Urban Stream Restoration/Mitigation: Negotiations, Daylighting, Bridges and Bugs

Jay Squires

Streets and Stormwater Manager

City of Spartanburg, South Carolina

Ward Marotti

Senior Project Manager

WK Dickson

community infrastructure consultants

SeSwA Southeast Stormwater Association

Annual Conference

4 October 2018

Hilton Head, SC

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

Restoration & BMPs: Greenville Branch, SC

- Introduction
- Impacts/Permitting
- Banking
- PRM
- Functional Uplift
- Habitat Enhancement
- Public Education
- Monitoring

WK DICKSON
community infrastructure consultants

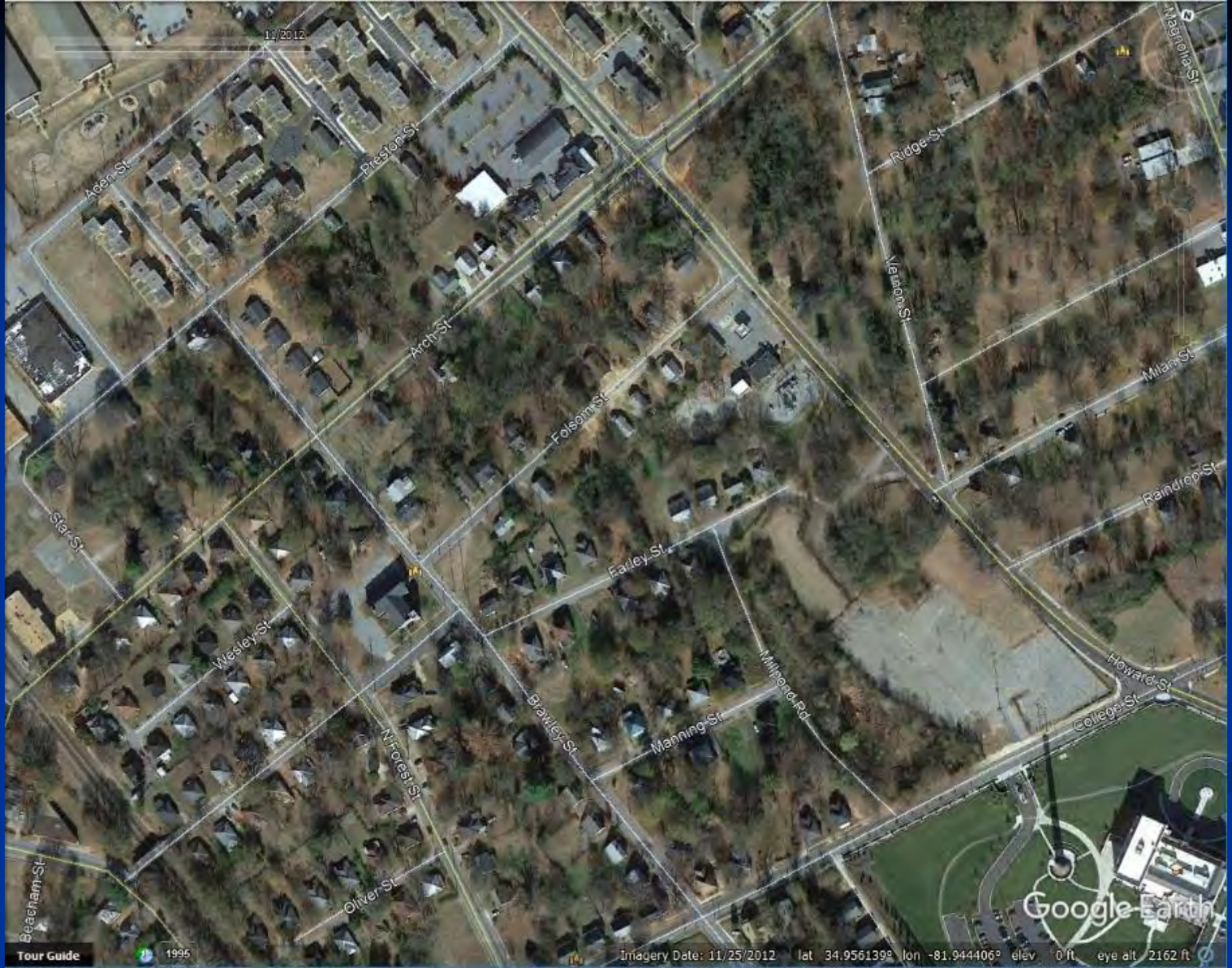
City of SPARTANBURG
south carolina

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina


Spartanburg Downtown Memorial Airport
6/2016
1994
2017
Fleetwood-Cir
Dade-St
California-Blvd
Maryland
Limestone-Dr
Linda-St
S-694
Ammons-Rd
Fairfield-Dr
Fairfield-Ct
S-695
Gratham-Cir
Wimberly-Dr
Butler-St
Airport-Rd
Madera-Dr
Staley-Dr
Mae-St
Venture-Blvd
Carolina-Dr-Ext
Miles-Rd
Granger-Rd
S-545
Google Earth
Tour Guide
lat 34.928317° lon -81.962813° elev 0 ft eye alt 6132 ft


Spartanburg Downtown Memorial Airport
10/2017
Wynton-St
Millwood-Dr
Earl-Dr
Limestone-Dr
Fleetwood-Dr
Bade-St
Maryland
California-Ave
S-694
Ammons-Rd
Fairwood-Dr
Fairfield-Ct
Chatham-St
Wimberly-Dr
Butler-St
Kimberly-Dr
Airport-Rd
Madera-Dr
Mae-St
Staley-Dr
Grange-Rd
Miles-Rd
Miles-Dr
Carolina-Dr-Ext
Jet-St
Venture-Blvd
Fortune-Dr
Google Earth
Tour Guide
1995
Imagery Date: 10/30/2017 lat 34.927225° lon -81.959458° elev 0 ft eye alt 6132 ft


Magnolia St
Ridge St
Preston St
Aden St
Vernon St
Arch St
Milam St
Folsom St
Raindrop St
Star St
Earley St
Wesley St
Howard St
Millpond Rd
College St
Brawley St
Manning St
N Forest St
Oliver St
Beacham St
Google Earth
Tour Guide
1995
Imagery Date: 11/25/2012 lat 34.956139° lon -81.944406° elev 0 ft eye alt 2162 ft

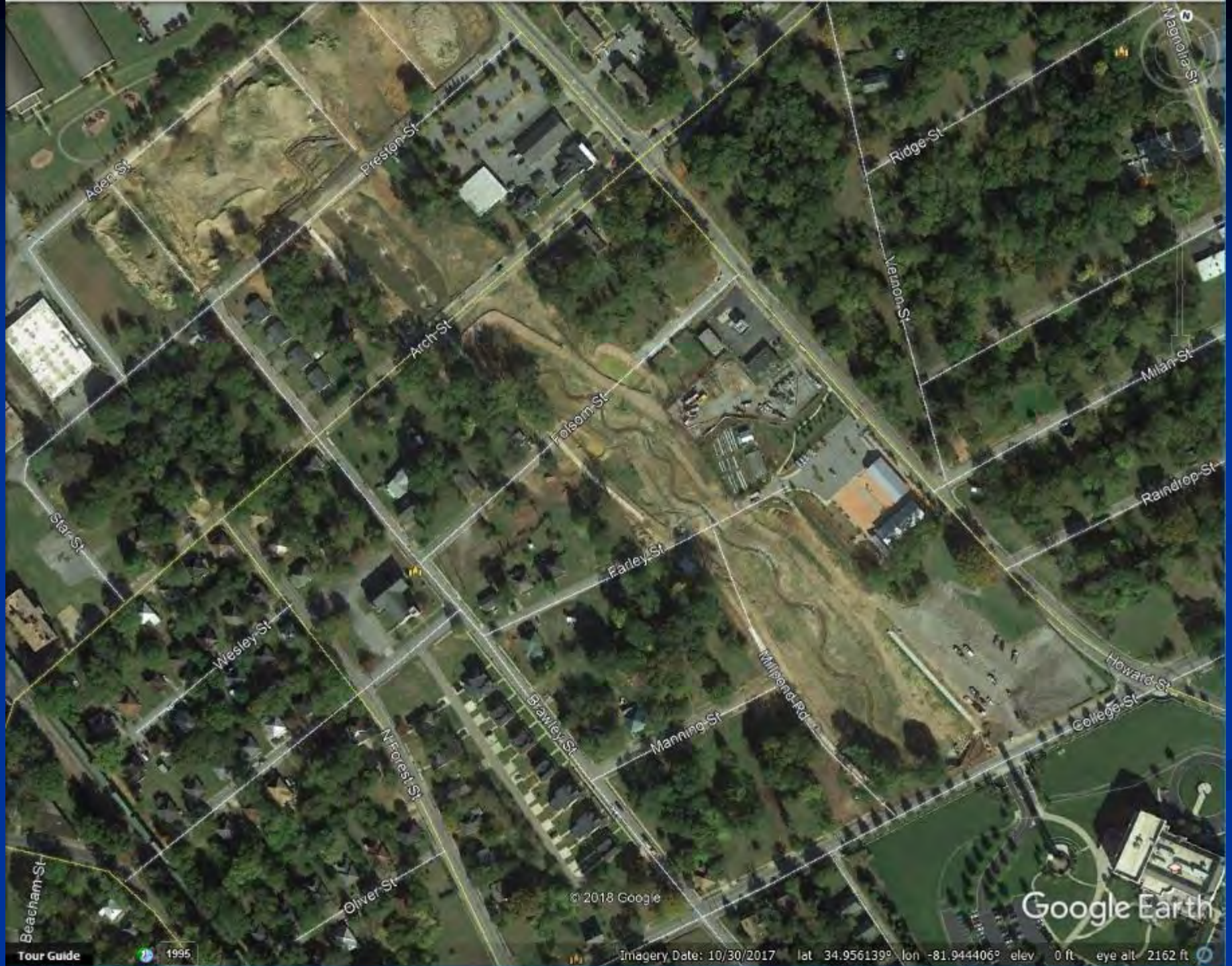

Magnolia St
Ridge St
Preston St
Aden St
Vernon St
Arch St
Milan St
Folsom St
Raindrop St
Star St
Earley St
Wesley St
Howard St
Millbend Rd
College St
Manning St
Brawley St
N Forest St
Oliver St
Beacham St
© 2018 Google
Google Earth
Tour Guide
1995
Imagery Date: 10/30/2017 lat 34.956139° lon -81.944406° elev 0 ft eye alt 2162 ft

Table 10. Required Wetland Mitigation Credits

Factor	Area 1 (Wetland 2)	Area 2 (Wetland 3)	Area 3 (Wetland 4)	Area 4 (Wetland 5)	Area 5 (Wetland 8)
Lost Type	3.0	3.0	0.2	3.0	3.0
Priority Category	1.5	1.5	1.5	1.5	1.5
Existing Condition	2.0	2.0	2.0	2.0	2.0
Duration	2.0	2.0	2.0	2.0	2.0
Dominant Impact	3.0	3.0	3.0	3.0	3.0
Cumulative Impact	0.2	0.2	0.2	0.2	0.2
Sum of r Factors	11.7	11.7	8.9	11.7	11.7
Impacted Area (AC)	0.05	0.02	0.65	0.17	0.06
R x AA=	0.6	0.2	5.8	2.0	0.7
Total Required Wetland Mitigation Credits= ∑ (RxA)= 9.3					

0.95 ac.

9.3 credits

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

Table 12. Required Stream Mitigation Credits

Factor	Impact 1 UT-A Reach 1 (Fill)	Impact 2 UT-A Reach 2 (Fill)	Impact 3 UT-A Reach 3 (Fill)	Impact 4 UT-B (Fill)	Impact 5 UT-C (Pipe)	Impact 6 UT-D (Pipe)	Impact 7 UT-E (Fill)	Impact 8 UT-L (Fill)
Stream Type	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Priority Category	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Existing Condition	0.5	0.5	0.8	0.8	0.8	0.8	0.5	0.5
Duration	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Dominant Impact	2.5	2.5	2.5	2.5	2.2	2.2	2.5	2.5
Cumulative Impact	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Sum of r Factors	6.0	6.0	6.3	6.3	6.0	6.0	6.0	6.0
Impacted Area (LF)	86.1	115.4	321.6	746.3	650.0	472.0	212.5	100.0
R x LL=	516.6	692.4	2,010.0	4,664.4	3,867.5	2,808.4	1,275.0	600.0
						Total Required Credits = Σ(R x LL) =		16,434.3

2,700 lf

16,343 credits

WK DICKSON
community infrastructure consultants

½ Restoration

9.3 wetland

16,343 stream

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

April 2008

Compensatory Mitigation for Losses of Aquatic Resources

40 CFR Part 332 (2008)

'08 Rule

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

Federal Register

Thursday,
April 10, 2008

Final Rule

Part II

Department of Defense

Department of the Army, Corps of Engineers
33 CFR Parts 325 and 332

Environmental Protection Agency

40 CFR Part 230
Compensatory Mitigation for Losses of Aquatic Resources; Final Rule

’08 Rule

- Mitigation Bank
- In Lieu Fee
- Permittee Responsible

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

Mitigation Bank

Credits Available/Purchased: Arrowhead Mitigation Bank

- Wetland (Restoration): 9.3
- Stream (Preservation): 8,334.6
- Stream (Restoration): 2,383.6

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

Remaining Credits Needed

- Stream (Restoration): 5,624.8

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

Permittee

Responsible

Mitigation

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

FEDERAL AVIATION ADMINISTRATION

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

U.S. Department
of Transportation

Federal Aviation Administration

Advisory Circular

Subject: HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS

Date: 8/28/2007

AC No: 150/5200-33B

Initiated by: AAS-300

Change:

1. PURPOSE. This Advisory Circular (AC) provides guidance on certain land uses that have the potential to attract hazardous wildlife on or near public-use airports. It also discusses airport development projects (including airport construction, expansion, and renovation) affecting aircraft movement near hazardous wildlife attractants. Appendix 1 provides definitions of terms used in this AC.

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

FAA Advisory Circular 150/33B

Minimum separations:

Piston-Powered: 5,000 feet

Turbine-Powered: 10,000 feet

Approach, Departure, and Circling Airspace: 5 mi.

WK DICKSON
community infrastructure consultants

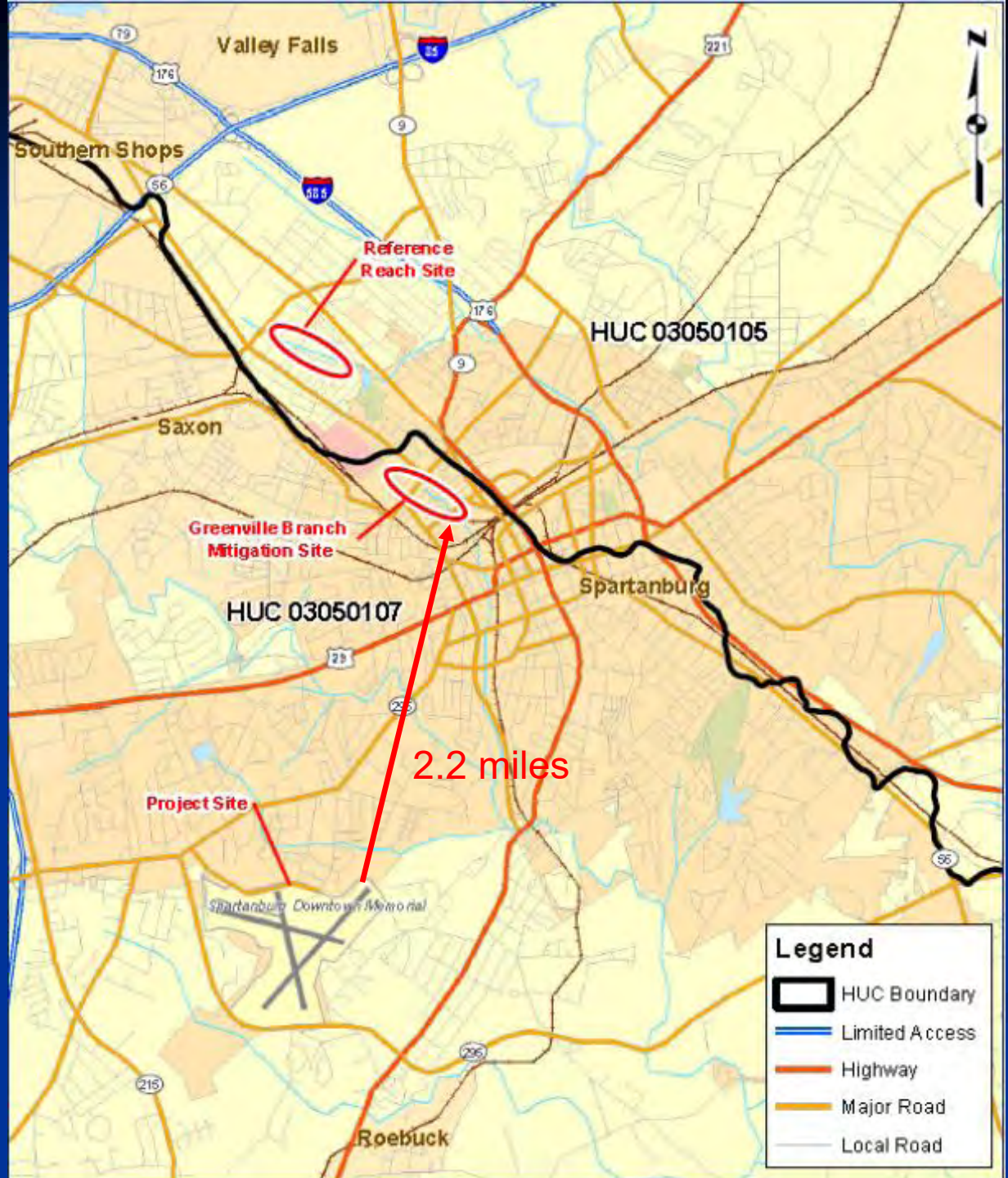
City of SPARTANBURG
south carolina

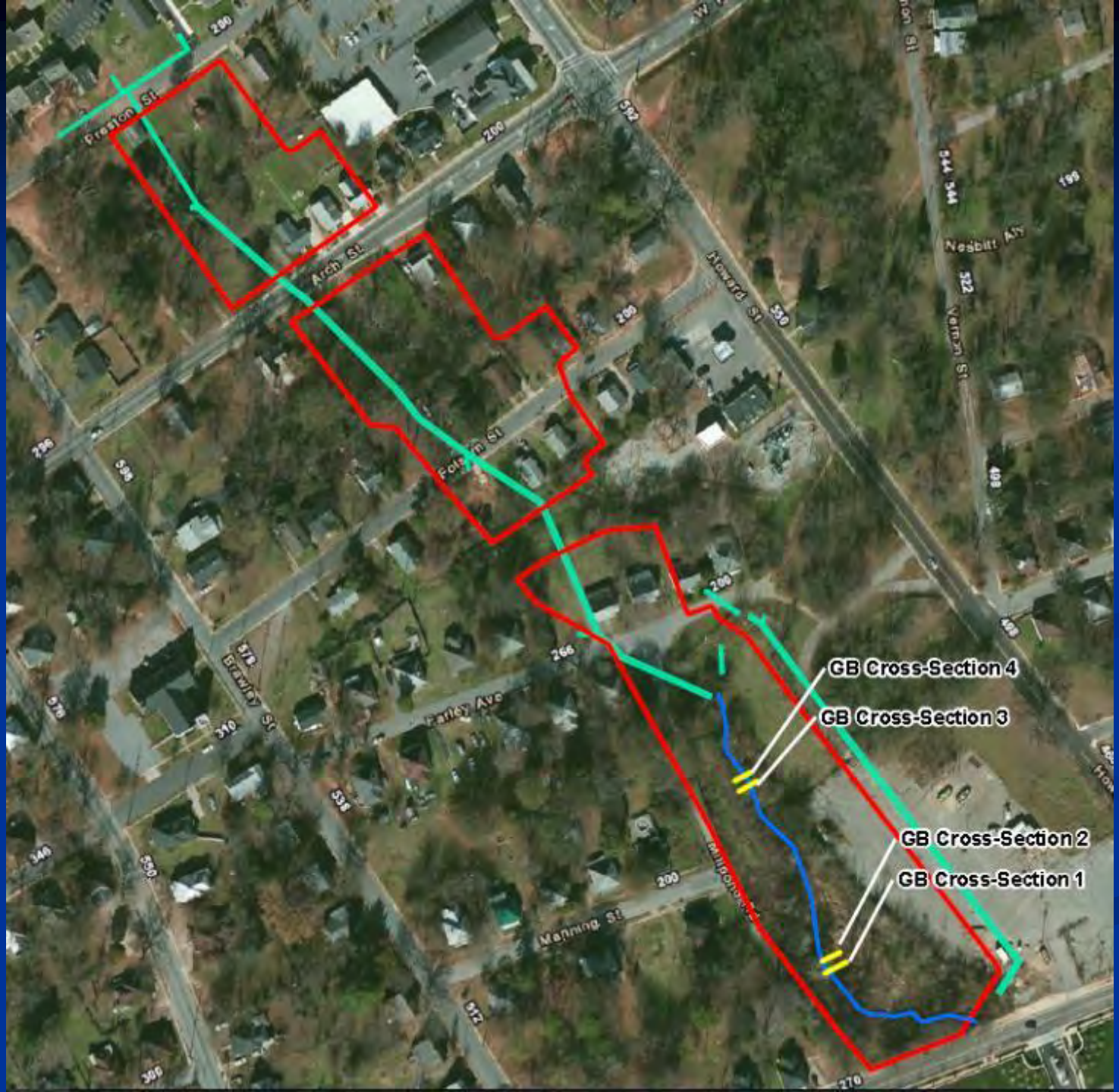
FAA Advisory Circular 150/33B

10,000 ft

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina


Valley Falls
Southern Shops
Reference
Reach Site
HUC 03050105
Saxon
Greenville Branch
Mitigation Site
HUC 03050107
Spartanburg
2.2 miles
Project Site
Roebuck
Legend
HUC Boundary
Limited Access
Highway
Major Road
Local Road


GB Cross-Section 4
GB Cross-Section 3
GB Cross-Section 2
GB Cross-Section 1
Preston St
Arch St
Howard St
Nesbit Ave
Vernon St
Fortson St
Brawley St
Farley Ave
Manning St

Permittee-Responsible Mitigation Plan

Greenville Branch Stream Restoration
Spartanburg, SC
SAC-2013-00233-5C

PERMITTEE:
City of Spartanburg

SUBMITTED TO:
U.S. Army Corps of Engineers, Charleston District
U.S. Environmental Protection Agency, Region 4
U.S. Fish and Wildlife Service, Charleston Ecological Services
National Oceanic and Atmospheric Administration, National Marine Fisheries Service
US Department of Agriculture, Natural Resource Conservation Service
S.C. Department of Natural Resources
S.C. Department of Health and Environmental Control

PREPARED BY:

WK Dickson & Co., Inc.
616 Colonnade Drive
Charlotte, NC 28205
704-334-5348
WKD # 20140118.00.CL

January 2016

SPA Rwy Ext. USACE/SCDHEC Joint Permit

Coordination/Submittal Timeline

Project Milestone	*Date*
Pre-Application Pkg. Submittal to USACE(Part of the Environmental Assessment NEPA Document Coordination)	9.5.2013
USACE Project Consultation (Part of the Environmental Assessment NEPA Document Coordination)	9.16.2013
404/401 Joint Permit Submittal	**5.12.2014**
USACE Information Request No. 1 Received	5.27.2014
USACE Information Request No. 1 Response Submittal	9.10.2014
USACE Required Public Notice	9.22.2014
SCDHEC Required Public Notice	10.26.2014
USACE Information Request No. 2 Received	12.5.2014
USACE Information Request No. 2 Response Submittal	1.13.2015
Mitigation Plan Submittal to USACE/SCDHEC	2.2.2015
USACE Information Reqest No. 3 Received	3.3.2015
SCDNR Mitigation Plan Comments Received	3.9.2015
USACE Information Request No. 3 Response Submittal	3.11.2015
USACE Information Request No. 4 Received (Meeting/e-mail)	4.8.2015
SCDHEC Information Request No. 1 Received (e-mail)	4.9.2015
USACE Issues Jurisdictional Determination	5.1.2015
USACE Information Request No. 5 Received (e-mail)	5.4.2015
USACE Information Request No. 4 / SCDHEC Request No. 1 Response Submittal	5.12.2015
Hydrology Questions Answered for USACE Hydrology Review (via phone/e-mail)	5.21.2015
USACE Information Request No. 5 Response Submittal	5.22.2015
Addendum to USACE Response No. 4 (addt'l Mitigation Site Review Information)	6.12.2015
SCDHEC Comments on Mitigation Plan	6.25.2015
SCDHEC Information Request No. 2	7.15.2015
USACE Information Request No. 6 Received	7.22.2015
USACE Req. No. 6 / SCDHEC Req. No. 2 Response Submittal	8.14.2015
Meeting of USACE & City of Spartanburg/Airport Administration	10.13.2015
USACE Meeting Summary/Information Req. No. 7 Received	10.28.2015
USACE Req. No. 7 Response Submittal	11.23.2015
USACE/City of Spartanburg E-mail Correspondence on No. 7 Response Submittal	11.30.2015 - 12.4.2015
USACE Solicits Comments from Review Agencies on Response No. 7 Submittal	12.1.2015
USACE Notifies the City of the intent to issue the permit with special conditions and requests a meeting to discuss details of conditions	1.7.2016
USACE meets with Consultants and City Representative to discuss permit issuance and conditions	1.8.2016
SCDHEC Issues 401 NOD (15 day decision appeal period begins)	4.20.2016
SCDHEC Issues 401 Permit	5.6.2016
USACE Issues Joint 404/401 Permit	**5.12.2016**

DEPARTMENT OF THE ARMY PERMIT

Permittee: DARWIN SIMPSON

CITY OF SPARTANBURG
500 AMMONS ROAD
SPARTANBURG, SOUTH CAROLINA 29306

Permit No: SAC-2013-00233

2 YEARS!!!

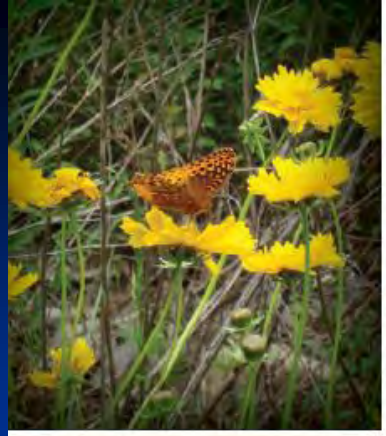
Issuing Office: CHARLESTON DISTRICT

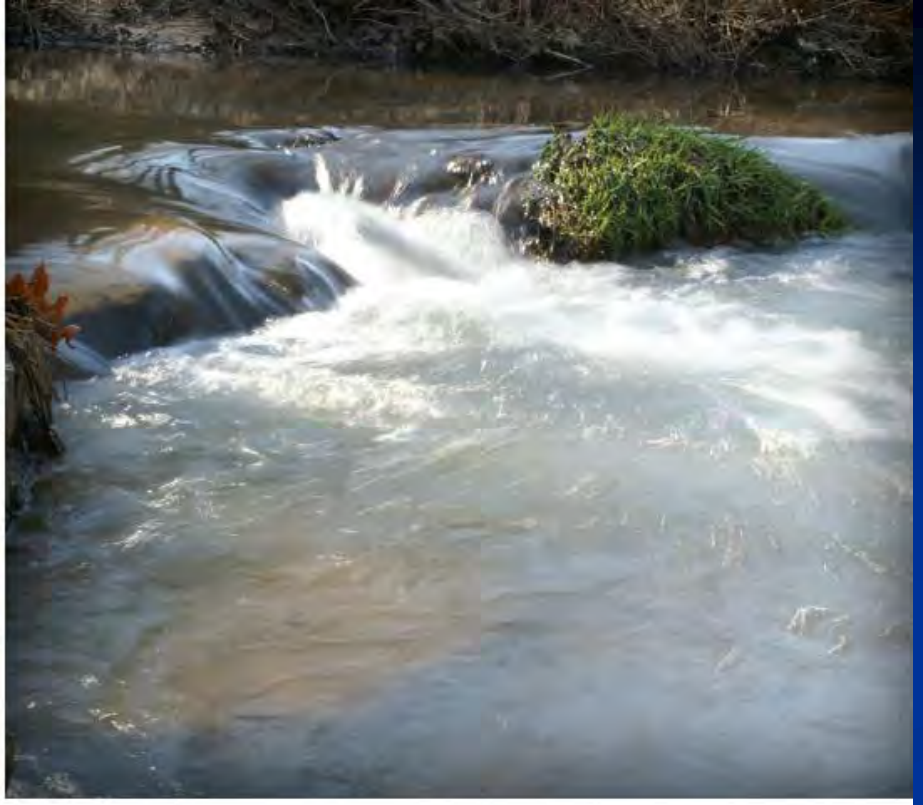
NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina





StreamMechanics

A Function-Based Framework

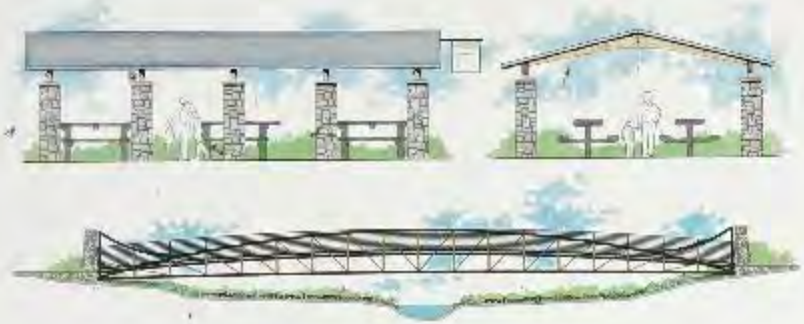
for Stream Assessment & Restoration Projects

EPA 843-K-12-006 » May 2012

#BUTTERFLYCREEK

Butterfly Creek & Greenway

COMING FALL 2017



City of SPARTANBURG south carolina

CityOfSpartanburg.org

northside development group

SpartanburgNDG.com


SANY


HYDREMA


SANY
SY85C
SANY


SOSS
CON
SOSSAMON CONSTRUCTION
GENERAL CONTRACTOR
CONSTRUCTION MANAGEMENT


STREAM
MITIGATION
"RESTORATION AND MAINTAINABILITY OF THE CHEMICAL, BIOLOGICAL,
AND PHYSICAL INTEGRITY OF THE NATION'S WATERS"

WK DICKSON
community infrastructure consultants

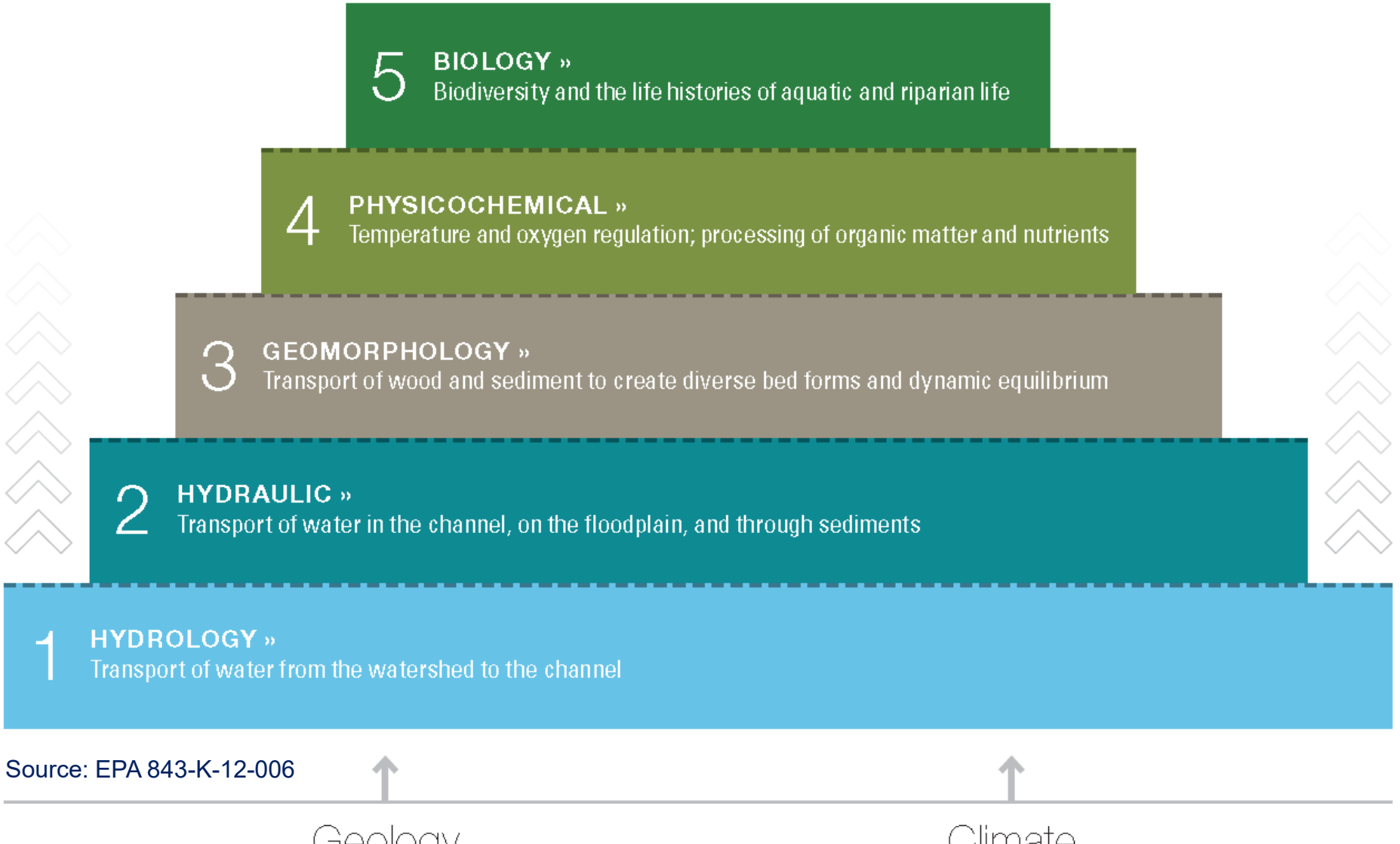
City of SPARTANBURG
south carolina

Permit Conditions

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

Stream Function Pyramid



Source: EPA 843-K-12-006

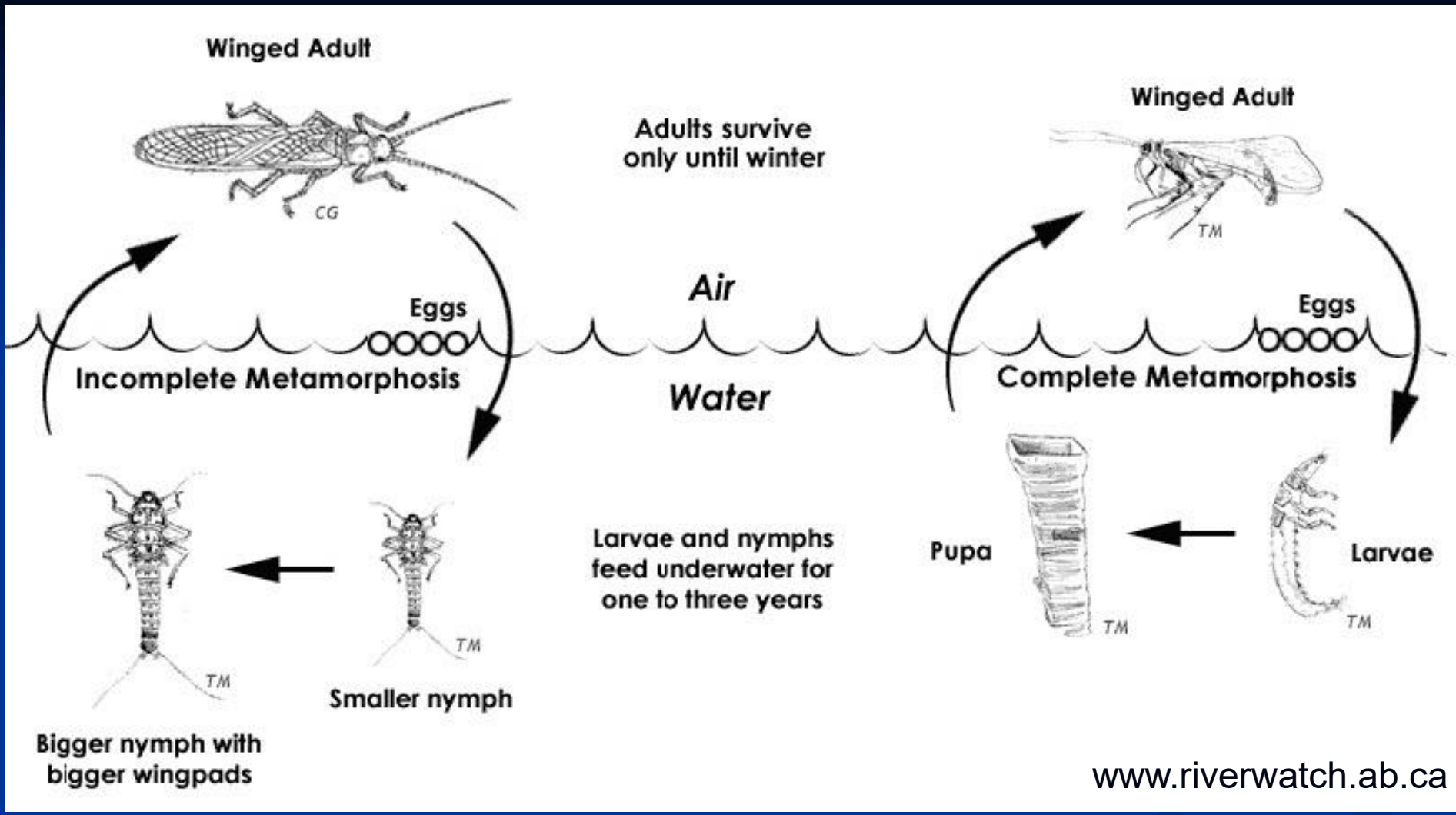
WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina


Benthic Macroinvertebrates

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina



www.riverwatch.ab.ca

Stonefly

Caddisfly

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

Table 7: Ambient Data – 16 October 2015: Dry Weather Event

Site	DO (mg/L)	pH	Temperature (°C)	E. Coli (MPN/100mL)	TSS (mg/L)
Preston Street	6.1	6.4	20.4	80	21.2
Farley Street	8.3	5.8	19.3	20	ND
College Street	7.5	5.8	19.2	92	3.4

Table 8: Ambient Data – 28 October 2015: Wet Weather Event

Site	DO (mg/L)	pH	Temperature (°C)	E. Coli (MPN/100mL)	TSS (mg/L)
Preston Street	8.1	7.0	19.4	286	4.4
Farley Street	9.1	6.7	17.1	332	ND
College Street	7.9	6.8	16.6	386	5.6

Table 9: Benthic Macroinvertebrate Results: 29 October 2015

Taxa	Site	
	GB	REF
EPHEMEROPTERA		
Maccaffertium modestum	-	A+
Baetis Pluto	-	C
PLECOPTERA		
Allocapnia spp	-	C
TRICHOPTERA		
Cheumatopsyche spp	R	A+
Hydropsyche betteni	-	R
Chimarra sp	-	A+
Molanna blenda	-	R
COLEOPTERA		
Helichus spp	-	R
Stenelmis crenata	-	C
Neoporus spp	-	C
ODONATA		
Calopteryx sp	R	C
Argia spp	R	-
Boyeria grafiana	-	R
DIPTERA: MISC.		
Dixella indiana	-	R

Table 9: Benthic Macroinvertebrate Results: 29 October 2015

Taxa	Site	
Pseudolimnophila sp	-	R
Simulium spp	-	C
DIPTERA: CHIRONOMIDAE		
Parametriocnemus lundbecki	-	C
Tvetenia bavarica gr	-	R
Nanocladius sp	-	R
Paracladopelma sp	-	R
Microtendipes sp	-	C
Phaenopsectra flavipes gr	-	R
OLIGOCHAETA		
Enchytraeidae	R	R
Lumbriculus variegatus	R	-
CRUSTACEA		
Cambarus spp	C	C
Caecidotea sp	-	R
Total Taxa Richness	**6**	**24**
EPT Taxa Richness	**1**	**7**
EPT Abundance	**1**	**35**

R=Rare, C=Common, A= Abundant

GB=Greenville Branch, Ref = Reference Reach (Glen Park)

Total Taxa Richness	6	24
EPT Taxa Richness	1	7
EPT Abundance	1	35

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

Ambient Performance Criteria

DO	Daily average not less than 5.0 mg/L with a low of 4.0 mg/L.
pH	Between 6.0 and 8.5.
E. Coli	Not to exceed a geometric mean of 126/100mL based on at least four (4) samples collected from a given sampling site over a 30 day period, nor shall a single sample maximum exceed 349/100mL.
Turbidity	Not to exceed 50 NTUs provided existing uses are maintained.

* These ambient metrics are required to demonstrate use support for Freshwaters and are taken directly from ***R61-68 Water Classification and Standards*: DEHEC, 27 June 2014**. While there is no standard conversion for Nephelometric Turbidity Units to mg/l of total suspended solids, a 1:1 ratio is generally accepted. TSS success will, therefore, be below 50 mg/l and/or 50 NTUs.

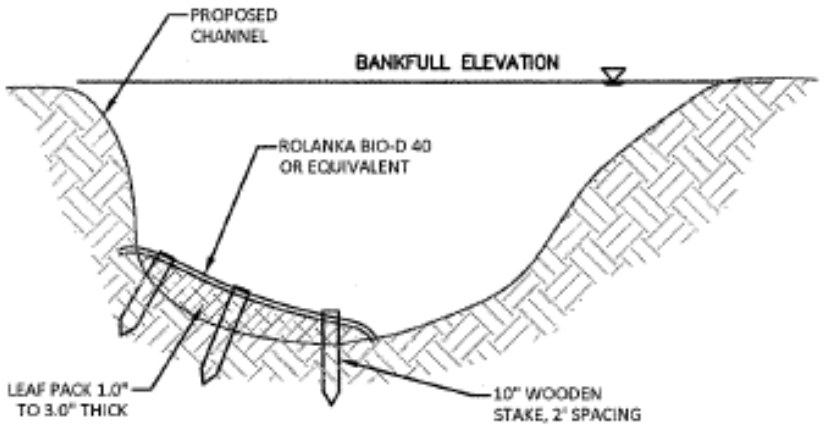
Benthic Performance Criteria

Year 5:

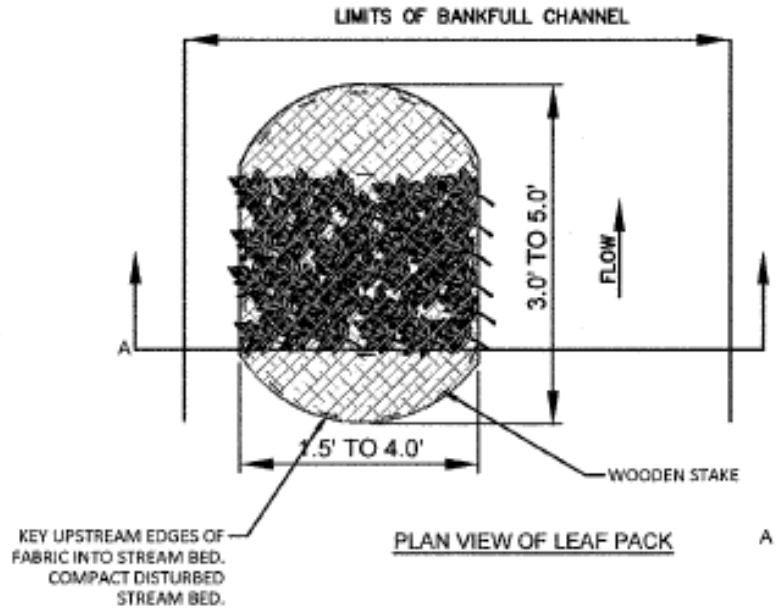
Total Taxa Richness: 10
EPT Taxa Richness: 3
EPT Abundance: 15

WK DICKSON
community infrastructure consultants

Aquatic Habitat Enhancement



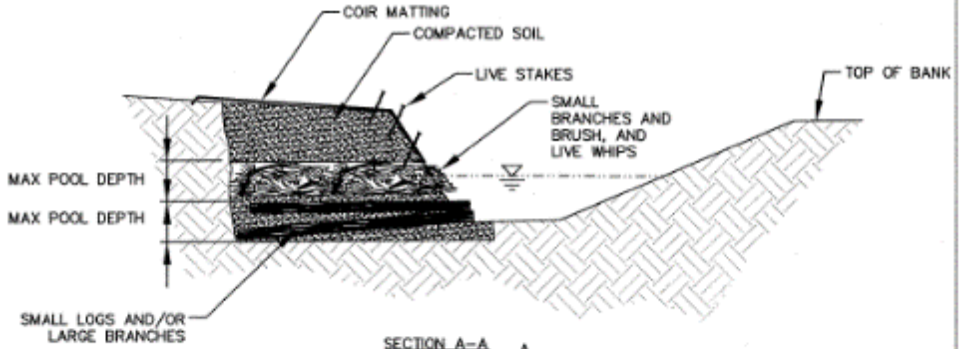
SECTION A-A

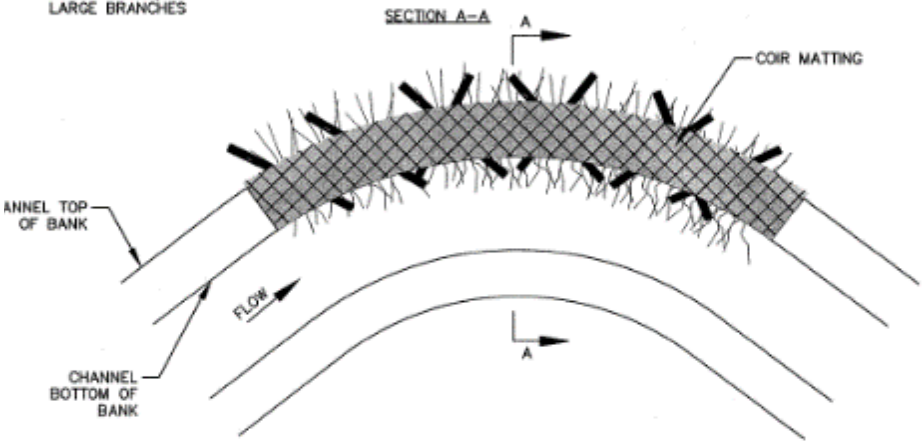


PLAN VIEW OF LEAF PACK

LEAF PACK

NTS





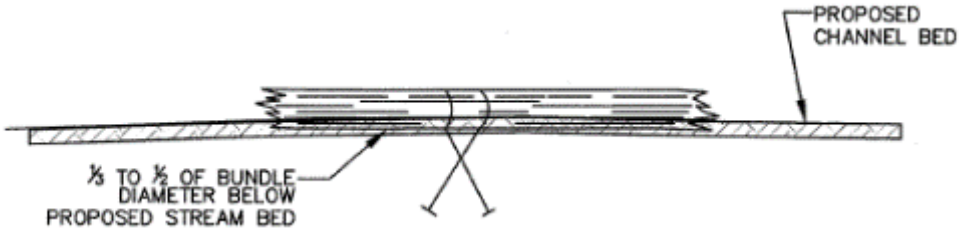
TYPICAL PLAN VIEW

NOTES:

1. OVER EXCAVATE THE OUTSIDE BEND OF THE CHANNEL. PLACE LARGER BRANCHES AND LOGS IN A CRISS-CROSS PATTERN. LOCK IN PLACE WITH FILL COVERING 6 IN TO 18 IN OF THE LARGER LOGS.
2. LOGS AND LARGE BRANCHES SHALL HAVE A MINIMUM DIAMETER OF 6". TYPICAL DIAMETERS SHALL RANGE BETWEEN 8" AND 16".
3. PLACE SMALLER BRANCHES AND BRUSH OVER THE LARGER LOGS AND COMPACT LIGHTLY TOGETHER. BACKFILL AND COMPACT TO LOCK IN PLACE. LIVE WHIPS MAY BE INCLUDED WITHIN THE SMALL BRANCHES AND BRUSH LAYER.
4. LOG AND BRANCH MATERIALS MAY BE HARVESTED ON SITE (EXCLUDING ANY INVASIVE SPECIES).
5. INSTALL EROSION CONTROL (COIR) MATTING OVER COMPACTED SOIL AND KEY IN PER MANUFACTURER'S INSTRUCTIONS.
6. INSTALL 2 TO 4 ROWS OF LIVE STAKES ABOVE THE SMALL BRANCHES AND BRUSH LAYER.

BRUSH TOE

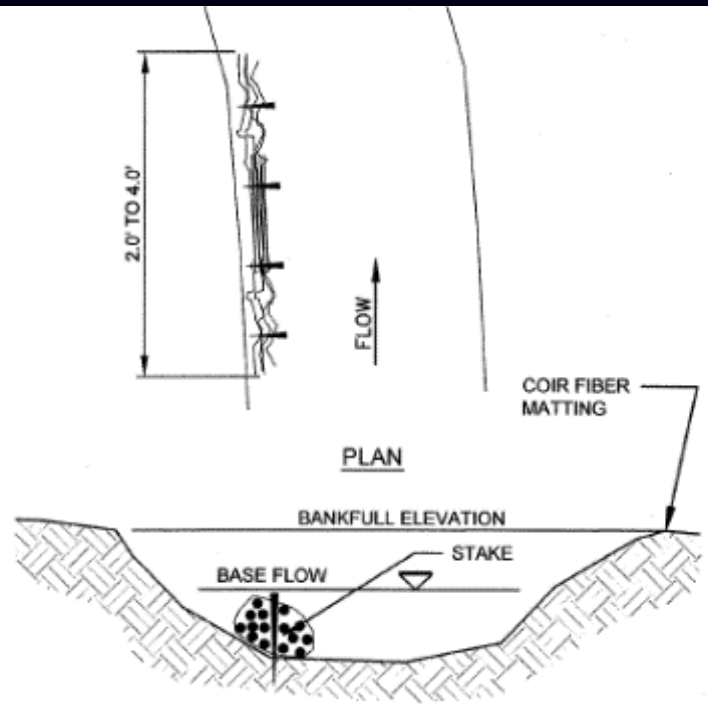
NTS



USE STICKS AND LOGS OF VARYING SIZES 1"–4" DIAMETER AND 1'–4' LONG. WOODY DEBRIS SHALL BE HELD IN PLACE USING TWINE AND WOODEN STAKES AND SHALL BE PLACED ACCORDING TO DESIGN PLANS AND AS DIRECTED BY ENGINEER.

WOODY DEBRIS BUNDLE

NOTE:
WHEN INSTALLING SMALL WOODY DEBRIS STRUCTURES AS LOCATED ON THE PLAN SHEETS, CONTRACTOR SHALL ALTERNATE BETWEEN WATTLE, SMALL LOG, AND DEAD BRUSH STRUCTURES BASED ON READILY AVAILABLE MATERIALS AND PER DIRECTION OF THE ENGINEER.



TYPICAL SECTION

NOTE: USE DEAD BRUSH AND TOPS 0.5 TO 2.0 INCHES IN DIAMETER. TIE BUNDLES WITH TWINE AND STAKE TO THE CHANNEL BED. IF PINE STRAW IS READILY AVAILABLE ON-SITE, ADD TO BUNDLE.

DEAD BRUSH

SMALL WOODY DEBRIS & HABITAT STRUCTURES

NTS


SANY
SANY
SANY


CRADLE STAKES


147
WK DICKSON
community infrastructure consultants

Monitoring

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

Monitoring

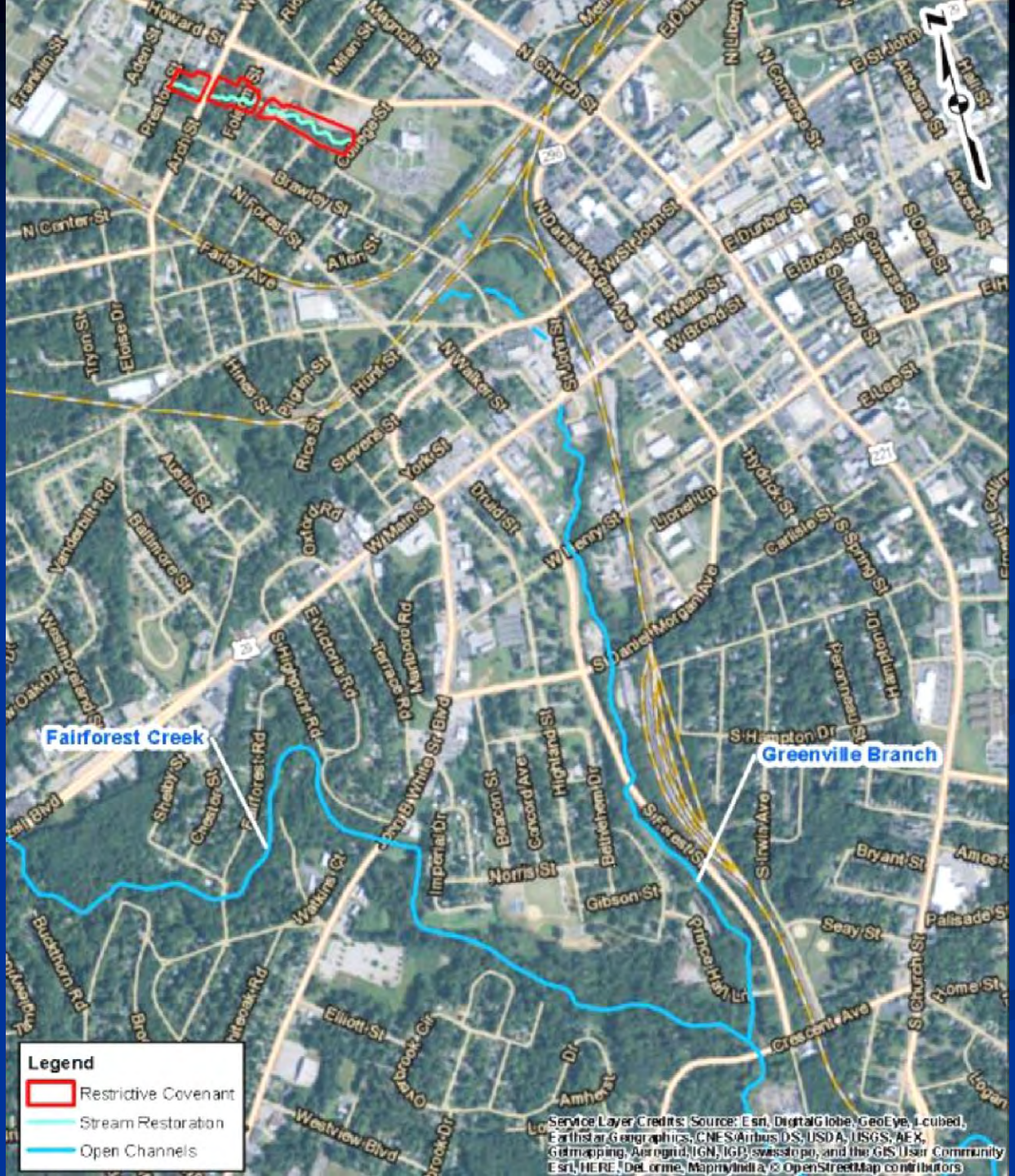
WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

Watershed Plan

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina


Fairforest Creek
Greenville Branch
Legend
Restrictive Covenant
Stream Restoration
Open Channels
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina


CAT


SANY

WK DICKSON
community infrastructure consultants

City of SPARTANBURG
south carolina

Ward Marotti

Senior Project Manager

919-368-8043

wmarotti@wkdickson.com

WK DICKSON

community infrastructure consultants

Jay Squires

Streets and Stormwater Manager

864-596-2089

jsquires@cityofspartanburg.org

City of SPARTANBURG

south carolina