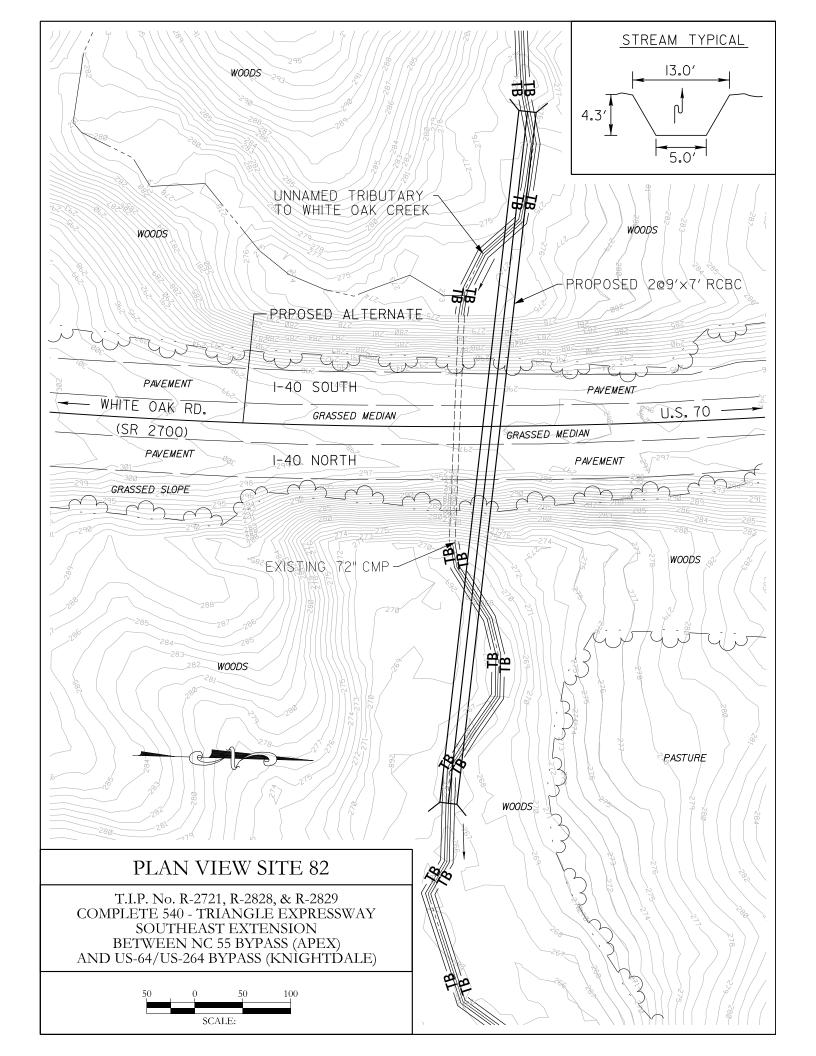


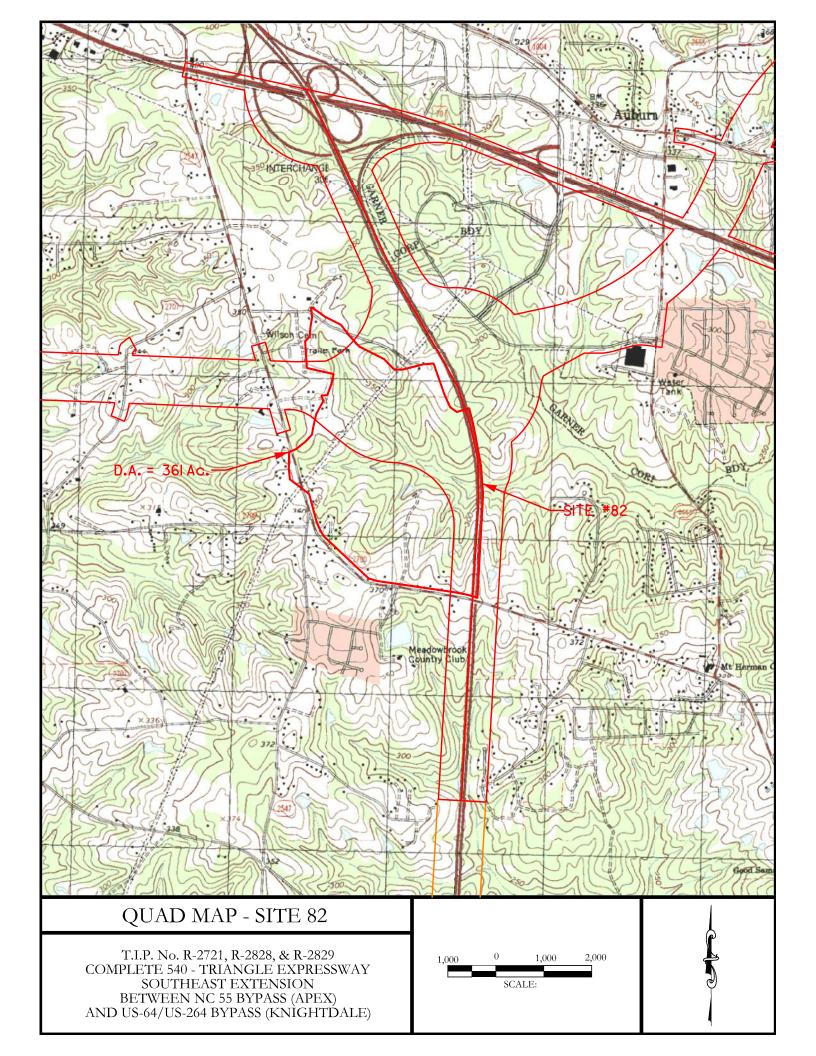
Looking Upstream from Proposed Crossing



Looking Downstream from Proposed Crossing

## **Site 82**





## **North Carolina**

4/18/2014 PROJECT NAME: Triangle Expressway SE Ext.

ENGLISH

0.55 Drainage Area =

sq. miles

STREAM NAME: Unnamed Trib. to White Oak Creek

REGION: BLUE RIDGE

METHOD USED: Fact Sheet 007-00

IONS (OLD) RURAL EQUATIONS Report 01-42	മ	(cfs)	95.27	166.15	224.43	315.69	393.92	489.53	593.76	
IONS (OLD)	മ									1
<b>USGS RURAL REGRESSION EQUATI</b>	astal Plain	(cts)	47.56	105.21	161.08	263.38	360.36	485.15	640.56	

## **USGS URBAN REGRESSION EQUATIONS**

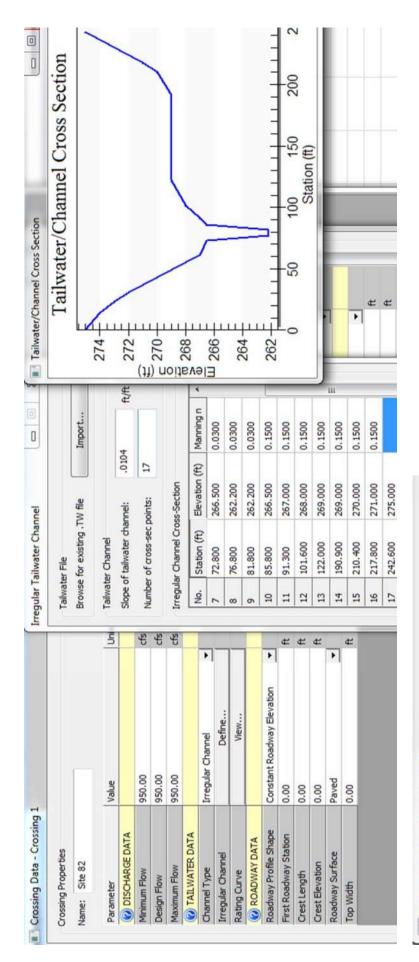
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(These Equations are used only for comparison)

								(Based on 2.80xQ10)	
		(cfs)							
ioi companson)	<b>Coastal Plain</b>	(cfs) (cfs)	276.05	373.11	541.61	693.33	898.74	1044.70	1460.94
ins are used oring	Sand Hills	(cfs)	107.47	127.50	154.75	176.99	204.68	356.99	269.80
( Hese Edualic	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

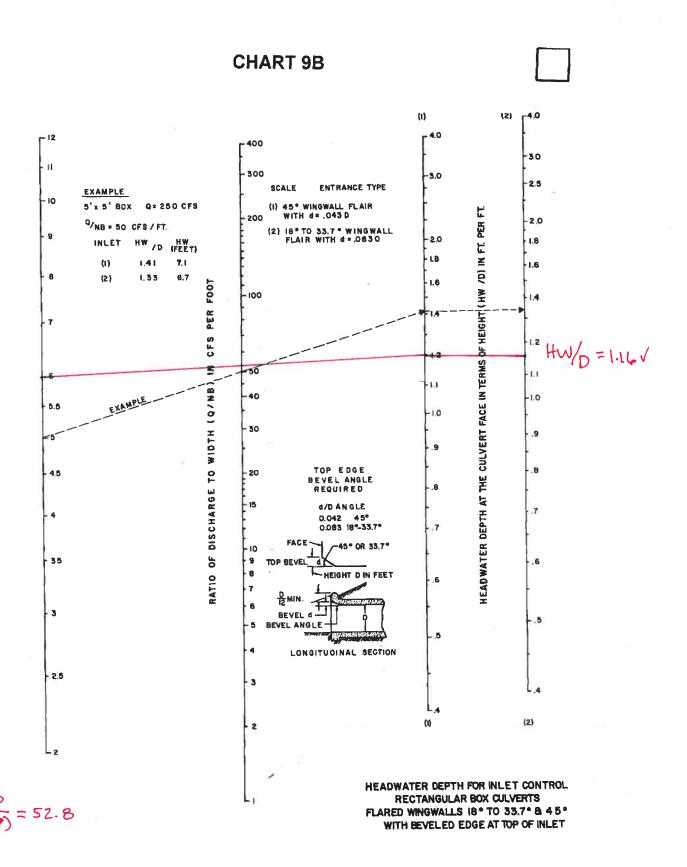
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FEMA	FREQUENCY Disharges			10YR	50YR	100YR	500YR		
	Blue Ridge Discharge Used					950		(Based on 2.80xQ10)	(Based on 3.66xQ10)
	Blue Ridge	(cts)	463.34	585.74	831.95	932.53	1025.08	1640.06	2143.79
	Coastal Plain	(cts)	406.78	532.79	781.54	905.63	1022.67	1491.82	1950.02
45	Sand Hills	(cts)	287.99	358.22	457.94	524.48	581.75	1003.02	1311.09
% Impervious =	FREQUENCY		5YR	10YR	25YR	50YR	100YR	200YR	500YR

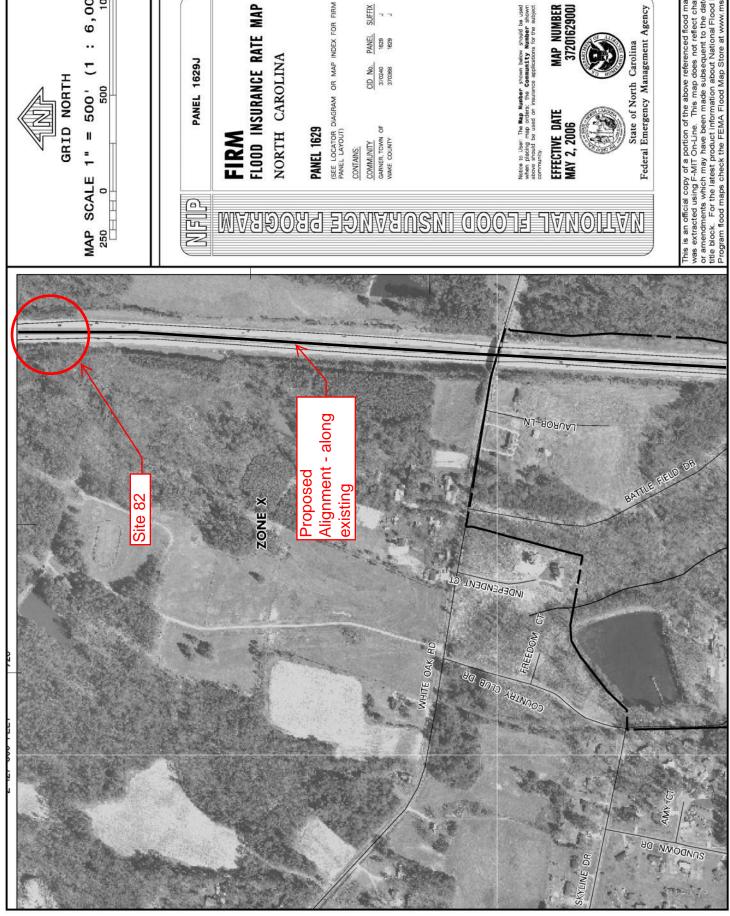


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Flow (cfs)	Elevation (ft) Depth (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)
950.000	268.770	6.570	7.275	4.264
950.000	268.770	6.570	7.275	4.264
950.000	268.770	6.570	7.275	4.264
950.000	268.770	6.570	7.275	4.264
950.000	268.770	6.570	7.275	4.264
950.000	268.770	6.570	7.275	4.264
950.000	268.770	6.570	7.275	4.264
950.000	268.770	6.570	7.275	4.264
950.000	268.770	6.570	7.275	4.264
950.000	268.770	6.570	7.275	4.264
950.000	268.770	6.570	7.275	4.264



PROPOSED STRUCTURE:



SUFFIX

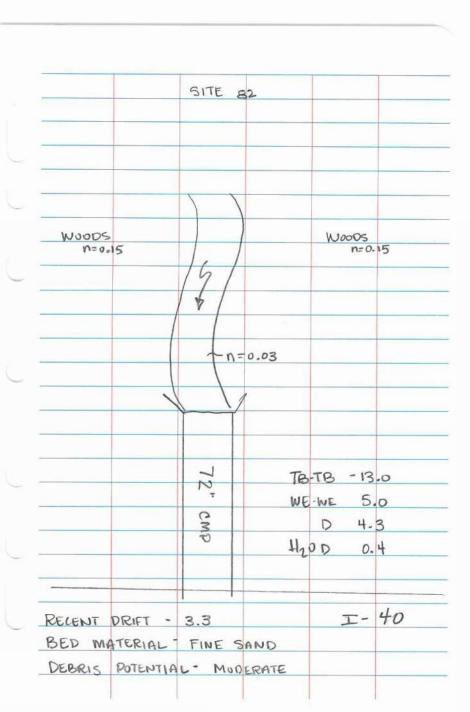
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MAP NUMBER 3720162900J

Name	Index Number	Classification	Neuse River Basin Class Date
Description		Sı	pecial Designation
Whealton Creek	27-150-31-3	SA;HQW,NSW	05/01/88
From source to Gale Creek			
Wheat Swamp Creek	27-86-24	C;Sw,NSW	05/01/88
From source to Contentnea Creek			
Wheeler Gut	27-125-3	SC;NSW	05/01/88
From source to Dawson Creek			
Whitaker Branch	27-12-1-2	WS-IV;NSW	08/03/92
From source to Robertson Creek			
White Mash Run	27-77-2.5	C;Sw,NSW	05/01/88
From source to Falling Creek			
White Oak Branch	27-52-5-2	C;NSW	05/01/88
From source to Stone Creek			
White Oak Creek (Austin Pond)	27-43-11	C;NSW	05/01/88
From source to Swift Creek			
White Oak Swamp	27-86-9-3-1-2	C;Sw,NSW	05/01/88
From source to Juniper Swamp			
Whitehurst Creek	27-150-7-1	SC;Sw,HQW,N	SW 08/01/90
From source to Chapel Creek			
Whiteoak Swamp	27-86-11-2	WS-III;NSW	08/03/92
From source to Toisnot Swamp			
Whiteoak Swamp	27-86-11-7	C;Sw,NSW	05/01/88
From source to Toisnot Swamp			
Whitleys Creek (Whitelace Creek)	27-76	C;Sw,NSW	05/01/88
From source to Neuse River			
Whittaker Creek	27-130	SA;HQW,NSW	05/01/88
From source to Neuse River			
Wildcat Branch	27-34-7	C;NSW	05/01/88
From source to Walnut Creek			
Williams Creek	27-43-2	WS-III;NSW	08/03/92
From source to Swift Creek			
Williamson Branch	27-33-18-1	C;NSW	05/01/88
From source to Pigeon House Branch			





Shot of inlet of existing 72-inch CMP crossing under I-40



Looking Upstream from existing 72-inch inlet



Shot of outlet of existing 72-inch CMP crossing under I-40



Looking Downstream from existing 72-inch outlet