

Section 404/NEPA Merger Project Team Meeting
Concurrence Point No. 2A
August 9, 2018

Project Description:

Widen Sweeten Creek Road (US 25A) to a multilane roadway from Hendersonville Road (US 25) to Rock Hill Road (SR 3081) in Asheville, Buncombe County, North Carolina, State Transportation Improvement Project (STIP) No. U-2801A, Federal-Aid No. STP-025A(5), WBS No. 34859.1.FR3.

Purpose and Need of Project:

The Merger Team met and concurred with the project Purpose and Need on April 12, 2017 (Concurrence Point No. 1 [CP 1]).

The need for this study can be summarized as follows:

- *Traffic congestion exists along the existing facility and is expected to worsen in the future.*

Based on the traffic forecast completed in September of 2016, Sweeten Creek Road (US 25A) currently carries between 21,100 and 13,700 vehicles per day (vpd) (2016 Annual Average Daily Traffic), with the larger volume occurring in the vicinity of the Rock Hill Road (SR 3081) intersection. These volumes are forecasted to increase to between approximately 26,000 and 17,100 vpd in 2040 without construction of the project.

Sweeten Creek Road currently exhibits signs of congestion and poor operations during the morning and afternoon peak hours, indicating that the roadway is reaching its traffic carrying capacity. Currently, the roadway is experiencing substantial congestion and operational issues primarily as a result of the high traffic volumes, signalized intersections with considerable side street volume, the lack of opportunity for vehicles to pass slower vehicles, and numerous driveways and full access intersections located along the corridor.

With the expected increase in traffic volumes along the corridor in 2040, further operational degradation is expected without improvements to the corridor.

The purpose for the proposed action is as follows:

- *Alleviate motorized vehicle congestion along Sweeten Creek Road (US 25A) from Hendersonville Road (US 25) to Rock Hill Road (SR 3081)*

The measure of performance for evaluating this improvement will be level of service (LOS). The project is intended to bring the peak hour operations at the study area signalized intersections to an overall LOS D (or better), with an exception of LOS E at the following intersections:

- Rock Hill Road/US 25A
- Mills Gap Road/US 25A
- Pensacola Road/Christ School Road/US 25A
- US 25/US 25A

The Detailed Study Alternatives to be Carried Forward

A concurrence meeting was held with members of the Merger Team on June 6, 2018 to discuss the Detailed Study Alternatives to be carried forward for the proposed project. Multiple design alternatives and their respective preliminary impacts were presented in the meeting package and reviewed during the CP2 meeting.

The study area for this project includes US 25A (Sweeten Creek Road) and approximately 300 feet on either side of the roadway between Rock Hill Road (SR 3081) and Hendersonville Road (US 25) in Buncombe County. The study area includes an expanded area around the Givens Estate property to evaluate a possible Blueridge Railroad realignment to the west to avoid impacting a U.S. Army Corps of Engineers wetland conservation area on the east side of Sweeten Creek Road.

The Detailed Study Alternatives to be Carried Forward include:

- A “Best-Fit” Alignment Alternative that consists of the following widening scenarios for each of the 8 sections:
 - **Section 1** – East-side widening
 - **Section 2** – East-side widening
 - **Section 3** – East-side widening
 - **Section 4** – West-side widening
 - **Section 5** – Hybrid of East and West side widening, as presented in the meeting
 - **Section 6** – West-side widening
 - **Section 7** – East-side widening
 - **Section 8** – West-side widening

Information for Concurrence Point 2A – Bridging Decisions and Alignment Review

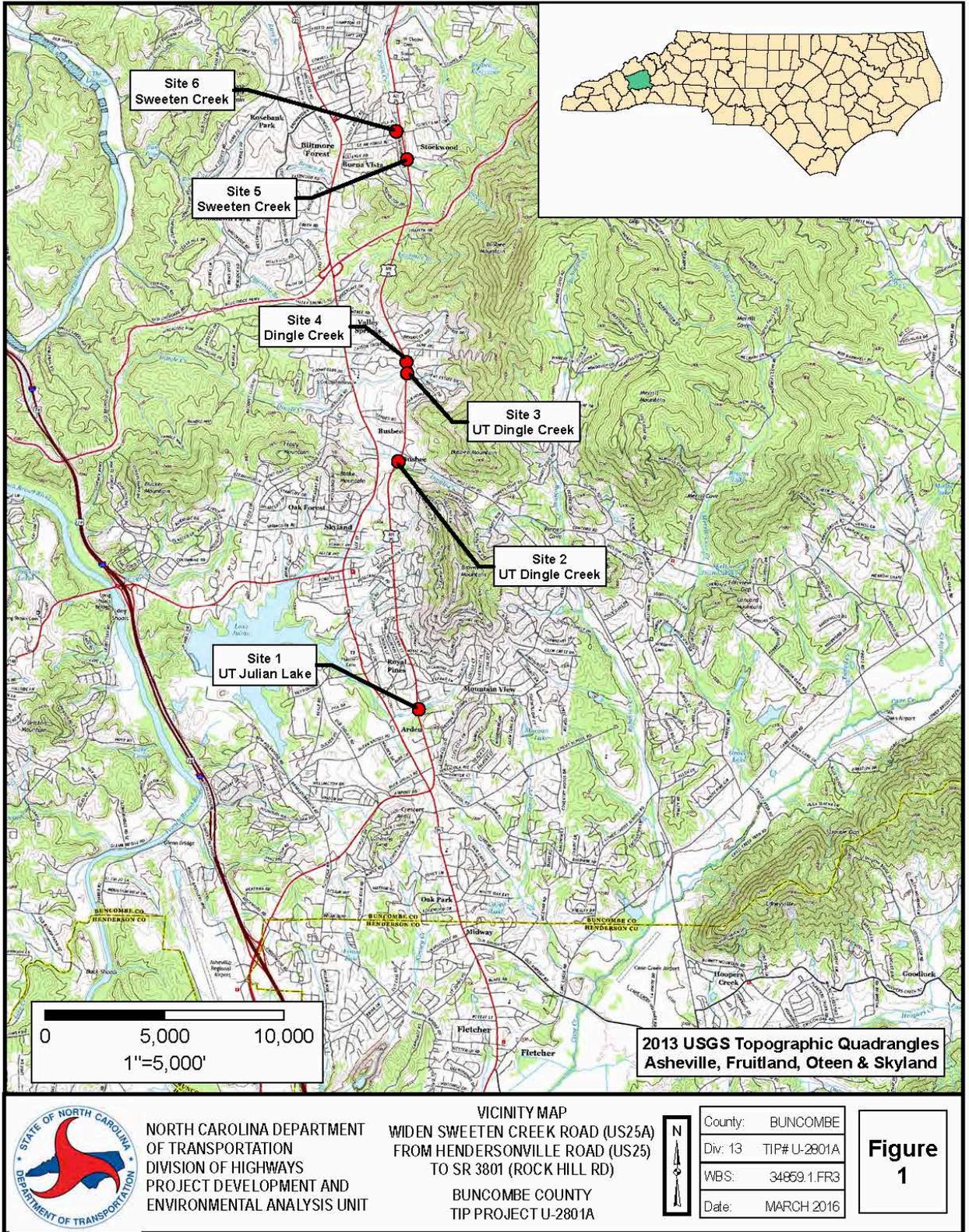
Purpose of this meeting:

The purpose of the Merger Team meeting is to discuss the results of the preliminary hydraulics study such that concurrence can be met for bridging decisions and alignment review (CP 2A). The meeting will be held in the Structures Conference Room at the Century Center Building in Raleigh, NC.

Preliminary Hydraulic Study for Environmental Impact Conclusions:

A Preliminary Hydraulics Study was completed for the proposed project on June 21, 2016 and revised based on additional NCDOT input on June 23, 2018 (see **Appendix B**). The report identified six (6) existing major stream crossing locations along Sweeten Creek Road (see **Figure 1** below), all located within the French Broad River Basin.

The report includes recommendations for the existing stream crossing structures, as summarized in **Table 1**. All stream crossings are jurisdictional streams; therefore, the culvert and pipe recommendations are oversized to account for the buried depth of the structures to maintain depth requirements for hydraulic performance.



Site 6
Sweeten Creek

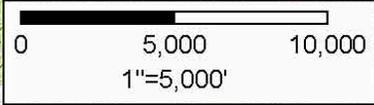
Site 5
Sweeten Creek

Site 4
Dingle Creek

Site 3
UT Dingle Creek

Site 2
UT Dingle Creek

Site 1
UT Julian Lake



2013 USGS Topographic Quadrangles
Asheville, Fruitland, Oteen & Skyland



NORTH CAROLINA DEPARTMENT
OF TRANSPORTATION
DIVISION OF HIGHWAYS
PROJECT DEVELOPMENT AND
ENVIRONMENTAL ANALYSIS UNIT

VICINITY MAP
WIDEN SWEETEN CREEK ROAD (US25A)
FROM HENDERSONVILLE ROAD (US25)
TO SR 3801 (ROCK HILL RD)
BUNCOMBE COUNTY
TIP PROJECT U-2801A



| | |
|---------|--------------|
| County: | BUNCOMBE |
| Div: 13 | TIP# U-2801A |
| WBS: | 34859.1.FR3 |
| Date: | MARCH 2016 |

Figure
1

Table 1 – Hydraulic Structure Recommendations

PRELIMINARY HYDRAULIC RECOMMENDATIONS FOR MAJOR ⁽¹⁾ CROSSINGS

Revised June 11, 2018

DATE: REV 6/11/2018
 PROJECT NUMBER: U-2801A
 WBS ELEMENT #: 34859.1.FR3
 PROJECT DESCRIPTION: Sweeten Creek widening from US-25 (Hendersonville Rd) to SR 3081 (Rock Hill Rd)
 NAME: CAC

| SITE NUMBER | ALT ID ⁽²⁾ | ROUTE | STATION | LAT | LONG | STREAM NAME | STREAM CLASS | FEMA STUDY TYPE | DRAINAGE AREA (Mi ²) | EXISTING STRUCTURE | MINIMUM RECOMMENDED STRUCTURE | Proposed Hw/d (50-Yr Design) | Debris Potential | Notes |
|-------------|-----------------------|---------|---------|---------|-----------|--------------------|--------------|-----------------|----------------------------------|------------------------------|-------------------------------|------------------------------|------------------|---------------------------------|
| | | | | | | | | | | Number, Size, Structure Type | Number, Size, Structure Type | | | |
| 1 | N/A | US-25A | N/A | 35.4691 | -82.51432 | UT to Lake Julian | C | N/A | 0.45 | 1 @ 8' x 5' RCBC | 1 @ 10' x 9' RCBC | 1.1 | Moderate | Buried 1'; analyzed as 10' x 8' |
| 2 | N/A | US-25A | N/A | 35.4977 | -82.51824 | UT to Dingle Creek | C | N/A | 0.32 | 1 @ 42" CMP | 42" RCP | 44.8 | Moderate | Downstream 42" Controls |
| 3 | N/A | US-25A | N/A | 35.5079 | -82.51765 | UT to Dingle Creek | C | N/A | 0.42 | 1 @ 42" CMP | 1 @ 10' x 9' RCBC | 1.1 | Moderate | Buried 1'; analyzed as 10' x 8' |
| 4 | N/A | US-25A | N/A | 35.5089 | -82.51773 | Dingle Creek | C | Limited | 0.38 | 1 @ 42" CMP | 1 @ 10' x 8' RCBC | 1.1 | Moderate | Buried 1'; analyzed as 10' x 7' |
| 5 | N/A | US-25A | N/A | 35.5324 | -82.51869 | Sweeten Creek | C | Limited | 0.28 | 1 @ 42" CMP | 1 @ 9' x 8' RCBC | 1.0 | Moderate | Buried 1'; analyzed as 9' x 7' |
| 6 | N/A | SR 3081 | N/A | 35.5353 | -82.52009 | Sweeten Creek | C | Detailed | 0.72 | 1 @ 84" CMP | 1 @ 13' x 9' RCBC | 1.0 | Moderate | Buried 1'; analyzed as 13' x 8' |

NOTES:
 (1) Major Crossings - conveyance greater than 72" pipe (This table should be used for Merger CP2A concurrence.)
 (2) Provided in NRTR or other NES documents

The following pages provide basic information about, and photographs of, each stream crossing in the report.

Site 1 (UT to Lake Julian) *No FEMA Study*

This stream crossing has a drainage area of 0.45 square miles. The current land use is primarily residential and wooded. The existing structure is an 8-foot span, bottomless reinforced concrete box culvert (RCBC) skewed 75 degrees to the roadway. The upstream opening is 8 feet by 5 feet, and the downstream opening is 8 feet by 4.5 feet. The structure is in fair condition, with some cracking and spalling of the concrete. The centerline of the roadway is approximately 18 feet above the creek bed, and the normal depth of flow is approximately 0.5 feet, with ordinary high water at approximately 2 feet above the stream bed. The stream has migrated to the right, causing a scour hole approximately 10 feet wide by 6 feet deep behind the upstream wing wall. Preliminary calculations suggest that the 100-year storm does not overtop the road.

Site 1 - Downstream Face



Site 1 - Downstream Channel



Site 1 - Upstream Face



Site 1 - Upstream Channel



Site 2 (UT to Dingle Creek) *No FEMA Study*

This stream crossing has a drainage area of 0.32 square miles. The current land use is primarily residential, with some commercial development along the roadway. The existing structure is a 42" corrugated metal pipe (CMP) with a concrete headwall. The structure is in fair condition. It ties to a system behind Goodwill off of Hendersonville Road and outfalls through a 42" CMP approximately 850 feet from US-25 Alt. The pipe is buried 6 inches at the outlet. Aggradation on the inlet side has caused the bed to rise 1.5

feet above the pipe invert. The centerline of the roadway is approximately 20 feet above the elevation of the creek bed. Normal water depth is 0.5 feet, and ordinary high water is 2.5 feet above the streambed. There is a 24" CMP outfall upstream of the crossing which has caused some scour; however, no scour was observed downstream. Banks are stable and vegetated up and downstream. Preliminary calculations suggest that the 100-year storm does not overtop the road.

Site 2 - Upstream Face



Site 2 - Upstream Channel



Site 2 - Downstream Outlet



Site 2 - Downstream Channel



Site 3 (UT to Dingle Creek) *No FEMA Study*

This stream crossing has a drainage area of 0.42 square miles. The current land use is primarily residential. The existing structure is a 42" corrugated metal pipe (CMP) with a concrete headwall skewed 135 degrees to the roadway. It ties into an existing system with Dingle Creek (Site 4) after passing under Sweeten Creek Road and outfalls to the West of the railroad through a 72" CMP approximately 110 feet downstream. Existing structure is in fair condition. The upstream banks are vegetated and stable, but the downstream left bank at the outfall has been undercut and is actively eroding. The centerline of the roadway is approximately 17 feet above the creek bed. Normal depth of flow is approximately 0.3 feet, and ordinary high water is about 2.5 feet above the streambed. Preliminary calculations suggest that the 100-year storm does not overtop the road.

Site 3 – Upstream Face



Site 3 – Upstream Channel



Site 3 – 72-inch outfall



Site 3 – Downstream Channel



Site 4 (Dingle Creek) *FEMA Limited Detail Study*

This stream crossing has a drainage area of 0.38 square miles. The current land use is primarily residential. The existing structure is a concrete pipe slip lined with a 42" corrugated metal pipe (CMP). The structure is in poor condition: there is a crack in the headwall downstream, the pipe is corroded, and the upstream pipe entrance is damaged. The centerline of the road is approximately 14 feet above the creek bed. The normal depth of flow is approximately 0.4 feet, and the ordinary high water is 1.5 feet above the streambed. The pipe is buried 6 inches. No scour was observed downstream. Banks on both the upstream and downstream side are vegetated and stable, and there are no structures in the floodplain. Downstream of this crossing the stream runs parallel to the roadway for approximately 200 feet. According to residents in the area and bridge maintenance staff, the roadway has not overtopped. The FEMA model shows overtopping at the 100-year discharge. There are multiple structures in the 100-year floodplain from 300-700 feet upstream of the culvert.

Site 4 – Upstream Face



Site 4 – Upstream Channel



Site 4 – Downstream Face



Downstream Channel



Site 5 (Sweeten Creek) *FEMA Limited Detail Study*

This stream crossing has a drainage area of 0.28 square miles. The current land use is primarily residential. The existing structure is a 48" reinforced concrete pipe (RCP) that has been partially slip lined upstream with a 42" corrugated metal pipe (CMP), skewed 135 degrees to the roadway. The structure is deteriorated and in poor condition. The centerline of the road is approximately 8 feet above the creek bed. The normal water depth is approximately 0.5 feet, with ordinary high water approximately 4 feet above the streambed. According to residents in the area and bridge maintenance staff, the roadway has not overtopped. The FEMA model shows overtopping at the 100-year discharge. There is a structure in the 100-year floodplain just upstream in the Northeast quadrant of the culvert crossing. This structure is the upstream structure for site 6.

Site 5 – Upstream Face



Site 5 – Upstream Channel



Site 5 – Downstream Face



Site 5 – Downstream Channel



Site 6 (Sweeten Creek) *FEMA Detailed Study*

This stream crossing has a drainage area of 0.72 square miles. The current land use is primarily residential, with some commercial development along the roadway. The existing structure is an 84" corrugated metal pipe (CMP) with a concrete headwall at a 90-degree skew to the roadway. The structure is in fair condition. The centerline of the road is approximately 10 feet above the creek bed. The normal water depth is 0.5 feet. Upstream and downstream banks are vegetated and stabilized with rip rap. There is an 8-inch sewer line across the channel upstream, as well as a 24-inch RCP outfall. The pipe is buried 6 inches at the outlet, and there are two additional CMP outfalls downstream that have been damaged. According to residents in the area and bridge maintenance staff, the roadway has not overtopped. The FEMA model shows overtopping at the 100-year discharge. There is a structure in the 100-year floodplain upstream in the Southwest quadrant of the crossing. There are also multiple structures downstream on both sides of the creek 200 feet downstream of the culvert. This structure is the downstream structure for site 5.

Site 6 – Upstream Face



Site 6 – Upstream Channel



Site 6 – Downstream Face



Site 6 – Downstream Channel



Site 2 hydraulically requires a box culvert; however, an existing 42" corrugated metal pipe (CMP) is attached to the existing roadway pipe at the outlet end. This pipe extends an additional 850 feet downstream under parking lots and eventually discharges into Dingle Creek. This existing CMP controls the hydraulic capacity through the roadway embankment; therefore, we are recommending upgrading the roadway pipe to a Concrete Pipe as a culvert would not create a more efficient crossing.

Sites 5 and 6 have embankment heights of 8 feet and 9 feet above the stream bed, respectively. The height of the proposed replacement box culverts will require the roadway profile to be raised in order to have the required minimum fill height over the culvert and freeboard for the 100-year flood. In addition, if wildlife passage is an issue taller culverts may be required which would lead to a greater increase in the roadway profile at sites 5 and 6. Prior to commitment to the taller structures, a more detailed hydraulic analysis is recommended as there are structures within the floodplain of Sweeten Creek and Rock Hill Road currently overtops in the 100-year storm event.

Buncombe County is a participant in the National Flood Insurance Program, administered by the Federal Emergency Management Agency (FEMA). Based on the most current information available from the NC Floodplain Mapping Program (FMP), three of the six sites listed in Table 3 are in designated flood hazard zones. Sites 4 and 5 are within limited detail flood study reaches of Dingle Creek and Sweeten Creek, respectively. Site 6 is within the detailed flood study reaches of Sweeten Creek. The NCDOT Hydraulics Unit will coordinate with the FMP, the delegated state agency for administering FEMA's National Flood Insurance Program, to determine the status of the project with regard to applicability of NCDOT'S Memorandum of Agreement with FMP, or approval of a Conditional Letter of Map Revision (CLOMR) and subsequent final Letter of Map Revision (LOMR). This project involves construction activities on or adjacent to a FEMA-regulated stream. Therefore, the Division shall submit sealed as-built construction plans to the Hydraulics Unit upon completion of project construction, certifying that the drainage structures and roadway embankment that are located within the 100-year floodplain were built as shown in the construction plans, both horizontally and vertically.

A Natural Resources Technical Report (NRTR) was prepared for the project and completed in November 2016. The field review meeting with representatives from the USACE, NCDENR, NCDOT, and Three Oaks will be held after the corresponding WAM forms are completed and closer to the Concurrence Point 3 meeting for the project.

APPENDIX A

Water resources within the Project Study Area
and
their jurisdictional characteristics

To provide information on the water resources and their jurisdictional characteristics, Section 3.2 and 5.1 from the NRTR have been included as follows.

3.2 Water Resources (from NRTR)

Water resources in the study area are part of the French Broad River basin [U.S. Geological Survey (USGS) Hydrologic Unit 06010105]. Twenty-nine streams were identified in the study area (Table 4). The location of each water resource is shown in Figure 3. The physical characteristics of these streams are provided in Table 5.

Table 4. Water resources in the study area

| Stream Name | Map ID | NCDWR Index Number | Best Usage Classification |
|---------------------------------------|------------------|--------------------|---------------------------|
| Sweeten Creek (Including Pond 1) | Sweeten Creek | 6-78-24 | C |
| Dingle Creek | Dingle Creek | 6-71 | C |
| Four Mile Branch | Four Mile Branch | 6-72 | C |
| UT to Sweeten Creek | SA | 6-78-24 | C |
| UT to Sweeten Creek | SB | 6-78-24 | C |
| UT to Sweeten Creek | SC | 6-78-24 | C |
| UT to Sweeten Creek | SD | 6-78-24 | C |
| UT to Sweeten Creek | SE | 6-78-24 | C |
| UT to Sweeten Creek | SF | 6-78-24 | C |
| UT to Four Mile Branch | SH | 6-72 | C |
| UT to Four Mile Branch | SI | 6-72 | C |
| UT to Four Mile Branch | SJ | 6-72 | C |
| UT to Dingle Creek (Including Pond 2) | SK | 6-71 | C |
| UT to Powell Creek (Lake Julian) | SL-I | 6-62 | C |
| UT to Powell Creek (Lake Julian) | SL-P | 6-62 | C |
| UT to Powell Creek (Lake Julian) | SM | 6-62 | C |
| UT to Powell Creek (Lake Julian) | SN | 6-62 | C |
| UT to Powell Creek (Lake Julian) | SO | 6-62 | C |
| UT to Powell Creek (Lake Julian) | SP | 6-62 | C |
| UT to Powell Creek (Lake Julian) | SQ | 6-62 | C |
| UT to Powell Creek (Lake Julian) | SR | 6-62 | C |
| UT to Powell Creek (Lake Julian) | SS | 6-62 | C |
| UT to Dingle Creek | ST | 6-71 | C |
| UT to Dingle Creek | SU | 6-71 | C |
| UT to Dingle Creek | SV | 6-71 | C |
| UT to Dingle Creek | SW | 6-71 | C |
| UT to Dingle Creek | SX | 6-71 | C |
| UT to Dingle Creek | SY | 6-71 | C |
| UT to Dingle Creek | SZ | 6-71 | C |
| UT to Dingle Creek | SBB | 6-71 | C |

Table 5. Physical characteristics of water resources in the study area

| Map ID | Bank Height (ft) | Bankful Width (ft) | Water Depth (in) | Channel Substrate | Velocity | Clarity |
|------------------|------------------|--------------------|------------------|-------------------------------------|----------|---------|
| Sweeten Creek | 5-8 | 8-10 | 2-16 | Silt, Sand, Gravel, Cobble, Boulder | Moderate | Clear |
| Dingle Creek | 0.5-3 | 3-5 | 6-20 | Sand, Gravel, Cobble | Moderate | Clear |
| Four Mile Branch | 2-5 | 4-7 | 1-12 | Silt, Sand, Gravel, Cobble | Moderate | Clear |
| SA | 1-4 | 5-8 | 2-12 | Silt, Sand, Gravel, Cobble | Moderate | Clear |
| SB | 2-4 | 4-5 | 2-6 | Silt, Sand Gravel, Cobble | Slow | Clear |
| SC | 1-2 | 2-4 | 0-8 | Silt, Sand, Gravel, Cobble | Slow | Clear |
| SD | 1 | 2 | 2 | Silt, Sand | Slow | Clear |
| SE | 1 | 2-3 | 2 | Silt, Sand, Gravel | Moderate | Clear |
| SF | 1 | 2-3 | 1-2 | Sand, Gravel, Cobble | Slow | Clear |
| SH | 2-4 | 2-4 | 2-6 | Clay, Silt, Sand, Gravel, Cobble | Moderate | Clear |
| SI | 2-4 | 2-4 | 0-6 | Clay, Silt, Sand, Gravel, Cobble | Moderate | Clear |
| SJ | 1-2 | 2-5 | 2-10 | Silt, Sand, Gravel, Cobble | Moderate | Clear |
| SK | 1-2 | 1-3 | 0-8 | Silt, Sand, Gravel | Slow | Clear |
| SL-I* | 0-2 | 1-2 | 0-3 | Silt, Sand | NA | Clear |
| SL-P** | 2-4 | 1-4 | 0-8 | Sand, Gravel | Slow | Clear |
| SM | 0.5-2 | 1-3 | 0 | Sand, Gravel, Cobble | NA | NA |
| SN | 1-4 | 2-4 | 0-5 | Sand, Gravel | Slow | Clear |
| SO | 2-5 | 3-6 | 4-40 | Sand, Gravel, Cobble | Moderate | Clear |
| SP | 2-4 | 3-6 | 6-30 | Sand, Gravel, Cobble | Slow | Clear |
| SQ | 1-3 | 1-2 | 2-10 | Sand, Gravel, Cobble | Moderate | Clear |
| SR | 0.5-1 | 3-5 | 4-8 | Sand, Gravel, Cobble | Moderate | Clear |
| SS | 1-2 | 2-3 | 2-10 | Sand, Gravel, Cobble | Moderate | Clear |
| ST | 0.5-2 | 2-3 | 6-12 | Silt, Sand, Gravel | Slow | Clear |
| SU | 2-4 | 2-3 | 10-20 | Silt, Sand | Slow | Clear |
| SV | 3-6 | 3-6 | 6-40 | Silt, Sand, Gravel, Cobble | Moderate | Clear |
| SW | 0.5-1.5 | 3-4 | 6-12 | Sand, Gravel, Cobble | Slow | Clear |
| SX | 1-4 | 4-6 | 6-36 | Silt, Sand, Gravel, Cobble | Moderate | Clear |
| SY | 2-3.5 | 3-5 | 6-20 | Silt, Sand, Gravel | Moderate | Clear |
| SZ | 0.5-1 | 1-2.5 | 2-8 | Silt, Sand | Slow | Clear |
| SBB | 3-5 | 3-4 | 6-12 | Sand, Gravel, Cobble | Slow | Clear |

* I: Intermittent portion

** P: Perennial portion

There are two ponds within the study area. Pond 1 is located on a residential property south of Sweeten Creek and east of Sweeten Creek Road (Figure 3-2). Pond 2 is associated with stream SK (Figure 3-6).

There are no designated anadromous fish waters or Primary Nursery Areas (PNA) in the study area. There are no designated Outstanding Water Resources (OWR), High Quality Waters (HQW), or water supply watersheds (WS-I or WS-II) within 1.0 mile downstream of the study area. The North Carolina Wildlife Resources Commission (NCWRC) has identified no waters as trout waters within 1.0 mile of the study area. There are no streams listed for turbidity or sedimentation on the North Carolina 2014 Final 303(d) list of impaired waters within 1.0 mile downstream of the study area.

There is one benthic monitoring site within 1.0 mile downstream of the study area located at the crossing of US 25 with on an Unnamed Tributary (UT) to Dingle Creek; it was last sampled on February 10, 1987, and received a Biotic Index (BI) of 5.22. There are no sites monitored by the NC Stream Fish Community Assessment Program or the NCDWR Ambient Monitoring System within 1.0 mile downstream of the study area.

5.1 Clean Water Act Waters of the U.S. (from NRTR)

Twenty-nine jurisdictional streams were identified in the study area (Table 6). The locations of these streams are shown on Figure 3. USACE and NCDWR stream forms are included in Appendix C. The physical characteristics and water quality designations of each jurisdictional stream are detailed in Section 3.2. Jurisdictional streams in the study area could be designated as cool water streams for the purposes of stream mitigation.

Table 6. Jurisdictional characteristics of water resources in the study area

| Map ID | Length (ft.) | Classification | Compensatory Mitigation Required | River Basin Buffer |
|------------------|--------------|----------------|----------------------------------|--------------------|
| Sweeten Creek | 2,462 | Perennial | Yes | Not Subject |
| Dingle Creek | 341 | Perennial | Yes | Not Subject |
| Four Mile Branch | 568 | Perennial | Yes | Not Subject |
| SA | 2,086 | Perennial | Yes | Not Subject |
| SB | 103 | Perennial | Yes | Not Subject |
| SC | 527 | Perennial | Yes | Not Subject |
| SD | 52 | Intermittent | Undetermined | Not Subject |
| SE | 52 | Intermittent | Undetermined | Not Subject |
| SF | 377 | Perennial | Yes | Not Subject |
| SH | 584 | Perennial | Yes | Not Subject |
| SI | 441 | Perennial | Yes | Not Subject |
| SJ | 223 | Perennial | Yes | Not Subject |
| SK | 105 | Intermittent | Undetermined | Not Subject |
| SL-I* | 265 | Intermittent | Undetermined | Not Subject |
| SL-P** | 521 | Perennial | Yes | Not Subject |
| SM | 104 | Intermittent | Undetermined | Not Subject |

Table 6. Jurisdictional characteristics of water resources in the study area

| Map ID | Length (ft.) | Classification | Compensatory Mitigation Required | River Basin Buffer |
|--------------|---------------|----------------|----------------------------------|--------------------|
| SN | 75 | Intermittent | Undetermined | Not Subject |
| SO | 579 | Perennial | Yes | Not Subject |
| SP | 608 | Perennial | Yes | Not Subject |
| SQ | 959 | Intermittent | Undetermined | Not Subject |
| SR | 322 | Perennial | Yes | Not Subject |
| SS | 187 | Perennial | Yes | Not Subject |
| ST | 146 | Intermittent | Undetermined | Not Subject |
| SU | 115 | Intermittent | Undetermined | Not Subject |
| SV | 257 | Perennial | Yes | Not Subject |
| SW | 158 | Intermittent | Undetermined | No Subject |
| SX | 563 | Perennial | Yes | Not Subject |
| SY | 760 | Perennial | Yes | Not Subject |
| SZ | 89 | Intermittent | Undetermined | Not Subject |
| SBB | 168 | Intermittent | Undetermined | Not Subject |
| Total | 13,797 | | | |

* I: Intermittent portion

** P: Perennial portion

Twenty jurisdictional wetlands were identified within the study area (Figure 3). Wetland classification and quality rating data are presented in Table 7. All wetlands are within the French Broad River basin (USGS Hydrologic Unit 06010105). USACE wetland delineation forms and NCDWR wetland rating forms for each site are included in Appendix C.

Descriptions of the terrestrial communities at each wetland site are presented in Section 4.1. Wetlands WA, WB, WC, WD, WF, WG, WH, WI, WJ, WK, WL, WM, WP, WQ, WR, WS, and WT are included within the Acidic Cove Forest (Typic Subtype) community. Wetlands WE, WN, and WO are included in the Maintained/Disturbed community.

Table 7. Jurisdictional characteristics of wetlands in the study area (continued)

| Map ID | NCWAM Classification | Hydrologic Classification | NCDWQ Wetland Rating | Area (ac.) |
|--------|----------------------------|---------------------------|----------------------|------------|
| WA | Bottomland Hardwood Forest | Riparian | 54 | 0.2 |
| WB | Bottomland Hardwood Forest | Riparian | 51 | 0.1 |
| WC | Bottomland Hardwood Forest | Riparian | 43 | 0.01 |
| WD | Bottomland Hardwood Forest | Riparian | 49 | 1.1 |
| WE | Headwater Forest | Riparian | 23 | 0.04 |
| WF | Headwater Forest | Riparian | 34 | 0.03 |
| WG | Bottomland Hardwood Forest | Riparian | 47 | 0.4 |
| WH | Headwater Forest | Riparian | 42 | 0.1 |
| WI | Headwater Forest | Riparian | 35 | 0.1 |
| WJ | Headwater Forest | Riparian | 39 | 0.1 |
| WK | Headwater Forest | Riparian | 56 | 0.1 |

Table 7. Jurisdictional characteristics of wetlands in the study area (continued)

| Map ID | NCWAM Classification | Hydrologic Classification | NCDWQ Wetland Rating | Area (ac.) |
|--------|----------------------|---------------------------|----------------------|------------|
| WL | Headwater Forest | Riparian | 24 | 0.04 |
| WM | Headwater Forest | Riparian | 45 | 0.02 |
| WN | Headwater Forest | Riparian | 52 | 0.1 |
| WO | Headwater Forest | Riparian | 26 | 0.01 |
| WP | Headwater Forest | Riparian | 79 | 0.2 |
| WQ | Headwater Forest | Riparian | 67 | 0.1 |
| WR | Headwater Forest | Riparian | 19 | 0.1 |
| WS | Headwater Forest | Riparian | 35 | 0.01 |
| WT | Headwater Forest | Riparian | 49 | 0.3 |
| | | | Total | 3.0 |

APPENDIX B

Preliminary Hydraulics Report
(Revised – June 23, 2018)



1151 SE Cary Parkway, Suite 101
Cary, North Carolina 27518
(919) 557-0929
www.ecologicaleng.com

June 21, 2016 (Revised June 23, 2018)

MEMORANDUM TO: William (Bill) S. Zerman, Jr., P.E.
TIP Engineer Coordinator – Western

FROM: Jenny S. Fleming, P.E.
Senior Project Engineer

Subject: Preliminary Hydraulics Technical Report for U-2801A, US-25 Alt (Sweeten Creek Road), Buncombe County

Project Description:

U-2801A is the widening of 5.5 miles of US-25 Alt (Sweeten Creek Road) from US 25 (Hendersonville Road) to SR 3081 (Rock Hill Rd). The project study area is located in southern Buncombe County and is located partially within the corporate limits of the City of Asheville. Sweeten Creek Road (US-25 Alt) runs North-South through the project study area. The existing road is a two-way, two lane road with 11 foot lanes and no paved shoulder. The proposed project will widen to a 4-lane divided highway with curb and gutter and sidewalks, 12-foot lanes, and 4-foot paved shoulders. Functional designs have not yet been developed. The project will likely be a best-fit scenario, with a combination of East-side, West-side, and symmetrical widening to minimize impacts to existing homes and businesses.

Existing Conditions/Structures:

The proposed widening of Sweeten Creek Road will impact six major stream crossings, all located within the French Broad River Basin, as listed below.

Site 1 (UT to Lake Julian) No FEMA Study

This stream crossing has a drainage area of 0.45 square miles. The current land use is primarily residential and wooded. The existing structure is an 8-foot span, bottomless reinforced concrete box culvert (RCBC) skewed 75 degrees to the roadway. The upstream opening is 8 feet by 5 feet, and the downstream opening is 8 feet by 4.5 feet. The structure is in fair condition, with some cracking and spalling of the concrete. The centerline of the roadway is approximately 18 feet above the creek bed, and the normal depth of flow is approximately 0.5 feet, with ordinary high water at approximately 2 feet above the stream bed. The stream has migrated to the right, causing a scour hole approximately 10 feet wide by 6 feet deep behind the upstream wing wall. Preliminary calculations suggest that the 100 year storm does not overtop the road.

Site 2 (UT to Dingle Creek) No FEMA Study

This stream crossing has a drainage area of 0.32 square miles. The current land use is primarily residential, with some commercial development along the roadway. The existing structure is a 42" corrugated metal pipe (CMP) with a concrete headwall. The structure is in fair condition. It ties to a system behind Goodwill off of Hendersonville Road and outfalls through a 42" CMP approximately 850

feet from US-25 Alt. The pipe is buried 6 inches at the outlet. Aggradation on the inlet side has caused the bed to rise 1.5 feet above the pipe invert. The centerline of the roadway is approximately 20 feet above the elevation of the creek bed. Normal water depth is 0.5 feet, and ordinary high water is 2.5 feet above the streambed. There is a 24" CMP outfall upstream of the crossing which has caused some scour; however, no scour was observed downstream. Banks are stable and vegetated up and downstream. Preliminary calculations suggest that the 100 year storm does not overtop the road.

Site 3 (UT to Dingle Creek) No FEMA Study

This stream crossing has a drainage area of 0.42 square miles. The current land use is primarily residential. The existing structure is a 42" corrugated metal pipe (CMP) with a concrete headwall skewed 135 degrees to the roadway. It ties into an existing system with Dingle Creek (Site 4) after passing under Sweeten Creek Road and outfalls to the West of the railroad through a 72" CMP approximately 110 feet downstream. Existing structure is in fair condition. The upstream banks are vegetated and stable, but the downstream left bank at the outfall has been undercut and is actively eroding. The centerline of the roadway is approximately 17 feet above the creek bed. Normal depth of flow is approximately 0.3 feet, and ordinary high water is about 2.5 feet above the streambed. Preliminary calculations suggest that the 100 year storm does not overtop the road.

Site 4 (Dingle Creek) FEMA Limited Detail Study

This stream crossing has a drainage area of 0.38 square miles. The current land use is primarily residential. The existing structure is a concrete pipe slip lined with a 42" corrugated metal pipe (CMP). The structure is in poor condition: there is a crack in the headwall downstream, the pipe is corroded, and the upstream pipe entrance is damaged. The centerline of the road is approximately 14 feet above the creek bed. The normal depth of flow is approximately 0.4 feet, and the ordinary high water is 1.5 feet above the streambed. The pipe is buried 6 inches. No scour was observed downstream. Banks on both the upstream and downstream side are vegetated and stable, and there are no structures in the floodplain. Downstream of this crossing the stream runs parallel to the roadway for approximately 200 feet. According to residents in the area and bridge maintenance staff, the roadway has not overtopped. The FEMA model shows overtopping at the 100-year discharge. There are multiple structures in the 100-year floodplain from 300-700 feet upstream of the culvert.

Site 5 (Sweeten Creek) FEMA Limited Detail Study

This stream crossing has a drainage area of 0.28 square miles. The current land use is primarily residential. The existing structure is a 48" reinforced concrete pipe (RCP) that has been partially slip lined upstream with a 42" corrugated metal pipe (CMP), skewed 135 degrees to the roadway. The structure is deteriorated and in poor condition. The centerline of the road is approximately 8 feet above the creek bed. The normal water depth is approximately 0.5 feet, with ordinary high water approximately 4 feet above the streambed. According to residents in the area and bridge maintenance staff, the roadway has not overtopped. The FEMA model shows overtopping at the 100-year discharge. There is a structure in the 100-year floodplain just upstream in the Northeast quadrant of the culvert crossing. This structure is the upstream structure for site 6.

Site 6 (Sweeten Creek) FEMA Detailed Study

This stream crossing has a drainage area of 0.72 square miles. The current land use is primarily residential, with some commercial development along the roadway. The existing structure is an 84" corrugated metal pipe (CMP) with a concrete headwall at a 90 degree skew to the roadway. The structure is in fair condition. The centerline of the road is approximately 10 feet above the creek bed. The normal water depth is 0.5 feet. Upstream and downstream banks are vegetated and stabilized with

rip rap. There is an 8-inch sewer line across the channel upstream, as well as a 24-inch RCP outfall. The pipe is buried 6 inches at the outlet, and there are two additional CMP outfalls downstream that have been damaged. According to residents in the area and bridge maintenance staff, the roadway has not overtopped. The FEMA model shows overtopping at the 100-year discharge. There is a structure in the 100-year floodplain upstream in the Southwest quadrant of the crossing. There are also multiple structures downstream on both sides of the creek 200 feet downstream of the culvert. This structure is the downstream structure for site 5.

The following table shows Hw/d calculations for existing structures using HDS-5 charts 9 and 2:

| Site | Existing Structure (Buried 1') | Q ₅₀ * (cfs) | d (ft) | Slope (for HDS-5) | Hw** (ft) | Hw/d (ft) |
|------|-----------------------------------|----------------------------|--------|----------------------|-----------|-----------|
| 1 | 1 @ 8' x 5' RCBC | 750 | 5 | 1% | 12.879 | 2.6 |
| 2 | 1 @ 42" CMP | 700 | 3.5 | 1% | 203.022 | 58.0 |
| 3 | 1 @ 42" CMP | 700 | 3.5 | 1% | 203.022 | 58.0 |
| 4 | 1 @ 42" CMP | 600 | 3.5 | 1% | 149.795 | 42.8 |
| 5 | 1 @ 42" CMP | 500 | 3.5 | 1% | 104.757 | 29.9 |
| 6 | 1 @ 42" CMP | 950 | 7 | 1% | 27.89 | 4.0 |

*Flows based on possible future development

**HDS-5 Chart 9 (18-33.7° wingwall flare) used for site 1; Chart 2 (with headwall) used for sites 2-6

Hydraulic Structure Recommendations:

Formulas from U.S. Geological Survey Fact Sheet 007-00 (Methods for Estimating Flood Magnitude and Frequency in Rural and Urban Areas in North Carolina, 2001) were used to obtain design flows for these recommended structures. Zoning maps of the area were used to determine a possible future impervious area to use in the formulas. The City of Asheville and Buncombe County do not have complete lists of allowable impervious area limits, so these numbers were obtained by examining other zoning ordinances around the state. (See the attached foldout for more information.)

| Site | Stream | Drainage Area (sq mi) | Impervious Area (%) | Design Flow Q ₅₀ (cfs) | USGS Q ₁₀₀ (cfs) | FEMA Q ₁₀₀ (cfs) | Recommended Structure (buried 1') | Hw/d at Q ₁₀₀ (USGS) |
|------|--------------------|-----------------------|---------------------|-----------------------------------|-----------------------------|-----------------------------|-----------------------------------|---------------------------------|
| 1 | UT to Lake Julian | 0.45 | 32.6 | 750 | 800 | N/A | 10'x9' RCBC | 1.1 |
| 2 | UT to Dingle Creek | 0.32 | 48.3 | 700 | 750 | N/A | 42" RCP | 51.4* |
| 3 | UT to Dingle Creek | 0.42 | 35.1 | 700 | 800 | N/A | 10'x9' RCBC | 1.1 |
| 4 | Dingle Creek | 0.38 | 28 | 600 | 700 | 400 | 10'x8' RCBC | 1.2 |
| 5 | Sweeten Creek | 0.28 | 29.1 | 500 | 600 | 660 | 9'x8' RCBC | 1.1 |
| 6 | Sweeten Creek | 0.72 | 32.8 | 950 | 1100 | 1050 | 12'x9' RCBC | 1.2 |

*Replacement structure is controlled by the 42" cmp downstream that conveys the UT to Dingle creek for approximately 850 feet.

Site 2 hydraulically requires a box culvert; however, an existing 42" corrugated metal pipe (CMP) is attached to the existing roadway pipe at the outlet end. This pipe extends an additional 850 feet downstream under parking lots and eventually discharges into Dingle Creek. This existing CMP controls the hydraulic capacity through the roadway embankment; therefore, we are recommending to upgrade the roadway pipe to a Concrete Pipe as a culvert would not create a more efficient crossing.

Sites 5 and 6 have embankment heights of 8 feet and 9 feet above the stream bed, respectively. The height of the proposed replacement box culverts will require the roadway profile to be raised in order to have the required minimum fill height over the culvert and freeboard for the 100-year flood. In addition, if wildlife passage is an issue taller culverts may be required which would lead to a greater increase in the roadway profile at sites 5 and 6. Prior to commitment to the taller structures, a more detailed hydraulic analysis is recommended as there are structures within the floodplain of Sweeten Creek and Rock Hill Road currently overtops in the 100-year storm event.

Floodplain Management:

Buncombe County is a participant in the National Flood Insurance Program, administered by the Federal Emergency Management Agency (FEMA). Based on the most current information available from the NC Floodplain Mapping Program (FMP), three of the six sites listed above are in designated flood hazard zones. Sites 4 and 5 are within limited detail flood study reaches of Dingle Creek and Sweeten Creek, respectively. Site 6 is within the detailed flood study reaches of Sweeten Creek. Attached are copies of the Flood Insurance Rate Map (FIRM) for these three sites, on which are delineated the established limits of the 100-year floodplain and floodway in the vicinity of the project. The Hydraulics Unit will coordinate with the FMP, the delegated state agency for administering FEMA's National Flood Insurance Program, to determine the status of the project with regard to applicability of NCDOT'S Memorandum of Agreement with FMP, or approval of a Conditional Letter of Map Revision (CLOMR) and subsequent final Letter of Map Revision (LOMR). This project involves construction activities on or adjacent to a FEMA-regulated stream. Therefore, the Division shall submit sealed as-built construction plans to the Hydraulics Unit upon completion of project construction, certifying that the drainage structures and roadway embankment that are located within the 100-year floodplain were built as shown in the construction plans, both horizontally and vertically.

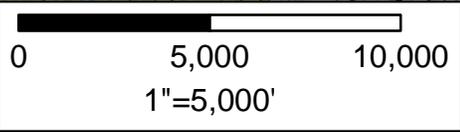
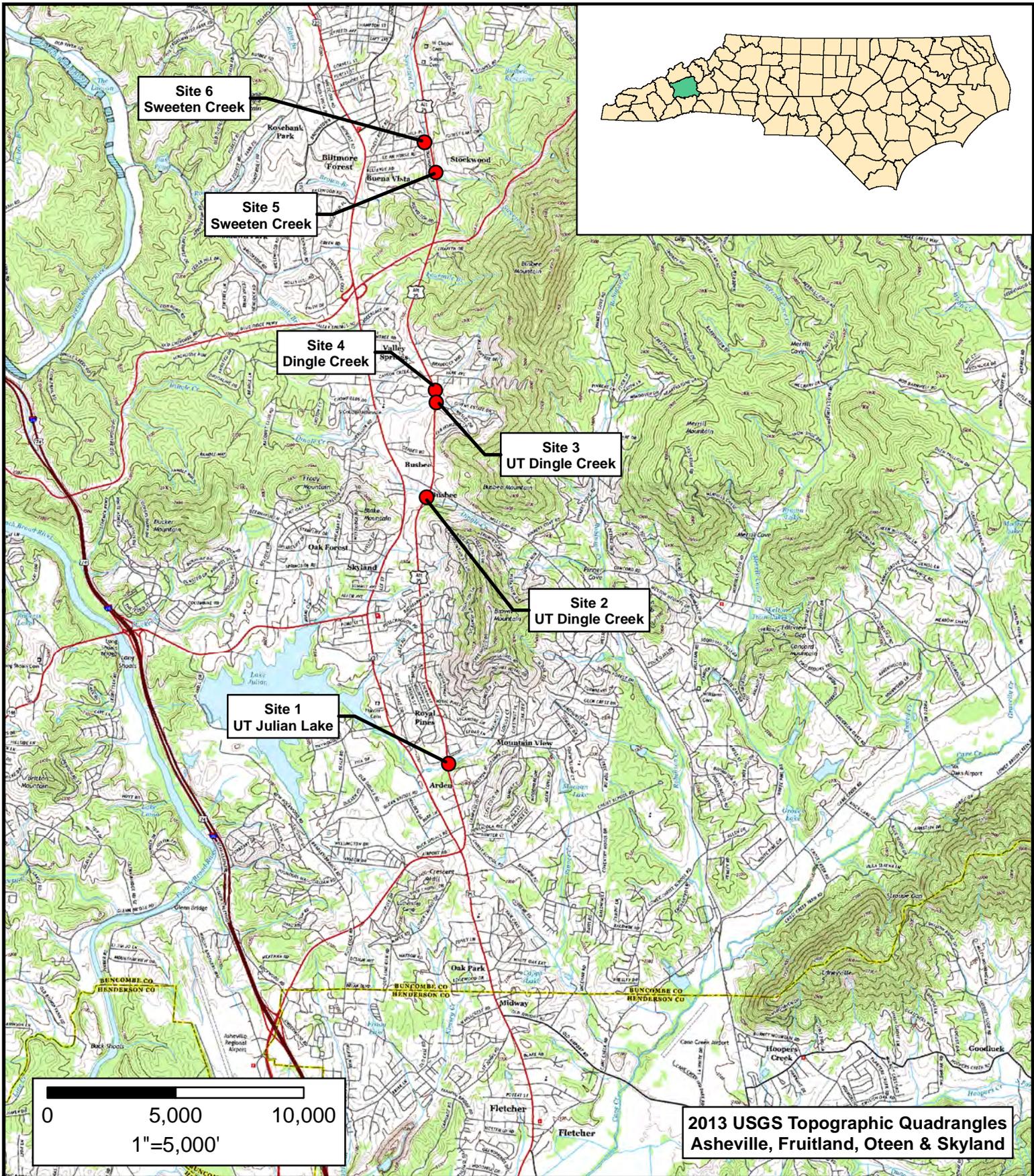
PRELIMINARY HYDRAULIC RECOMMENDATIONS FOR MAJOR⁽¹⁾ CROSSINGS

Revised June 11, 2018

DATE: REV 6/11/2018
PROJECT NUMBER: U-2801A
WBS ELEMENT #: 34859.1.FR3
PROJECT DESCRIPTION: Sweeten Creek widening from US-25 (Hendersonville Rd) to SR 3081 (Rock Hill Rd)
NAME: CAC

| SITE NUMBER | ALT ID ⁽²⁾ | ROUTE | STATION | LAT | LONG | STREAM NAME | STREAM CLASS | FEMA STUDY TYPE | DRAINAGE AREA (Mi ²) | EXISTING STRUCTURE | MINIMUM RECOMMENDED STRUCTURE | Proposed Hw/d (50-Yr Design) | Debris Potential | Notes |
|-------------|-----------------------|---------|---------|---------|-----------|--------------------|--------------|-----------------|----------------------------------|------------------------------|-------------------------------|------------------------------|------------------|---------------------------------|
| | | | | | | | | | | Number, Size, Structure Type | Number, Size, Structure Type | | | |
| 1 | N/A | US-25A | N/A | 35.4691 | -82.51432 | UT to Lake Julian | C | N/A | 0.45 | 1 @ 8' x 5' RCBC | 1 @ 10' x 9' RCBC | 1.1 | Moderate | Buried 1'; analyzed as 10' x 8' |
| 2 | N/A | US-25A | N/A | 35.4977 | -82.51824 | UT to Dingle Creek | C | N/A | 0.32 | 1 @ 42" CMP | 42" RCP | 44.8 | Moderate | Downstream 42" Controls |
| 3 | N/A | US-25A | N/A | 35.5079 | -82.51765 | UT to Dingle Creek | C | N/A | 0.42 | 1 @ 42" CMP | 1 @ 10' x 9' RCBC | 1.1 | Moderate | Buried 1'; analyzed as 10' x 8' |
| 4 | N/A | US-25A | N/A | 35.5089 | -82.51773 | Dingle Creek | C | Limited | 0.38 | 1 @ 42" CMP | 1 @ 10' x 8' RCBC | 1.1 | Moderate | Buried 1'; analyzed as 10' x 7' |
| 5 | N/A | US-25A | N/A | 35.5324 | -82.51869 | Sweeten Creek | C | Limited | 0.28 | 1 @ 42" CMP | 1 @ 9' x 8' RCBC | 1.0 | Moderate | Buried 1'; analyzed as 9' x 7' |
| 6 | N/A | SR 3081 | N/A | 35.5353 | -82.52009 | Sweeten Creek | C | Detailed | 0.72 | 1 @ 84" CMP | 1 @ 13' x 9' RCBC | 1.0 | Moderate | Buried 1'; analyzed as 13' x 8' |

NOTES:
(1) Major Crossings - conveyance greater than 72" pipe (This table should be used for Merger CP2A concurrence.)
(2) Provided in NRTR or other NES documents



**2013 USGS Topographic Quadrangles
Asheville, Fruitland, Oteen & Skyland**



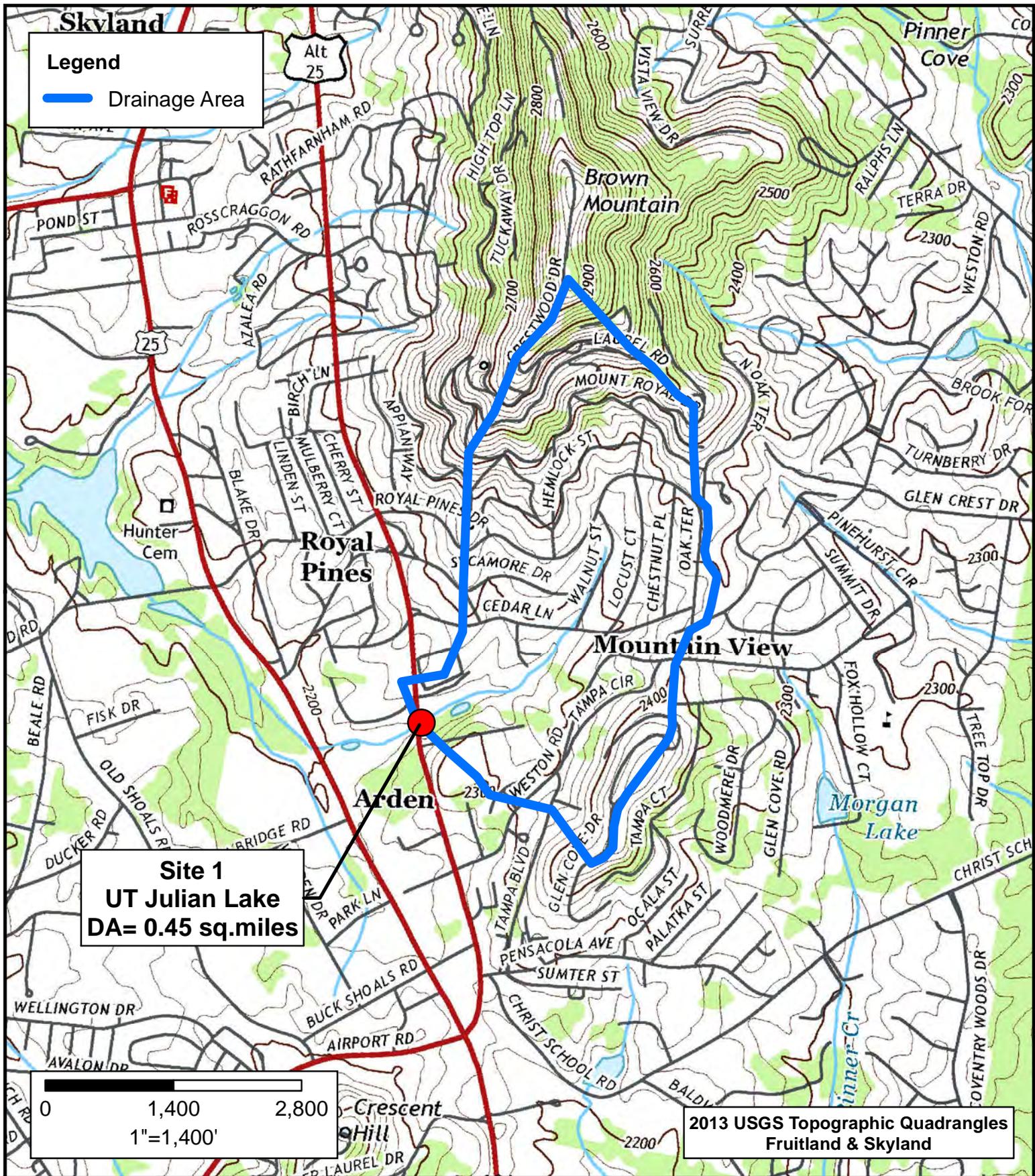
NORTH CAROLINA DEPARTMENT
OF TRANSPORTATION
DIVISION OF HIGHWAYS
PROJECT DEVELOPMENT AND
ENVIRONMENTAL ANALYSIS UNIT

VICINITY MAP
WIDEN SWEETEN CREEK ROAD (US25A)
FROM HENDERSONVILLE ROAD (US25)
TO SR 3801 (ROCK HILL RD)
BUNCOMBE COUNTY
TIP PROJECT U-2801A



| | |
|---------|--------------|
| County: | BUNCOMBE |
| Div: 13 | TIP# U-2801A |
| WBS: | 34859.1.FR3 |
| Date: | MARCH 2016 |

**Figure
1**



NORTH CAROLINA DEPARTMENT
 OF TRANSPORTATION
 DIVISION OF HIGHWAYS
 PROJECT DEVELOPMENT AND
 ENVIRONMENTAL ANALYSIS UNIT

SITE 1 DRAINAGE AREA MAP
 WIDEN SWEETEN CREEK ROAD (US25A)
 FROM HENDERSONVILLE ROAD (US25)
 TO SR 3801 (ROCK HILL RD)

BUNCOMBE COUNTY
 TIP PROJECT U-2801A



| | |
|---------|--------------|
| County: | BUNCOMBE |
| Div: 13 | TIP# U-2801A |
| WBS: | 34859.1.FR3 |
| Date: | MARCH 2016 |

Figure
2

Hydraulics Unit Pre-Design Report (Pre-Scoping) for Structure #:

Date: 06/21/2016

County: Stream:

Road #: Road Name:

Division: Location:

Latitude: Longitude: Decimal degrees, a min of 5 decimal points

Assigned to:

Prepared By:

Hydro Mgr: Hydro Reviewer:

Project Type:

Existing Structure

Structure Type: Yr Built:

Span Arrangement: OAL (ft): Skew: Abutment Type:

Number of Barrels: @ Span (ft): x Rise (ft):

Bed to Crown (ft): Clear Roadway (ft): Water Depth (ft): Superstructure Depth:

ADT: Year ADT: Scour Code (item113): Prior Survey Completed: Survey Date:

Drainage Area: Sq. Mi. Drainage Area Source: Roadway Overtops at Q100:

Discharge Method: USGS Region: Stream Gage Number(if applicable):

Q10 (cfs): Q25 (cfs): Q50 (cfs): Q100 (cfs): QBFE (cfs):

Structure in Flood Hazard Zone Panel #: Panel Date: Type of FIS: Date of FIS:

Enviromental

Quad Map: River Basin: Buffer Rule:

| | | | | | |
|---|---|--------------------------------|--|--|---|
| Primary Stream Classification | | | | Other Stream Classification | |
| <input type="checkbox"/> Class B | <input checked="" type="checkbox"/> Class C | <input type="checkbox"/> SA | <input type="checkbox"/> SB | <input type="checkbox"/> Anadromous Fish | <input type="checkbox"/> Area of Environmental Concern |
| <input type="checkbox"/> SC | <input type="checkbox"/> SWL | <input type="checkbox"/> WL | <input type="checkbox"/> WS I | <input type="checkbox"/> CAMA County | <input type="checkbox"/> Federal Wild & Scenic Rivers |
| <input type="checkbox"/> WS II | <input type="checkbox"/> WS III | <input type="checkbox"/> WS IV | <input type="checkbox"/> WS V | <input type="checkbox"/> HSB Required | <input type="checkbox"/> NC Natural & Scenic Rivers |
| Supplemental Stream Classification | | | | <input type="checkbox"/> Impaired [303d] | <input type="checkbox"/> Primary Nursery Area |
| <input type="checkbox"/> FWS | <input type="checkbox"/> HQW | <input type="checkbox"/> NSW | <input type="checkbox"/> ORW | <input type="checkbox"/> TVA | <input type="checkbox"/> Designated Shellfish Harvesting Area |
| <input type="checkbox"/> Sw | <input type="checkbox"/> Tr | <input type="checkbox"/> UWL | <input type="checkbox"/> w/in 0.5mi. of CA | <input type="checkbox"/> Designated Public Mountain Trout Waters | |

Up/Down Stream Features

| | |
|---|---|
| Upstream Feature: <input type="text" value="Culvert"/> Location: <input type="text" value="1300' Upstream On Cedar Ln 0.3 mi East of US-25A"/> Structure #: <input type="text"/> Route: <input type="text" value="SR 3159"/> Latitude: <input type="text" value="35.47211"/> Longitude: <input type="text" value="-82.50884"/> Prior Survey Completed: <input type="checkbox"/> Survey Date: <input type="text"/> Bed to Crown (ft): <input type="text"/> Year Built: <input type="text"/> | Structure Type: <input type="text" value="CMP"/> Span Arrangement: <input type="text" value="1@72"/> OAL (ft): <input type="text"/> Number of Barrels: <input type="text"/> @ Span (ft): <input type="text"/> x Rise (ft): <input type="text"/> |
| Downstream Feature: <input type="text" value="Culvert"/> Location: <input type="text" value="1100' Downstream On US-25 (Hendersonville Rd) 1,150 ft West of US-25A"/> Structure #: <input type="text"/> Route: <input type="text" value="US-25"/> Latitude: <input type="text" value="35.46823"/> Longitude: <input type="text" value="-82.51799"/> Prior Survey Completed: <input type="checkbox"/> Survey Date: <input type="text"/> Bed to Crown (ft) <input type="text"/> Year Built: <input type="text"/> | Structure Type: <input type="text" value="RCBC"/> Span Arrangement: <input type="text"/> OAL (ft): <input type="text"/> Number of Barrels: <input type="text" value="2"/> @ Span (ft): <input type="text" value="6.0"/> x Rise (ft): <input type="text" value="5.0"/> |

Preliminary Structure Estimate [Office Estimate]

Structure Type: Skew:

Dimensions/Spans:

Notes

PRELIMINARY DESIGN AND ASSESSMENT
STREAM CROSSING AND ENCROACHMENTS

COUNTY Buncombe PROJECT# U-2801A
STREAM UT to Lake Julian ROUTE US-25A
ASSESSMENT PREPARED BY Ecological Engineering, LLP DATE 6/21/2016

HYDROLOGIC EVALUATION

NEAREST GAUGING STATION ON THIS STREAM _____ (NONE X) _____

ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: No

FLOOD DATA:

Q10 440 cfs EST. BKWTR. _____ FT. Q25 650 cfs EST. BKWTR. _____ FT.
Q50 750 cfs EST. BKWTR. _____ FT. Q100 800 cfs EST. BKWTR. _____ FT.
Q500 _____ cfs OR OVERTOPPING CFS EST. BKWTR. _____ FT.

DRAINAGE AREA 0.45 sq mi METHOD to COMPUTE Q 2001 USGS Urban Equations - Future Dev

PROPERTY RELATED EVALUATIONS

DAMAGE POTENTIAL: LOW _____ MODERATE X HIGH _____
COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: YES _____ NO X
EXPLANATION: _____

LIST BUILDINGS IN FLOOD PLAIN Royal Pines Village LOCATION Northwest
FLOOR ELEVATION: _____

UPSTREAM LAND USE: Residential

ANTICIPATE ANY CHANGE? Future Development Possible

ANY FLOOD ZONE? (FIA STUDIES, ETC.) YES _____ NO X
TYPE OF STUDY No study

BASE FLOOD ELEVATION _____ (100yr.)

REGULATORY FLOODWAY WIDTH N/A (AS NOTED IN FIA STUDIES)

COMMENTS: _____

TRAFFIC RELATED EVALUATIONS

PRESENT YEAR _____ TRAFFIC COUNT _____ VPD %TRUCKS _____

DESIGN YEAR _____ TRAFFIC COUNT _____ VPD % TRUCKS _____

EMERGENCY ROUTE _____ SCHOOL BUS ROUTE _____ MAIL ROUTE _____

DETOUR AVAILABLE? _____ LENGTH OF DETOUR _____ MILES

DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? 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 N/A AGGRADATION/DEGRADATION N/A RESERVOIRS N/A

DIVERSIONS N/A DRAINAGE DISTRICT N/A NAVIGATION N/A

BACKWATER FROM ANOTHER SOURCE Yes

EXPLANATION: 0.6 Miles Upstream from Lake Julian

ROADWAY OVERFLOW SECTION (NONE X) LENGTH _____ ELEVATION _____

EMBANKMENT: SOIL TYPE Sand/gravel TYPE SLOPE COVER Woods

COMMENTS: _____

ENVIRONMENTAL CONSIDERATIONS

LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN (NONE _____)

Possible Wetlands

MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES NO _____ PROTECTION NEEDED Yes

ARE BANKS STABLE? No PROTECTION NEEDED Yes

DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? Moderate

COMMENTS: _____

ALTERNATIVES

RECOMMENDED DESIGN 10'x9' RCBC buried 1'

DETOUR STRUCTURE N/A

LOW ROAD GRADE Maintain Existing DETOUR GRADE _____

BRIDGE WATERWAY OPENING _____ CULVERT OPENING 80 square feet

WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES _____ NO

DISCUSSION: Hw/d=1.1

THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:

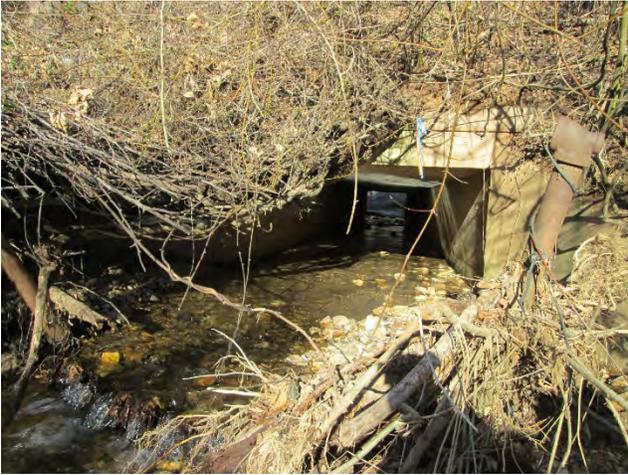
(1) NORMAL PROCESS

(2) _____ NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR

(3) _____ SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION

ADDRESSING: _____

Site 1



Downstream Face



Downstream Channel



Upstream Face



Upstream Channel



Looking North along US-25 Alt (Sweeten Creek Rd)



Looking South along US-25 Alt (Sweeten Creek Rd)



Looking East from US-25 Alt (Sweeten Creek Rd)

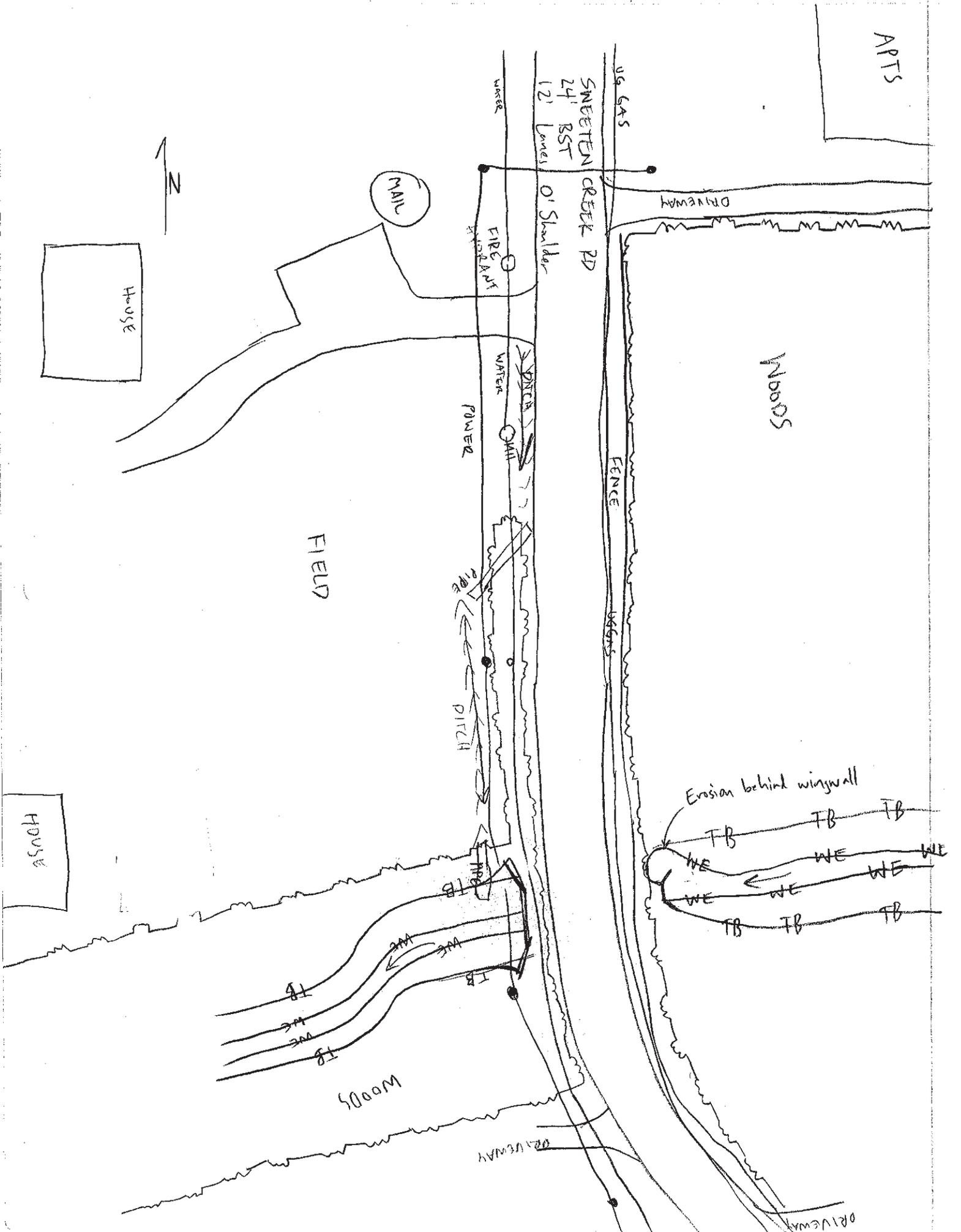


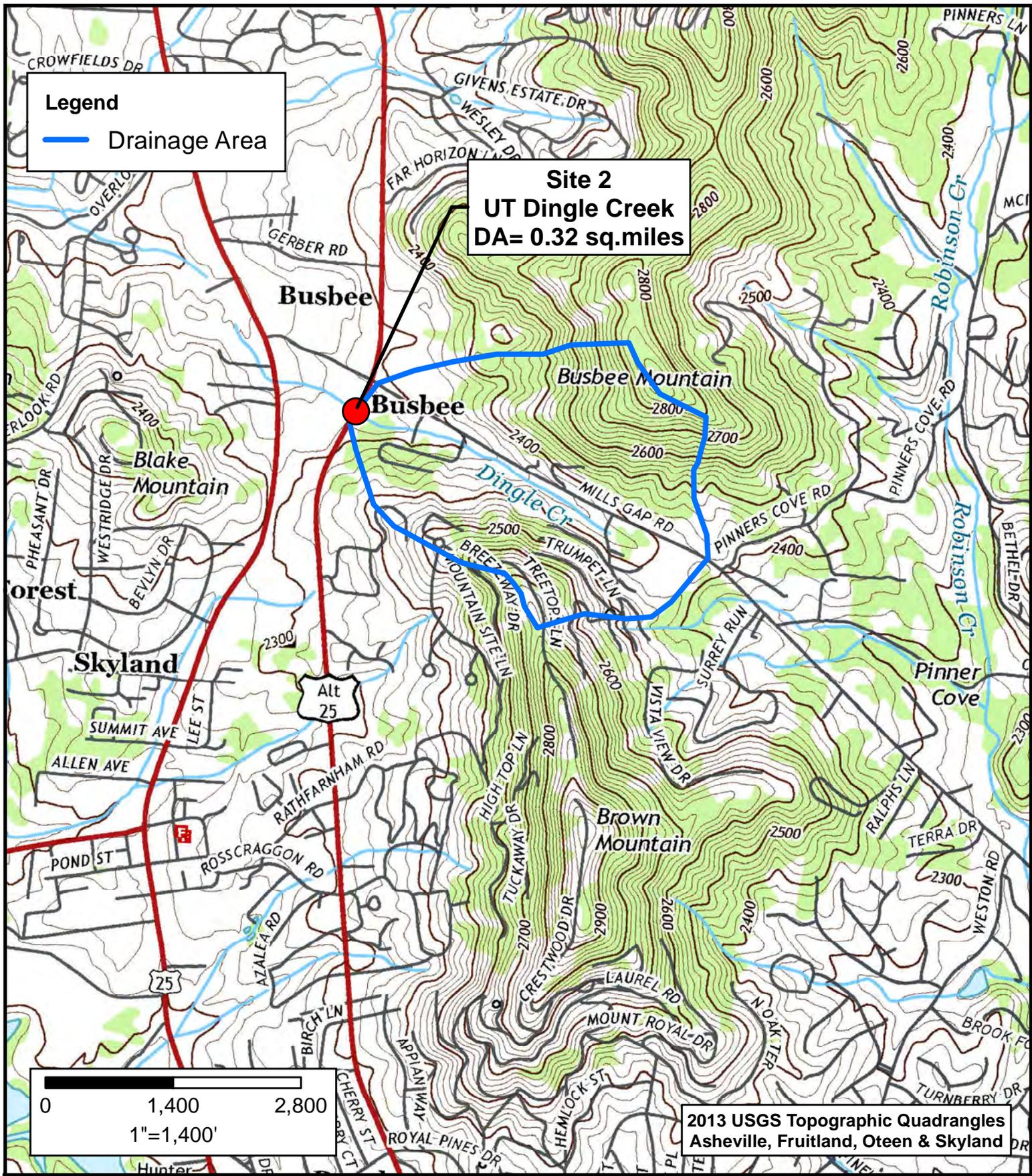
Looking West from US-25 Alt (Sweeten Creek Rd)

U-2901A

Site 1

Plan Sketch





NORTH CAROLINA DEPARTMENT
 OF TRANSPORTATION
 DIVISION OF HIGHWAYS
 PROJECT DEVELOPMENT AND
 ENVIRONMENTAL ANALYSIS UNIT

SITE 2 DRAINAGE AREA MAP
 WIDEN SWEETEN CREEK ROAD (US25A)
 FROM HENDERSONVILLE ROAD (US25)
 TO SR 3801 (ROCK HILL RD)

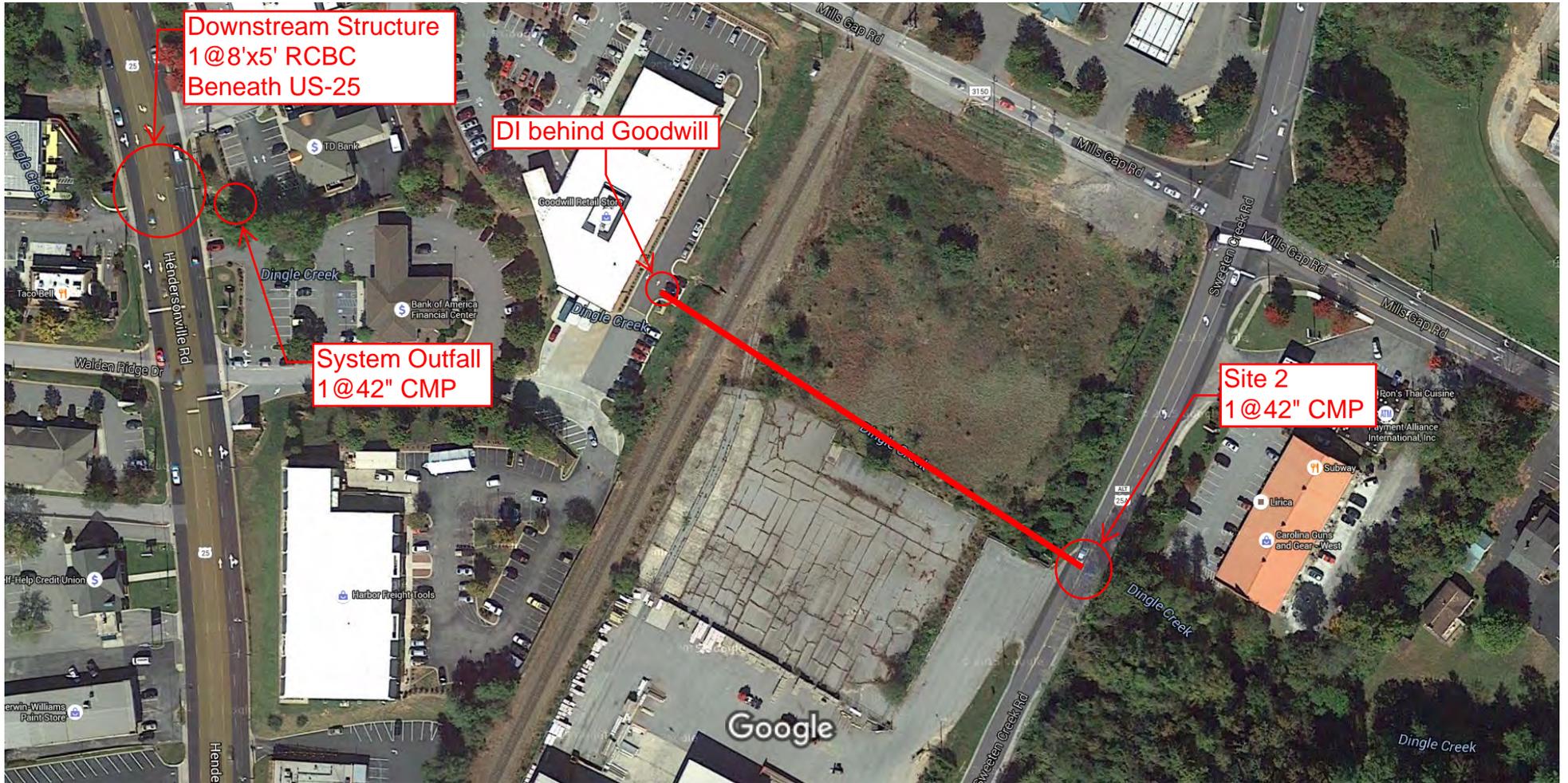
BUNCOMBE COUNTY
 TIP PROJECT U-2801A



| | |
|---------|--------------|
| County: | BUNCOMBE |
| Div: 13 | TIP# U-2801A |
| WBS: | 34859.1.FR3 |
| Date: | MARCH 2016 |

Figure
3

Google Maps Site 2 - UT to Dingle Creek



Imagery ©2016 DigitalGlobe, U.S. Geological Survey, Map data ©2016 Google 50 ft

Cover Page

Hydraulics Unit Pre-Design Report (Pre-Scoping) for Structure #:

Date: 06/21/2016

| | | |
|---|--|--|
| County: <input type="text" value="Buncombe"/> | Stream: <input type="text" value="UT to Dingle Creek"/> | Assigned to: <input type="text" value="ECOLOGICAL ENGINEERING LLP"/> |
| Road #: <input type="text" value="US-25A"/> | Road Name: <input type="text" value="Sweeten Creek Rd"/> | Prepared By: <input type="text" value="CAC"/> |
| Division: <input type="text" value="13"/> | Location: <input type="text" value="350 ft South of SR 3116"/> | Hydro Mgr: <input type="text" value="WSZ"/> |
| Latitude: <input type="text" value="35.49766"/> | Longitude: <input type="text" value="-82.51824"/> | Hydro Reviewer: <input type="text" value="WSZ"/> |
| Decimal degrees, a min of 5 decimal points | | Project Type: <input type="text"/> |

Existing Structure

| | |
|--|---|
| Structure Type: <input type="text" value="CMP"/> | Yr Built: <input type="text"/> |
| Span Arrangement: <input type="text" value="1@42"/> | OAL (ft): <input type="text"/> |
| Skew: <input type="text" value="90"/> | Abutment Type: <input type="text" value="Headwall-wo/ Wing Walls"/> |
| Number of Barrels: <input type="text"/> | @ Span (ft): <input type="text"/> |
| x Rise (ft): <input type="text"/> | |
| Bed to Crown (ft): <input type="text" value="20.0"/> | Clear Roadway (ft): <input type="text" value="24.0"/> |
| Water Depth (ft): <input type="text" value="0.5"/> | Superstructure Depth: <input type="text"/> |
| ADT: <input type="text"/> | Year ADT: <input type="text"/> |
| Scour Code (item113): <input type="text"/> | Prior Survey Completed: <input type="checkbox"/> |
| Survey Date: <input type="text"/> | |
| Drainage Area: <input type="text" value="0.3"/> | Sq. Mi. <input type="text"/> |
| Drainage Area Source: <input type="text" value="Quad"/> | Roadway Overtops at Q100: <input type="checkbox"/> |
| Discharge Method: <input type="text" value="USGS Regression Equations"/> | USGS Region: <input type="text" value="2- Mountain"/> |
| Stream Gage Number(if applicable): <input type="text"/> | |
| Q10 (cfs): <input type="text" value="430"/> | Q25 (cfs): <input type="text" value="600"/> |
| Q50 (cfs): <input type="text" value="700"/> | Q100 (cfs): <input type="text" value="750"/> |
| QBFE (cfs): <input type="text"/> | |
| <input type="checkbox"/> Structure in Flood Hazard Zone | Panel #: <input type="text"/> |
| Panel Date: <input type="text"/> | Type of FIS: <input type="text" value="NO STUDY"/> |
| Date of FIS: <input type="text"/> | |

Environmental

| | | |
|--|--|---|
| Quad Map: <input type="text" value="SKYLAND, NC"/> | River Basin: <input type="text" value="French Broad"/> | Buffer Rule: <input type="text" value="NA"/> |
| Primary Stream Classification | | Other Stream Classification |
| <input type="checkbox"/> Class B | <input checked="" type="checkbox"/> Class C | <input type="checkbox"/> SA |
| <input type="checkbox"/> SB | <input type="checkbox"/> SC | <input type="checkbox"/> SWL |
| <input type="checkbox"/> WL | <input type="checkbox"/> WS I | <input type="checkbox"/> WS II |
| <input type="checkbox"/> WS III | <input type="checkbox"/> WS IV | <input type="checkbox"/> WS V |
| Supplemental Stream Classification | | <input type="checkbox"/> Anadromous Fish |
| <input type="checkbox"/> FWS | <input type="checkbox"/> HQW | <input type="checkbox"/> Area of Environmental Concern |
| <input type="checkbox"/> NSW | <input type="checkbox"/> ORW | <input type="checkbox"/> CAMA County |
| <input type="checkbox"/> Federal Wild & Scenic Rivers | <input type="checkbox"/> HSB Required | <input type="checkbox"/> NC Natural & Scenic Rivers |
| <input type="checkbox"/> Primary Nursery Area | <input type="checkbox"/> Impaired [303d] | <input type="checkbox"/> Designated Shellfish Harvesting Area |
| <input type="checkbox"/> Designated Public Mountain Trout Waters | <input type="checkbox"/> TVA | |
| <input type="checkbox"/> Sw | <input type="checkbox"/> Tr | <input type="checkbox"/> w/in 0.5mi. of CA |

Up/Down Stream Features

| | |
|---|---|
| Upstream Feature: <input type="text" value="Culvert"/> | Structure Type: <input type="text" value="CMP"/> |
| Location: <input type="text" value="675' Upstream on Casteel Lane 675' East of US-25A"/> | Span Arrangement: <input type="text" value="1@42"/> |
| Structure #: <input type="text"/> | OAL (ft): <input type="text"/> |
| Route: <input type="text" value="Casteel Lane"/> | Number of Barrels: <input type="text"/> |
| Latitude: <input type="text" value="35.49713"/> | @ Span (ft): <input type="text"/> |
| Longitude: <input type="text" value="-82.51605"/> | x Rise (ft): <input type="text"/> |
| Prior Survey Completed: <input type="checkbox"/> | Bed to Crown (ft): <input type="text"/> |
| Survey Date: <input type="text"/> | Year Built: <input type="text"/> |
| Downstream Feature: <input type="text" value="Culvert"/> | Structure Type: <input type="text" value="RCBC"/> |
| Location: <input type="text" value="900' Downstream on US-25 (Hendersonville Rd) 950' West of US-25A"/> | Span Arrangement: <input type="text"/> |
| Structure #: <input type="text"/> | OAL (ft): <input type="text"/> |
| Route: <input type="text" value="US-25"/> | Number of Barrels: <input type="text" value="1"/> |
| Latitude: <input type="text" value="35.49846"/> | @ Span (ft): <input type="text" value="8.0"/> |
| Longitude: <input type="text" value="-82.52126"/> | x Rise (ft): <input type="text" value="5.0"/> |
| Prior Survey Completed: <input type="checkbox"/> | Bed to Crown (ft): <input type="text"/> |
| Survey Date: <input type="text"/> | Year Built: <input type="text"/> |

Preliminary Structure Estimate [Office Estimate]

| | |
|---|---------------------------------------|
| Structure Type: <input rcp"="" type="text" value="RCBC 42"/> | Skew: <input type="text" value="90"/> |
| Dimensions/Spans: <input type="text" value="9x9' buried 4'"/> Replace existing 42" CMP with 42" RCP tied to downstream 42" RCP | |

Notes

APPENDIX D

PRELIMINARY DESIGN AND ASSESSMENT
STREAM CROSSING AND ENCROACHMENTS

COUNTY Buncombe PROJECT# U-2801A
STREAM UT to Dingle Creek ROUTE US-25A
ASSESSMENT PREPARED BY Ecological Engineering, LLP DATE 6/21/2016

HYDROLOGIC EVALUATION

NEAREST GAUGING STATION ON THIS STREAM _____ (NONE X) _____

ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: No

FLOOD DATA:

Q10 430 cfs EST. BKWTR. _____ FT. Q25 600 cfs EST. BKWTR. _____ FT.
Q50 700 cfs EST. BKWTR. _____ FT. Q100 750 cfs EST. BKWTR. _____ FT.
Q500 _____ cfs OR OVERTOPPING CFS EST. BKWTR. _____ FT.

DRAINAGE AREA 0.32 sq mi METHOD to COMPUTE Q 2001 USGS Urban Equations - Future Dev

PROPERTY RELATED EVALUATIONS

DAMAGE POTENTIAL: LOW _____ MODERATE X HIGH _____
COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: YES _____ NO X
EXPLANATION: _____

LIST BUILDINGS IN FLOOD PLAIN Sweeten Creek Center LOCATION Northeast
FLOOR ELEVATION: _____

UPSTREAM LAND USE: Com/Res

ANTICIPATE ANY CHANGE? Future Development Possible

ANY FLOOD ZONE? (FIA STUDIES, ETC.) YES _____ NO X
TYPE OF STUDY No study

BASE FLOOD ELEVATION _____ (100yr.)

REGULATORY FLOODWAY WIDTH N/A (AS NOTED IN FIA STUDIES)

COMMENTS: _____

TRAFFIC RELATED EVALUATIONS

PRESENT YEAR _____ TRAFFIC COUNT _____ VPD %TRUCKS _____

DESIGN YEAR _____ TRAFFIC COUNT _____ VPD % TRUCKS _____

EMERGENCY ROUTE _____ SCHOOL BUS ROUTE _____ MAIL ROUTE _____

DETOUR AVAILABLE? _____ LENGTH OF DETOUR _____ MILES

DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? 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 N/A AGGRADATION/DEGRADATION X RESERVOIRS N/A

DIVERSIONS N/A DRAINAGE DISTRICT N/A NAVIGATION N/A

BACKWATER FROM ANOTHER SOURCE N/A

EXPLANATION: Bed has aggraded 1.5' above pipe inlet due to debris in channel

ROADWAY OVERFLOW SECTION (NONE X) LENGTH _____ ELEVATION _____

EMBANKMENT: SOIL TYPE Sand/gravel TYPE SLOPE COVER Woods

COMMENTS: _____

ENVIRONMENTAL CONSIDERATIONS

LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN (NONE _____)

Possible Wetlands

MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES _____ NO X PROTECTION NEEDED No

ARE BANKS STABLE? Yes PROTECTION NEEDED No

DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No

COMMENTS: _____

ALTERNATIVES

RECOMMENDED DESIGN Replace CMP with 42" RCP to connect to downstream 42"

DETOUR STRUCTURE _____

LOW ROAD GRADE Maintain Existing DETOUR GRADE _____

BRIDGE WATERWAY OPENING _____ CULVERT OPENING 9.6 Square Feet

WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES _____ NO X

DISCUSSION: Hw/d=44.8 (Downstream 42" pipe controls overall system)

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 2



Upstream Face



Upstream Channel



Downstream Outlet at TD Ameritrade



(Hendersonville Rd)

Looking Downstream from Outlet toward US-25



24-inch Outfall Upstream



Looking North along US-25 Alt (Sweeten Creek Rd)



Looking South along US-25 Alt (Sweeten Creek Rd)



Looking East from US-25 Alt (Sweeten Creek Rd)

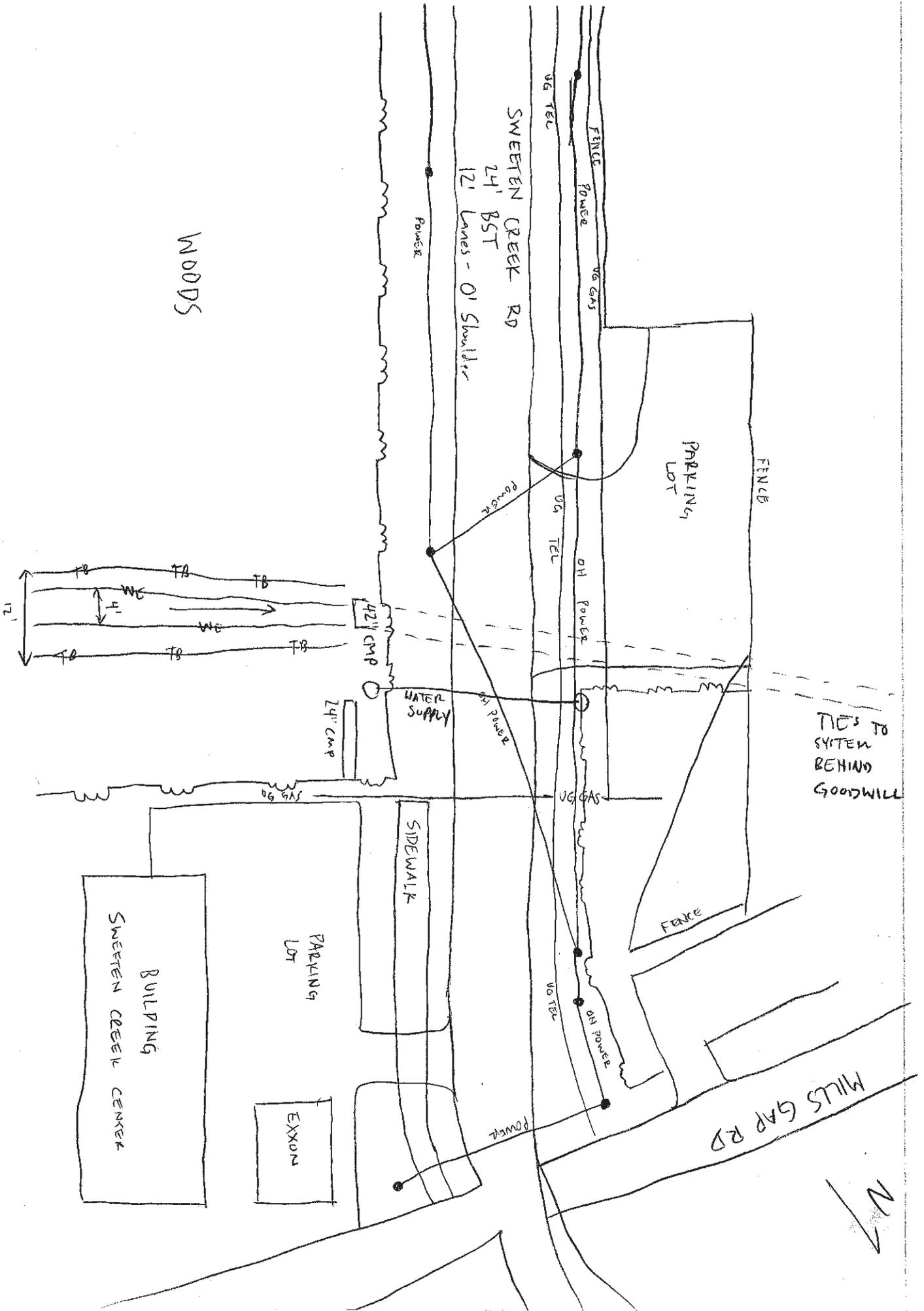


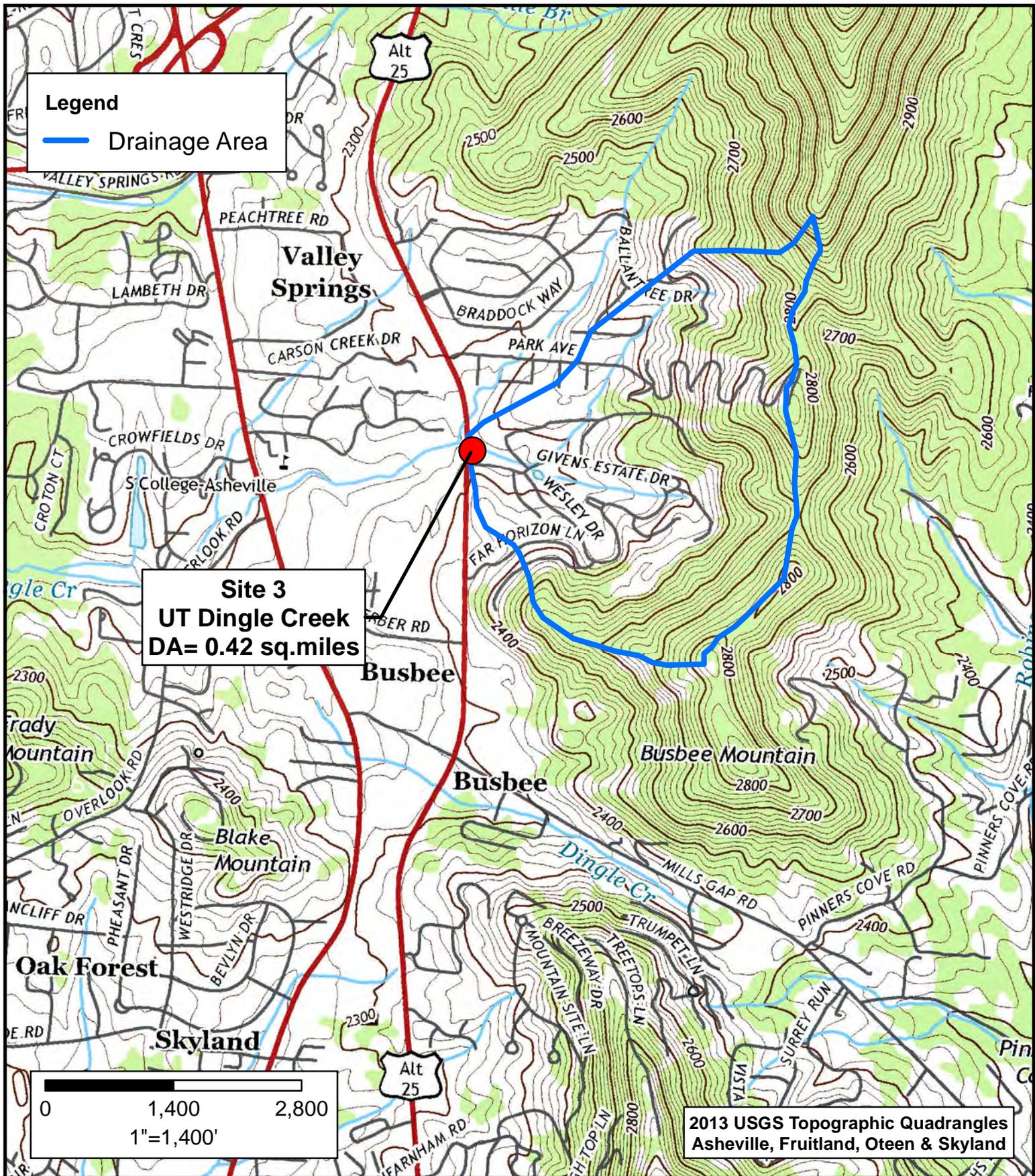
Looking West from US-25 Alt (Sweeten Creek Rd)

U-2801 A

Site 2

Plan Sketch





NORTH CAROLINA DEPARTMENT
 OF TRANSPORTATION
 DIVISION OF HIGHWAYS
 PROJECT DEVELOPMENT AND
 ENVIRONMENTAL ANALYSIS UNIT

SITE 3 DRAINAGE AREA MAP
 WIDEN SWEETEN CREEK ROAD (US25A)
 FROM HENDERSONVILLE ROAD (US25)
 TO SR 3801 (ROCK HILL RD)

BUNCOMBE COUNTY
 TIP PROJECT U-2801A



| | |
|---------|--------------|
| County: | BUNCOMBE |
| Div: 13 | TIP# U-2801A |
| WBS: | 34859.1.FR3 |
| Date: | MARCH 2016 |

Figure
4

Hydraulics Unit Pre-Design Report (Pre-Scoping) for Structure #:

Date: 06/21/2016

County: Stream:

Road #: Road Name:

Division: Location:

Latitude: Longitude: Decimal degrees, a min of 5 decimal points

Assigned to:

Prepared By:

Hydro Mgr: Hydro Reviewer:

Project Type:

Existing Structure

Structure Type: Yr Built:

Span Arrangement: OAL (ft): Skew: Abutment Type:

Number of Barrels: @ Span (ft): x Rise (ft):

Bed to Crown (ft): Clear Roadway (ft): Water Depth (ft): Superstructure Depth:

ADT: Year ADT: Scour Code (item113): Prior Survey Completed: Survey Date:

Drainage Area: Sq. Mi. Drainage Area Source: Roadway Overtops at Q100:

Discharge Method: USGS Region: Stream Gage Number(if applicable):

Q10 (cfs): Q25 (cfs): Q50 (cfs): Q100 (cfs): QBFE (cfs):

Structure in Flood Hazard Zone Panel #: Panel Date: Type of FIS: Date of FIS:

Enviromental

Quad Map: River Basin: Buffer Rule:

| | | | | | |
|---|---|--------------------------------|--|--|---|
| Primary Stream Classification | | | | Other Stream Classification | |
| <input type="checkbox"/> Class B | <input checked="" type="checkbox"/> Class C | <input type="checkbox"/> SA | <input type="checkbox"/> SB | <input type="checkbox"/> Anadromous Fish | <input type="checkbox"/> Area of Environmental Concern |
| <input type="checkbox"/> SC | <input type="checkbox"/> SWL | <input type="checkbox"/> WL | <input type="checkbox"/> WS I | <input type="checkbox"/> CAMA County | <input type="checkbox"/> Federal Wild & Scenic Rivers |
| <input type="checkbox"/> WS II | <input type="checkbox"/> WS III | <input type="checkbox"/> WS IV | <input type="checkbox"/> WS V | <input type="checkbox"/> HSB Required | <input type="checkbox"/> NC Natural & Scenic Rivers |
| Supplemental Stream Classification | | | | <input type="checkbox"/> Impaired [303d] | <input type="checkbox"/> Primary Nursery Area |
| <input type="checkbox"/> FWS | <input type="checkbox"/> HQW | <input type="checkbox"/> NSW | <input type="checkbox"/> ORW | <input type="checkbox"/> TVA | <input type="checkbox"/> Designated Shellfish Harvesting Area |
| <input type="checkbox"/> Sw | <input type="checkbox"/> Tr | <input type="checkbox"/> UWL | <input type="checkbox"/> w/in 0.5mi. of CA | <input type="checkbox"/> Designated Public Mountain Trout Waters | |

Up/Down Stream Features

Upstream Feature:

Location:

Structure #: Route:

Latitude: Longitude:

Prior Survey Completed: Survey Date: Bed to Crown (ft): Year Built:

Structure Type:

Span Arrangement: OAL (ft):

Number of Barrels: @ Span (ft): x Rise (ft):

Downstream Feature:

Location:

Structure #: Route:

Latitude: Longitude:

Prior Survey Completed: Survey Date: Bed to Crown (ft): Year Built:

Structure Type:

Span Arrangement: OAL (ft):

Number of Barrels: @ Span (ft): x Rise (ft):

Preliminary Structure Estimate [Office Estimate]

Structure Type: Skew:

Dimensions/Spans:

Notes

APPENDIX D

PRELIMINARY DESIGN AND ASSESSMENT
STREAM CROSSING AND ENCROACHMENTS

COUNTY Buncombe PROJECT# U-2801A
STREAM UT to Dingle Creek ROUTE US-25A
ASSESSMENT PREPARED BY Ecological Engineering, LLP DATE 6/21/2016

HYDROLOGIC EVALUATION

NEAREST GAUGING STATION ON THIS STREAM _____ (NONE X) _____

ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: No

FLOOD DATA:

Q10 430 cfs EST. BKWTR. _____ FT. Q25 650 cfs EST. BKWTR. _____ FT.
Q50 700 cfs EST. BKWTR. _____ FT. Q100 800 cfs EST. BKWTR. _____ FT.
Q500 _____ cfs OR OVERTOPPING CFS EST. BKWTR. _____ FT.

DRAINAGE AREA 0.42 sq mi METHOD to COMPUTE Q 2001 USGS Urban Equations - Future Dev

PROPERTY RELATED EVALUATIONS

DAMAGE POTENTIAL: LOW X MODERATE _____ HIGH _____
COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: YES _____ NO X
EXPLANATION: _____

LIST BUILDINGS IN FLOOD PLAIN None LOCATION _____
FLOOR ELEVATION: _____

UPSTREAM LAND USE: Residential

ANTICIPATE ANY CHANGE? Future Development Possible

ANY FLOOD ZONE? (FIA STUDIES, ETC.) YES X NO _____
TYPE OF STUDY No Study - Located in zone AE of Dingle Creek LDS

BASE FLOOD ELEVATION 2278.9' (100yr.)

REGULATORY FLOODWAY WIDTH N/A (AS NOTED IN FIA STUDIES)

COMMENTS: Backwater from Dingle Creek

TRAFFIC RELATED EVALUATIONS

PRESENT YEAR _____ TRAFFIC COUNT _____ VPD %TRUCKS _____

DESIGN YEAR _____ TRAFFIC COUNT _____ VPD % TRUCKS _____

EMERGENCY ROUTE _____ SCHOOL BUS ROUTE _____ MAIL ROUTE _____

DETOUR AVAILABLE? _____ LENGTH OF DETOUR _____ MILES

DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? 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 N/A AGGRADATION/DEGRADATION X RESERVOIRS N/A

DIVERSIONS N/A DRAINAGE DISTRICT N/A NAVIGATION N/A

BACKWATER FROM ANOTHER SOURCE Dingle Creek

EXPLANATION: Bed has aggraded 1.5' above pipe inlet due to debris in channel

ROADWAY OVERFLOW SECTION (NONE X) LENGTH _____ ELEVATION _____

EMBANKMENT: SOIL TYPE Sand/gravel TYPE SLOPE COVER Woods

COMMENTS: _____

ENVIRONMENTAL CONSIDERATIONS

LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN (NONE _____)

Possible Wetlands

MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES NO _____ PROTECTION NEEDED

ARE BANKS STABLE? Upstream - Yes, Downstream - No PROTECTION NEEDED Yes - Downstream

DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No

COMMENTS: Banks downstream being undercut

ALTERNATIVES

RECOMMENDED DESIGN 1 @ 10' x 9' RCBC Buried 1.0'

DETOUR STRUCTURE _____

LOW ROAD GRADE Maintain existing DETOUR GRADE _____

BRIDGE WATERWAY OPENING _____ CULVERT OPENING 80 sq. ft.

WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES _____ NO

DISCUSSION: _____

THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:

- (1) NORMAL PROCESS
 - (2) _____ NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR
-

- (3) _____ SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION

ADDRESSING: _____

Site 3



Upstream Face



Upstream Channel



Junction



72-inch Outfall Downstream



Downstream Channel

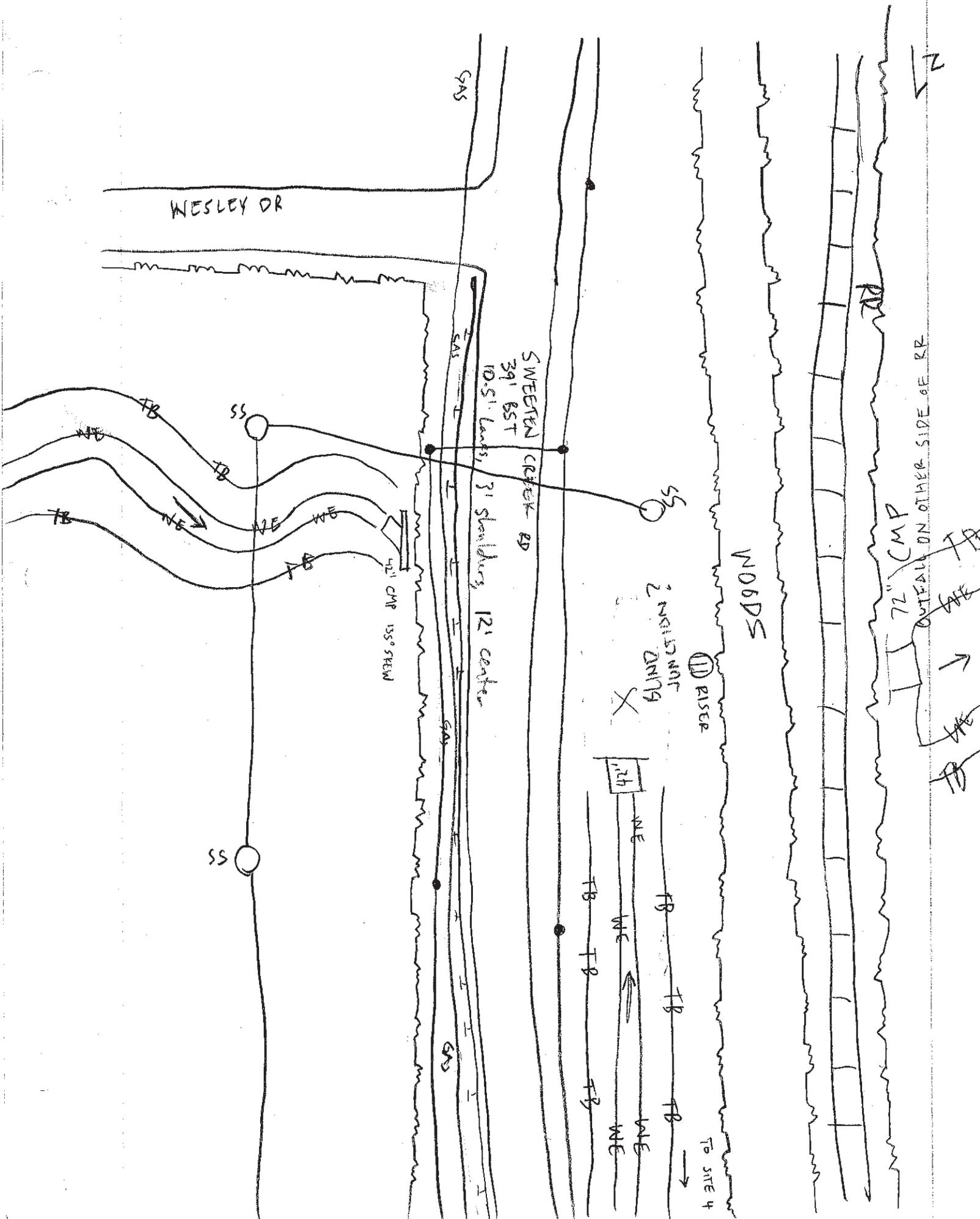


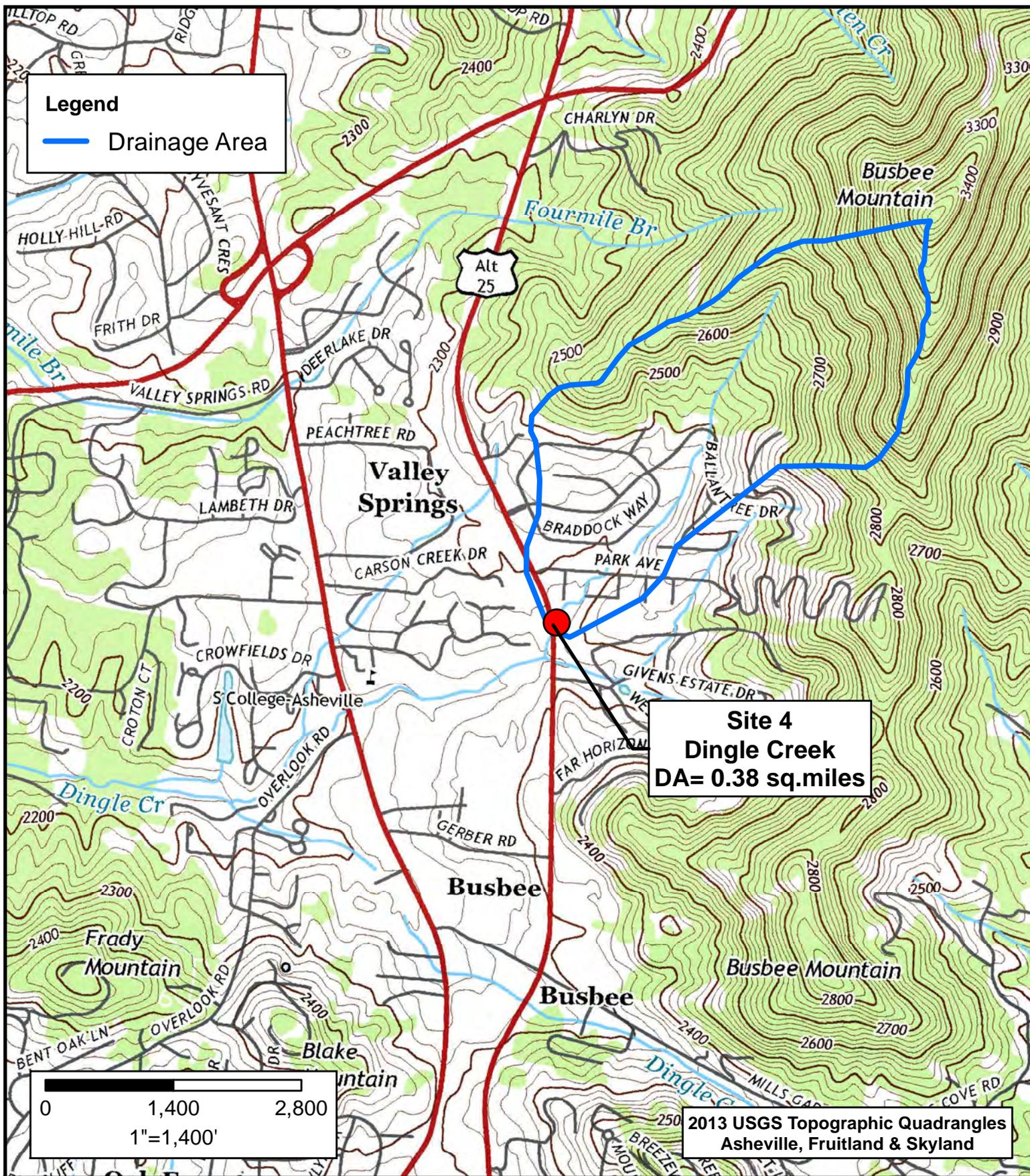
Downstream Left Bank Undercut

U-2801A

Site 3

Plan Sketch





NORTH CAROLINA DEPARTMENT
 OF TRANSPORTATION
 DIVISION OF HIGHWAYS
 PROJECT DEVELOPMENT AND
 ENVIRONMENTAL ANALYSIS UNIT

SITE 4 DRAINAGE AREA MAP
 WIDEN SWEETEN CREEK ROAD (US25A)
 FROM HENDERSONVILLE ROAD (US25)
 TO SR 3801 (ROCK HILL RD)
 BUNCOMBE COUNTY
 TIP PROJECT U-2801A



| | |
|---------|--------------|
| County: | BUNCOMBE |
| Div: 13 | TIP# U-2801A |
| WBS: | 34859.1.FR3 |
| Date: | MARCH 2016 |

**Figure
 5**

Hydraulics Unit Pre-Design Report (Pre-Scoping) for Structure #:

Date: 06/21/2016

County: Stream:

Road #: Road Name:

Division: Location:

Latitude: Longitude: Decimal degrees, a min of 5 decimal points

Assigned to:

Prepared By:

Hydro Mgr: Hydro Reviewer:

Project Type:

Existing Structure

Structure Type: Yr Built:

Span Arrangement: OAL (ft): Skew: Abutment Type:

Number of Barrels: @ Span (ft): x Rise (ft):

Bed to Crown (ft): Clear Roadway (ft): Water Depth (ft): Superstructure Depth:

ADT: Year ADT: Scour Code (item113): Prior Survey Completed: Survey Date:

Drainage Area: Sq. Mi. Drainage Area Source: Roadway Overtops at Q100:

Discharge Method: USGS Region: Stream Gage Number(if applicable):

Q10 (cfs): Q25 (cfs): Q50 (cfs): Q100 (cfs): QBFE (cfs):

Structure in Flood Hazard Zone Panel #: Panel Date: Type of FIS: Date of FIS:

Environmental

Quad Map: River Basin: Buffer Rule:

| | | | | | |
|---|---|--------------------------------|--|--|---|
| Primary Stream Classification | | | | Other Stream Classification | |
| <input type="checkbox"/> Class B | <input checked="" type="checkbox"/> Class C | <input type="checkbox"/> SA | <input type="checkbox"/> SB | <input type="checkbox"/> Anadromous Fish | <input type="checkbox"/> Area of Environmental Concern |
| <input type="checkbox"/> SC | <input type="checkbox"/> SWL | <input type="checkbox"/> WL | <input type="checkbox"/> WS I | <input type="checkbox"/> CAMA County | <input type="checkbox"/> Federal Wild & Scenic Rivers |
| <input type="checkbox"/> WS II | <input type="checkbox"/> WS III | <input type="checkbox"/> WS IV | <input type="checkbox"/> WS V | <input type="checkbox"/> HSB Required | <input type="checkbox"/> NC Natural & Scenic Rivers |
| Supplemental Stream Classification | | | | <input type="checkbox"/> Impaired [303d] | <input type="checkbox"/> Primary Nursery Area |
| <input type="checkbox"/> FWS | <input type="checkbox"/> HQW | <input type="checkbox"/> NSW | <input type="checkbox"/> ORW | <input type="checkbox"/> TVA | <input type="checkbox"/> Designated Shellfish Harvesting Area |
| <input type="checkbox"/> Sw | <input type="checkbox"/> Tr | <input type="checkbox"/> UWL | <input type="checkbox"/> w/in 0.5mi. of CA | <input type="checkbox"/> Designated Public Mountain Trout Waters | |

Up/Down Stream Features

| | |
|--|--|
| <p>Upstream Feature: <input type="text" value="Culvert"/></p> <p>Location: <input type="text" value="850' Upstream On Park Ave 790 feet Northeast of US-25A"/></p> <p>Structure #: <input type="text"/> Route: <input type="text" value="Park Ave"/></p> <p>Latitude: <input type="text" value="35.51062"/> Longitude: <input type="text" value="-82.51586"/></p> <p>Prior Survey Completed: <input type="checkbox"/> Survey Date: <input type="text"/> Bed to Crown (ft): <input type="text"/> Year Built: <input type="text"/></p> | <p>Structure Type: <input type="text" value="CMP"/></p> <p>Span Arrangement: <input type="text" value="1@54" x36"=""/> OAL (ft): <input type="text"/></p> <p>Number of Barrels: <input type="text"/> @ Span (ft): <input type="text"/> x Rise (ft): <input type="text"/></p> |
| <p>Downstream Feature: <input type="text" value="Culvert"/></p> <p>Location: <input type="text" value="350' Downstream 60' West of US-25A (between RR and US-25A)"/></p> <p>Structure #: <input type="text"/> Route: <input type="text" value="N/A"/></p> <p>Latitude: <input type="text" value="35.50836"/> Longitude: <input type="text" value="-82.51785"/></p> <p>Prior Survey Completed: <input type="checkbox"/> Survey Date: <input type="text"/> Bed to Crown (ft): <input type="text"/> Year Built: <input type="text"/></p> | <p>Structure Type: <input type="text" value="RCP"/></p> <p>Span Arrangement: <input type="text" value="1@48"/> OAL (ft): <input type="text"/></p> <p>Number of Barrels: <input type="text"/> @ Span (ft): <input type="text"/> x Rise (ft): <input type="text"/></p> |

Preliminary Structure Estimate [Office Estimate]

Structure Type: Skew:

Dimensions/Spans:

Notes

PRELIMINARY DESIGN AND ASSESSMENT
STREAM CROSSING AND ENCROACHMENTS

COUNTY Buncombe PROJECT# U-2801A
STREAM Dingle Creek ROUTE US-25A
ASSESSMENT PREPARED BY Ecological Engineering, LLP DATE 6/21/2016

HYDROLOGIC EVALUATION

NEAREST GAUGING STATION ON THIS STREAM _____ (NONE) _____

ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: Yes

FLOOD DATA:

Q10 360 cfs EST. BKWTR. _____ FT. Q25 550 cfs EST. BKWTR. _____ FT.
Q50 600 cfs EST. BKWTR. _____ FT. Q100 700 cfs EST. BKWTR. _____ FT.
Q500 _____ cfs OR OVERTOPPING CFS EST. BKWTR. _____ FT.

DRAINAGE AREA 0.38 sq mi METHOD to COMPUTE Q 2001 USGS Urban Equations - Future Dev

PROPERTY RELATED EVALUATIONS

DAMAGE POTENTIAL: LOW _____ MODERATE HIGH _____

COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED

ENCROACHMENT: YES NO _____

EXPLANATION: Current residential structure within flood zone AE;

Multiple residential properties upstream

LIST BUILDINGS IN FLOOD PLAIN Residences LOCATION Upstream
FLOOR ELEVATION: _____

UPSTREAM LAND USE: Residential

ANTICIPATE ANY CHANGE? Future development possible

ANY FLOOD ZONE? (FIA STUDIES, ETC.) YES NO _____

TYPE OF STUDY Limited Detailed Study

BASE FLOOD ELEVATION 2278.9 ft (100yr.)

REGULATORY FLOODWAY WIDTH 416 ft (AS NOTED IN FIA STUDIES)

COMMENTS: Limited Detailed Study - Non-encroachment width; FIS shows 274 ft
(54 ft upstream of crossing) and 416 ft (33 ft downstream from crossing)

TRAFFIC RELATED EVALUATIONS

PRESENT YEAR _____ TRAFFIC COUNT _____ VPD %TRUCKS _____

DESIGN YEAR _____ TRAFFIC COUNT _____ VPD % TRUCKS _____

EMERGENCY ROUTE _____ SCHOOL BUS ROUTE _____ MAIL ROUTE _____

DETOUR AVAILABLE? _____ LENGTH OF DETOUR _____ MILES

DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? 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 N/A AGGRADATION/DEGRADATION N/A RESERVOIRS N/A

DIVERSIONS N/A DRAINAGE DISTRICT N/A NAVIGATION N/A

BACKWATER FROM ANOTHER SOURCE N/A

EXPLANATION: _____

ROADWAY OVERFLOW SECTION (NONE _____) LENGTH 849.4 ft ELEVATION 14' above bed

EMBANKMENT: SOIL TYPE Sand/gravel TYPE SLOPE COVER Woods

COMMENTS: Overflow length obtained from Limited Detailed Study model

ENVIRONMENTAL CONSIDERATIONS

LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN (NONE _____)

Possible Wetlands

MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES _____ NO PROTECTION NEEDED No

ARE BANKS STABLE? Yes PROTECTION NEEDED No

DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No

COMMENTS: _____

ALTERNATIVES

RECOMMENDED DESIGN 10'x8' RCBC buried 1'

DETOUR STRUCTURE _____

LOW ROAD GRADE Maintain Existing DETOUR GRADE _____

BRIDGE WATERWAY OPENING _____ CULVERT OPENING 63 square feet

WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES _____ NO

DISCUSSION: Hw/d=1.2

THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:

(1) NORMAL PROCESS

(2) _____ NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR

(3) _____ SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION

ADDRESSING: _____

Site 4



Upstream Face



Upstream Channel



Downstream Face



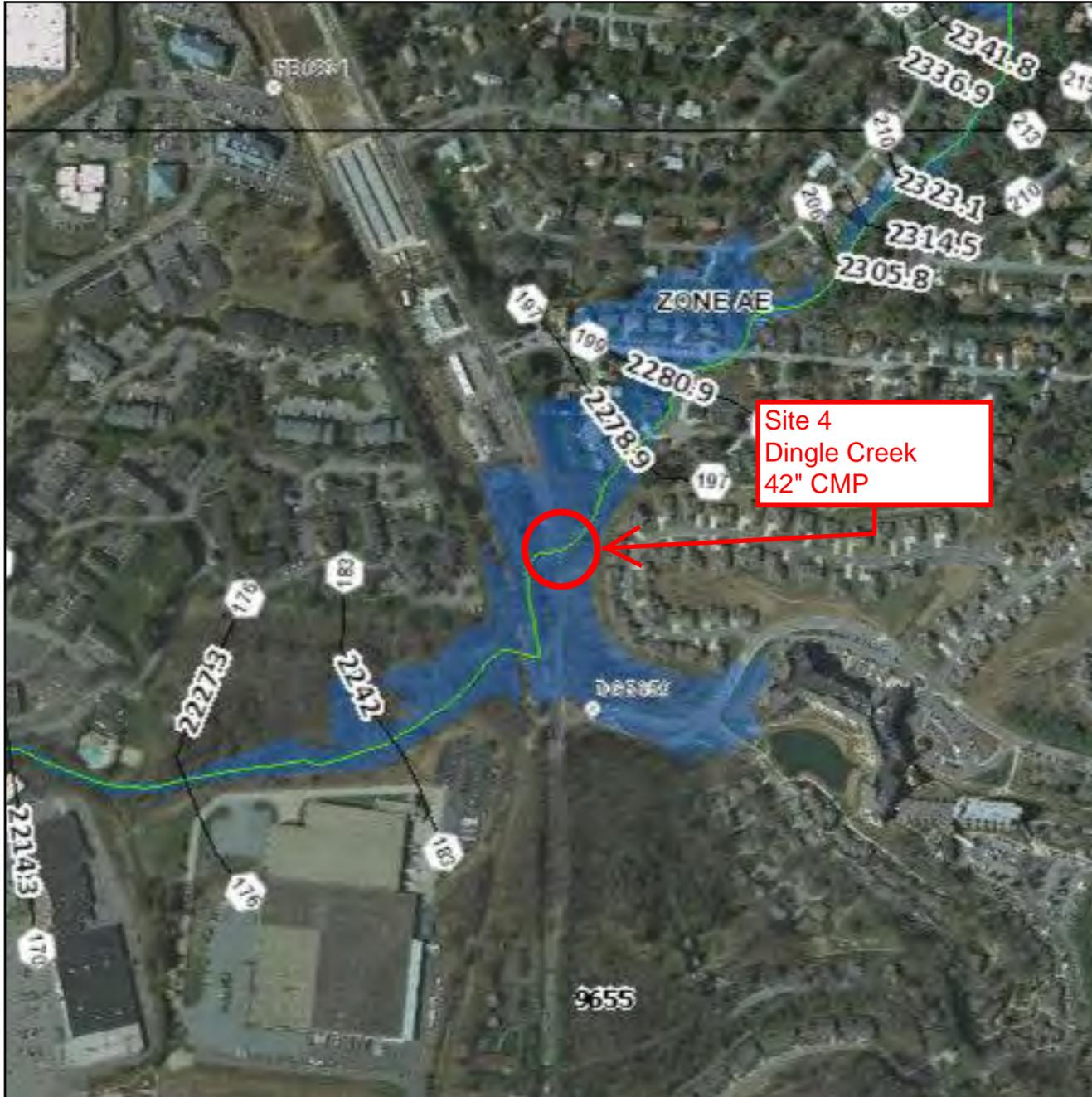
Downstream Channel



Looking North along US-25 Alt (Sweeten Creek Rd)



Looking South along US-25 Alt (Sweeten Creek Rd)



Without Base Flood Elevation (BFE)
Zone A, V, A99

With BFE or Depth
Zone AE, AO, AH, VE, AR

Regulatory Floodway

0.2% Annual Chance Flood Hazard

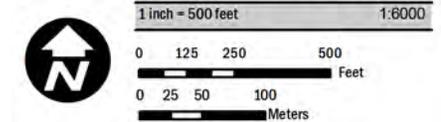
Future Conditions 1% Annual Chance Flood Hazard *Zone X*

Areas Determined to be Outside the 0.2% Annual Chance Flood Hazard *Zone X*

Jurisdiction Boundary

FIRM Panel Boundary

North Carolina State Plane Projection Feet (Zone 3200)
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)



FEMA National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

Panel(s): 9656, 9655

CONTAINS:

COMMUNITY **CID**
CITY OF ASHEVILLE 370032

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

SELECTED PANELS:

| MAP NUMBER | EFFECTIVE DATE |
|-------------|----------------|
| 3700965600J | 1/6/2010 |
| 3700965500J | 1/6/2010 |

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% Annual Chance |
| At the Henderson/Buncombe County boundary | 60.31 | * | * | 8150 | * |
| At the confluence of Robinson Creek | 54.47 | * | * | 7940 | * |
| Approximately 100 feet upstream of Cross Creek Farm Road | 47.91 | * | * | 7620 | * |
| Approximately 0.4 mile upstream of River Cane Drive | 45.67 | * | * | 7500 | * |
| At the confluence of Gap Creek | 32.58 | * | * | 6540 | * |
| At US Highway 74 | 18.47 | * | * | 4610 | * |
| Approximately 1.3 miles upstream of Miller Road (SR 2800) | 12.87 | * | * | 3680 | * |
| Cane Creek (into Hominy Creek) | | | | | |
| At the confluence with Hominy Creek | 1.97 | * | * | 1620 | * |
| Curtis Creek | | | | | |
| At the confluence with South Hominy Creek | 2.76 | * | * | 1410 | * |
| Approximately 1,100 feet upstream of Curtis Creek Road (SR 1113) | 2.18 | * | * | 1210 | * |
| Dick Branch | | | | | |
| At the confluence with Flat Creek (into French Broad River) | 3.37 | * | * | 1590 | * |
| Dillingham Creek | | | | | |
| At mouth | 33.40 | * | * | 6300 | * |
| Approximately 800 feet downstream of Dillingham Road | 24.60 | * | * | 5100 ¹ | * |
| At Williams Branch Road (SR 2174) | 23.33 | * | * | 5330 | * |
| At the confluence of Town Branch Creek | 9.15 | * | * | 2970 | * |
| Dingle Creek | | | | | |
| At the confluence with French Broad River | 4.22 | * | * | 2370 | * |
| Approximately 600 feet downstream of Crowfields Lane | 2.03 | * | * | 1920 | * |
| At Ballantree Drive | 0.12 | * | * | 200 | * |
| Dix Creek | | | | | |
| At the confluence with Newfound Creek | 7.66 | * | * | 2660 | * |
| Approximately 300 feet downstream of Bear Creek Road (SR 1607) | 5.02 | * | * | 2040 | * |
| Eller Cove | | | | | |
| At the confluence with Reems Creek | 2.00 | * | * | 1150 | * |
| Emma Branch | | | | | |
| At the confluence with Smith Mill Creek | 1.67 | * | * | 1030 | * |
| Approximately 1,000 feet upstream of Hazel Mill Road | 0.52 | * | * | 500 | * |
| Emma Branch Tributary 2 | | | | | |
| At the confluence with Emma Branch | 0.31 | * | * | 360 | * |
| Flat Creek | | | | | |
| At the confluence with Broad River | 10.45 | * | * | 3750 | * |
| Approximately 0.9 mile upstream of the confluence with Broad River | 9.99 | * | * | 3640 | * |
| Flat Creek (into French Broad River) | | | | | |
| At the confluence with French Broad River | 24.71 | * | * | 5530 | * |
| Approximately 1.6 miles downstream of US Highway 25/70 | 19.64 | * | * | 4790 | * |
| Approximately 0.4 mile upstream of the confluence of Dick Branch | 12.28 | * | * | 2960 | * |
| Approximately 300 feet downstream of I-26 | 7.05 | * | * | 2520 | * |
| Approximately 1,100 feet upstream of Chambers Road | 4.34 | * | * | 1860 | * |

Table 17 - Limited Detailed Flood Hazard Data

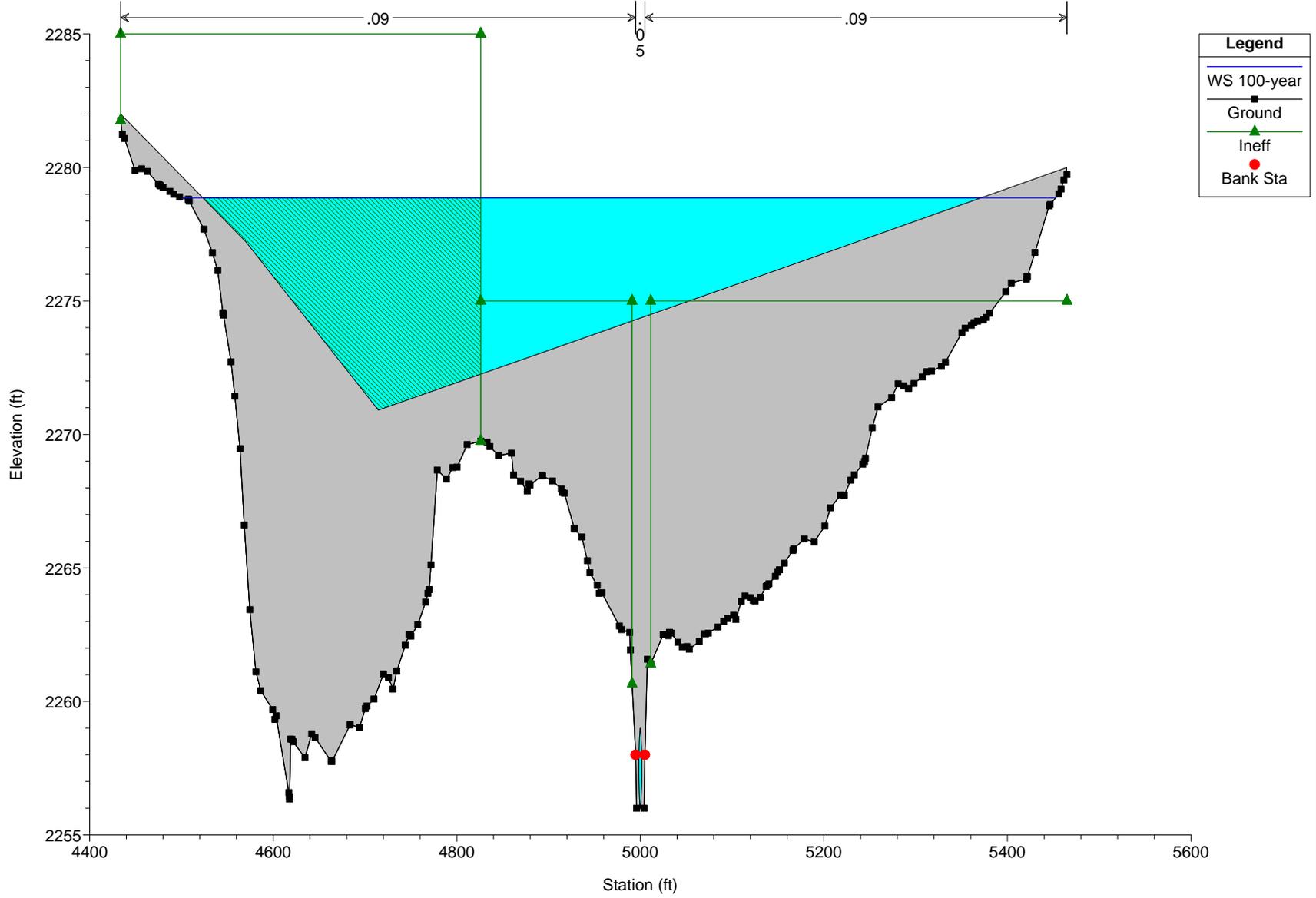
| Cross Section | Stream Station | Flood Discharge (cfs) | 1% Annual Chance Water-Surface Elevation (feet NAVD 88) | Non-Encroachment Width (feet) Left/Right from Stream Centerline |
|---------------------|----------------|-----------------------|---|---|
| 105 | 10,494 | 5,330 | 2,300.3 | 37 / 44 |
| 112 | 11,187 | 5,330 | 2,311.8 | 39 / 155 |
| 117 | 11,705 | 5,330 | 2,316.8 | 31 / 40 |
| 123 | 12,287 | 5,330 | 2,324.4 | 51 / 37 |
| 132 | 13,184 | 5,300 | 2,335.2 | 139 / 17 |
| 133 | 13,298 | 5,300 | 2,339.9 | 13 / 105 |
| 136 | 13,604 | 5,300 | 2,342.1 | 23 / 47 |
| 139 | 13,852 | 5,300 | 2,347.1 | 41 / 45 |
| 143 | 14,308 | 5,300 | 2,353.7 | 37 / 45 |
| 149 | 14,856 | 5,300 | 2,359.1 | 29 / 68 |
| 155 | 15,494 | 5,300 | 2,366.6 | 27 / 35 |
| 156 | 15,578 | 5,300 | 2,371.6 | 14 / 174 |
| 158 | 15,800 | 5,300 | 2,371.8 | 103 / 62 |
| 160 | 16,005 | 5,300 | 2,373.7 | 149 / 25 |
| 166 | 16,575 | 5,300 | 2,380.6 | 131 / 46 |
| 172 | 17,152 | 5,300 | 2,387.7 | 36 / 43 |
| 176 | 17,633 | 5,300 | 2,394.0 | 76 / 26 |
| 181 | 18,138 | 5,300 | 2,400.9 | 44 / 43 |
| 188 | 18,752 | 5,160 | 2,410.4 | 40 / 48 |
| 193 | 19,301 | 3,450 | 2,418.6 | 50 / 24 |
| 197 | 19,705 | 3,450 | 2,424.5 | 38 / 60 |
| 204 | 20,407 | 3,450 | 2,433.2 | 54 / 33 |
| 208 | 20,849 | 2,970 | 2,440.5 | 43 / 37 |
| 214 | 21,352 | 2,970 | 2,447.0 | 67 / 33 |
| 215 | 21,458 | 2,970 | 2,451.6 | 72 / 119 |
| 217 | 21,666 | 2,970 | 2,454.8 | 25 / 179 |
| 219 | 21,912 | 2,970 | 2,459.8 | 28 / 111 |
| 225 | 22,468 | 2,970 | 2,468.7 | 32 / 64 |
| 229 | 22,896 | 2,970 | 2,478.5 | 24 / 194 |
| 230 | 22,966 | 2,970 | 2,479.6 | 30 / 187 |
| 232 | 23,242 | 2,970 | 2,485.0 | 36 / 86 |
| 235 | 23,527 | 2,970 | 2,491.6 | 40 / 154 |
| 239 | 23,940 | 2,930 | 2,499.4 | 17 / 208 |
| 240 | 24,034 | 2,930 | 2,501.5 | 17 / 208 |
| 241 | 24,084 | 2,930 | 2,503.3 | 132 / 94 |
| 246 | 24,569 | 2,930 | 2,513.3 | 164 / 35 |
| 250 | 24,971 | 2,930 | 2,522.6 | 228 / 15 |
| 250 | 25,018 | 2,930 | 2,524.3 | 228 / 17 |
| 256 | 25,626 | 2,930 | 2,535.8 | 16 / 17 |
| 257 | 25,709 | 2,930 | 2,537.9 | 18 / 19 |
| 258 | 25,810 | 2,930 | 2,541.2 | 42 / 27 |
| 259 | 25,916 | 2,790 | 2,542.9 | 13 / 24 |
| 260 | 26,010 | 2,790 | 2,545.3 | 28 / 24 |
| Dingle Creek | | | | |
| 004 | 441 | 2,370 | 2,007.3 ¹ | 27 / 21 |

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 |
|---------------|----------------|-----------------------|---|---|
| 011 | 1,059 | 2,370 | 2,007.9 | 15 / 14 |
| 018 | 1,831 | 2,370 | 2,020.9 | 23 / 29 |
| 027 | 2,699 | 2,370 | 2,030.1 | 20 / 34 |
| 033 | 3,321 | 2,370 | 2,036.4 | 19 / 19 |
| 038 | 3,812 | 2,320 | 2,043.4 | 107 / 24 |
| 039 | 3,880 | 2,320 | 2,045.7 | 180 / 62 |
| 040 | 3,966 | 2,320 | 2,045.8 | 58 / 17 |
| 041 | 4,080 | 2,320 | 2,048.4 | 69 / 30 |
| 046 | 4,554 | 2,320 | 2,052.6 | 20 / 63 |
| 052 | 5,180 | 2,320 | 2,059.6 | 24 / 43 |
| 059 | 5,873 | 2,320 | 2,068.5 | 28 / 17 |
| 067 | 6,693 | 2,320 | 2,078.9 | 56 / 17 |
| 076 | 7,592 | 2,320 | 2,087.1 | 52 / 57 |
| 086 | 8,627 | 2,190 | 2,097.5 | 21 / 61 |
| 096 | 9,647 | 2,190 | 2,108.6 | 15 / 73 |
| 102 | 10,230 | 2,190 | 2,114.0 | 21 / 99 |
| 107 | 10,682 | 2,190 | 2,118.4 | 24 / 103 |
| 107 | 10,730 | 2,190 | 2,121.6 | 24 / 231 |
| 111 | 11,140 | 2,190 | 2,123.1 | 20 / 146 |
| 116 | 11,579 | 2,190 | 2,128.3 | 31 / 72 |
| 116 | 11,647 | 2,190 | 2,130.5 | 81 / 208 |
| 122 | 12,154 | 2,190 | 2,136.4 | 17 / 11 |
| 128 | 12,809 | 2,190 | 2,142.9 | 41 / 119 |
| 136 | 13,608 | 2,190 | 2,150.3 | 101 / 69 |
| 143 | 14,333 | 2,190 | 2,158.1 | 20 / 103 |
| 150 | 15,020 | 1,920 | 2,167.7 | 59 / 18 |
| 153 | 15,262 | 1,920 | 2,172.4 | 88 / 36 |
| 154 | 15,351 | 1,920 | 2,175.2 | 109 / 41 |
| 157 | 15,675 | 1,920 | 2,179.3 | 72 / 25 |
| 160 | 15,956 | 1,920 | 2,184.7 | 27 / 20 |
| 162 | 16,190 | 1,240 | 2,190.2 | 100 / 23 |
| 162 | 16,243 | 1,240 | 2,193.8 | 100 / 23 |
| 163 | 16,338 | 1,240 | 2,193.9 | 35 / 35 |
| 167 | 16,665 | 1,240 | 2,208.7 | 28 / 33 |
| 170 | 17,015 | 1,240 | 2,214.3 | 20 / 14 |
| 176 | 17,595 | 1,240 | 2,227.3 | 18 / 21 |
| 183 | 18,271 | 1,020 | 2,242.0 | 19 / 32 |
| 187 | 18,717 | 870 | 2,251.5 | 40 / 40 |
| 188 | 18,834 | 870 | 2,278.9 | 95 / 487 |
| 192 | 19,188 | 400 | 2,278.9 | 270 / 146 |
| 193 | 19,275 | 400 | 2,278.9 | 154 / 120 |
| 197 | 19,657 | 390 | 2,278.9 | 57 / 72 |
| 197 | 19,707 | 390 | 2,278.9 | 20 / 58 |
| 198 | 19,780 | 390 | 2,280.4 | 17 / 45 |
| 199 | 19,926 | 390 | 2,280.9 | 6 / 7 |

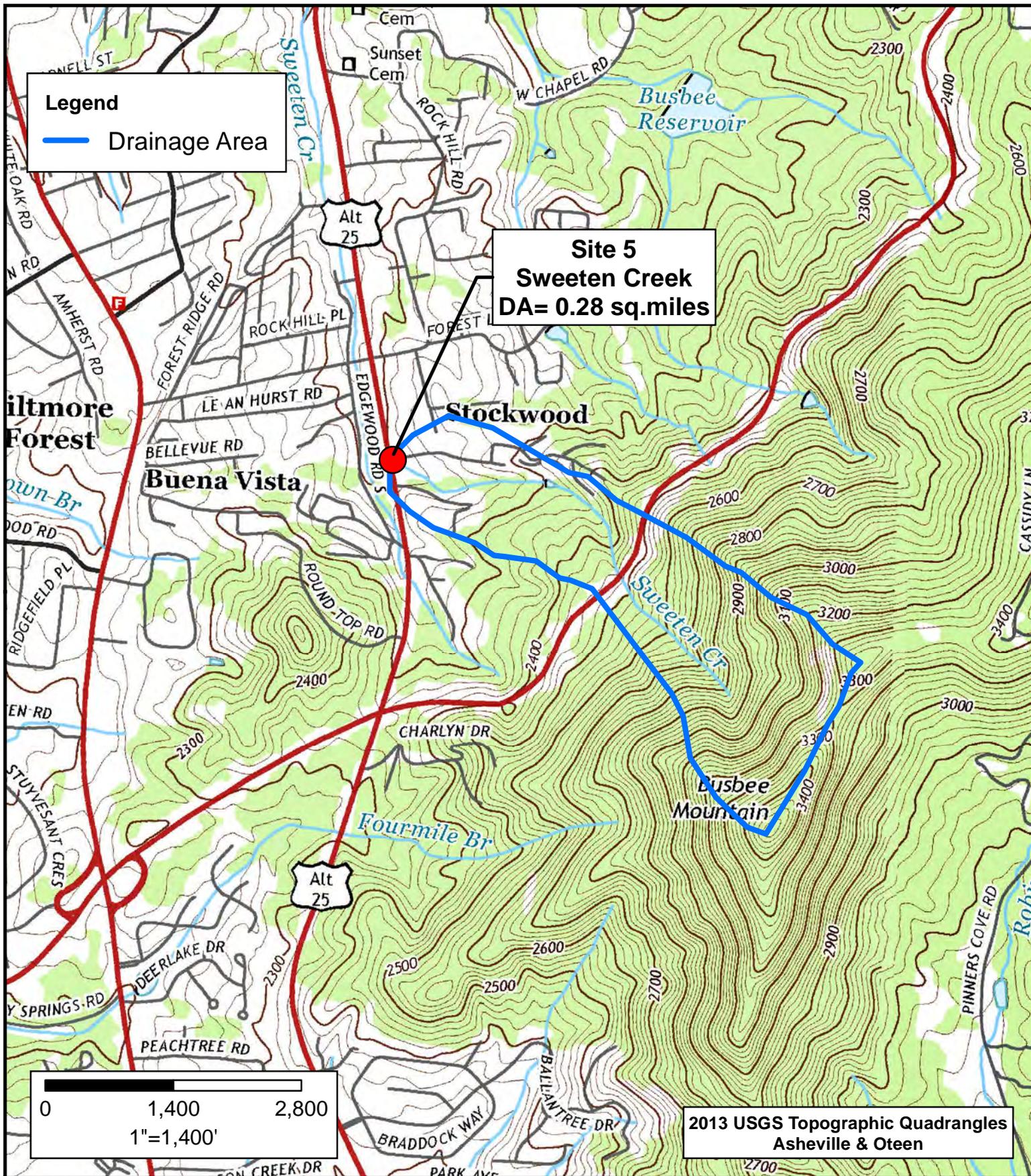
Dingle Creek Limited Detail Study Plan: Floodway Run 2/22/2016

Dingle_Crk_XS47Structure ID: Sweeten Creek US 25Approximate Su



Legend

- WS 100-year
- Ground
- Ineff
- Bank Sta



Legend
 — Drainage Area

**Site 5
 Sweeten Creek
 DA= 0.28 sq.miles**

**2013 USGS Topographic Quadrangles
 Asheville & Oteen**

0 1,400 2,800
 1"=1,400'



NORTH CAROLINA DEPARTMENT
 OF TRANSPORTATION
 DIVISION OF HIGHWAYS
 PROJECT DEVELOPMENT AND
 ENVIRONMENTAL ANALYSIS UNIT

SITE 5 DRAINAGE AREA MAP
 WIDEN SWEETEN CREEK ROAD (US25A)
 FROM HENDERSONVILLE ROAD (US25)
 TO SR 3801 (ROCK HILL RD)
 BUNCOMBE COUNTY
 TIP PROJECT U-2801A



| | |
|---------|--------------|
| County: | BUNCOMBE |
| Div: 13 | TIP# U-2801A |
| WBS: | 34859.1.FR3 |
| Date: | MARCH 2016 |

**Figure
 6**

Hydraulics Unit Pre-Design Report (Pre-Scoping) for Structure #:

Date: 06/21/2016

County: Stream:

Road #: Road Name:

Division: Location:

Latitude: Longitude: Decimal degrees, a min of 5 decimal points

Assigned to:

Prepared By:

Hydro Mgr: Hydro Reviewer:

Project Type:

Existing Structure

Structure Type: Yr Built:

Span Arrangement: OAL (ft): Skew: Abutment Type:

Number of Barrels: @ Span (ft): x Rise (ft):

Bed to Crown (ft): Clear Roadway (ft): Water Depth (ft): Superstructure Depth:

ADT: Year ADT: Scour Code (item113): Prior Survey Completed: Survey Date:

Drainage Area: Sq. Mi. Drainage Area Source: Roadway Overtops at Q100:

Discharge Method: USGS Region: Stream Gage Number(if applicable):

Q10 (cfs): Q25 (cfs): Q50 (cfs): Q100 (cfs): QBFE (cfs):

Structure in Flood Hazard Zone Panel #: Panel Date: Type of FIS: Date of FIS:

Enviromental

Quad Map: River Basin: Buffer Rule:

Primary Stream Classification

Class B Class C SA SB

SC SWL WL WS I

WS II WS III WS IV WS V

Supplemental Stream Classification

FWS HQW NSW ORW

Sw Tr UWL w/in 0.5mi. of CA

Other Stream Classification

Anadromous Fish Area of Environmental Concern

CAMA County Federal Wild & Scenic Rivers

HSB Required NC Natural & Scenic Rivers

Impaired [303d] Primary Nursery Area

TVA Designated Shellfish Harvesting Area

Designated Public Mountain Trout Waters

Up/Down Stream Features

Upstream Feature:

Location:

Structure #: Route:

Latitude: Longitude:

Prior Survey Completed: Survey Date: Bed to Crown (ft): Year Built:

Structure Type:

Span Arrangement: OAL (ft):

Number of Barrels: @ Span (ft): x Rise (ft):

Downstream Feature:

Location:

Structure #: Route:

Latitude: Longitude:

Prior Survey Completed: Survey Date: Bed to Crown (ft): Year Built:

Structure Type:

Span Arrangement: OAL (ft):

Number of Barrels: @ Span (ft): x Rise (ft):

Preliminary Structure Estimate [Office Estimate]

Structure Type: Skew:

Dimensions/Spans:

Notes

PRELIMINARY DESIGN AND ASSESSMENT
STREAM CROSSING AND ENCROACHMENTS

COUNTY Buncombe PROJECT# U-2801A
STREAM Sweeten Creek ROUTE US-25A
ASSESSMENT PREPARED BY Ecological Engineering, LLP DATE 6/21/2016

HYDROLOGIC EVALUATION

NEAREST GAUGING STATION ON THIS STREAM _____ (NONE) _____

ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: _____

FLOOD DATA:

Q10 300 cfs EST. BKWTR. _____ FT. Q25 460 cfs EST. BKWTR. _____ FT.
Q50 500 cfs EST. BKWTR. _____ FT. Q100 600 cfs EST. BKWTR. _____ FT.
Q500 _____ cfs OR OVERTOPPING CFS EST. BKWTR. _____ FT.

DRAINAGE AREA 0.28 sq mi METHOD to COMPUTE Q 2001 USGS Urban Equations - Future Dev

PROPERTY RELATED EVALUATIONS

DAMAGE POTENTIAL: LOW _____ MODERATE HIGH _____
COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED
ENCROACHMENT: YES _____ NO
EXPLANATION: _____

LIST BUILDINGS IN FLOOD PLAIN Residence Upstream LOCATION Northeast
FLOOR ELEVATION: _____

UPSTREAM LAND USE: Residential

ANTICIPATE ANY CHANGE? Future Development Possible

ANY FLOOD ZONE? (FIA STUDIES, ETC.) YES NO _____
TYPE OF STUDY Limited Detailed Study

BASE FLOOD ELEVATION 2208.6 ft (100yr.)

REGULATORY FLOODWAY WIDTH 60 ft (AS NOTED IN FIA STUDIES)

COMMENTS: Limited Detailed Study - Non-encroachment width; FIS shows 60 ft
(63 ft upstream of crossing) and 72 ft (51 ft downstream of crossing)

TRAFFIC RELATED EVALUATIONS

PRESENT YEAR _____ TRAFFIC COUNT _____ VPD %TRUCKS _____

DESIGN YEAR _____ TRAFFIC COUNT _____ VPD % TRUCKS _____

EMERGENCY ROUTE _____ SCHOOL BUS ROUTE _____ MAIL ROUTE _____

DETOUR AVAILABLE? _____ LENGTH OF DETOUR _____ MILES

DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? 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 N/A AGGRADATION/DEGRADATION N/A RESERVOIRS N/A

DIVERSIONS N/A DRAINAGE DISTRICT N/A NAVIGATION N/A

BACKWATER FROM ANOTHER SOURCE N/A

EXPLANATION: _____

ROADWAY OVERFLOW SECTION (NONE _____) LENGTH 300.3 ft ELEVATION 8' above bed

EMBANKMENT: SOIL TYPE Sand/gravel TYPE SLOPE COVER Woods/Grass/Rip Rap

COMMENTS: _____

ENVIRONMENTAL CONSIDERATIONS

LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN (NONE _____)

Possible Wetlands

MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES _____ NO PROTECTION NEEDED No

ARE BANKS STABLE? No PROTECTION NEEDED Yes

DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No

COMMENTS: Slight bank erosion upstream

ALTERNATIVES

RECOMMENDED DESIGN 9'x8' RCBC buried 1'

DETOUR STRUCTURE Recommend detour to the West

LOW ROAD GRADE Maintain Existing DETOUR GRADE _____

BRIDGE WATERWAY OPENING _____ CULVERT OPENING 63 square feet

WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES _____ NO

DISCUSSION: Hw/d=1.1

THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:

(1) NORMAL PROCESS

(2) _____ NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR

(3) _____ SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION

ADDRESSING: _____

Site 5



Upstream Face



Upstream Channel



Downstream Face



Downstream Channel



Looking North along US-25 Alt (Sweeten Creek Rd)

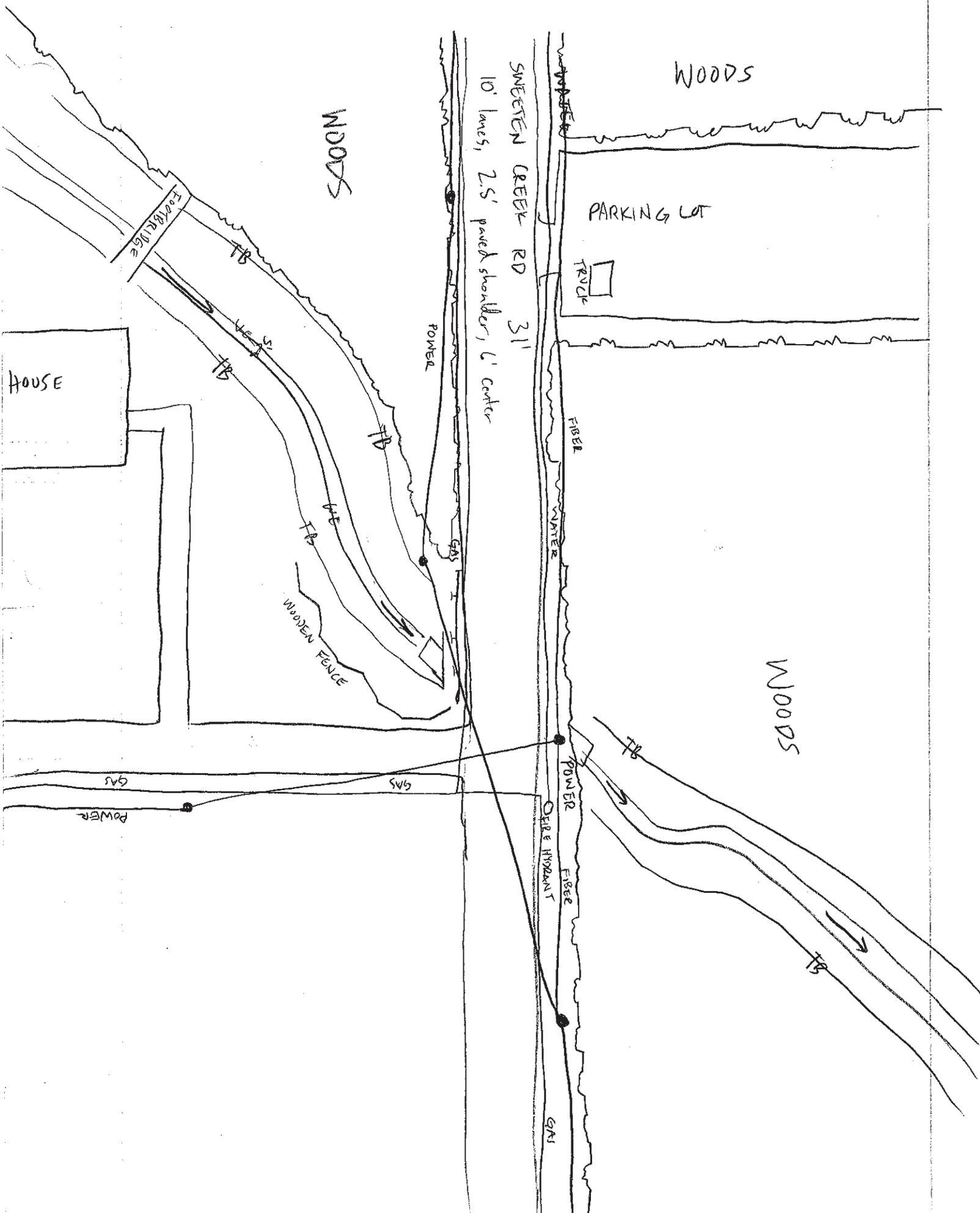


Looking South along US-25 Alt (Sweeten Creek Rd)

U-2801A

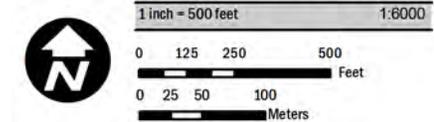
Site S

Plan Sketch





North Carolina State Plane Projection Feet (Zone 3200)
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)



FEMA National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

Panel(s): 9656
CONTAINS:
COMMUNITY CID
CITY OF ASHEVILLE 370032

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

SELECTED PANELS:
MAP NUMBER EFFECTIVE DATE
3700965600J 1/6/2010




Table 13 - Summary of Discharges

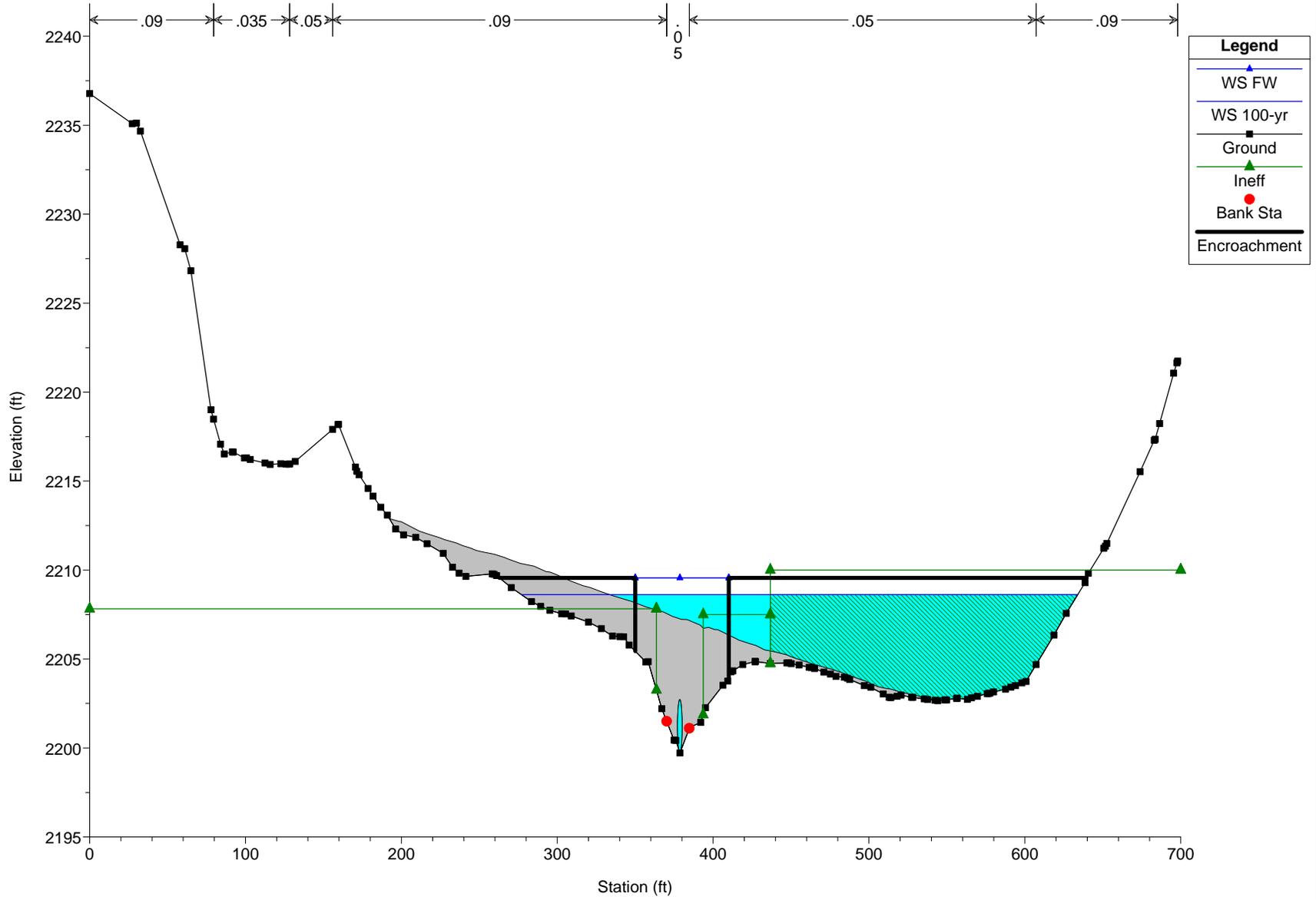
| Flooding Source | | Discharges (cfs) | | | |
|---|------------------------------|-------------------|------------------|------------------|--------------------|
| Location | Drainage Area (square miles) | 10% Annual Chance | 2% Annual Chance | 1% Annual Chance | 0.2% Annual Chance |
| Just upstream of westbound I-40 | 11.39 | * | * | 5730 | * |
| Approximately 0.3 mile upstream of NC Highway 9 | 10.89 | * | * | 5580 | * |
| At the confluence of Flat Creek (into Swannanoa River) | 4.84 | * | * | 2100 | * |
| At the confluence of Swannanoa River Tributary 35 | 4.39 | * | * | 1980 | * |
| Approximately 650 feet upstream of the confluence of Swannanoa River Tributary 35 | 3.64 | * | * | 1770 | * |
| Just upstream of Old US Highway 70 (SR 2702) | 3.42 | * | * | 1700 | * |
| Approximately 550 feet upstream of Old US Highway 70 (SR 2702) | 2.75 | * | * | 1480 | * |
| Approximately 0.2 mile downstream of Craven Hill Circle (SR 2706) | 1.78 | * | * | 1130 | * |
| Approximately 0.2 mile upstream of Craven Hill Circle (SR 2706) | 1.23 | * | * | 900 | * |
| Swannanoa River Tributary 24 | | | | | |
| At the confluence with Swannanoa River | 0.64 | * | * | 740 | * |
| Swannanoa River Tributary 26 | | | | | |
| At the confluence with Swannanoa River | 0.56 | * | * | 690 | * |
| At the confluence of Swannanoa River Tributary of Tributary 26 | 0.20 | * | * | 360 | * |
| Swannanoa River Tributary 28 | | | | | |
| At the confluence with Swannanoa River | 0.80 | * | * | 860 | * |
| At the confluence of Swannanoa River Tributary of Tributary 28 | 0.51 | * | * | 640 | * |
| Swannanoa River Tributary 33 | | | | | |
| At the confluence with Swannanoa River | 0.85 | * | * | 910 | * |
| At the confluence of Swannanoa River Tributary of Tributary 33 | 0.50 | * | * | 640 | * |
| Swannanoa River Tributary 35 | | | | | |
| At the confluence with Swannanoa River | 0.43 | * | * | 680 | * |
| Swannanoa River Tributary of Tributary 26 | | | | | |
| At the confluence with Swannanoa River Tributary 26 | 0.18 | * | * | 330 | * |
| Swannanoa River Tributary of Tributary 28 | | | | | |
| At the confluence with Swannanoa River Tributary 28 | 0.38 | * | * | 530 | * |
| Swannanoa River Tributary of Tributary 33 | | | | | |
| At the confluence with Swannanoa River Tributary 33 | 0.17 | * | * | 300 | * |
| Sweeten Creek | | | | | |
| At the confluence with Swannanoa River | 5.78 | * | * | 2910 | * |
| At the confluence of Sweeten Creek Tributary 2 | 5.42 | * | * | 2700 | * |
| At the confluence of Sweeten Creek Tributary 3 | 4.96 | * | * | 2410 | * |
| At the confluence of Sweeten Creek Tributary 4 | 2.91 | * | * | 1250 | * |
| Approximately 260 feet downstream of US Highway 25 | 0.62 | * | * | 660 | * |
| Sweeten Creek Tributary 2 | | | | | |
| At the confluence with Sweeten Creek | 0.36 | * | * | 470 | * |
| Sweeten Creek Tributary 3 | | | | | |
| At the confluence with Sweeten Creek | 0.90 | * | * | 1180 | * |
| Approximately 1.0 mile north at Buena Vista Road | 0.40 | * | * | 670 | * |
| Just downstream of Taft Avenue | 0.40 | * | * | 440 | * |
| Sweeten Creek Tributary 4 | | | | | |
| At the confluence with Sweeten Creek | 1.60 | * | * | 1320 | * |

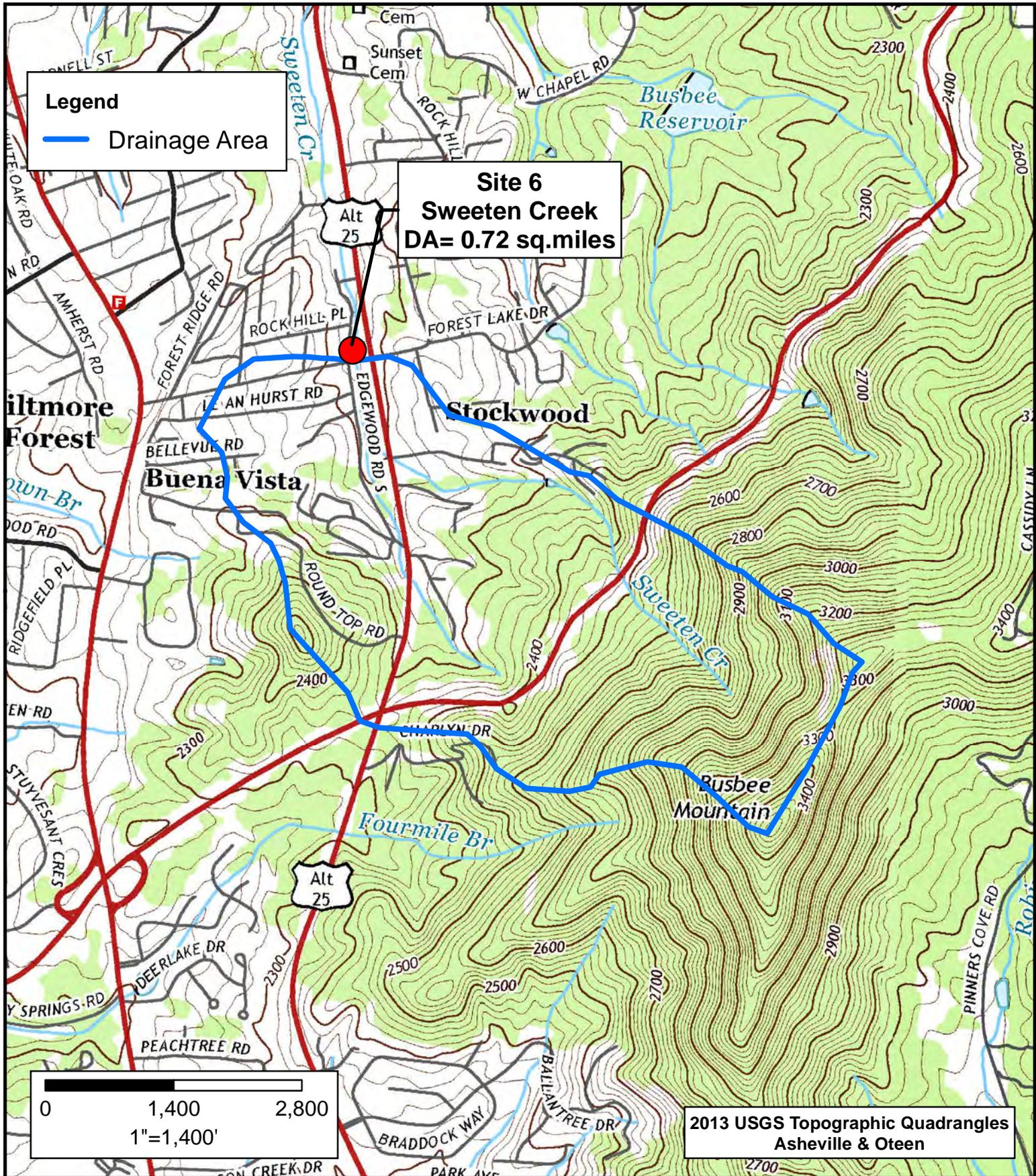
Table 17 - Limited Detailed Flood Hazard Data

| 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 |
|----------------------------------|----------------|-----------------------|---|---|
| 007 | 708 | 300 | 2,293.8 | 19 / 25 |
| 008 | 808 | 300 | 2,298.3 | 7 / 56 |
| 011 | 1,098 | 300 | 2,301.5 | 16 / 9 |
| 015 | 1,529 | 300 | 2,308.5 | 7 / 8 |
| 020 | 1,964 | 300 | 2,316.0 | 12 / 14 |
| 024 | 2,366 | 300 | 2,328.7 | 9 / 8 |
| Sweeten Creek | | | | |
| 183 | 18,321 | 660 | 2,192.7 | 20 / 22 |
| 185 | 18,511 | 660 | 2,196.0 | 30 / 40 |
| 186 | 18,624 | 660 | 2,200.9 | 12 / 60 |
| 187 | 18,738 | 660 | 2,208.6 | 27 / 33 |
| 189 | 18,911 | 660 | 2,210.4 | 15 / 14 |
| 192 | 19,197 | 660 | 2,223.3 | 31 / 16 |
| 195 | 19,465 | 660 | 2,234.5 | 13 / 35 |
| 198 | 19,819 | 660 | 2,250.9 | 12 / 17 |
| 202 | 20,182 | 660 | 2,273.3 | 15 / 15 |
| 203 | 20,276 | 660 | 2,281.7 | 18 / 15 |
| 203 | 20,333 | 660 | 2,286.4 | 19 / 21 |
| 205 | 20,464 | 660 | 2,298.6 | 34 / 23 |
| Sweeten Creek Tributary 2 | | | | |
| 000 | 23 | 730 | 2,010.2 ¹ | 23 / 16 |
| 001 | 76 | 470 | 2,010.7 | 90 / 6 |
| 003 | 280 | 470 | 2,014.6 | 90 / 8 |
| 004 | 435 | 470 | 2,014.8 | 55 / 14 |
| 007 | 689 | 470 | 2,016.8 | 40 / 25 |
| 008 | 761 | 470 | 2,017.8 | 40 / 25 |
| 008 | 840 | 470 | 2,020.0 | 50 / 60 |
| 009 | 884 | 470 | 2,021.7 | 50 / 60 |
| 010 | 1,031 | 470 | 2,028.5 | 15 / 76 |
| 012 | 1,230 | 470 | 2,028.8 | 7 / 123 |
| 016 | 1,592 | 470 | 2,032.2 | 10 / 9 |
| 020 | 1,984 | 470 | 2,039.8 | 10 / 11 |
| 024 | 2,389 | 470 | 2,068.9 | 14 / 20 |
| Sweeten Creek Tributary 3 | | | | |
| 074 | 7,423 | 440 | 2,135.6 | 20 / 15 |
| 075 | 7,507 | 440 | 2,135.8 | 25 / 25 |
| 078 | 7,759 | 440 | 2,136.7 | 21 / 15 |
| 082 | 8,170 | 440 | 2,144.3 | 13 / 12 |
| 085 | 8,502 | 440 | 2,154.3 | 20 / 9 |
| 086 | 8,607 | 440 | 2,156.6 | 22 / 35 |
| 087 | 8,693 | 440 | 2,158.3 | 30 / 28 |
| 088 | 8,762 | 440 | 2,158.4 | 15 / 14 |
| 090 | 8,953 | 440 | 2,163.0 | 34 / 4 |
| 090 | 9,016 | 440 | 2,167.7 | 20 / 20 |
| 092 | 9,235 | 440 | 2,169.9 | 14 / 14 |
| 096 | 9,594 | 440 | 2,181.8 | 36 / 35 |

lds_sweeten_crk Plan: lds_sweeten_crk 2/22/2016

US 25





NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS
 PROJECT DEVELOPMENT AND ENVIRONMENTAL ANALYSIS UNIT

SITE 6 DRAINAGE AREA MAP
 WIDEN SWEETEN CREEK ROAD (US25A)
 FROM HENDERSONVILLE ROAD (US25)
 TO SR 3801 (ROCK HILL RD)

BUNCOMBE COUNTY
 TIP PROJECT U-2801A



| | |
|---------|--------------|
| County: | BUNCOMBE |
| Div: 13 | TIP# U-2801A |
| WBS: | 34859.1.FR3 |
| Date: | MARCH 2016 |

Figure 7

Hydraulics Unit Pre-Design Report (Pre-Scoping) for Structure #:

Date: 06/21/2016

County: Stream:

Road #: Road Name:

Division: Location:

Latitude: Longitude: Decimal degrees, a min of 5 decimal points

Assigned to:

Prepared By:

Hydro Mgr: Hydro Reviewer:

Project Type:

Existing Structure

Structure Type: Yr Built:

Span Arrangement: OAL (ft): Skew: Abutment Type:

Number of Barrels: @ Span (ft): x Rise (ft):

Bed to Crown (ft): Clear Roadway (ft): Water Depth (ft): Superstructure Depth:

ADT: Year ADT: Scour Code (item113): Prior Survey Completed: Survey Date:

Drainage Area: Sq. Mi. Drainage Area Source: Roadway Overtops at Q100:

Discharge Method: USGS Region: Stream Gage Number(if applicable):

Q10 (cfs): Q25 (cfs): Q50 (cfs): Q100 (cfs): QBFE (cfs):

Structure in Flood Hazard Zone Panel #: Panel Date: Type of FIS: Date of FIS:

Enviromental

Quad Map: River Basin: Buffer Rule:

| | | | | | |
|---|---|--------------------------------|--|--|---|
| Primary Stream Classification | | | | Other Stream Classification | |
| <input type="checkbox"/> Class B | <input checked="" type="checkbox"/> Class C | <input type="checkbox"/> SA | <input type="checkbox"/> SB | <input type="checkbox"/> Anadromous Fish | <input type="checkbox"/> Area of Environmental Concern |
| <input type="checkbox"/> SC | <input type="checkbox"/> SWL | <input type="checkbox"/> WL | <input type="checkbox"/> WS I | <input type="checkbox"/> CAMA County | <input type="checkbox"/> Federal Wild & Scenic Rivers |
| <input type="checkbox"/> WS II | <input type="checkbox"/> WS III | <input type="checkbox"/> WS IV | <input type="checkbox"/> WS V | <input type="checkbox"/> HSB Required | <input type="checkbox"/> NC Natural & Scenic Rivers |
| Supplemental Stream Classification | | | | <input type="checkbox"/> Impaired [303d] | <input type="checkbox"/> Primary Nursery Area |
| <input type="checkbox"/> FWS | <input type="checkbox"/> HQW | <input type="checkbox"/> NSW | <input type="checkbox"/> ORW | <input type="checkbox"/> TVA | <input type="checkbox"/> Designated Shellfish Harvesting Area |
| <input type="checkbox"/> Sw | <input type="checkbox"/> Tr | <input type="checkbox"/> UWL | <input type="checkbox"/> w/in 0.5mi. of CA | <input type="checkbox"/> Designated Public Mountain Trout Waters | |

Up/Down Stream Features

| | |
|---|---|
| <p>Upstream Feature: <input type="text" value="Culvert"/></p> <p>Location: <input type="text" value="1200' Upstream On US-25A 0.2 Miles South of SR 3081"/></p> <p>Structure #: <input type="text"/> Route: <input type="text" value="US-25 Alt"/></p> <p>Latitude: <input type="text" value="35.53242"/> Longitude: <input type="text" value="-82.51869"/></p> <p>Prior Survey Completed: <input type="checkbox"/> Survey Date: <input type="text"/></p> | <p>Structure Type: <input type="text" value="CMP"/></p> <p>Span Arrangement: <input type="text" value="1@42"/> OAL (ft): <input type="text"/></p> <p>Number of Barrels: <input type="text"/> @ Span (ft): <input type="text"/> x Rise (ft): <input type="text"/></p> <p>Bed to Crown (ft): <input type="text" value="12.0"/> Year Built: <input type="text"/></p> |
| <p>Downstream Feature: <input type="text" value="Culvert"/></p> <p>Location: <input type="text" value="900' Downstream on Private Drive 150 ft West of US-25A"/></p> <p>Structure #: <input type="text"/> Route: <input type="text" value="Private Drive"/></p> <p>Latitude: <input type="text" value="35.53771"/> Longitude: <input type="text" value="-82.52054"/></p> <p>Prior Survey Completed: <input type="checkbox"/> Survey Date: <input type="text"/></p> | <p>Structure Type: <input type="text" value="CMP"/></p> <p>Span Arrangement: <input type="text" value="1@60"/> OAL (ft): <input type="text"/></p> <p>Number of Barrels: <input type="text"/> @ Span (ft): <input type="text"/> x Rise (ft): <input type="text"/></p> <p>Bed to Crown (ft) <input type="text"/> Year Built: <input type="text"/></p> |

Preliminary Structure Estimate [Office Estimate]

Structure Type: Skew:

Dimensions/Spans:

Notes

PRELIMINARY DESIGN AND ASSESSMENT
STREAM CROSSING AND ENCROACHMENTS

COUNTY Buncombe PROJECT# U-2801A
STREAM Sweeten Creek ROUTE SR 3081
ASSESSMENT PREPARED BY Ecological Engineering, LLP DATE 6/21/2016

HYDROLOGIC EVALUATION

NEAREST GAUGING STATION ON THIS STREAM _____ (NONE X) _____

ARE FLOOD STUDIES AVAILABLE ON THIS STREAM: _____

FLOOD DATA:

Q10 600 cfs EST. BKWTR. _____ FT. Q25 850 cfs EST. BKWTR. _____ FT.
Q50 950 cfs EST. BKWTR. _____ FT. Q100 1100 cfs EST. BKWTR. _____ FT.
Q500 _____ cfs OR OVERTOPPING CFS EST. BKWTR. _____ FT.

DRAINAGE AREA 0.72 sq mi METHOD to COMPUTE Q 2001 USGS Urban Equations - Future Dev

PROPERTY RELATED EVALUATIONS

DAMAGE POTENTIAL: LOW _____ MODERATE X HIGH _____

COULD THIS BE SIGNIFICANTLY INCREASED BY PROPOSED

ENCROACHMENT: YES X NO _____

EXPLANATION: Residential and commercial properties are currently
within the floodway upstream and downstream

LIST BUILDINGS IN FLOOD PLAIN Residences LOCATION Upstream
FLOOR ELEVATION: _____

UPSTREAM LAND USE: Res/Com

ANTICIPATE ANY CHANGE? Future development possible

ANY FLOOD ZONE? (FIA STUDIES, ETC.) YES X NO _____

TYPE OF STUDY Detailed Study

BASE FLOOD ELEVATION 2178.3 ft (100yr.)

REGULATORY FLOODWAY WIDTH 56 ft (AS NOTED IN FIA STUDIES)

COMMENTS: _____

TRAFFIC RELATED EVALUATIONS

PRESENT YEAR _____ TRAFFIC COUNT _____ VPD %TRUCKS _____

DESIGN YEAR _____ TRAFFIC COUNT _____ VPD % TRUCKS _____

EMERGENCY ROUTE _____ SCHOOL BUS ROUTE _____ MAIL ROUTE _____

DETOUR AVAILABLE? _____ LENGTH OF DETOUR _____ MILES

DOES THE LEVEL OF TRAFFIC SERVICE OF AN EXISTING CROSSING VARY GREATLY FROM STANDARD DESIGN LEVELS? 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 N/A AGGRADATION/DEGRADATION N/A RESERVOIRS N/A

DIVERSIONS N/A DRAINAGE DISTRICT N/A NAVIGATION N/A

BACKWATER FROM ANOTHER SOURCE N/A

EXPLANATION: _____

ROADWAY OVERFLOW SECTION (NONE _____) LENGTH 119 ft ELEVATION 10' above bed

EMBANKMENT: SOIL TYPE Sand/gravel TYPE SLOPE COVER Woods

COMMENTS: Overflow section from Detailed Study model

ENVIRONMENTAL CONSIDERATIONS

LIST SPECIAL CONDITIONS OR CONSIDERATIONS WHICH AFFECT HYDRAULIC DESIGN (NONE _____)

Possible wetlands

MISCELLANEOUS COMMENTS

IS THERE UNUSUAL SCOUR POTENTIAL? YES _____ NO PROTECTION NEEDED No

ARE BANKS STABLE? Yes PROTECTION NEEDED Yes

DOES STREAM CARRY APPRECIABLE AMOUNT OF LARGE DEBRIS? No

COMMENTS: Stabilize banks with rip rap to match existing conditions

ALTERNATIVES

RECOMMENDED DESIGN 13'x9' RCBC buried 1'

DETOUR STRUCTURE _____

LOW ROAD GRADE Maintain Existing DETOUR GRADE _____

BRIDGE WATERWAY OPENING _____ CULVERT OPENING 104 square feet

WERE OTHER HYDRAULIC ALTERNATIVES CONSIDERED? YES _____ NO

DISCUSSION: Hw/d=1.2

THIS SITE ASSESSMENT INDICATES THE DESIGN SHOULD FOLLOW:

(1) NORMAL PROCESS

(2) _____ NORMAL PROCESS WITH SPECIAL SPECIFIC CONSIDERATION FOR

(3) _____ SPECIFIC DESIGN PROCESS WITH APPROPRIATE RISK/ECONOMIC EVALUATION

ADDRESSING: _____

Site 6



Upstream Face



Upstream Channel



Downstream Face



Downstream Channel



Sewer Line and 24-inch Outfall Upstream



Looking North from SR 3081 (Rock Hill Rd)



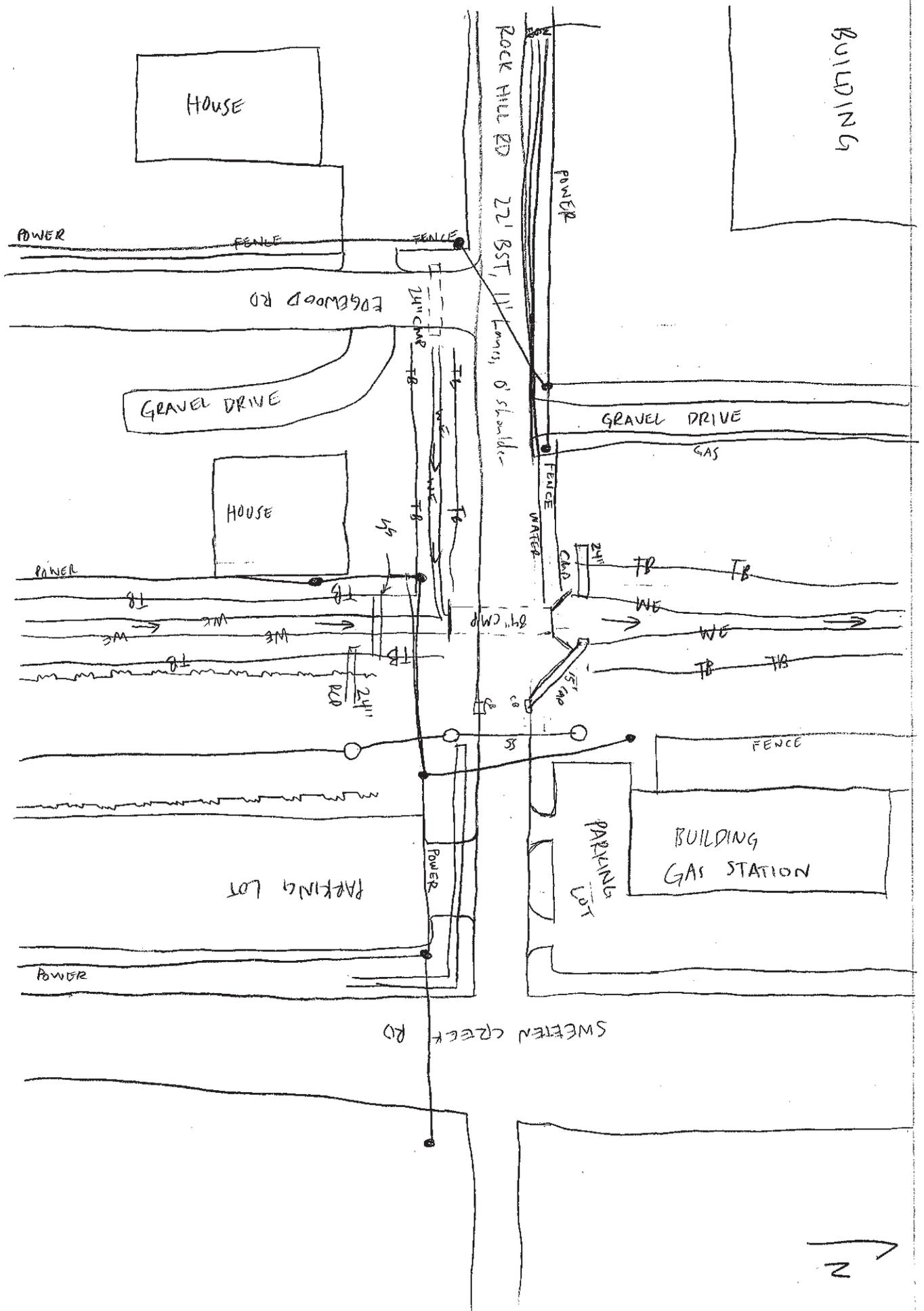
Looking South from SR 3081 (Rock Hill Rd)



Looking East along SR 3081 (Rock Hill Rd)



Looking West along SR 3081 (Rock Hill Rd)

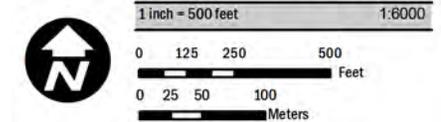




Site 6
Sweeten Creek
84" CMP

| | |
|--|--|
| | Without Base Flood Elevation (BFE) <i>Zone A, V, A99</i> |
| | With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i> |
| | Regulatory Floodway |
| | 0.2% Annual Chance Flood Hazard |
| | Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i> |
| | Areas Determined to be Outside the 0.2% Annual Chance Flood Hazard <i>Zone X</i> |
| | Jurisdiction Boundary |
| | FIRM Panel Boundary |

North Carolina State Plane Projection Feet (Zone 3200)
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)



FEMA National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

Panel(s): 9656
CONTAINS:
COMMUNITY CID
CITY OF ASHEVILLE 370032

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

SELECTED PANELS:
MAP NUMBER EFFECTIVE DATE
3700965600J 1/6/2010




Table 13 - Summary of Discharges

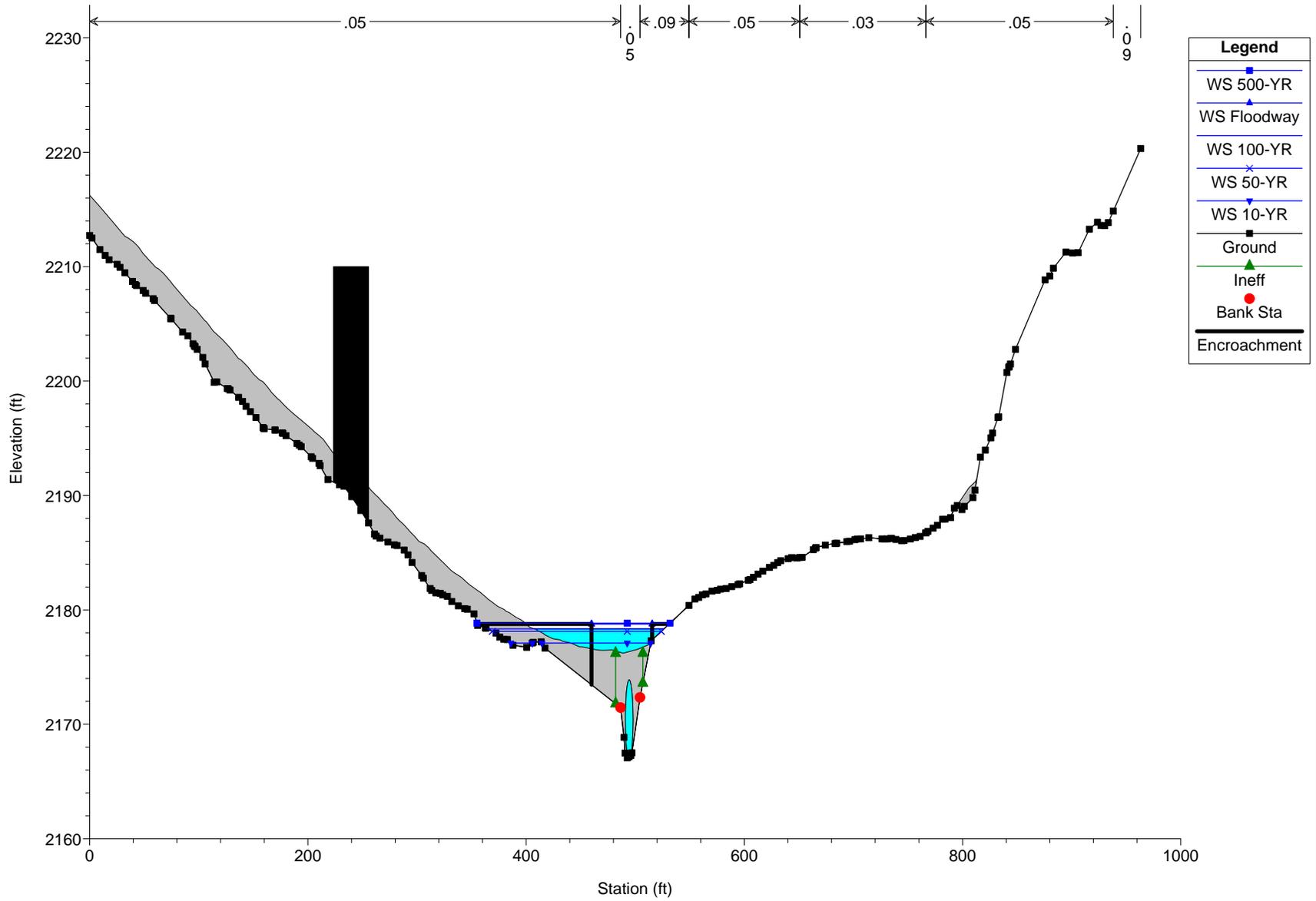
| Flooding Source | | Discharges (cfs) | | | |
|---|------------------------------|-------------------|------------------|------------------|--------------------|
| Location | Drainage Area (square miles) | 10% Annual Chance | 2% Annual Chance | 1% Annual Chance | 0.2% Annual Chance |
| Just upstream of westbound I-40 | 11.39 | * | * | 5730 | * |
| Approximately 0.3 mile upstream of NC Highway 9 | 10.89 | * | * | 5580 | * |
| At the confluence of Flat Creek (into Swannanoa River) | 4.84 | * | * | 2100 | * |
| At the confluence of Swannanoa River Tributary 35 | 4.39 | * | * | 1980 | * |
| Approximately 650 feet upstream of the confluence of Swannanoa River Tributary 35 | 3.64 | * | * | 1770 | * |
| Just upstream of Old US Highway 70 (SR 2702) | 3.42 | * | * | 1700 | * |
| Approximately 550 feet upstream of Old US Highway 70 (SR 2702) | 2.75 | * | * | 1480 | * |
| Approximately 0.2 mile downstream of Craven Hill Circle (SR 2706) | 1.78 | * | * | 1130 | * |
| Approximately 0.2 mile upstream of Craven Hill Circle (SR 2706) | 1.23 | * | * | 900 | * |
| Swannanoa River Tributary 24 | | | | | |
| At the confluence with Swannanoa River | 0.64 | * | * | 740 | * |
| Swannanoa River Tributary 26 | | | | | |
| At the confluence with Swannanoa River | 0.56 | * | * | 690 | * |
| At the confluence of Swannanoa River Tributary of Tributary 26 | 0.20 | * | * | 360 | * |
| Swannanoa River Tributary 28 | | | | | |
| At the confluence with Swannanoa River | 0.80 | * | * | 860 | * |
| At the confluence of Swannanoa River Tributary of Tributary 28 | 0.51 | * | * | 640 | * |
| Swannanoa River Tributary 33 | | | | | |
| At the confluence with Swannanoa River | 0.85 | * | * | 910 | * |
| At the confluence of Swannanoa River Tributary of Tributary 33 | 0.50 | * | * | 640 | * |
| Swannanoa River Tributary 35 | | | | | |
| At the confluence with Swannanoa River | 0.43 | * | * | 680 | * |
| Swannanoa River Tributary of Tributary 26 | | | | | |
| At the confluence with Swannanoa River Tributary 26 | 0.18 | * | * | 330 | * |
| Swannanoa River Tributary of Tributary 28 | | | | | |
| At the confluence with Swannanoa River Tributary 28 | 0.38 | * | * | 530 | * |
| Swannanoa River Tributary of Tributary 33 | | | | | |
| At the confluence with Swannanoa River Tributary 33 | 0.17 | * | * | 300 | * |
| Sweeten Creek | | | | | |
| At the confluence with Swannanoa River | 5.78 | * | * | 2910 | * |
| At the confluence of Sweeten Creek Tributary 2 | 5.42 | * | * | 2700 | * |
| At the confluence of Sweeten Creek Tributary 3 | 4.96 | * | * | 2410 | * |
| At the confluence of Sweeten Creek Tributary 4 | 2.91 | * | * | 1250 | * |
| Approximately 260 feet downstream of US Highway 25 | 0.62 | * | * | 660 | * |
| Sweeten Creek Tributary 2 | | | | | |
| At the confluence with Sweeten Creek | 0.36 | * | * | 470 | * |
| Sweeten Creek Tributary 3 | | | | | |
| At the confluence with Sweeten Creek | 0.90 | * | * | 1180 | * |
| Approximately 1.0 mile north at Buena Vista Road | 0.40 | * | * | 670 | * |
| Just downstream of Taft Avenue | 0.40 | * | * | 440 | * |
| Sweeten Creek Tributary 4 | | | | | |
| At the confluence with Sweeten Creek | 1.60 | * | * | 1320 | * |

Table 22 - 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 | Without Floodway | With Floodway | Increase |
| 158 | 15,751 | 38 | 279 | 3.8 | 2,141.4 | 2,141.4 | 2,141.6 | 0.2 |
| 159 | 15,886 | 60 | 462 | 2.3 | 2,147.7 | 2,147.7 | 2,148.1 | 0.4 |
| 162 | 16,155 | 32 | 182 | 5.8 | 2,147.9 | 2,147.9 | 2,148.2 | 0.3 |
| 165 | 16,485 | 40 | 265 | 4.0 | 2,154.9 | 2,154.9 | 2,155.4 | 0.5 |
| 166 | 16,608 | 31 | 181 | 5.8 | 2,155.2 | 2,155.2 | 2,155.8 | 0.6 |
| 168 | 16,847 | 26 | 100 | 10.5 | 2,162.1 | 2,162.1 | 2,162.1 | 0.0 |
| 173 | 17,327 | 44 | 137 | 7.7 | 2,173.1 | 2,173.1 | 2,173.1 | 0.0 |
| 174 | 17,398 | 56 | 385 | 2.7 | 2,178.3 | 2,178.3 | 2,178.8 | 0.5 |
| 176 | 17,639 | 27 | 103 | 10.2 | 2,180.0 | 2,180.0 | 2,180.0 | 0.0 |
| 183 | 18,321 | 42 | 116 | 5.7 | 2,192.7 | 2,192.7 | 2,193.1 | 0.4 |
| Sweeten Creek Tributary 3 | | | | | | | | |
| 002 | 210 | 75 | 309 | 3.8 | 2,019.4 ⁶ | 2,018.0 | 2,018.8 | 0.8 |
| 006 | 612 | 40 | 188 | 6.0 | 2,020.8 ⁶ | 2,020.7 | 2,021.3 | 0.6 |
| 012 | 1,160 | 30 | 175 | 6.2 | 2,025.6 | 2,025.6 | 2,026.2 | 0.6 |
| 018 | 1,750 | 32 | 101 | 10.4 | 2,044.1 | 2,044.1 | 2,044.1 | 0.0 |
| 026 | 2,580 | 50 | 177 | 5.6 | 2,061.3 | 2,061.3 | 2,061.9 | 0.6 |
| 031 | 3,080 | 50 | 494 | 2.0 | 2,075.0 | 2,075.0 | 2,075.0 | 0.0 |
| 035 | 3,465 | 55 | 200 | 4.7 | 2,075.9 | 2,075.9 | 2,076.1 | 0.2 |
| 037 | 3,730 | 45 | 217 | 4.2 | 2,080.3 | 2,080.3 | 2,081.1 | 0.8 |
| 049 | 4,910 | 35 | 111 | 7.5 | 2,092.1 | 2,092.1 | 2,092.2 | 0.1 |
| 056 | 5,620 | 40 | 197 | 4.0 | 2,110.1 | 2,110.1 | 2,110.5 | 0.4 |
| 060 | 6,040 | 50 | 180 | 4.2 | 2,117.5 | 2,117.5 | 2,118.4 | 0.9 |
| 063 | 6,290 | 40 | 156 | 4.7 | 2,118.0 | 2,118.0 | 2,118.7 | 0.7 |
| 067 | 6,700 | 40 | 161 | 4.6 | 2,123.9 | 2,123.9 | 2,124.6 | 0.7 |
| 069 | 6,940 | 30 | 206 | 3.4 | 2,130.2 | 2,130.2 | 2,130.3 | 0.1 |
| 072 | 7,200 | 35 | 182 | 3.7 | 2,135.6 | 2,135.6 | 2,135.8 | 0.2 |
| Sweeten Creek Tributary 4 | | | | | | | | |
| 002 | 165 | 165 | 1,988 | 0.7 | 2,093.2 | 2,093.2 | 2,094.1 | 0.9 |
| 007 | 675 | 97 | 1,204 | 1.1 | 2,093.2 | 2,093.2 | 2,094.1 | 0.9 |
| 017 | 1,653 | 111 | 671 | 2.0 | 2,093.4 | 2,093.4 | 2,094.3 | 0.9 |
| 024 | 2,425 | 102 | 327 | 4.0 | 2,099.5 | 2,099.5 | 2,100.1 | 0.6 |
| 029 | 2,920 | 60 | 204 | 6.5 | 2,109.6 | 2,109.6 | 2,109.9 | 0.3 |
| 031 | 3,097 | 65 | 433 | 3.1 | 2,118.0 | 2,118.0 | 2,118.4 | 0.4 |
| 036 | 3,621 | 55 | 161 | 8.2 | 2,125.1 | 2,125.1 | 2,125.7 | 0.6 |
| 042 | 4,198 | 35 | 105 | 9.3 | 2,139.0 | 2,139.0 | 2,139.1 | 0.1 |
| Tomahawk Branch | | | | | | | | |
| 004 | 369 | 80 | 282 | 5.5 | 2,287.1 ¹ | 2,285.6 | 2,286.6 | 1.0 |
| 011 | 1,109 | 50 | 22 | 7.0 | 2,291.4 | 2,291.4 | 2,292.0 | 0.6 |
| 018 | 1,795 | 60 | 204 | 7.3 | 2,298.0 | 2,298.0 | 2,298.1 | 0.1 |
| 024 | 2,429 | 75 | 688 | 2.2 | 2,312.6 | 2,312.6 | 2,313.1 | 0.5 |
| 027 | 2,746 | 65 | 554 | 2.7 | 2,312.6 | 2,312.6 | 2,313.3 | 0.7 |
| 034 | 3,379 | 105 | 449 | 3.2 | 2,315.5 | 2,315.5 | 2,316.1 | 0.6 |
| 039 | 3,854 | 120 ² | 349 | 4.1 | 2,319.2 | 2,319.2 | 2,320.2 | 1.0 |
| 044 | 4,382 | 35 | 165 | 8.1 | 2,329.9 | 2,329.9 | 2,329.9 | 0.0 |
| 046 | 4,594 | 35 | 142 | 9.3 | 2,336.3 | 2,336.3 | 2,336.3 | 0.0 |

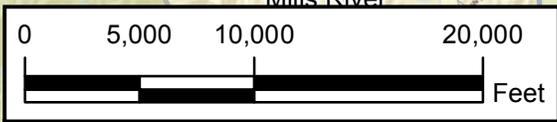
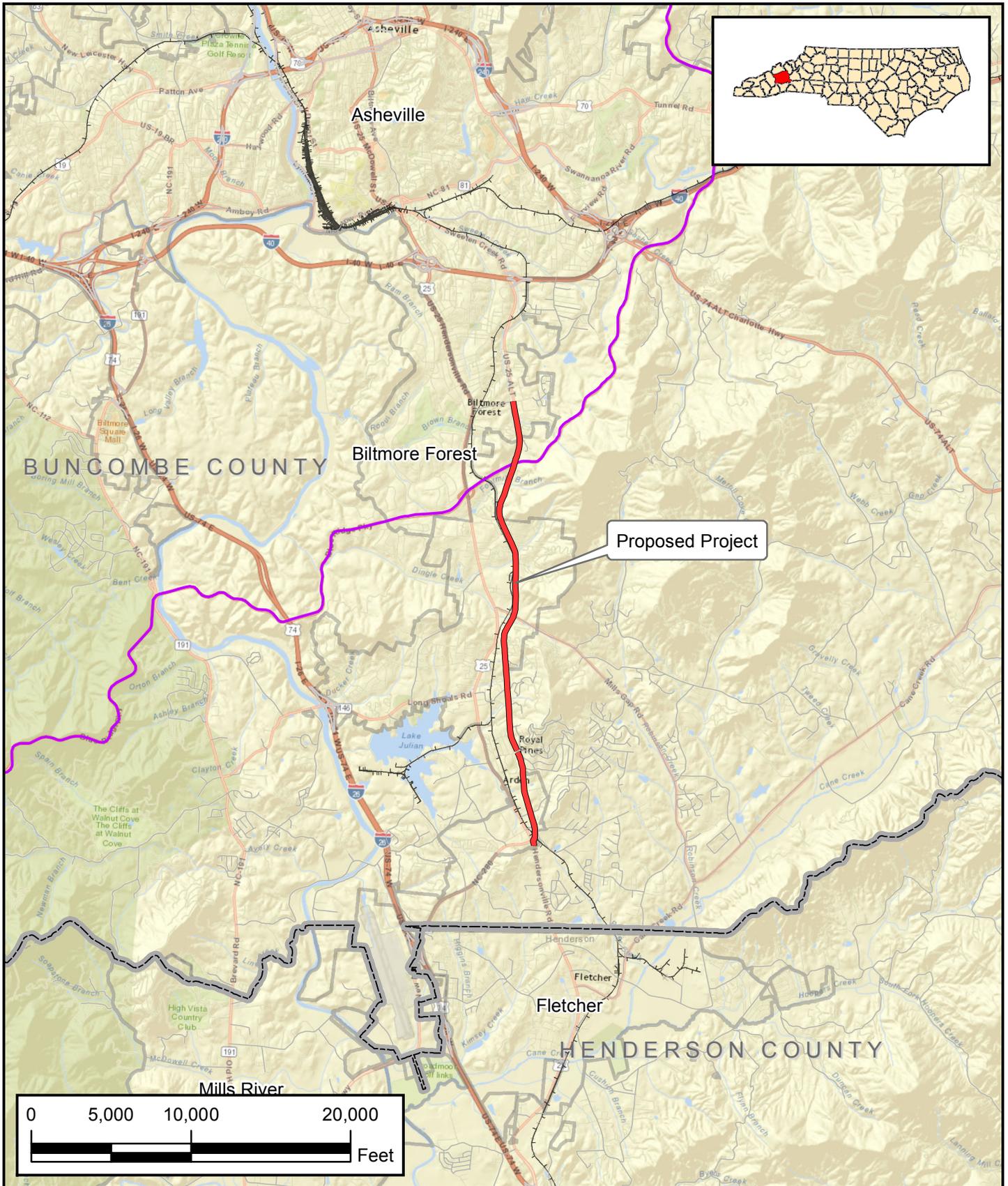
Sweeten Creek - Detailed Study Plan: Detailed 2/23/2016

Rock Hill Road - FBSTR474



FIGURES

- Figure 1 – Vicinity Map
- Figure 2 – Study Area Map
- Figure 3 – Environmental Features Mapbook



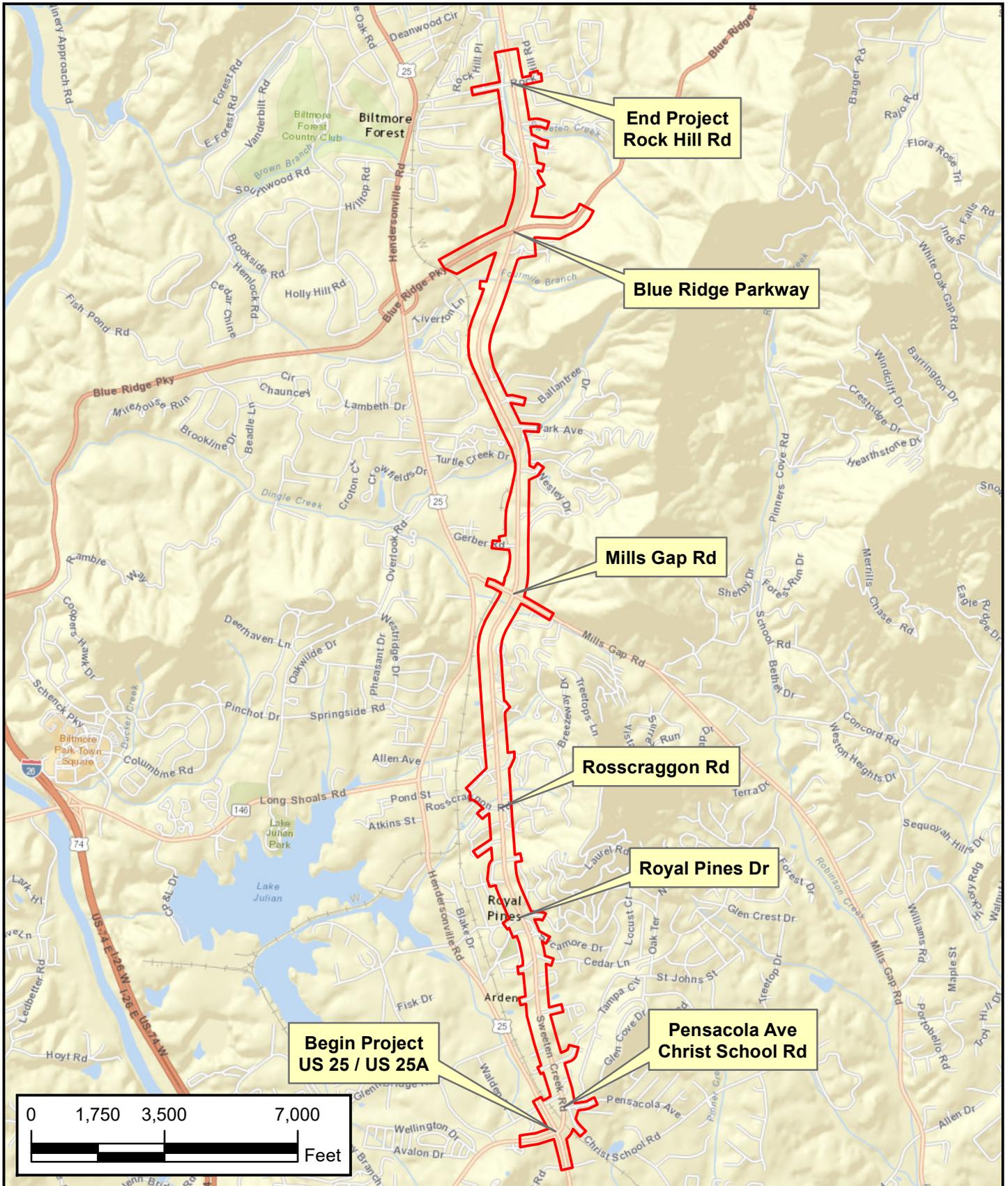
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS
 PROJECT DEVELOPMENT AND ENVIRONMENTAL ANALYSIS UNIT

VICINITY MAP
WIDEN SWEETEN CREEK ROAD (US 25A) FROM HENDERSONVILLE ROAD (US 25) TO SR 3801 (ROCK HILL RD)
 BUNCOMBE COUNTY
 TIP PROJECT U-2801A



| | |
|---------|-----------------|
| County: | BUNCOMBE |
| Div: | 13 TIP# U-2801A |
| WBS: | 34859.1.FR3 |
| Date: | SEPT 2015 |

Figure 1



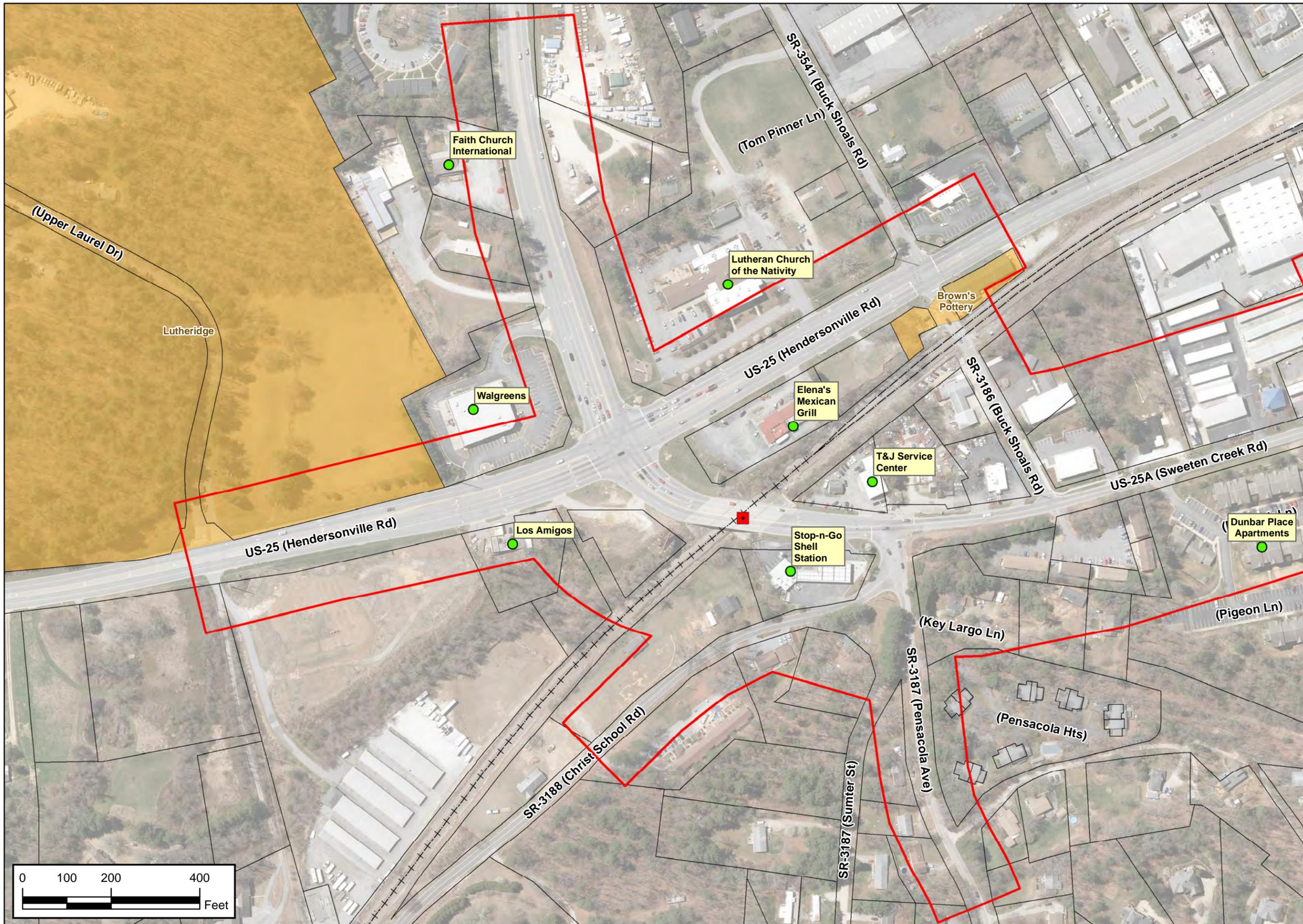
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS
 PROJECT DEVELOPMENT AND ENVIRONMENTAL ANALYSIS UNIT

STUDY AREA MAP
WIDEN SWEETEN CREEK ROAD (US 25A) FROM HENDERSONVILLE ROAD (US 25) TO SR 3801 (ROCK HILL RD)
 BUNCOMBE COUNTY
 TIP PROJECT U-2801A



| | |
|---------|-------------------|
| County: | BUNCOMBE |
| Div: | 13 TIP# U-2801A |
| WBS: | 34859.1.FR3 |
| Date: | MARCH 2017 |

Figure 2



ESRI Aerial Photograph



NORTH CAROLINA DEPARTMENT
OF TRANSPORTATION
DIVISION OF HIGHWAYS
PROJECT DEVELOPMENT AND
ENVIRONMENTAL ANALYSIS UNIT

ENVIRONMENTAL FEATURES MAP
WIDEN SWEETEN CREEK RD
FROM HENDERSONVILLE RD (US 25)
TO SR 3801 (ROCK HILL HD)
BUNCOMBE COUNTY
STIP PROJECT U-2801A



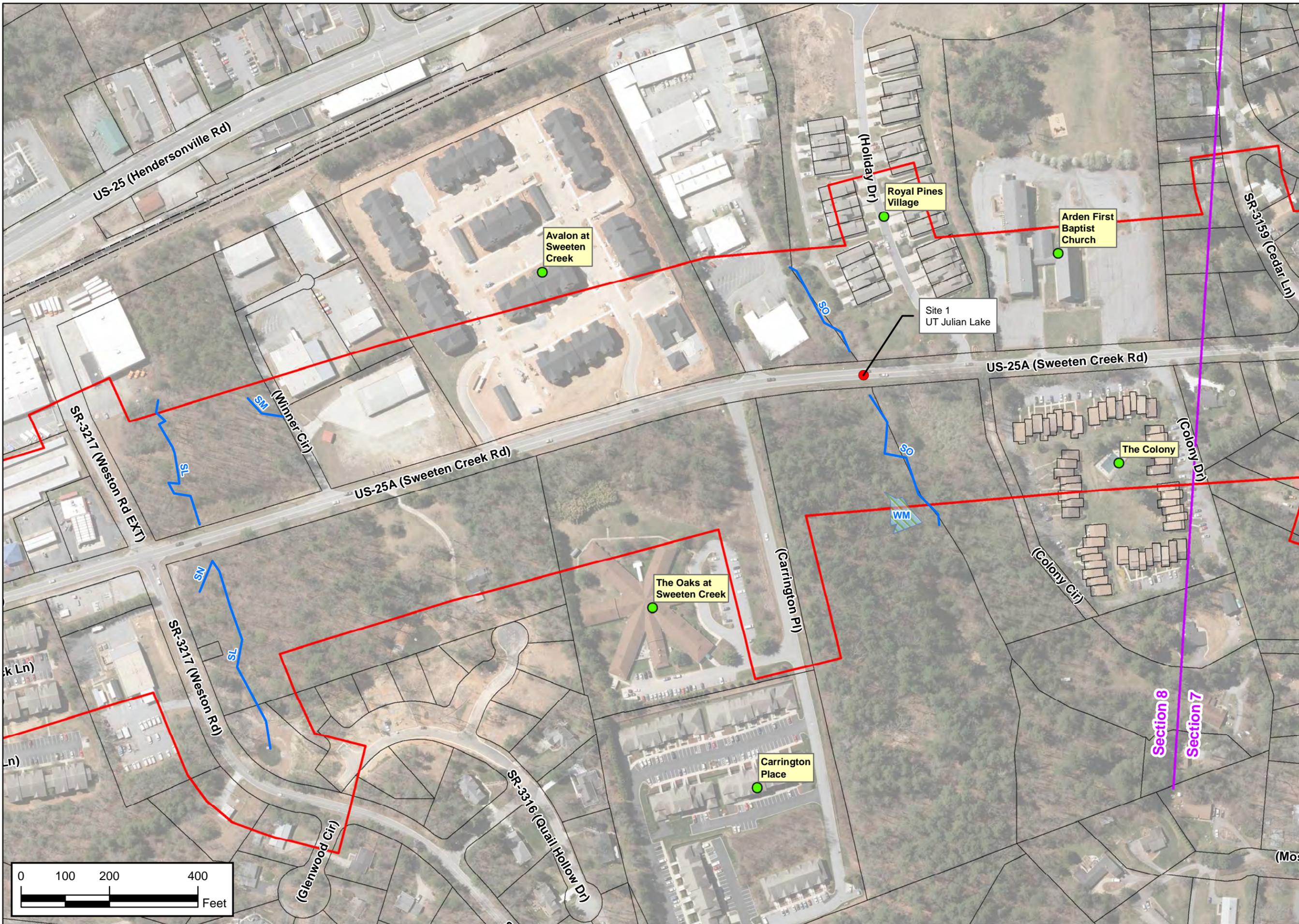
By:
C ROWELLS

County:
BUNCOMBE

| | |
|------------|------------------|
| Div: 13 | STIP# U-2801A |
|------------|------------------|

Date:
JULY 2018

Figure
2-1



ESRI Aerial Photograph



NORTH CAROLINA DEPARTMENT
OF TRANSPORTATION
DIVISION OF HIGHWAYS
PROJECT DEVELOPMENT AND
ENVIRONMENTAL ANALYSIS UNIT

ENVIRONMENTAL FEATURES MAP
WIDEN SWEETEN CREEK RD
FROM HENDERSONVILLE RD (US 25)
TO SR 3801 (ROCK HILL HD)
BUNCOMBE COUNTY
STIP PROJECT U-2801A



By:
C ROWELLS

County:
BUNCOMBE

| | |
|------------|------------------|
| Div: 13 | STIP# U-2801A |
|------------|------------------|

Date:
JULY 2018

Figure
2-2



ESRI Aerial Photograph



NORTH CAROLINA DEPARTMENT
OF TRANSPORTATION
DIVISION OF HIGHWAYS
PROJECT DEVELOPMENT AND
ENVIRONMENTAL ANALYSIS UNIT

ENVIRONMENTAL FEATURES MAP
WIDEN SWEETEN CREEK RD
FROM HENDERSONVILLE RD (US 25)
TO SR 3801 (ROCK HILL HD)
BUNCOMBE COUNTY
STIP PROJECT U-2801A



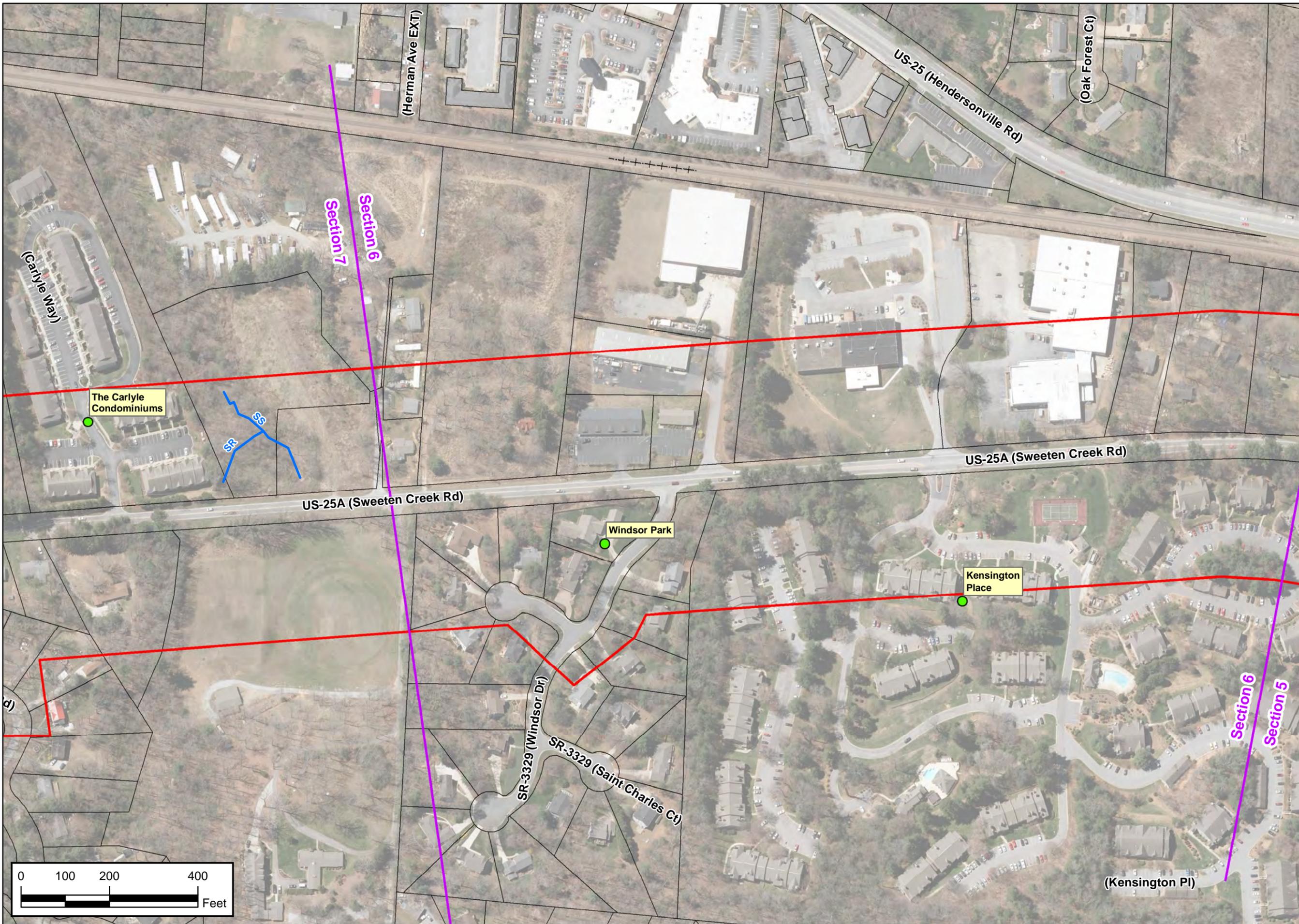
By:
C ROWELLS

County:
BUNCOMBE

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| Div: 13 | STIP# U-2801A |
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Date:
JULY 2018

Figure
2-3



NORTH CAROLINA DEPARTMENT
OF TRANSPORTATION
DIVISION OF HIGHWAYS
PROJECT DEVELOPMENT AND
ENVIRONMENTAL ANALYSIS UNIT

ENVIRONMENTAL FEATURES MAP
WIDEN SWEETEN CREEK RD
FROM HENDERSONVILLE RD (US 25)
TO SR 3801 (ROCK HILL HD)
BUNCOMBE COUNTY
STIP PROJECT U-2801A



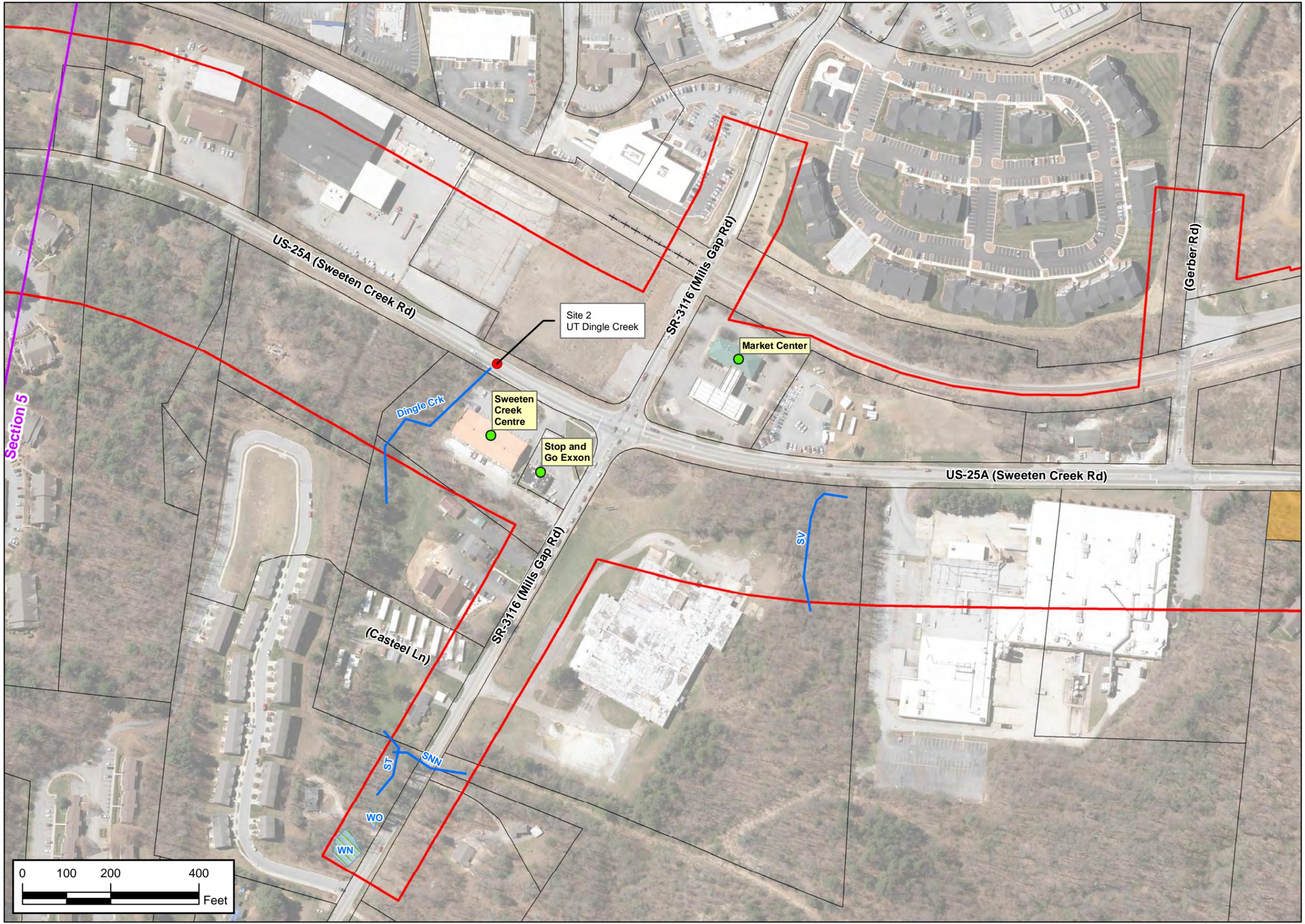
By:
C ROWELLS

County:
BUNCOMBE

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| Div: 13 | STIP# U-2801A |
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Date:
JULY 2018

Figure
2-5



NORTH CAROLINA DEPARTMENT
OF TRANSPORTATION
DIVISION OF HIGHWAYS
PROJECT DEVELOPMENT AND
ENVIRONMENTAL ANALYSIS UNIT

ENVIRONMENTAL FEATURES MAP
WIDEN SWEETEN CREEK RD
FROM HENDERSONVILLE RD (US 25)
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BUNCOMBE COUNTY
STIP PROJECT U-2801A



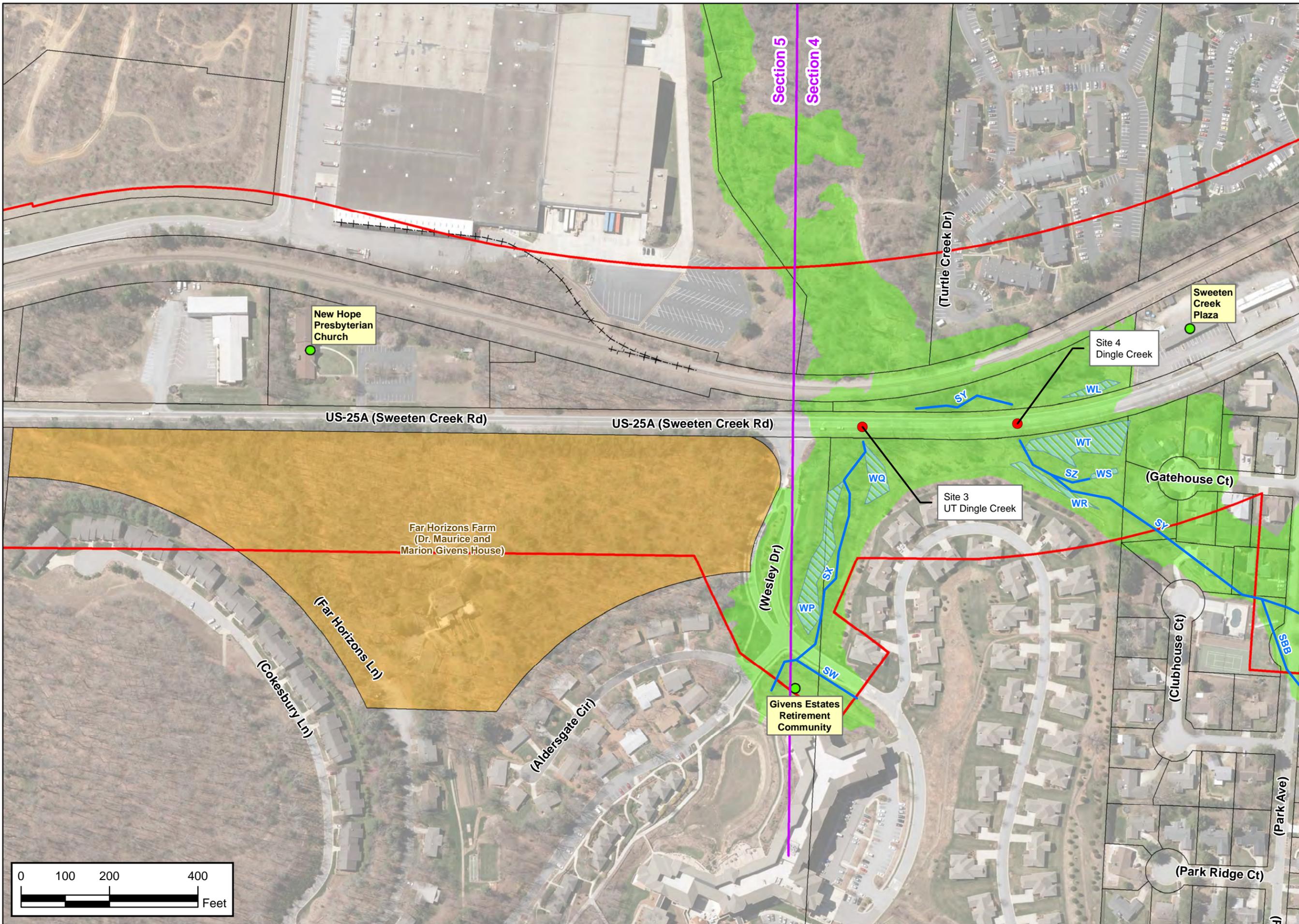
By:
C ROWELLS

County:
BUNCOMBE

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| Div: 13 | STIP# U-2801A |
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Date:
JULY 2018

Figure
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NORTH CAROLINA DEPARTMENT
OF TRANSPORTATION
DIVISION OF HIGHWAYS
PROJECT DEVELOPMENT AND
ENVIRONMENTAL ANALYSIS UNIT

ENVIRONMENTAL FEATURES MAP
WIDEN SWEETEN CREEK RD
FROM HENDERSONVILLE RD (US 25)
TO SR 3801 (ROCK HILL HD)
BUNCOMBE COUNTY
STIP PROJECT U-2801A



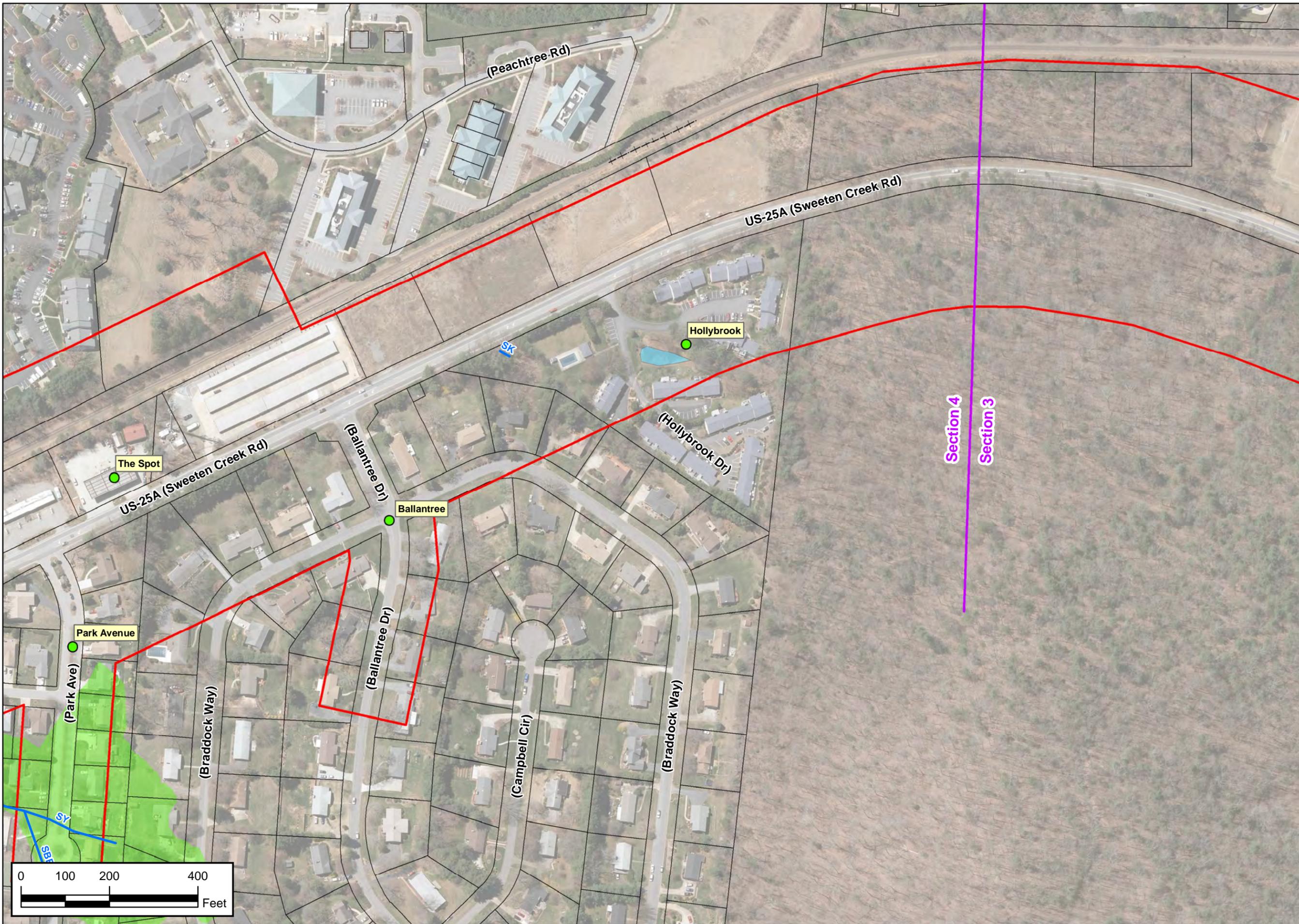
By:
C ROWELLS

County:
BUNCOMBE

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| Div: 13 | STIP# U-2801A |
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Date:
JULY 2018

Figure
2-7



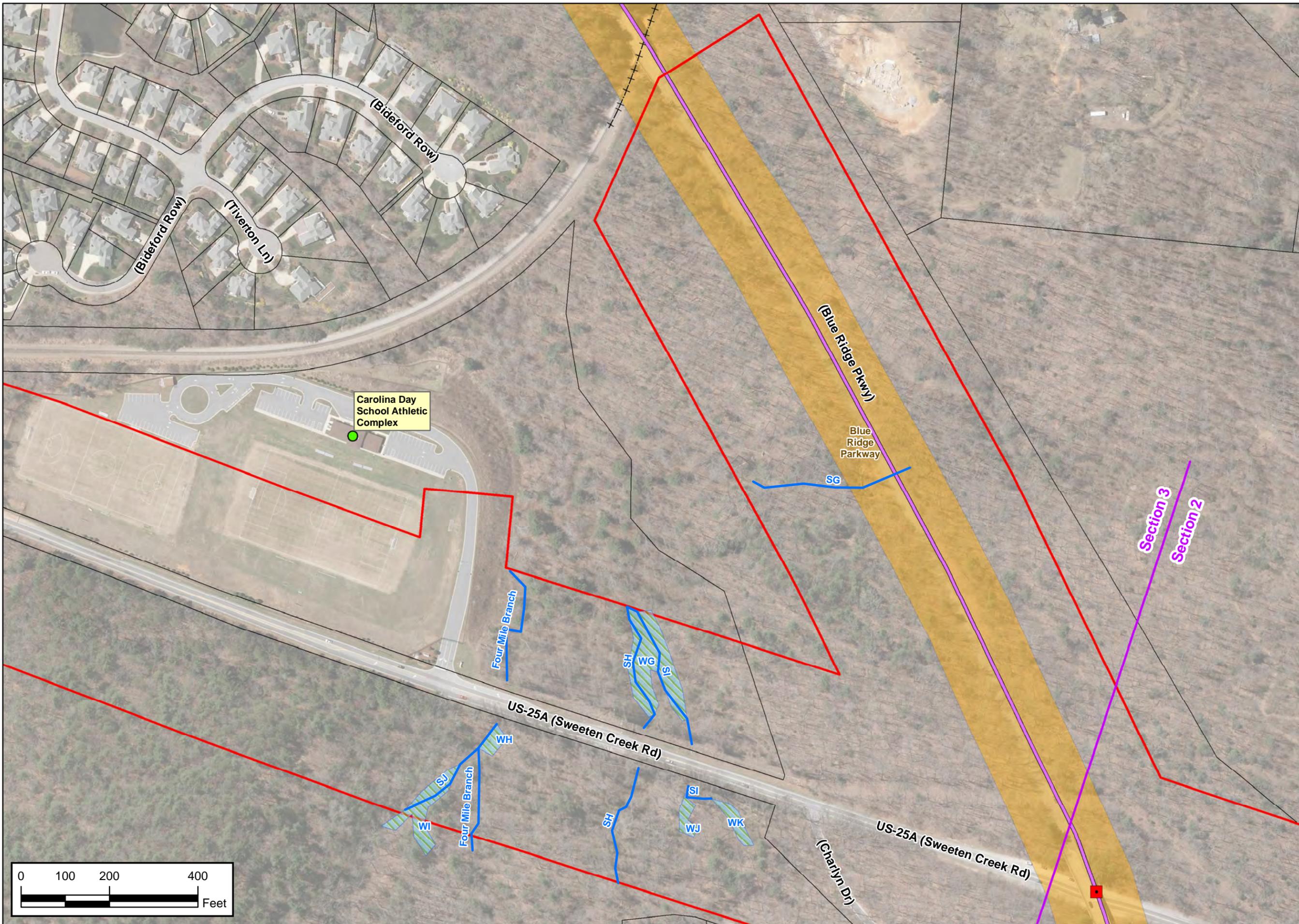
NORTH CAROLINA DEPARTMENT
OF TRANSPORTATION
DIVISION OF HIGHWAYS
PROJECT DEVELOPMENT AND
ENVIRONMENTAL ANALYSIS UNIT

ENVIRONMENTAL FEATURES MAP
WIDEN SWEETEN CREEK RD
FROM HENDERSONVILLE RD (US 25)
TO SR 3801 (ROCK HILL HD)
BUNCOMBE COUNTY
STIP PROJECT U-2801A



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| County: BUNCOMBE | |
| Div: 13 | STIP# U-2801A |
| Date: JULY 2018 | |

Figure
2-8



NORTH CAROLINA DEPARTMENT
OF TRANSPORTATION
DIVISION OF HIGHWAYS
PROJECT DEVELOPMENT AND
ENVIRONMENTAL ANALYSIS UNIT

ENVIRONMENTAL FEATURES MAP
WIDEN SWEETEN CREEK RD
FROM HENDERSONVILLE RD (US 25)
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STIP PROJECT U-2801A



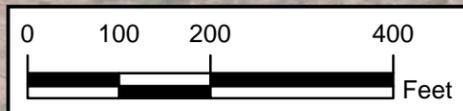
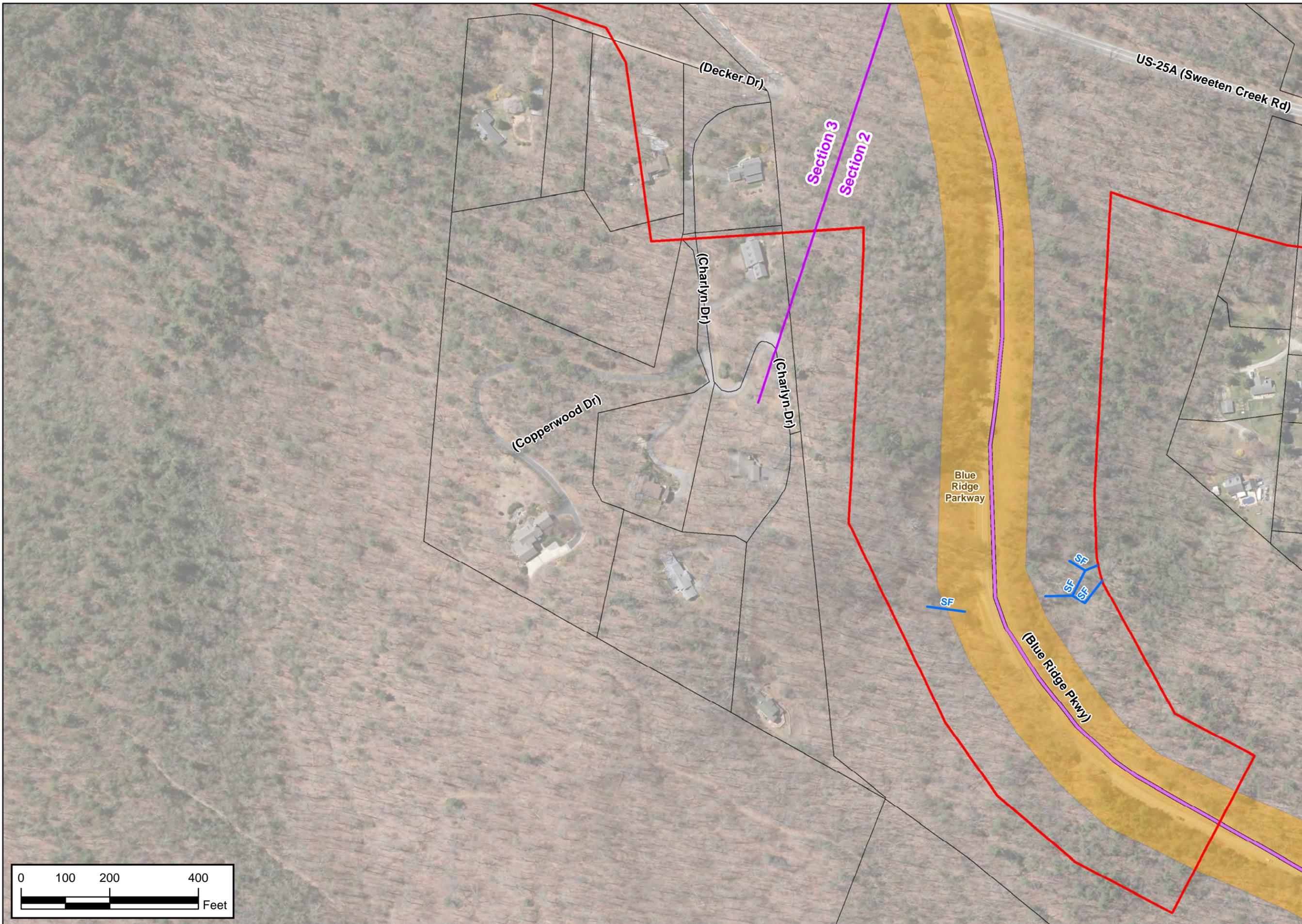
By:
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| Div: 13 | STIP# U-2801A |
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Date:
JULY 2018

Figure
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ESRI Aerial Photograph



NORTH CAROLINA DEPARTMENT
OF TRANSPORTATION
DIVISION OF HIGHWAYS
PROJECT DEVELOPMENT AND
ENVIRONMENTAL ANALYSIS UNIT

ENVIRONMENTAL FEATURES MAP
WIDEN SWEETEN CREEK RD
FROM HENDERSONVILLE RD (US 25)
TO SR 3801 (ROCK HILL HD)
BUNCOMBE COUNTY
STIP PROJECT U-2801A



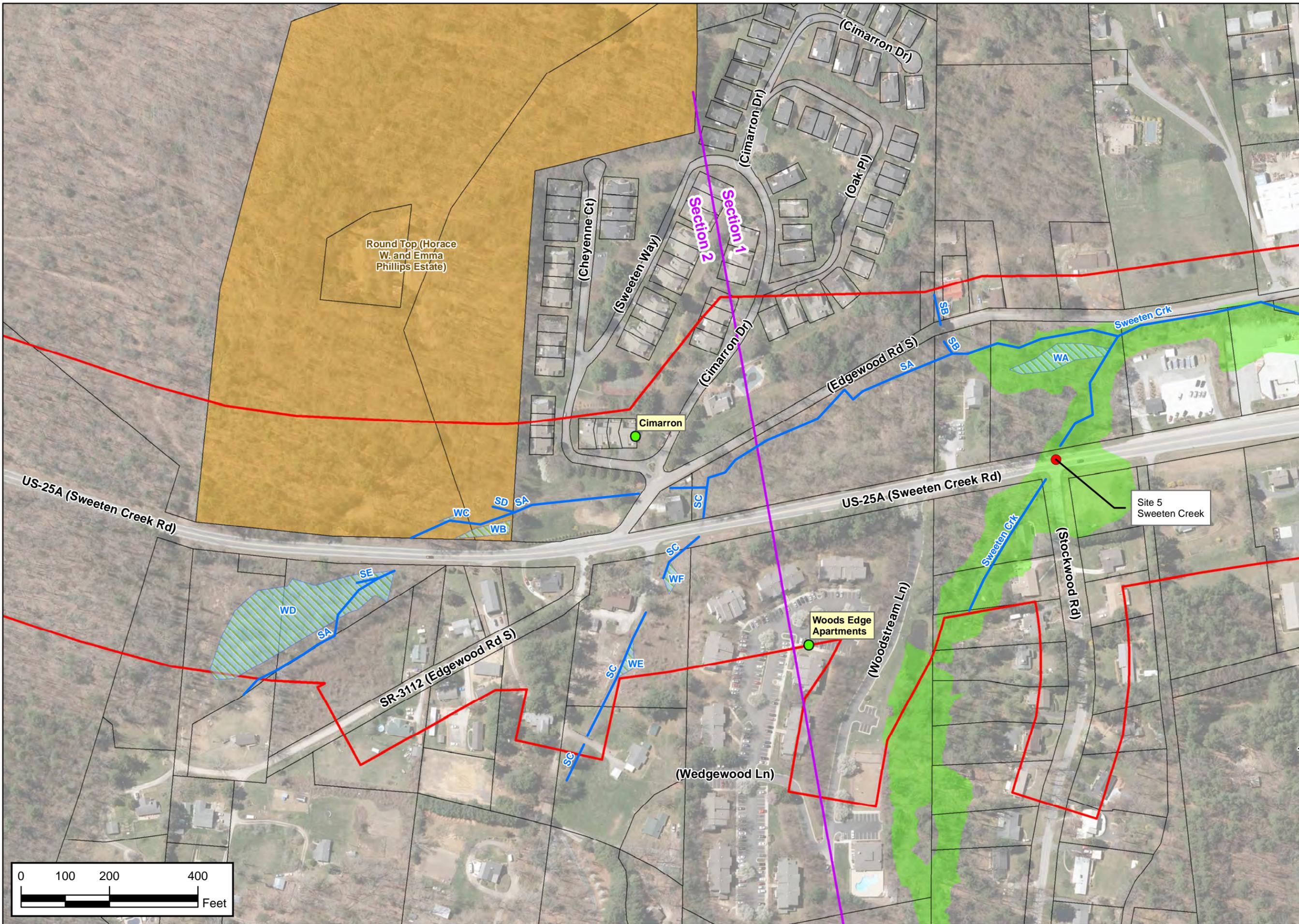
By:
C ROWELLS

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BUNCOMBE

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| Div: 13 | STIP# U-2801A |
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Date:
JULY 2018

Figure
2-10



ESRI Aerial Photograph



NORTH CAROLINA DEPARTMENT
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PROJECT DEVELOPMENT AND
ENVIRONMENTAL ANALYSIS UNIT

ENVIRONMENTAL FEATURES MAP
WIDEN SWEETEN CREEK RD
FROM HENDERSONVILLE RD (US 25)
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BUNCOMBE COUNTY
STIP PROJECT U-2801A



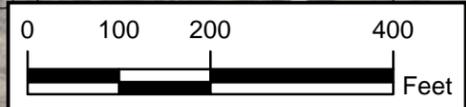
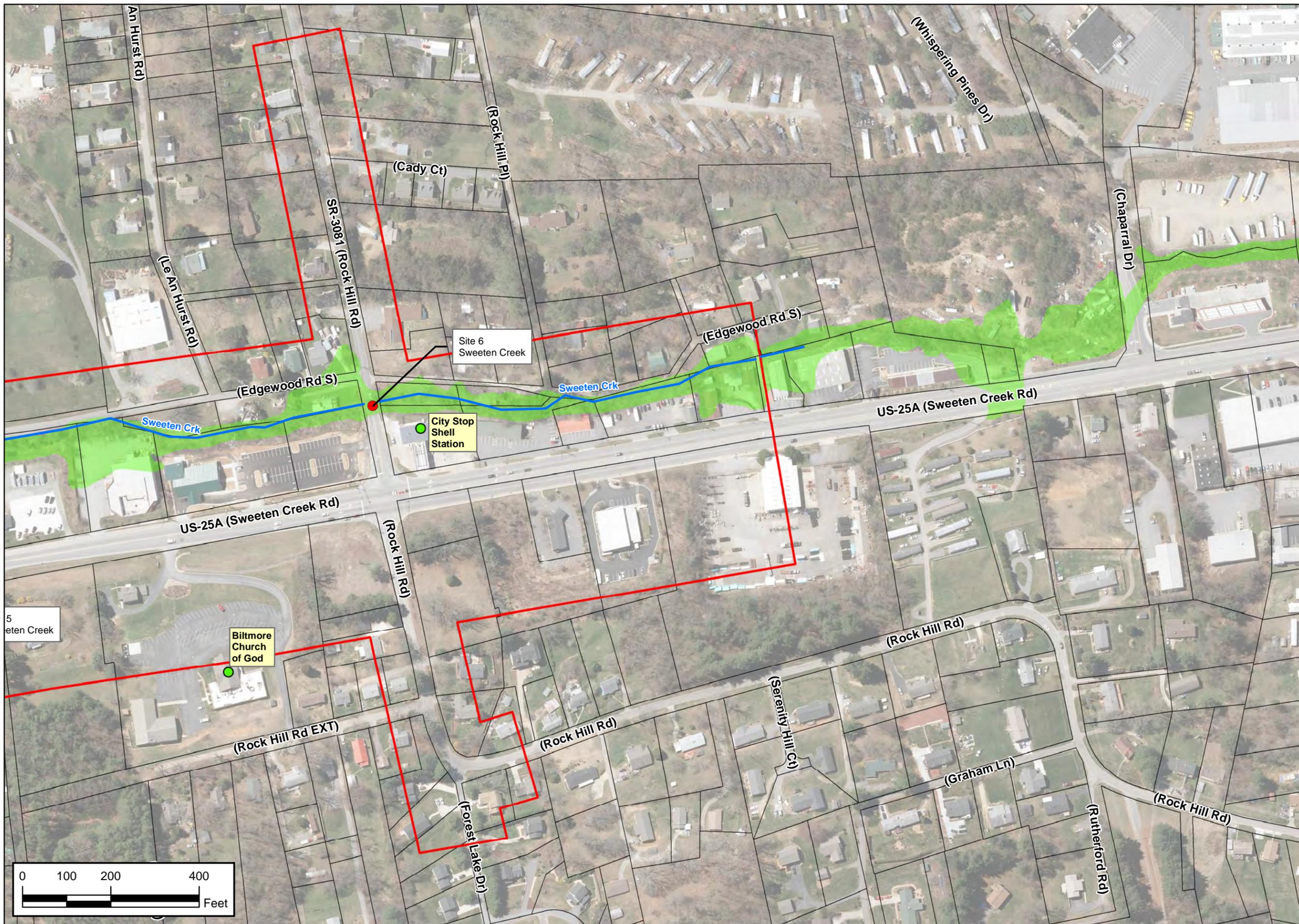
By:
C ROWELLS

County:
BUNCOMBE

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| Div: 13 | STIP# U-2801A |
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Date:
JULY 2018

Figure
2-11



NORTH CAROLINA DEPARTMENT
OF TRANSPORTATION
DIVISION OF HIGHWAYS
PROJECT DEVELOPMENT AND
ENVIRONMENTAL ANALYSIS UNIT

ENVIRONMENTAL FEATURES MAP
WIDEN SWEETEN CREEK RD
FROM HENDERSONVILLE RD (US 25)
TO SR 3801 (ROCK HILL HD)
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STIP PROJECT U-2801A



By:
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| Div: 13 | STIP# U-2801A |
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Date:
JULY 2018

Figure
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