

# **Section 404 / NEPA Interagency Merger Process Concurrence Meeting**

R-4707: SR 4471 (Reedy Fork Parkway) / US 29  
Interchange Improvements

Guilford County

STIP Project R-4707

WBS No. 36599.1.5

North Carolina Department of Transportation



**MERGER CONCURRENCE POINT 2A, 3, and 4A**

**November 8, 2017**

# Table of Contents

1. Introduction .....	1
1.1 Project Background .....	1
1.2 Public Involvement .....	1
2. Merger Team Concurrences to Date .....	2
2.1 CP1 & CP2.....	2
2.2 CP2 Revisited .....	2
3. Alternatives Considered.....	3
3.1 Summary of Alternatives Considered.....	3
3.2 Build Alternatives.....	3
4. CP2A: Bridging Decisions and Alignment Review.....	4
5. CP3: Least Environmentally Damaging Practicable Alternative (LEDPA) .....	5
6. CP4A: Avoidance and Minimization.....	7
7. Project Schedule .....	7
<b>Appendix</b>	
Figure 1A – Vicinity Map.....	8
Figure 1B – Jurisdictional Resources Map .....	9
Figure 2 – Alternative 1: Single Point Urban Interchange (SPUI).....	10
Figure 3 – Alternative 1 Revised: Diverging Diamond Interchange (DDI) .....	11
Figure 4 – Alternative 2: Partial Cloverleaf Interchange (PARCLO).....	12
Figure 5A – Alternative 1: Major Crossing Site 1 .....	13
Figure 5B – Alternative 1: Major Crossing Site 1A .....	14
Figure 6A – Alternative 1 Revised: Major Crossing Site 1 .....	15
Figure 6B – Alternative 1 Revised: Major Crossing Site 1C .....	16
Figure 7A – Alternative 2: Major Crossing Site 1.....	17
Figure 7B – Alternative 2: Major Crossing Site 1B .....	18
Figure 8 – Alternative 1, 1 Revised, & 2: Major Crossing Site 2.....	19
Figure 9 – Alternative 1, 1 Revised, & 2: Major Crossing Site 3.....	20
Attachment A – NCDOT Memorandum – Advantages of Diverging Diamond Interchange over Single Point Urban Interchange .....	21-22
Section 404/NEPA Merger Project Team Agreement Forms .....	23-25

# 1. INTRODUCTION

The North Carolina Department of Transportation (NCDOT) proposes a bridge replacement and an improvement to the existing interchange on US 29 at SR 4771 (Reedy Fork Parkway) in Guilford County. The proposed project would also include the realignment, part on new location, and upgrade of the existing SR 4771 (Reedy Fork Parkway) and SR 2526 (Summit Avenue). The proposed action is included in the 2018-2027 State Transportation Improvement Plan (STIP) as project number R-4707. Funding for Right-of-Way is expected to begin in Fiscal Year 2018 and construction to begin in Fiscal Year 2020.

## 1.1. PROJECT BACKGROUND

The project is located in northern Guilford County, approximately eight miles northeast of downtown Greensboro (Figure 1A). US 29 is a four-lane, median-divided facility that links I-40 in Greensboro with US 58 in Danville, Virginia. The study area is moderately developed and includes a mixture of light industry, institutional, and residential uses. There are currently plans for additional commercial, industrial and residential development in the vicinity of the existing interchange.

Traffic volumes are projected to increase on US 29 and Reedy Fork Parkway. The existing US 29 interchange, Summit Avenue, and Reedy Fork Parkway are not capable of handling these traffic volumes without experiencing substantial delays and increased accident potential.

## 1.2. PUBLIC INVOLVEMENT

A Citizens Informational Workshop (CIW) was held on November 13, 2006 at the Reedy Fork Community Center. Participants were able to view the alternative exhibits that depicted environmental constraints, proposed study area, business access and typical sections. Some concerns raised by the public regarding the project included truck access to local businesses, existing delays at study areas intersections, and increased truck traffic within the study area. Employees from local businesses directly impacted by the proposed project expressed the need for a traffic light at the intersection of Eckerson Road and Reedy Fork Parkway. Concerns were also raised regarding the existing roadway design not supporting wide turns for large trucks and the need for future designs to support the large truck volume that is anticipated to serve the local industrial facilities in the study area. Citizens also praised the inclusion of future bicycle facilities included in the project design.

Due to the passage of time and re-initiation of the project development process, a Public Meeting was held on April 21, 2016 to update the public on the project studies, to present the design alternatives, and to request their comments on the design alternatives and the project in general. The Public Hearing is anticipated in the Spring of 2018 after preparation of the State Environmental Assessment (SEA).

## 2. MERGER HISTORY

### 2.1 CP1 & CP2: PROJECT PURPOSE AND NEED AND STUDY AREA DEFINED AND DESIGN OPTIONS FOR DETAILED STUDY

The Merger Team concurred on the following Purpose and Need Statement on September 21, 2006.

The proposed project is intended to benefit the local citizens of the Greensboro area. The project's purpose is to provide a set of objectives that will address the transportation needs identified in the study area. The purpose of this project is:

- To replace a structurally deficient bridge over US 29.
- To improve the existing US 29 / Reedy Fork Parkway Interchange to meet interstate standards in anticipation of the future upgrade of US 29 to I-785 (TIP U-2525).
- To accommodate the future traffic volumes from the Reedy Fork Ranch development and other anticipated future developments in the study area.

The Merger Team also concurred on the Design Options for Detailed Study on September 21, 2006. The following alternatives were presented to the merger team at the meeting, and the first three alternatives were selected to be carried forward for detailed study. Alternative 4 (Tight Partial Cloverleaf) was not carried forward.

- Alternative 1 (SPUI): This is a single point urban interchange where all left turns are handled at one signalized intersection and all right movements are free flow.
- Alternative 2 (Partial Cloverleaf): All ramp movements are located on the south side of the interchange.
- Alternative 3 (Traditional Diamond): This design has a one-way diagonal ramp in each interchange quadrant. The ramps are aligned with free-flow terminals on US 29 with signalized intersections on Reedy Fork Parkway at the ramp intersections.
- Alternative 4 (Tight Partial Cloverleaf): All ramp movements are located on the south side of the interchange.

With the funding constraints, this project was on hold for several years. In 2013, the project was reinitiated to refine and update the design alternatives with updated traffic volumes. A Diverging Diamond Interchange (DDI) was studied to improve traffic operations and to minimize human and natural environmental impacts.

### 2.2 CP2 REVISITED: DESIGN OPTIONS FOR DETAILED STUDY

The Merger Team was presented with Design Options for Detailed Study on May 18, 2016. In addition to the previously studied alternatives, an Alternative 1 Revised, which included a Diverging Diamond Interchange was presented to the merger team at the meeting. Alternative 3 (Traditional Diamond) and Alternative 4 (Tight Partial Cloverleaf) were not carried forward. The merger team selected the following alternatives to be carried forward for detailed study:

- Alternative 1 Single Point Urban Interchange (SPUI)
- Alternative 1 Revised Diverging Diamond Interchange (DDI)
- Alternative 2 (Partial Cloverleaf)

### **3. ALTERNATIVES CONSIDERED**

#### **3.1 SUMMARY OF ALTERNATIVES TO BE CONSIDERED**

The identification, consideration, and analysis of alternatives are key to the NEPA process and the goal of objective decision-making. Consideration of alternatives leads to a solution that satisfies the transportation need and avoids and minimizes adverse impacts to environmental and community resources. The jurisdictional resources map is shown on Figure 1B.

#### **3.2 BUILD ALTERNATIVES**

The Build Alternatives under consideration for R-4707 consist of three interchange configurations. Each interchange configuration will meet the project's purpose and need by providing a new bridge and improved interchange. Based on an examination of traffic operations, all Build Alternatives would provide for Level of Service D or better in the 2040 Design Year.

The connecting roadways associated with the construction of the new Reedy Fork Parkway Interchange on US 29 would not vary between the Build Alternatives. In all Build Alternatives, Reedy Fork Parkway connects to US 29 with the following improvements:

- Removal of the existing structurally deficient bridge over US 29;
- Improvements to existing Summit Avenue;
- Improved traffic flow, safety, and truck movements;
- Improved bicycle and pedestrian facilities on Reedy Fork Parkway.

**Build Alternative 1: Single Point Urban Interchange (SPUI)** - The SPUI Alternative involves the signalization of three intersections on Reedy Fork Parkway between Summit Avenue and Eckerson Road (see Figure 2). Summit Avenue will be realigned to tie into the realigned and extended Reedy Fork Parkway forming a signalized four-leg intersection. For this alternative, three intersections will be signalized along Reedy Fork Parkway between Summit Avenue and the proposed Service Road connecting Reedy Fork Parkway to existing land uses along US 29.

**Build Alternative 1 Revised: Diverging Diamond Interchange (DDI)** – A diverging diamond interchange (DDI) is a type of diamond interchange in which the two directions of traffic from US 29 cross to the opposite side on both sides of the bridge at the interchange (see Figure 3).

**Build Alternative 2: Partial Cloverleaf Interchange** – The partial cloverleaf interchange includes a loop and a ramp in the southeast and southwest quadrants of the proposed Reedy Fork Road Interchange (see Figure 4). The ramp terminals connect with planned roadways on the north side of Reedy Fork Parkway.

A traffic capacity report was completed in February 2017 to analyze the existing 2016, 2020, and the projected 2040 traffic operations at the existing US 29/Reedy Fork Parkway interchange and to analyze the 2040 future traffic conditions for three (3) interchange build alternatives.

Based on the analysis, the current interchange operates below capacity during the 2016 existing conditions and is projected to operate over capacity by year 2040 if no improvements are made to the interchange.

It has been determined that all three (3) of the build alternatives will operate at acceptable levels of service (LOS D or better) in design year 2040 if the recommended geometrics and traffic control is implemented as noted in this report.

#### 4. CP2A: BRIDGING DECISIONS AND ALIGNMENT REVIEW

For all three alternatives carried forward for detailed study following CP2, the alignment of Reedy Fork Parkway was shifted south to avoid environmental and commercial impacts, and to maintain operation of the existing interchange during construction. Based on these alignment refinements, functional designs and cost estimates were developed for the three alternatives listed below:

- Alternative 1 – Single Point Urban Interchange (SPUI)
- Alternative 1 Revised – Diverging Diamond Interchange (DDI)
- Alternative 2 – Partial Cloverleaf Interchange (PARCLO)

A comparison of bridges and major hydraulic crossings through the interchange area are shown below in Tables 1 and 2 for each alternative, and are depicted on Figures 5A, 5B, 6, 7A, 7B, 8, and 9.

**TABLE 1  
BRIDGE COMPARISON**

Evaluation Factor	Alternative 1 -SPUI	Alternative 1 Revised - DDI	Alternative 2 – PARCLO
Bridge Length (ft)	156	156	168
Bridge Area (sq ft)	22,448	18,967	17,808

**TABLE 2**  
**MAJOR HYDRAULIC CROSSINGS (See Figures 5A, 5B, 6A, 6B, 7A, 7B, 8, & 9)**

SITE NUMBER	ALT ID	ROUTE	STATION	STREAM NAME	New Structure/ Extension	EXISTING STRUCTURE	MINIMUM RECOMMENDED STRUCTURE	Length of Culvert or Extension (LF)	Notes
						Number, Size, Structure Type	Number, Size, Structure Type		
1	1	US-29	69+25 -L-	Reedy Fork Trib. 9	Extension	3@7'x8' RCBC	3@7'x8' RCBC	455	Retain and extend existing culvert with beveled headwall
	1REV	US-29	69+25 -L-	Reedy Fork Trib. 9	Extension	3@7'x8' RCBC	3@7'x8' RCBC	438	Retain and extend existing culvert with beveled headwall
	2	US-29	69+25 -L-	Reedy Fork Trib. 9	Extension	3@7'x8' RCBC	3@7'x8' RCBC	581	Retain and extend existing culvert with beveled headwall
1A	1	SR 2526	44+57 -Y-	Reedy Fork Trib. 9	New	N/A	3@7'x11' RCBC	305	Bury culvert. Beveled Headwall
1B	2	SR 2526	44+20 -Y-	Reedy Fork Trib. 9	New	N/A	3@7'x11' RCBC	339	Bury culvert. Beveled Headwall
1C	1REV	SR 2526	44+40 -Y-	Reedy Fork Trib. 9	New	N/A	3@7'x11' RCBC	412	Bury culvert. Beveled Headwall
2	1, 1REV, 2	SR 4771	20+93 -Y2-	Reedy Fork Trib. 9	Extension	3@7'x8' RCBC	3@7'x8' RCBC	0	Retain and clean out existing culvert
3	1, 1REV, 2	SR 4772	57+80 -Y-	UT to Reedy Fork	Extension	2@8'x8' RCBC	2@8'x8' RCBC	19	Retain and extend existing culvert

## 5. CP3: LEAST ENVIRONMENTALLY DAMAGING PRACTICABLE ALTERNATIVE (LEDPA)

The project Roadway Engineers have established anticipated right-of-way requirements based on preliminary functional roadway design. Due to variations in the topography, among other factors, there are some variations along each alternative.

The anticipated right-of-way limits were utilized to develop anticipated impacts for each Build Alternative. Stream and wetland impacts were calculated in GIS based on slope stakes plus 25 feet. Table 3 summarizes the impact analysis. All impacts included in this report are based on preliminary functional roadway design; avoidance and minimization will continue to be pursued throughout the design development.

**TABLE 3**  
**R-4707 ALTERNATIVES COMPARISON**

Evaluation Factor	Alternative 1 -SPUI	Alternative 1 Revised - DDI	Alternative 2 - Partial Clover
<b>Impacts</b>			
Additional Right of Way Needed- acres	47	49	53
Residential Relocations	0	0	0
Business Relocations	0	0	0
Schools Impacted	0	0	0
Parks Impacted	0	0	0
Churches/Cemeteries Impacted	0	0	0

Receptors Impacted by Noise	0			0			0		
<b>Cultural Resource Factors</b>									
Potential Archaeological Sites	0			0			0		
Recorded Archaeological Sites	0			0			0		
Historic Properties Effected	0			0			0		
<b>Natural Resources Factors</b>									
Protected Species Impacted	0			0			0		
<b>Stream - linear feet* (SQ**) Impacts</b>	<b>Total</b>	<b>Direct</b>	<b>Buffer</b>	<b>Total</b>	<b>Direct</b>	<b>Buffer</b>	<b>Total</b>	<b>Direct</b>	<b>Buffer</b>
SD (East)(Perennial) (SQ-54)	913	869	44	944	910	34	842	670	172
SD (West)(Perennial) (SQ-54)	325	256	69	340	312	28	601	558	43
SO (Intermittent) (SQ-52)	112	71	41	95	32	63	458	288	170
SI (Intermittent) (SQ-45)	118	68	50	118	68	50	113	65	48
SR (Intermittent) (SQ-56)	---	---	---	---	---	---	203	177	26
SA (Perennial) (SQ-64)	61	16	45	61	14	47	61	16	45
<b>Stream Total</b>	<b>1529</b>	<b>1280</b>	<b>249</b>	<b>1558</b>	<b>1336</b>	<b>222</b>	<b>2278</b>	<b>1774</b>	<b>504</b>
<b>Wetlands – acres***(WR****) Impacts</b>	<b>Total</b>	<b>Direct</b>	<b>Buffer</b>	<b>Total</b>	<b>Direct</b>	<b>Buffer</b>	<b>Total</b>	<b>Direct</b>	<b>Buffer</b>
WJ (Headwater Forest) (WR-40)	0.47	0.41	0.06	0.40	0.33	0.07	0.56	0.54	0.02
WI (NTFM) (WR-49)	0.02	0.00	0.02	0.02	0.02	0.00	0.02	0.01	0.01
WF (Headwater Forest) (WR-36)	0.03	0.01	0.02	0.03	0.01	0.02	0.02	0.00	0.02
WL (Bottomland Hardwood Forest) (WR-36)	---	---	---	---	---	---	0.03	0.01	0.02
WA (NTFM) (WR-51)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Wetland Total</b>	<b>0.52</b>	<b>0.42</b>	<b>0.10</b>	<b>0.45</b>	<b>0.36</b>	<b>0.09</b>	<b>0.63</b>	<b>0.56</b>	<b>0.07</b>
Ponds	0			0			0		
Stream Crossings (#)	5			5			5		
<b>Physical Factors</b>									
Hazardous Materials Sites	0			0			0		
Number of Exceedances of CO NAAQS	0			0			0		
Federal Lands	0			0			0		
Railroad Crossings	0			0			0		
Greenway Crossings	0			0			0		
Low Income/Minority Populations (y/n)	N			N			N		
Limited English Proficiency Populations (y/n)	N			N			N		
<b>Cost Estimates</b>									
Right-of-way	\$18,128,000			\$18,488,000			\$15,800,000		
Utilities	\$642,000			\$590,000			\$409,000		
Construction	\$34,600,000			\$34,200,000			\$32,200,000		
Total	\$53,370,000			\$53,278,000			\$48,409,000		

Non-Tidal Freshwater Marsh (NTFM)

\*Stream impacts were calculated based on slope stakes plus 25 feet.

\*\*Stream Quality

\*\*\*Wetland impacts were calculated based on slope stakes plus 25 feet.

\*\*\*\*Wetland Rating

Although Alternative 2 is the least expensive option, it has the greatest stream and wetland impacts and right of way needs of the three alternatives, therefore, this option was eliminated from further consideration.

Alternative 1 and Alternative 1 Revised have comparable wetland impacts and stream impacts. Alternative 1 Revised has 29 feet more stream impacts but 0.07 acres fewer wetland impacts than Alternative 1. The



cost of the overall DDI design is approximately \$92,000 less than the SPUI, and as noted in the memo from the NCDOT State Traffic Management Engineer (Attachment A), the DDI is the preferred interchange in comparison to the SPUI, at this location and in general for new interchanges in North Carolina. A summary of the reasons include:

- Improved safety due to fewer traffic conflict points.
- Improved bicycle and pedestrian safety.
- Less bridge construction and maintenance costs.
- Simplified bridge geometry and shorter construction schedule.
- Two-phase traffic signal (DDI) is more efficient than three-phase traffic signal (SPUI).
- Improved traffic signal progression due to easier coordination with nearby signals.

For these reasons, NCDOT requests concurrence from the Merger Team to eliminate Alternatives 1 and 2 from further consideration and to recommend Alternative 1 Revised (DDI) as the LEDPA.

## 6. CP 4A: AVOIDANCE AND MINIMIZATION

The recommended alternative minimizes impacts to resources. However, it is not feasible for the proposed project to completely avoid impacts to jurisdictional resources and still meet the purpose and need of the project. Proposed impacts were calculated based on the proposed roadway slope stake limits plus an additional 25 feet.

The following avoidance and minimization efforts have been incorporated into the project:

- Modified interchange shifted to the south to avoid impacts to Hardy's Mill Pond.
- Tight ramp alignments considered to avoid impacts to the earthen dam in the southeast quadrant.
- Stream impacts minimized by daylighting a short segment of the stream in the southeast quadrant.
- Improvements along existing Reedy Fork Parkway designed to avoid impacts to the stream mitigation site at Reedy Fork (See Figures 2, 3, & 4).
- Adverse effects to businesses were avoided and minimized by shifting the bridge south.
- Widening of the proposed alignment varies between symmetrical widening and widening north or south of the existing roadway, as needed, to minimize impacts to land use and important environmental features.

Additional minimization may be achieved during final design with more precise mapping, including the project hydraulic design (Concurrence Points 4B and 4C), and utility relocation design.

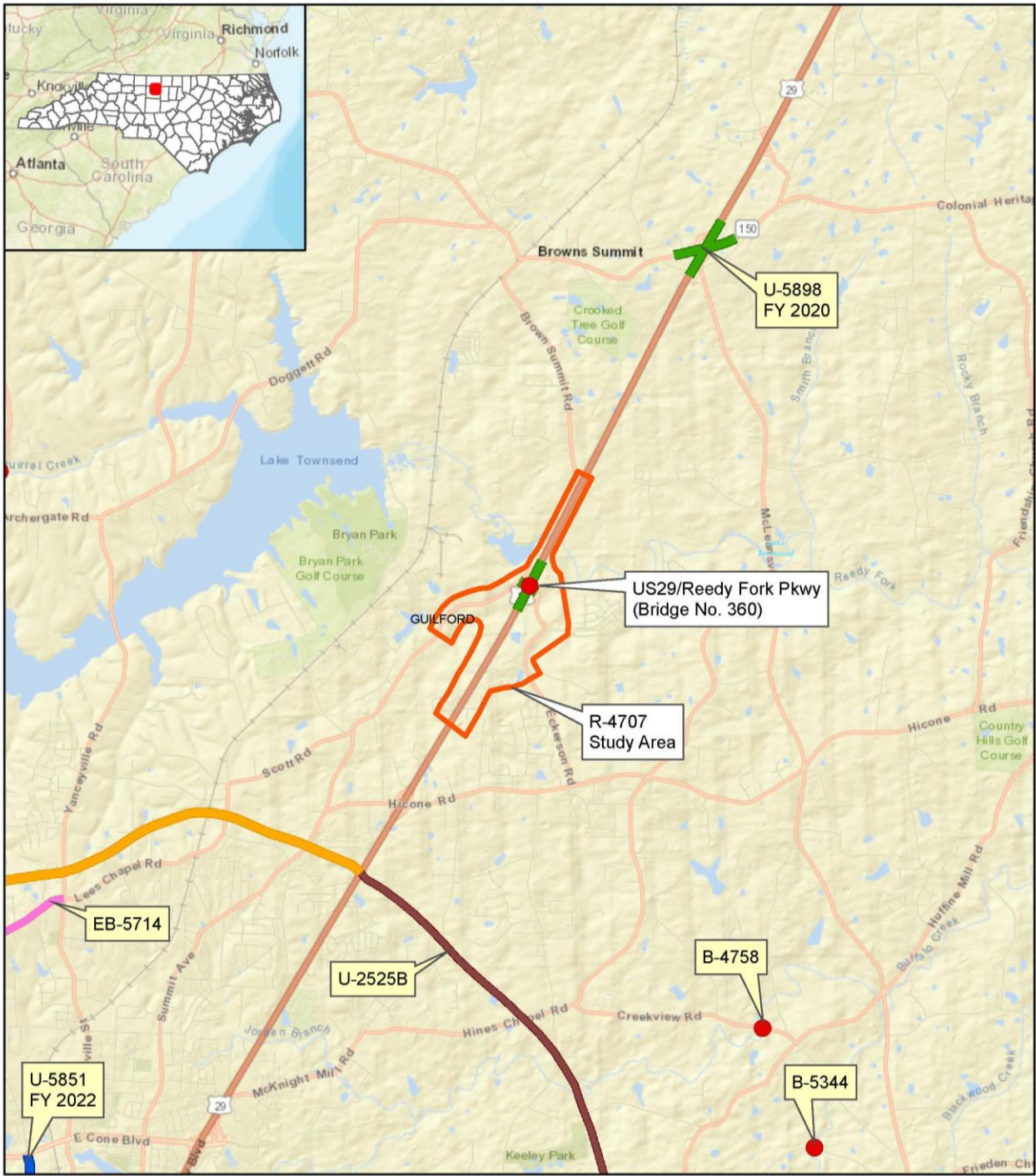
## 7. PROJECT SCHEDULE

The tentative project schedule is below:

- |                                   |               |
|-----------------------------------|---------------|
| • State Environmental Assessment  | February 2018 |
| • Public Hearing                  | Spring 2018   |
| • Begin Right-of-Way Acquisition* | FY 2019       |
| • Begin Construction*             | FY 2020       |

Notes: \* 2018-2027 STIP, August 2017; these major milestone target dates are preliminary and subject to change.




**FIGURE 1A**



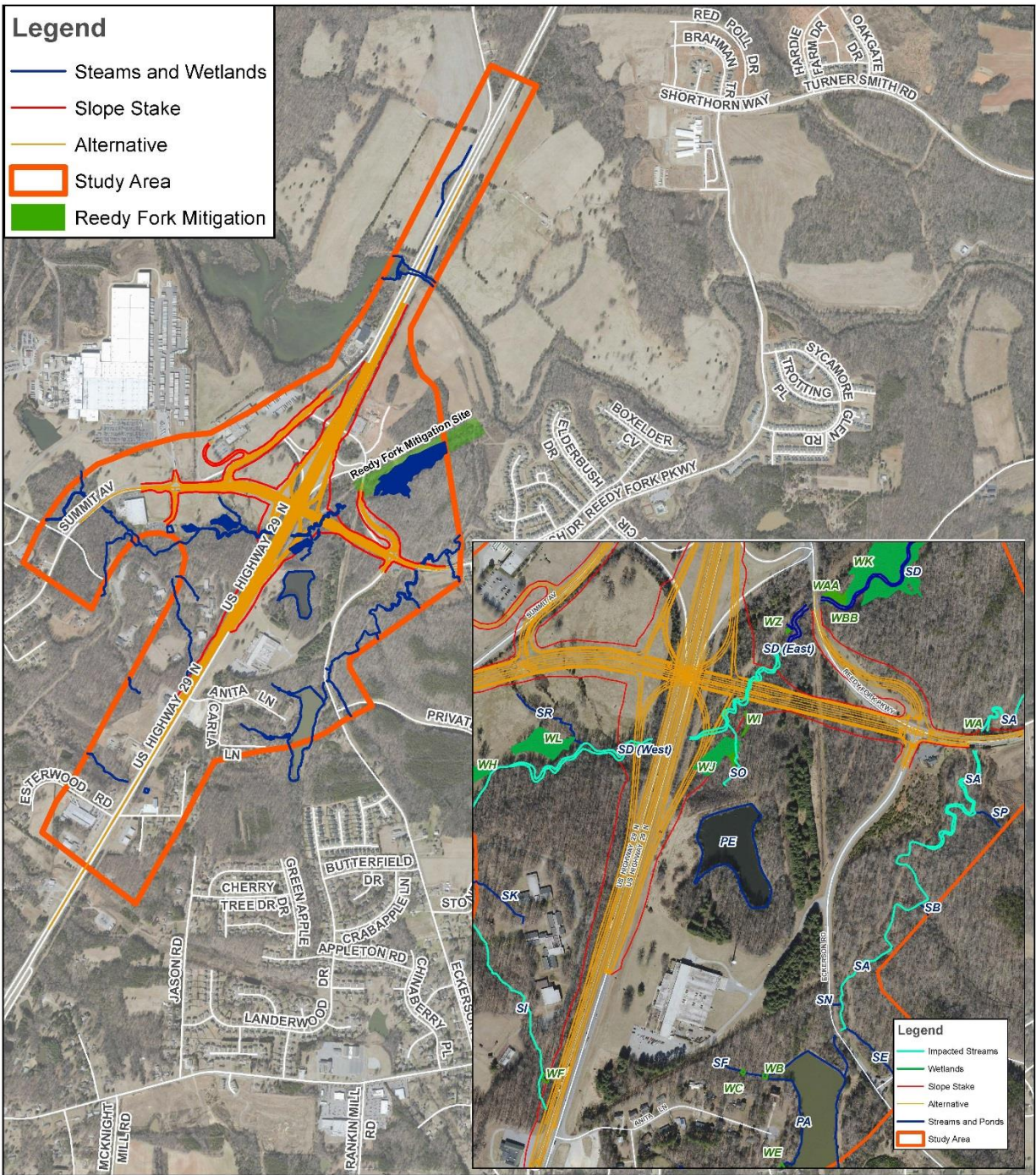
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS PROJECT DEVELOPMENT AND ENVIRONMENTAL ANALYSIS BRANCH		<b>VICINITY MAP</b> US 29 / REEDY FORK PARKWAY INTERCHANGE IMPROVEMENTS		County: GUILFORD
				Div: 7   R-4707
				WBS #: 36599.1.5
		MARCH 2017		Figure S-1
		0 2,500 5,000 10,000 Feet		




**FIGURE 1B**



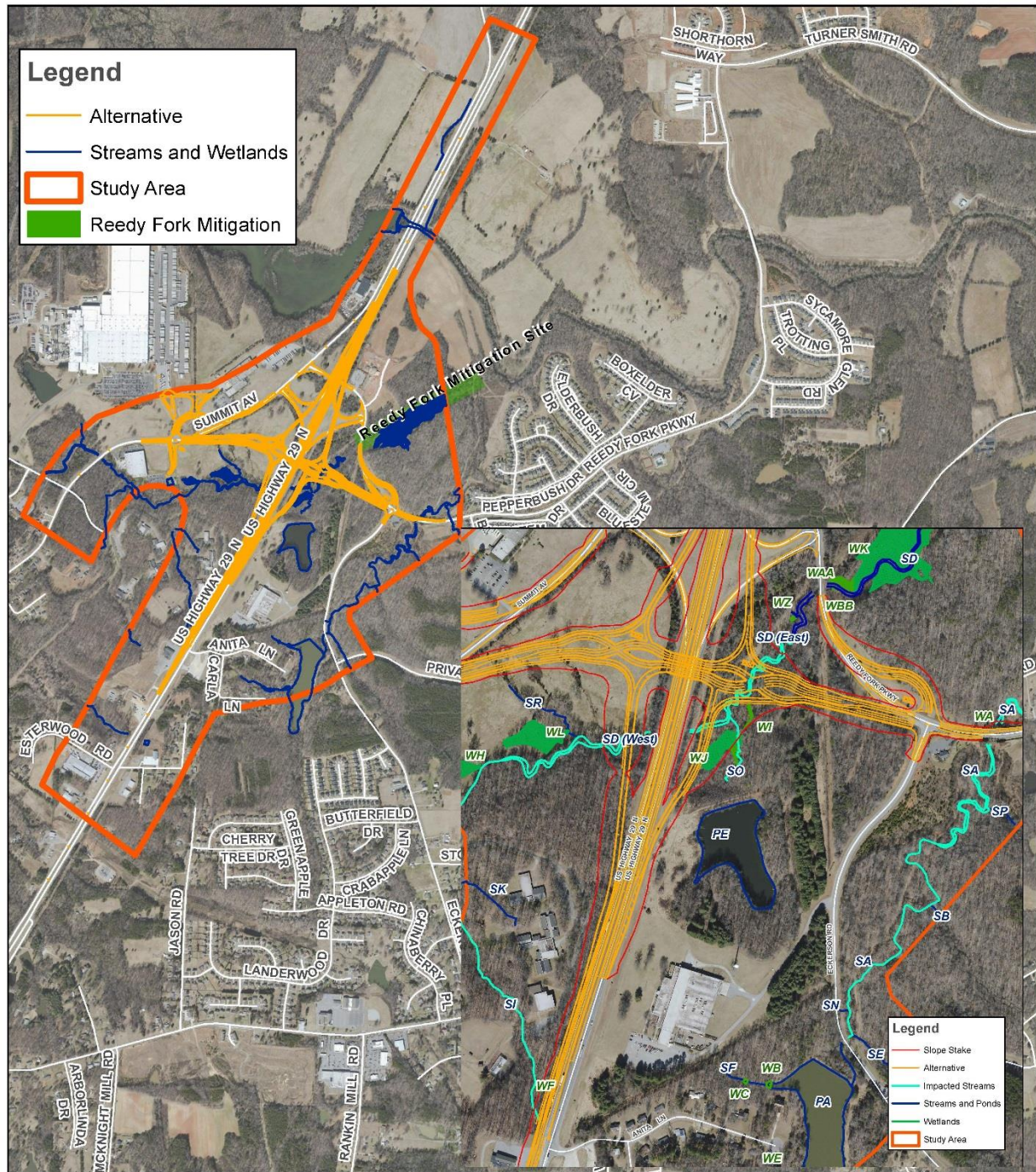
<p>NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS PROJECT DEVELOPMENT AND ENVIRONMENTAL ANALYSIS BRANCH</p> 	<p><b>JURISDICTIONAL RESOURCES MAP</b></p> <p>US 29 / REEDY FORK PARKWAY INTERCHANGE IMPROVEMENTS</p> <p>0 500 1,000 Feet</p> 		<p>County: GUILFORD</p>
	<p>Div: 7</p>	<p>R-4707</p>	<p>WBS #: 36599.1.5</p>
	<p>September 2017</p>		<p>Figure #1B</p>
			
	<p>0 500 1,000 Feet</p>		

**FIGURE 2**



<p>NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS PROJECT DEVELOPMENT AND ENVIRONMENTAL ANAYSIS BRANCH</p> 	<p><b>SINGLE POINT URBAN INTERCHANGE (SPUI) ALTERNATIVE 1</b></p> <p>US 29 / REEDY FORK PARKWAY INTERCHANGE IMPROVEMENTS</p> 		<p>County: GUILFORD</p>
	<p>Div: 7</p>	<p>R-4707</p>	<p>WBS #: 36599.1.5</p>
	<p>MARCH 2017</p>		<p>Figure #2</p>
			

**FIGURE 3**



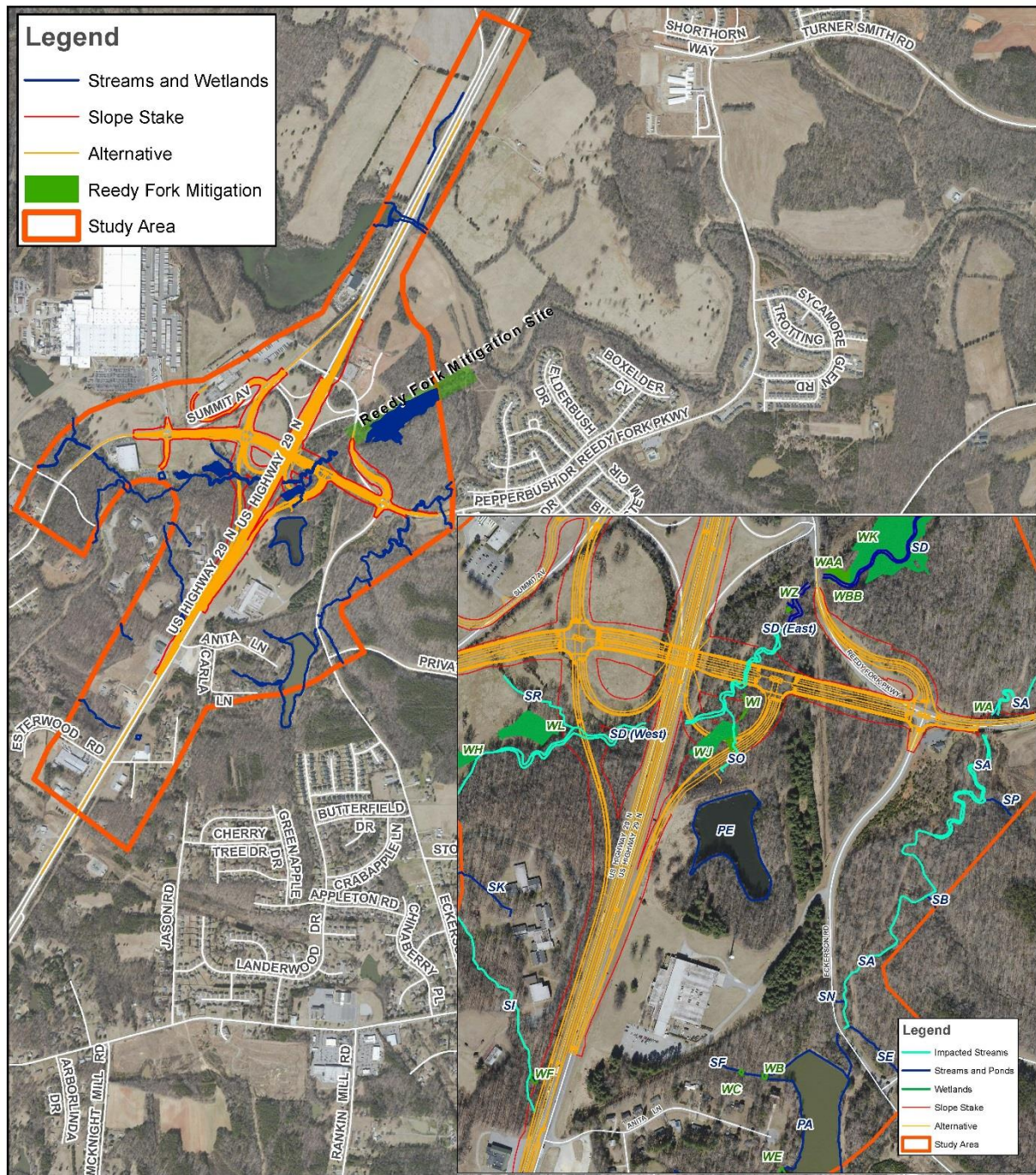
NORTH CAROLINA  
DEPARTMENT OF  
TRANSPORTATION  
DIVISION OF  
HIGHWAYS PROJECT  
DEVELOPMENT AND  
ENVIRONMENTAL  
ANAYSIS BRANCH

**DIVERGING DIAMOND INTERCHANGE (DDI)  
ALTERNATIVE 1 REVISED**  
US 29 / REEDY FORK PARKWAY  
INTERCHANGE IMPROVEMENTS



County: <b>GUILFORD</b>	
Div. 7	<b>R-4707</b>
WBS # <b>36599.1.5</b>	
<b>MARCH 2017</b>	
<b>Figure #3</b>	

**FIGURE 4**



NORTH CAROLINA  
DEPARTMENT OF  
TRANSPORTATION  
DIVISION OF  
HIGHWAYS PROJECT  
DEVELOPMENT AND  
ENVIRONMENTAL  
ANAYSIS BRANCH



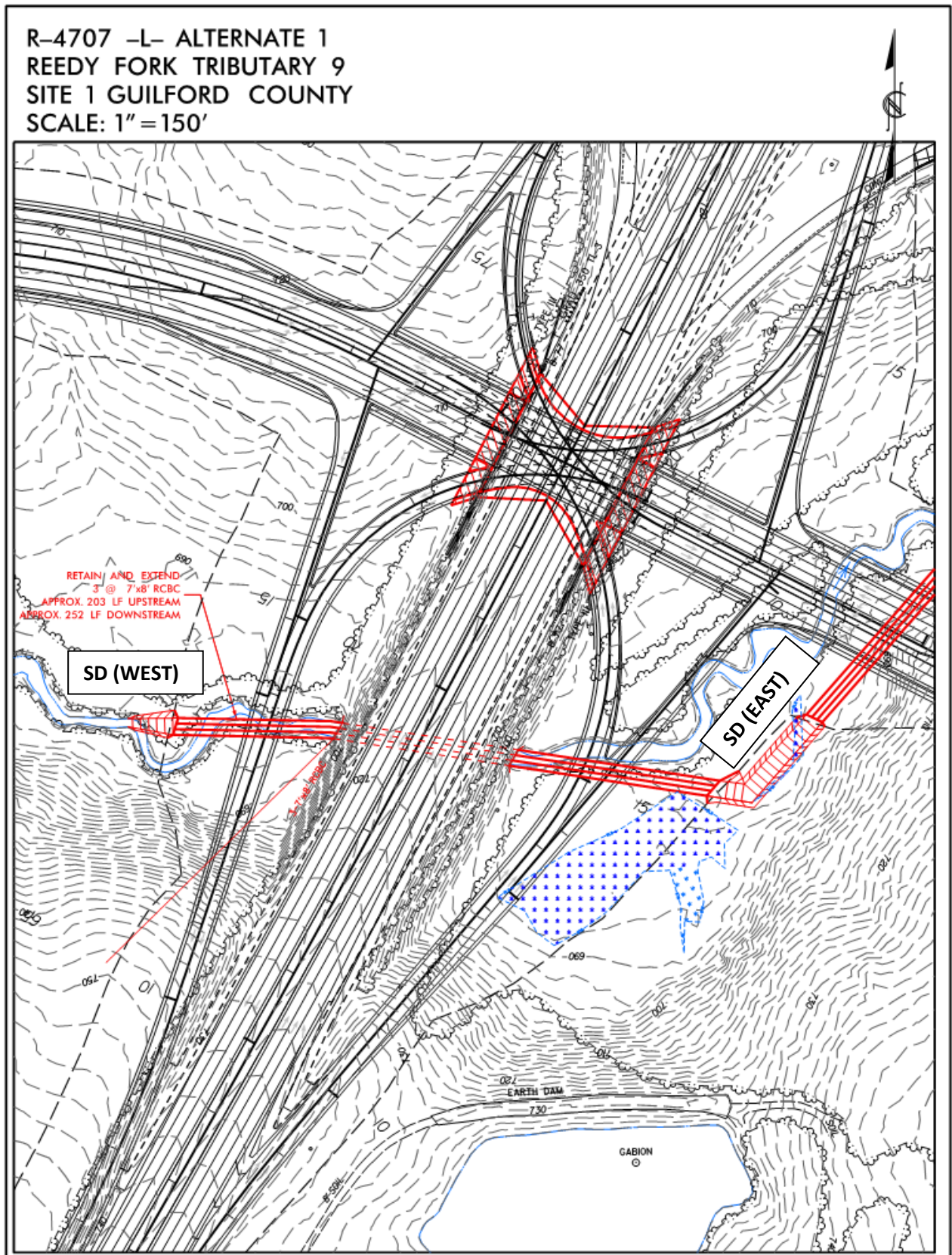
**PARTIAL CLOVERLEAF  
ALTERNATIVE 2**

US 29 / REEDY FORK PARKWAY  
INTERCHANGE IMPROVEMENTS

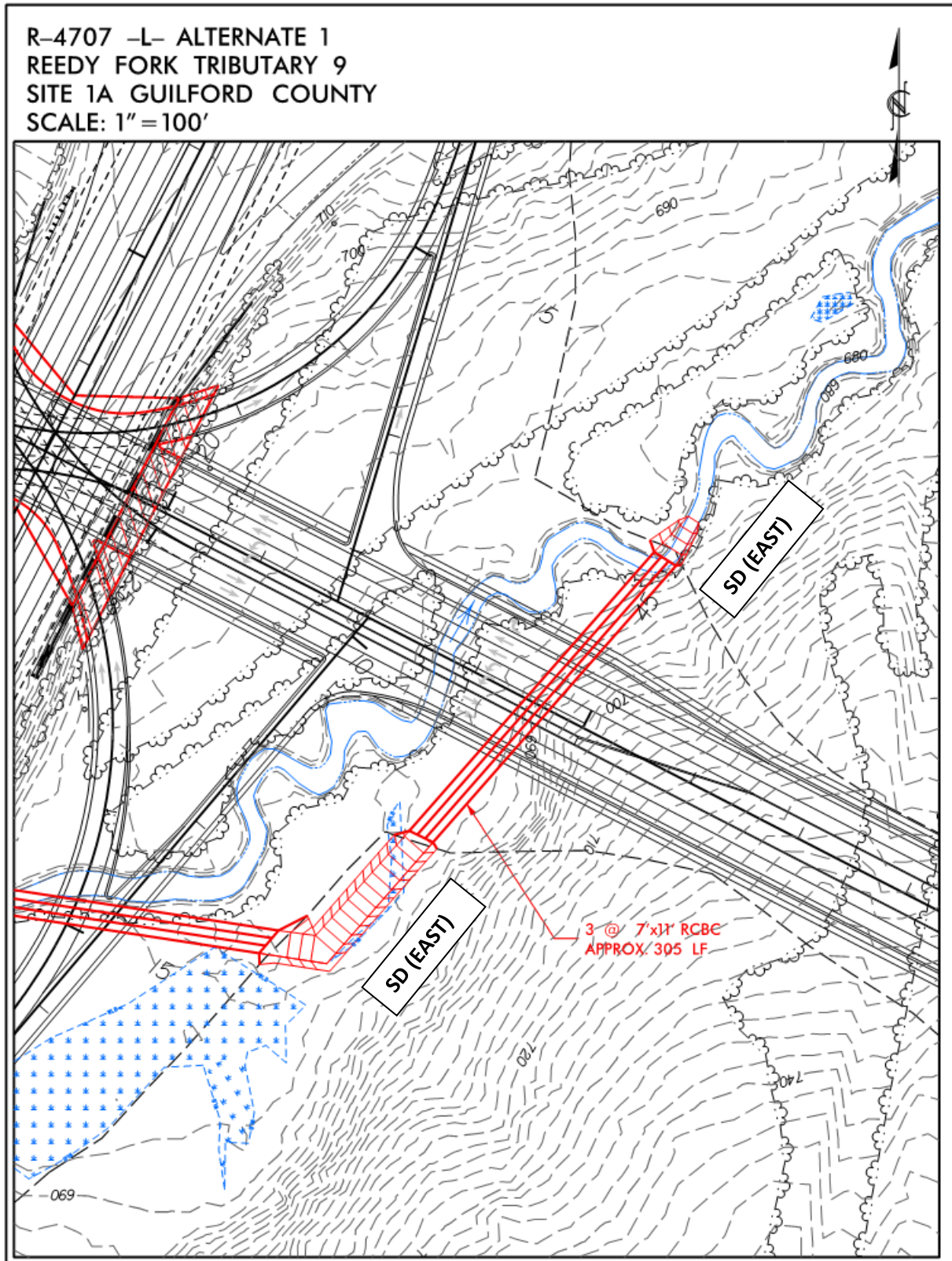


County: GUILFORD	
Div: 7	R-4707
WBS #: 36599.1.5	
MARCH 2017	
Figure #4	

**FIGURE 5A**



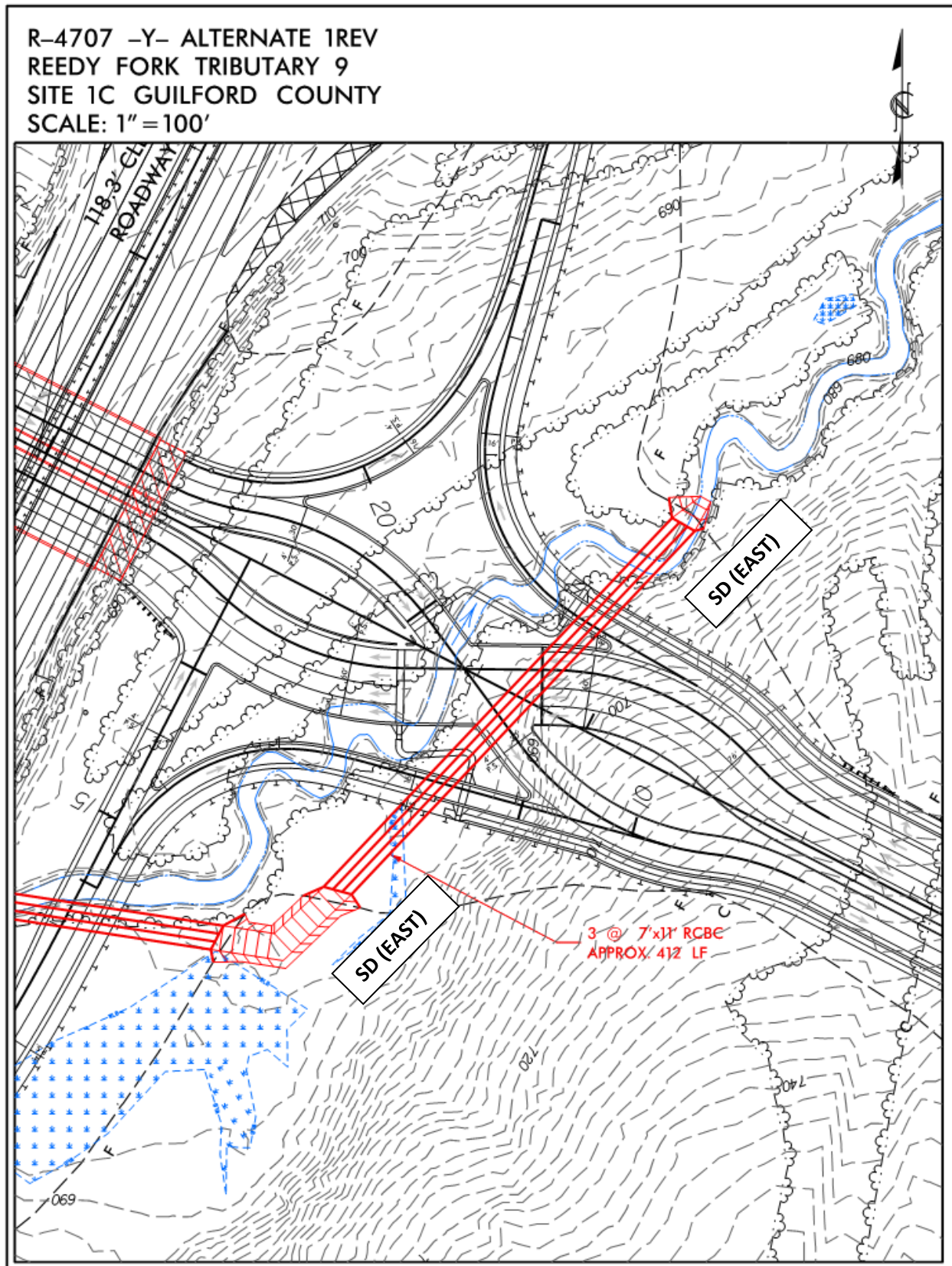
**FIGURE 5B**



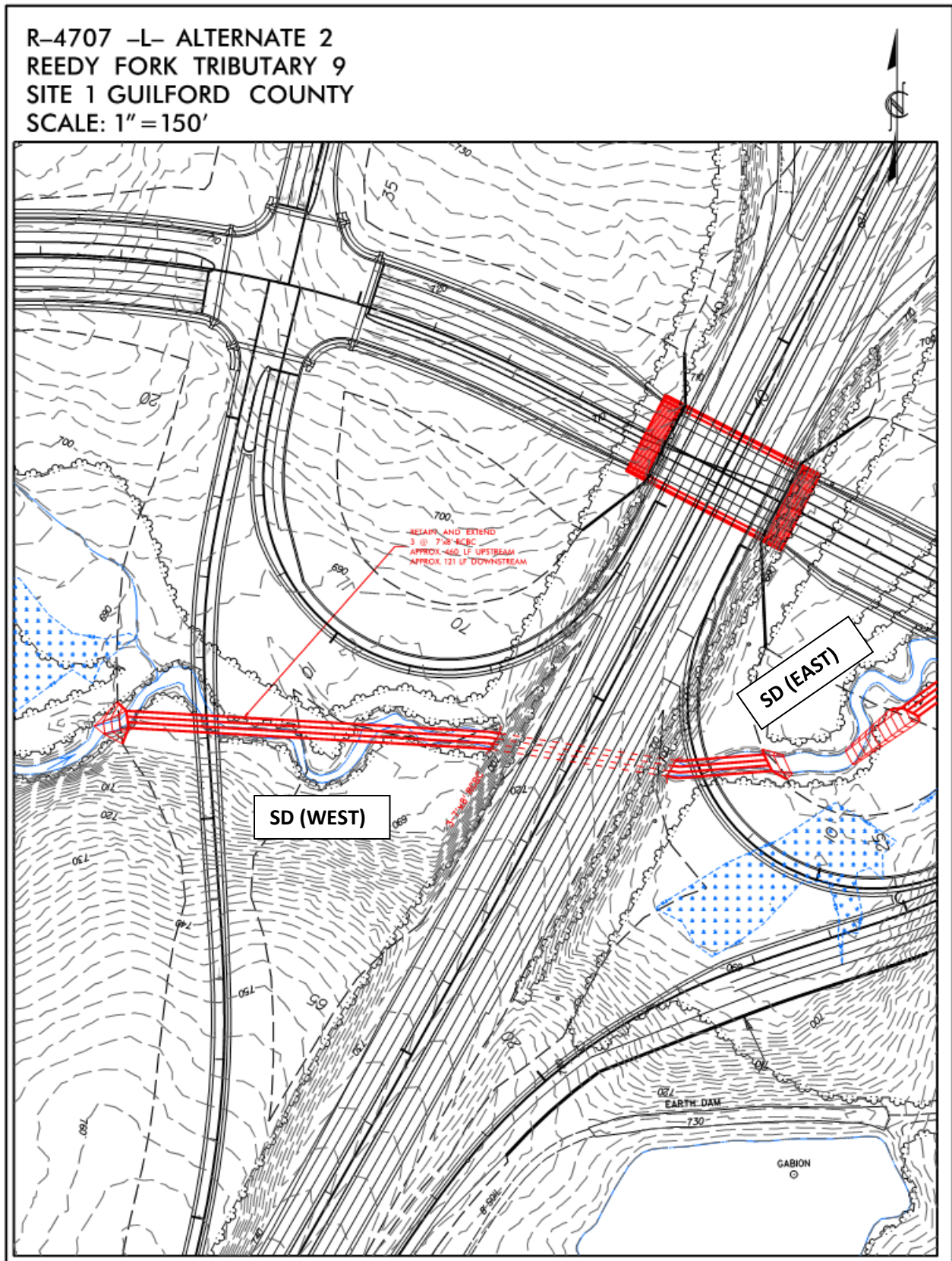




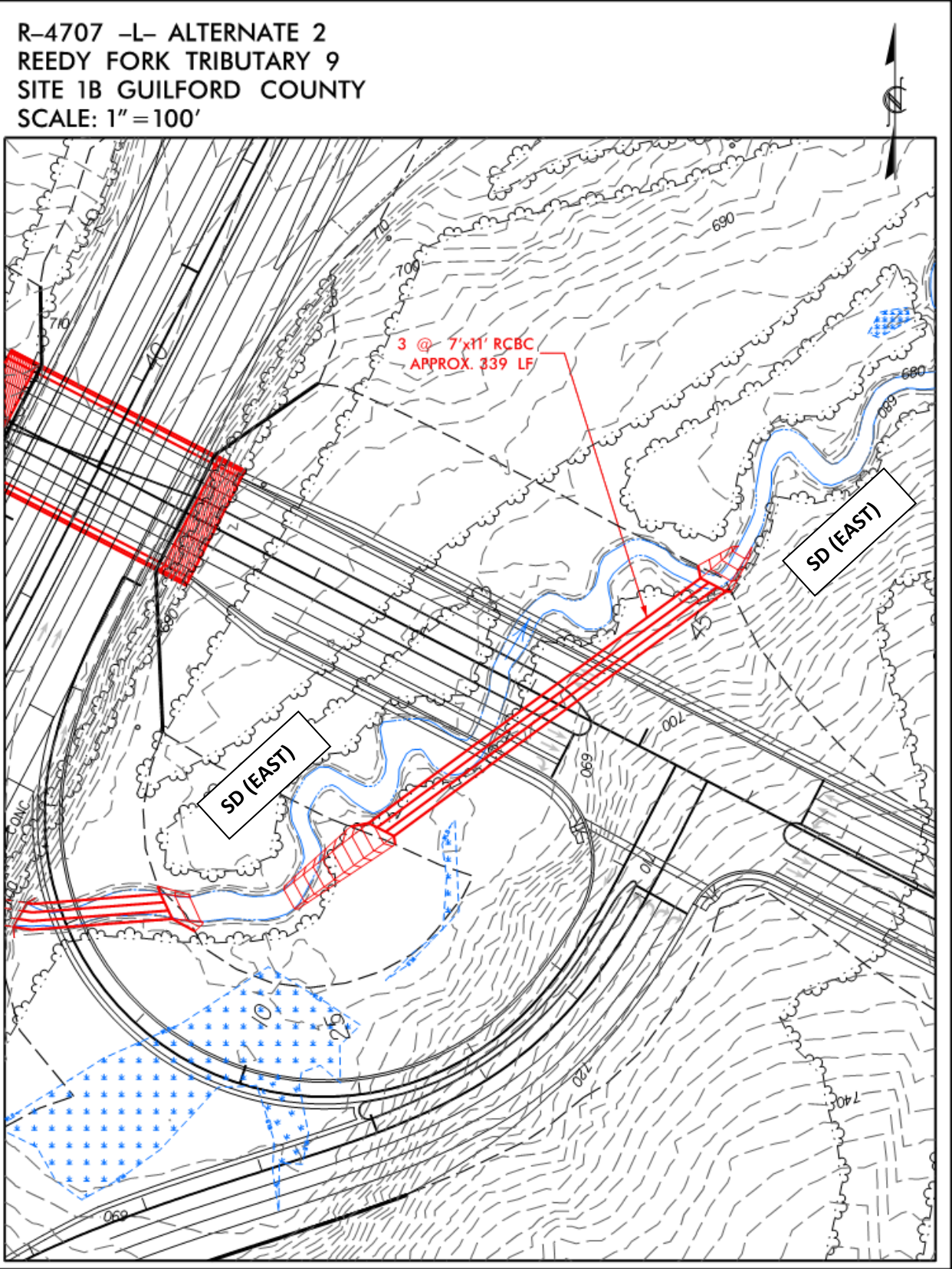
**FIGURE 6B**



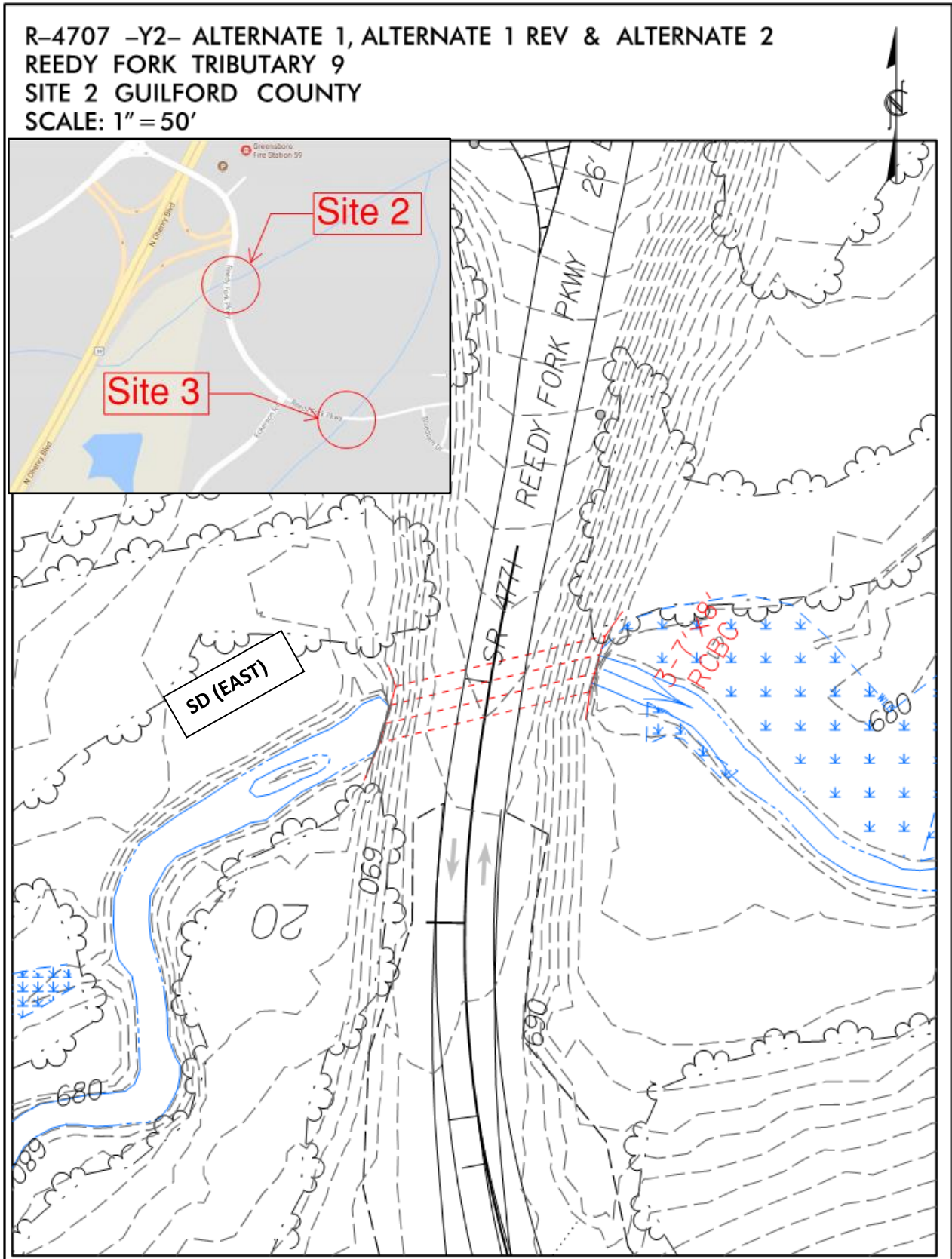
**FIGURE 7A**



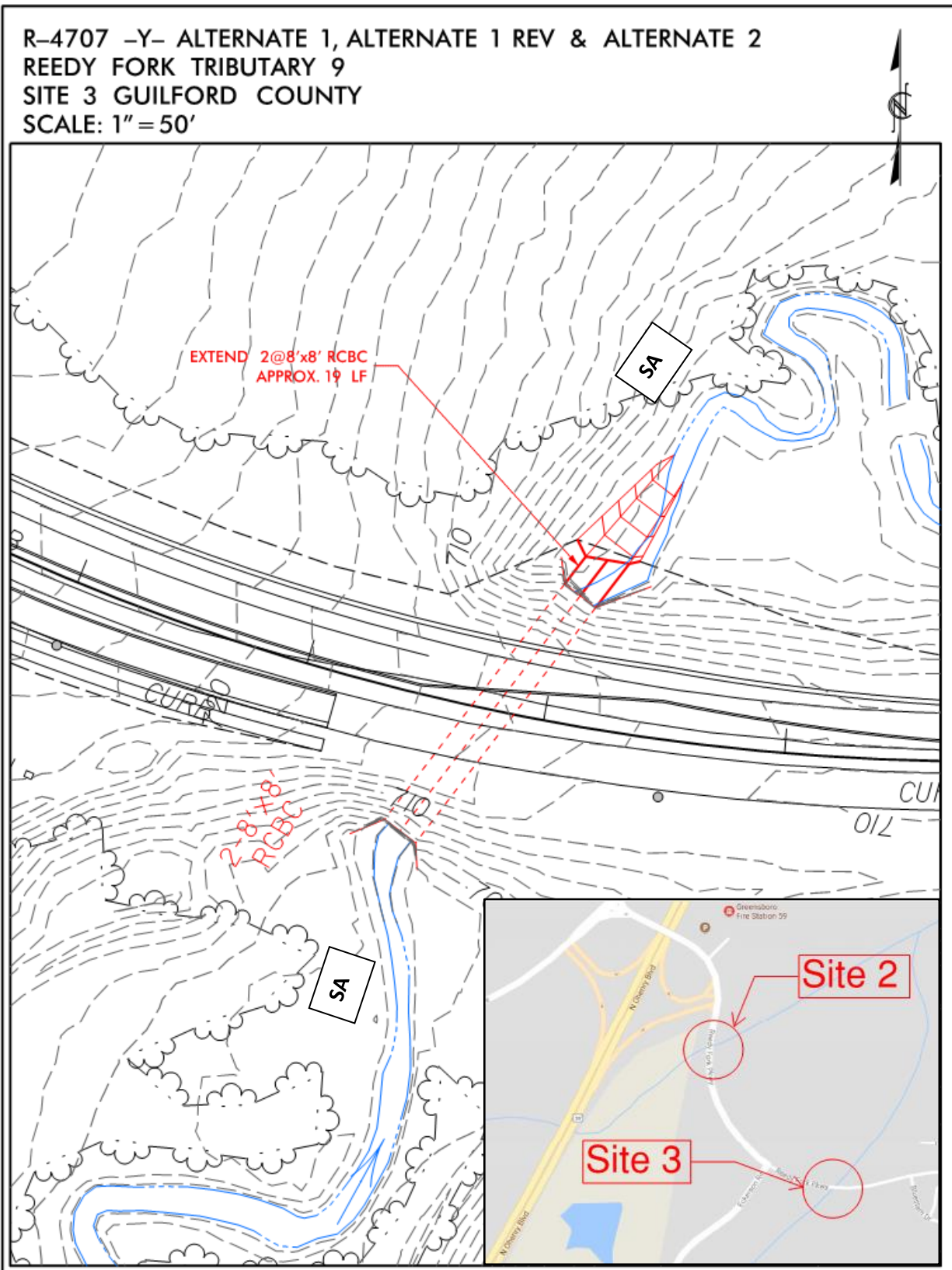
**FIGURE 7B**



**FIGURE 8**



**FIGURE 9**



# ATTACHMENT A



## STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

ROY COOPER  
GOVERNOR

JAMES H. TROGDON, III  
SECRETARY

October 26, 2017

Ahmad Al-Sharawneh  
Central Project Delivery  
Divisions 11-14  
North Carolina Department of Transportation  
1548 Mail Service Center  
Raleigh, NC 27699-1548

Dear Ahmad,

Per your request, I am happy to provide a justification for the choice of the DDI over the SPUI in the case of R-4707, which is the SR-4471 at US-29 interchange. There are five important advantages that the DDI enjoys over the SPUI in general and in this particular place. These include:

- **Safety**--The DDI has been shown in multiple national research projects to reduce crashes by 30 to 50 percent compared to conventional diamond interchanges, and to reduce injury crashes by 40 to 60 percent. Meanwhile, no such crash savings have been demonstrated for the SPUI.
- **Capacity**--A DDI uses two-phase signals and all of the cycle is available to minor street through movements. The lower cycle length at a DDI means less delay for motorists and pedestrians. Meanwhile, a SPUI uses three-phase signals, which mean more lost time per cycle. In addition, only one of the three phases is available to minor street through movements. The result is that the SPUI has a lower capacity than the DDI.
- **Signal progression**--The two-phase signals at a DDI mean that decent quality signal progression for the minor street through movements or some combination of through and left turn movements is possible. The lower cycle length also means that a DDI can use half-cycle operation for easier coordination with nearby signals. Meanwhile, the three-phase signal at a SPUI is a much more severe limitation to through or left turn progression, and half-cycle operation is not possible.
- **Bridge size**--As documented in the 2017 Merger Process Concurrence Points 2A, 3, and 4A report from 2017, the SPUI requires a substantially larger (about 3500 square feet) bridge than the DDI. This is almost always the result when the minor street bridges over the freeway, as it does in project R-4707. The larger bridge will mean increased construction cost and time and increased maintenance cost and effort throughout the life of the bridge.
- **Pedestrian accommodation**--DDIs are superior to SPUIs in terms of how they serve pedestrian demand. Both interchanges require pedestrians to cross right-turning ramps. The

*Mailing Address:*  
NC DEPARTMENT OF TRANSPORTATION  
TRANSPORTATION MOBILITY & SAFETY DIVISION  
1561 MAIL SERVICE CENTER  
RALEIGH, NC 27699-1561

*Telephone:* (919) 814-5000  
*Fax:* (919) 771-2745  
*Customer Service:* 1-877-368-4968

*Location:*  
750 N. GREENFIELD PARKWAY  
GARNER, NC 27529

*Website:* [www.ncdot.gov](http://www.ncdot.gov)

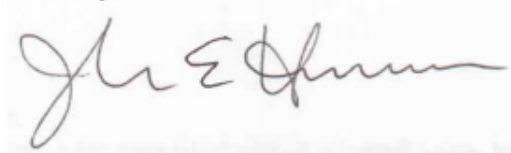
## ATTACHMENT A (Continued)

difference is in the crossing of other roadways. A DDI requires pedestrians to cross two shorter roadways (either left turn or through roadways). Meanwhile, a SPUI requires pedestrians to cross two left turn roadways simultaneously, at a long crossing during only one of the three signal phases. Pedestrian advocates have repeatedly asked highway agencies to avoid SPUIs when possible where there is pedestrian demand due to the difficulty in making the crossing.

DDIs are generally superior to SPUIs in almost every important measure except the size of the footprint. The result is that we are constructing many new DDIs, with at least ten opened in the past five years and dozens in the planning, design, and construction phases. In this case, the difference in footprint is small and does not make up for those other advantages the DDI provides. NCDOT is not constructing many more new SPUIs, especially new SPUIs where the side street passes over the freeway. Note that in places where the freeway crosses over the minor street, the bridge size disadvantage of the SPUI largely disappears and the SPUI becomes more competitive with the DDI, and we are building at least one SPUI of that type.

I hope that this helps. Please let me know if you need more information on this case or if I can help in some other way. Take care,

Sincerely,

A handwritten signature in black ink, appearing to read "Joe E. Hummer". The signature is fluid and cursive, written over a light gray rectangular background.

Joseph E. Hummer, PhD, PE  
State Traffic Management Engineer



**Section 404/NEPA Interagency Merger Process Agreement  
Concurrence Point Number 2A  
Bridging Decisions and Alignment Review**

WBS No.: 36599.1.5  
STIP Project: R-4707  
County: Guilford

Project Name/Description: R-4707: SR 4471 (Reedy Fork Parkway)/US 29 Interchange Improvements

The Project Team has reviewed the bridging and alignments of the three Detailed Study Alternatives and agreed to carry forward into Concurrence Point 3. The table below shows the beginning and end stations and associated roadway/hydraulic structure lengths associated with each alternative.

**PRELIMINARY HYDRAULIC RECOMMENDATIONS FOR MAJOR CROSSINGS**

SITE NUMBER	ALT ID	ROUTE	STATION	STREAM NAME	New Structure/Extension	EXISTING STRUCTURE	MINIMUM RECOMMENDED STRUCTURE	Length of Culvert or Extension (LF)	Notes
						Number, Size, Structure Type	Number, Size, Structure Type		
1	1	US-29	69+25 -L-	Reedy Fork Trib. 9	Extension	3@7'x8' RCBC	3@7'x8' RCBC	455	Retain and extend existing culvert with beveled headwall
	1REV	US-29	69+25 -L-	Reedy Fork Trib. 9	Extension	3@7'x8' RCBC	3@7'x8' RCBC	438	Retain and extend existing culvert with beveled headwall
	2	US-29	69+25 -L-	Reedy Fork Trib. 9	Extension	3@7'x8' RCBC	3@7'x8' RCBC	581	Retain and extend existing culvert with beveled headwall
1A	1	SR 2526	44+57 -Y-	Reedy Fork Trib. 9	New	N/A	3@7'x11' RCBC	305	Bury culvert. Beveled Headwall
1B	2	SR 2526	44+20 -Y-	Reedy Fork Trib. 9	New	N/A	3@7'x11' RCBC	339	Bury culvert. Beveled Headwall
1C	1REV	SR 2526	44+40 -Y-	Reedy Fork Trib. 9	New	N/A	3@7'x11' RCBC	412	Bury culvert. Beveled Headwall
2	1, 1REV, 2	SR 4771	20+93 -Y2-	Reedy Fork Trib. 9	Extension	3@7'x8' RCBC	3@7'x8' RCBC	0	Retain and clean out existing culvert
3	1, 1REV, 2	SR 4772	57+80 -Y-	UT to Reedy Fork	Extension	2@8'x8' RCBC	2@8'x8' RCBC	19	Retain and extend existing culvert

USACE \_\_\_\_\_

USEPA \_\_\_\_\_

NCDOT \_\_\_\_\_

FHWA \_\_\_\_\_

USFWS \_\_\_\_\_

NCWRC \_\_\_\_\_

NCDWR \_\_\_\_\_

SHPO \_\_\_\_\_

GUAMPO \_\_\_\_\_

**Section 404/NEPA Interagency Merger Process Agreement  
Concurrence Point Number 3  
LEDPA**

WBS No.: 36599.1.5  
STIP Project: R-4707  
County: Guilford

Project Name/Description: R-4707: SR 4471 (Reedy Fork Parkway)/US 29 Interchange Improvements

The Merger Team has concurred on this date of November 8, **2017** that the circled alternative is the **Least Environmentally Damaging Practicable Alternative** for **STIP Project R-4707**:

- Alternative 1 Single Point Urban Interchange (SPUI)
- Alternative 1 Revised Diverging Diamond Interchange (DDI)
- Alternative 2 (Partial Cloverleaf)

USACE \_\_\_\_\_

USEPA \_\_\_\_\_

NCDOT \_\_\_\_\_

FHWA \_\_\_\_\_

USFWS \_\_\_\_\_

NCWRC \_\_\_\_\_

NCDWR \_\_\_\_\_

SHPO \_\_\_\_\_

GUAMPO \_\_\_\_\_

**Section 404/NEPA Interagency Merger Process Agreement  
Concurrence Point Number 4A  
Avoidance and Minimization Measures**

WBS No.: 36599.1.5  
STIP Project: R-4707  
County: Guilford

Project Name/Description: R-4707: SR 4471 (Reedy Fork Parkway)/US 29 Interchange Improvements

The Project Team has concurred on this date to use the following measures to minimize or avoid impacts. The typical section varies along the project corridor, and was selected so that the project would meet the purpose and need of the project with the minimal footprint feasible.

In addition, the following avoidance and minimization measures were included in the design:

- Alternatives involved shifting the modified interchange to the south of existing to avoid impacts to Hardy's Mill Pond.
- Alternatives considered a tight ramp alignment to avoid impacts to the earthen dam in the southeast quadrant.
- Alternatives considered minimizing stream impacts by daylighting a short segment of the stream in the southeast quadrant.
- Proposed improvements along existing Reedy Fork Parkway avoided impacts to the stream mitigation site at Reedy Creek.
- Avoidance and minimization measures were incorporated to avoid an adverse effect to businesses.
- The widening portion of the proposed alignment varies between symmetrical widening and widening north or south of the existing roadway, as needed, to minimize impacts to land use and important environmental features.

USACE \_\_\_\_\_

USEPA \_\_\_\_\_

NCDOT \_\_\_\_\_

FHWA \_\_\_\_\_

USFWS \_\_\_\_\_

NCWRC \_\_\_\_\_

NCDWR \_\_\_\_\_

GUAMPO \_\_\_\_\_

SHPO \_\_\_\_\_