





**Uplift of a Wet Weather
Stream: Satisfying
Regulatory Requirements**

Agawela Drive Stream Project
Chattanooga, TN





01 Project Background/Design

02 Permitting Process

03 Construction Techniques

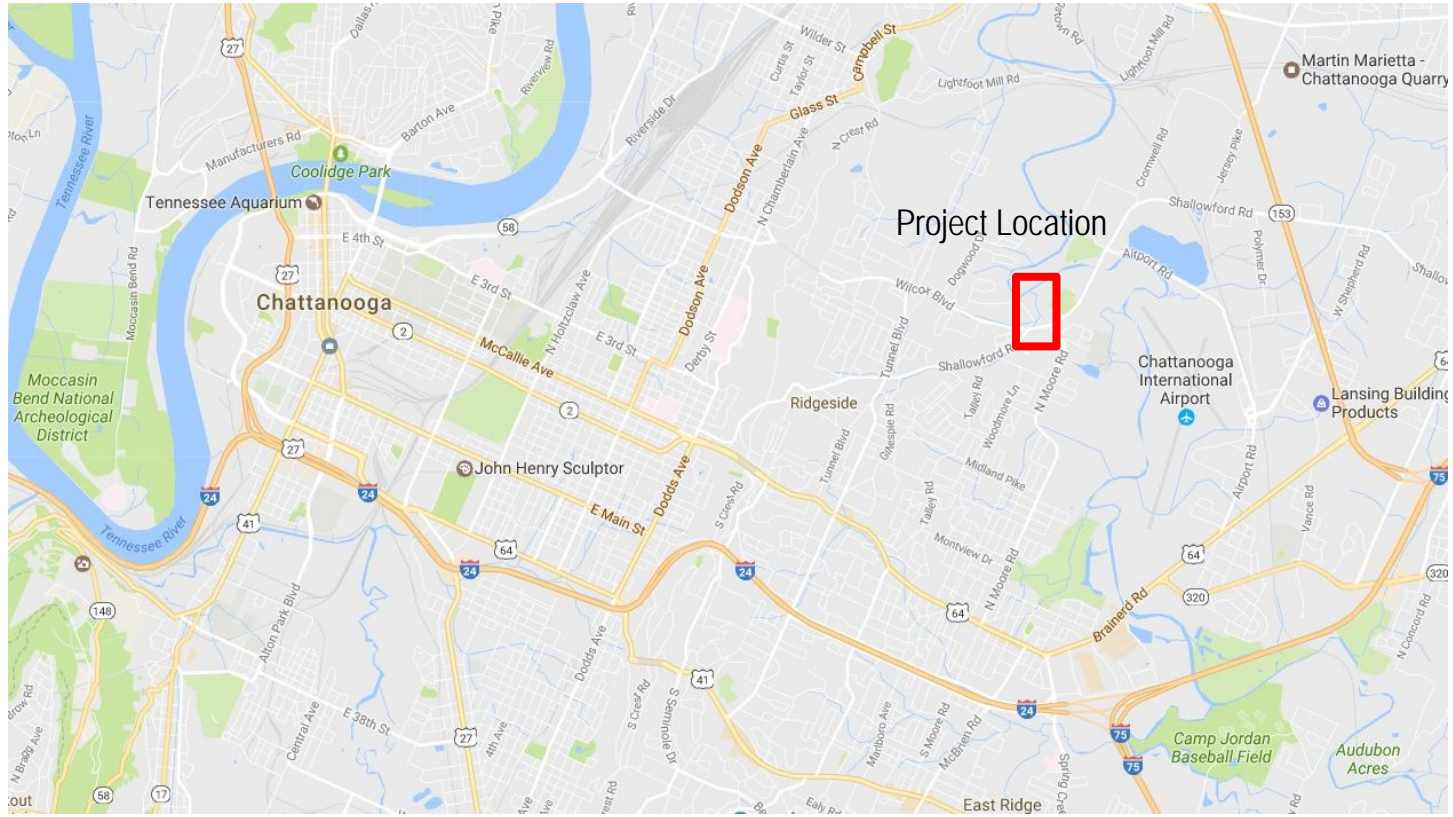
04 Lessons Learned

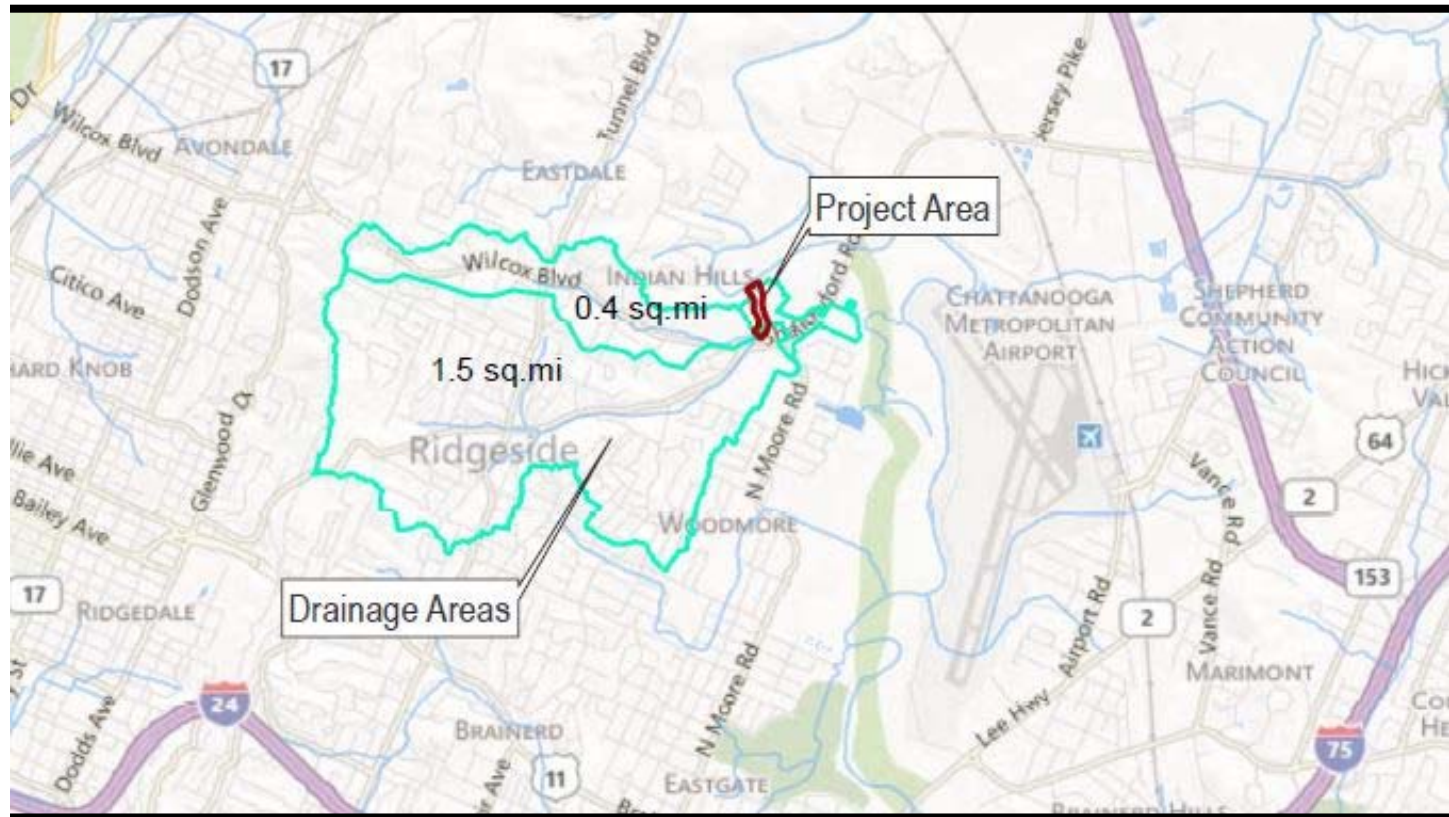
Project Scope

- CSO Consent Decree Program
- Supplemental Environmental Project
- Severely Entrenched Urbanized Stream
- Restoration/Stabilization of approx. 1,500 LF of stream using natural channel design principles
- Project Location:
 - Un-named tributary to South Chickamauga Creek









Design Criteria

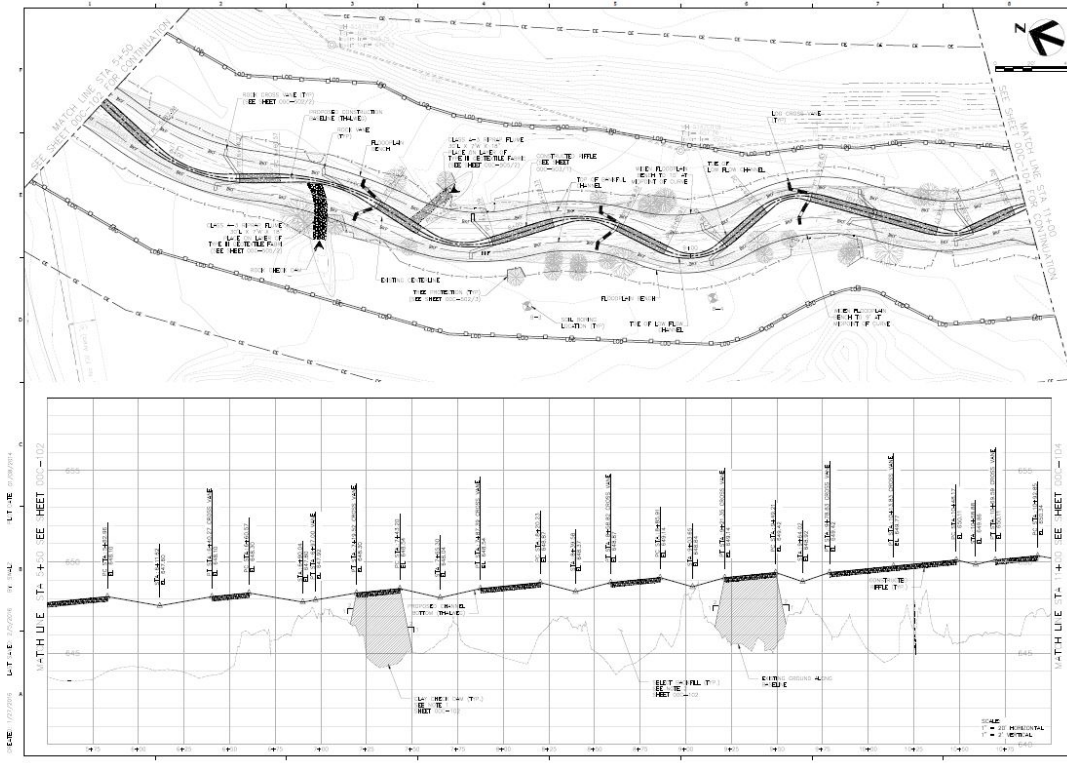
- TMDL for Habitat Alteration and Sediment
- Establish a stable stream
- Raise stream to reconnect with floodplain
- Stabilize culvert at Agawela Dr.
- Utilize natural channel design principles as available within corridor
- Conservation Easements
- Fill slopes on both sides





Agawela Drive Stream Corridor





DATE: 10/20/2016
 TIME: 10:00 AM
 SHEET NO: 00C-103

HR

HYDROLOGICAL
 ENGINEERING
 CONSULTANTS

AGAWELA DRIVE
 STREAM RESTORATION PROJECT
 CITY OF CHATTANOOGA, TN
 CONSENT PERMITS PROGRAM

PROJECT NO: 2016-0001
 SHEET NO: 00C-103
 DATE: 10/20/2016

NO.	REVISION	DATE

PROJECT NO: 2016-0001
 SHEET NO: 00C-103
 DATE: 10/20/2016

CIVIL
 PLAN AND PROFILE
 MAIN CHANNEL

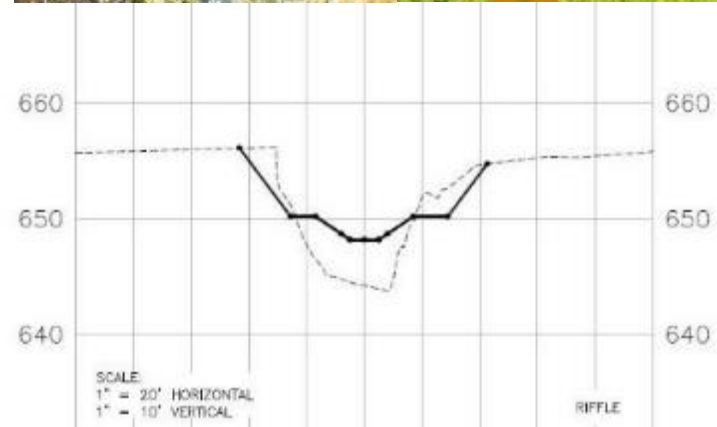
Design Criteria Cont'd

- o Corridor constraints



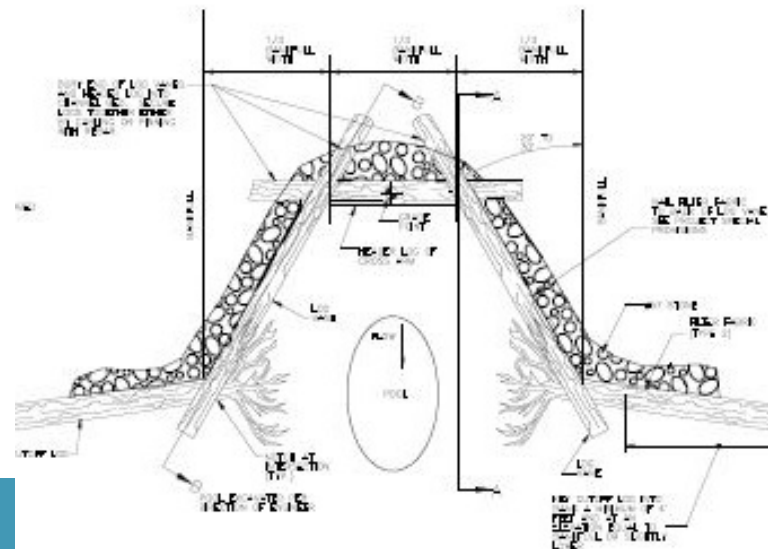
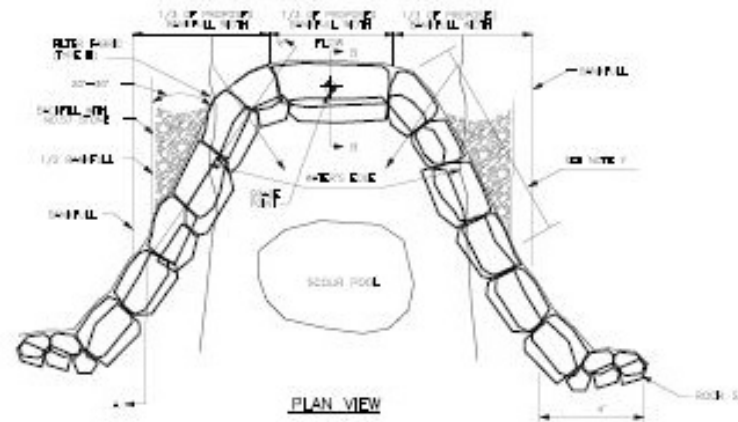
Design Elements

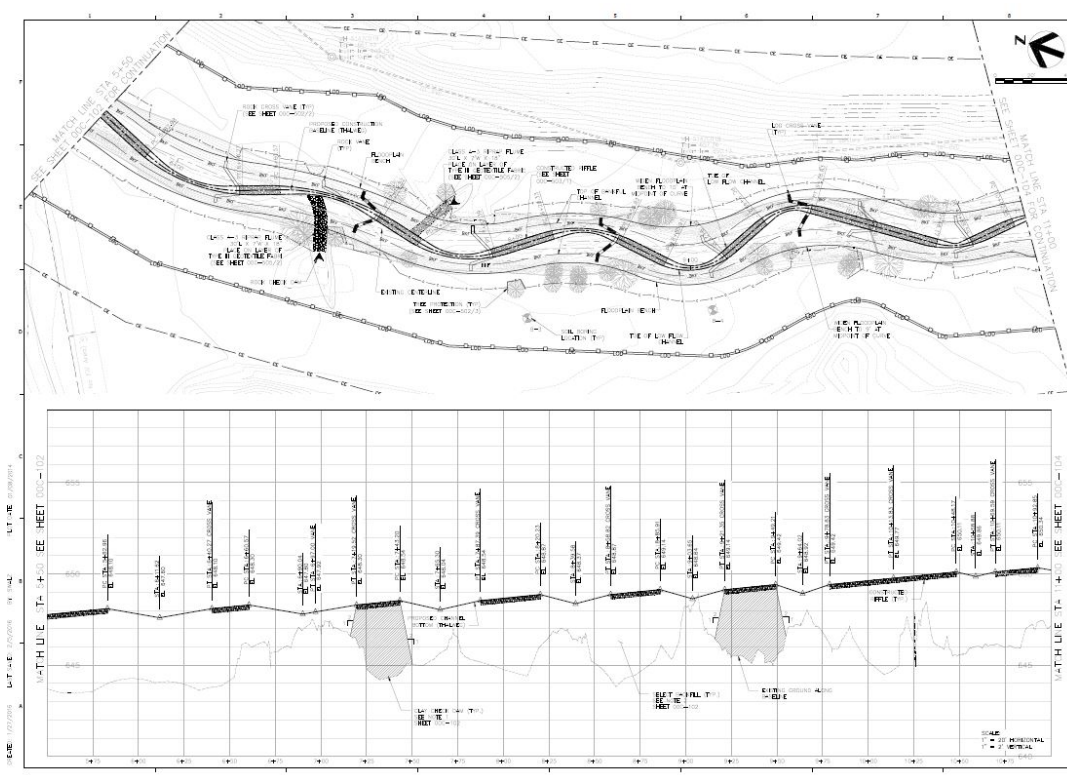
- Field Assessment and Analysis including:
 - Biological Surveys (Macro., Fish, Vegetation, Trees)
 - Wetlands Determination
 - Cultural Resources Survey
- Hydrologic Analysis
 - Total Drainage Area 1251 ac (1.9 sq. mi)
 - Calculated Bankfull Flow – 70 cfs
- 50-foot Buffer Established for Conservation Easement



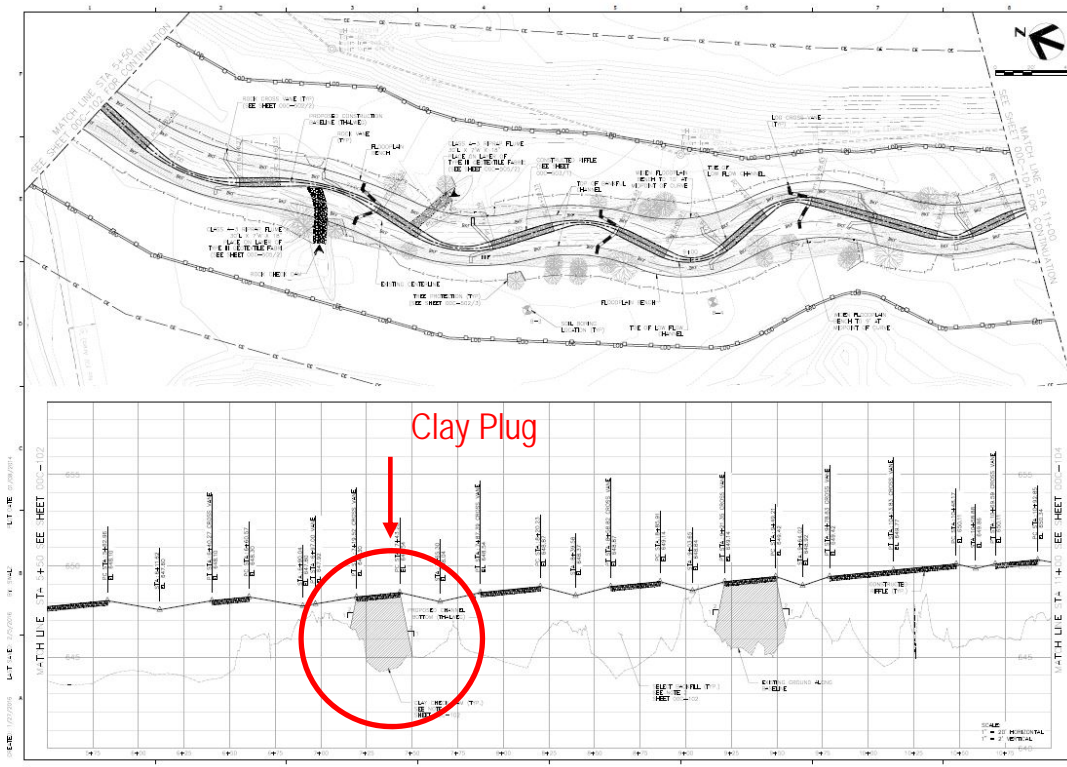
Design Elements Cont'd

- Install rip-rap armoring at upstream confluence locations
- Raise stream approx. 3 to 4 feet
- Install rock and log grade control structures
- Install pool downstream of grade control structure to dissipate energy
- Glide downstream of pool
- Rock riffle structures downstream of glide
- Coconut Fiber Matting & Coir Log
- 2300 trees, shrubs & live stakes





 HOKU, INC. 1500 KALANOAUE AVE., SUITE 200 HONOLULU, HI 96815																																									
																																									
AGAWELA DRIVE STREAM RESTORATION PROJECT CITY OF CHATTANOOGA, TN CONSENT PERMITS PROGRAM																																									
																																									
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CITY OF CHATTAHOOCHEE

AGAWELA DRIVE
 STREAM RESTORATION PROJECT
 CITY OF CHATTAHOOCHEE, TN
 CONSENT PERMITS PROGRAM

NOV 14 2013

NO. 1	DATE	DESCRIPTION

DATE: 10/14/13
 SHEET NO: 00X-103
 PROJECT: AGAWELA DRIVE STREAM RESTORATION PROJECT
 DRAWN BY: J. W. BROWN
 CHECKED BY: J. W. BROWN
 SCALE: AS SHOWN
 SHEET TITLE: CIVIL
 PLAN AND PROFILE
 MAIN CHANNEL

Permitting

- TDEC Individual Aquatic Resource Alternation Permit (ARAP)
- TVA Section 26a
- USACE Section 10/Section 404
 - USFWS & TWRA
- Requires Annual Monitoring for 5 years
 - Maintain base flow
 - Show functional uplift of aquatic/biological





Project Timeline

- Design NTP Jan 2013
- General NWP Application Dec 2014
- General NWP Denied by TDEC Jan 2014
- Revised & Resubmitted for Individual Permit Feb 2015
- Received Approved ARAP Aug 2015
- Discussions with TDEC regarding mitigation Calendar Year 2015
- Bid Opening March 2016
- Construction Start June 2016
- In-Stream Work Complete Sept. 2016
- Plantings (Trees, Shrubs, Live Stakes) Feb 2017
- Final Completion March 2017

Construction

- Bidding
 - Minimum Quals (2 projects, each >500LF, >1000SY of planting, 4 Rock/2 Log Structures)
 - Curl Construction & Excavating
 - 1% over Engineer's Estimate
 - Unknown to City
 - Performed very well
- Subcontractors:
 - Backwater Environmental: in-stream structures
 - Reed Landscaping: Trees, Shrubs, Live Stakes
- Bid Cost: \$889k
- Actual Cost: \$767k



Construction Cont'd

- Timeline
 - NTP: June 2016
 - In-stream Work: July thru Sept 2016
 - Plantings: Feb 2017
- In-stream completed without pump around system
 - Recall the drought conditions in fall/winter 2016
 - Very few in-stream flow events during construction



Raising Stream to Grade

- Utilized on-site soil where available
- Imported clay material for plugs and for general site fill
- Compaction tested to 95% proctor
- Clear and Grub
 - Stock pile trees to mulch
 - Save hardwood trees for structures
- Install fill to grade
- Cut and shape channel





Rock Grade Control Structures

- Rock material – granite from nearby quarry
- 3' x 3' x 2' (on average)
- Stacked two high
- Geotextile underlayment
- Stone backfill
- Excavator with thumb and GPS





Log Grade Control Structures

- Utilized on-site timber
- 12" to 18" in diameter
- Hardwood
- Stacked two high
- Attached with rebar & cable straps
- Geotextile underlayment
- Stone backfill
- Excavator with thumb and GPS





Riffle Structures

- Installed upstream of grade control structures
- Header stones 2' diameter/square
- Filler stones 15" to 18"
- Smaller stone Class A-3 Riprap
- Geotextile underlayment
- Stone backfill
- Excavator with thumb and GPS



Coir Matting & Coir Logs

- Coir matting installed in flow channel
- Wrapped under coir log
- Held down with stakes
- Established vegetation locks in matting
- Coir logs placed at each of runs and riffles
- 12" diameter logs





Tree & Shrub Planting

- 2300 Live Stakes
 - Along low flow channel
- 2270 – 3 gallon containerized trees/shrubs
- 75 – 1.5" caliper ball & burlap trees
- Species
 - Live Stakes – Tag Alder, Silky Dogwood, Silky Willow and Elderberry
 - Ball & Burlap/Containerized – Red Maple, River Birch, Water Oak, Black Walnut, Sycamore, Silver Maple, Sugarberry, Willow Oak



Tree & Shrub Planting Cont'd

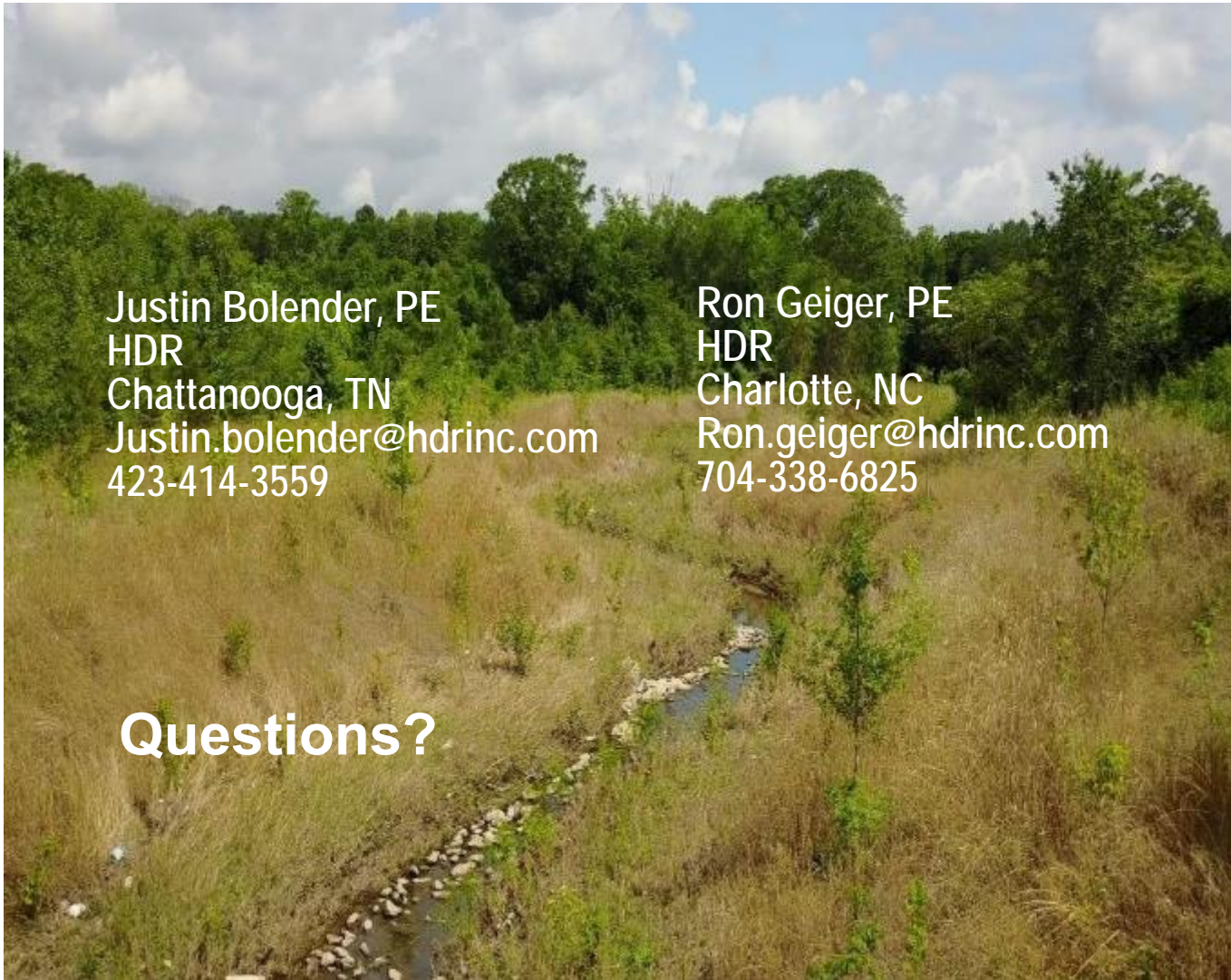
- Containerized Species
 - Tag Alder
 - Bottonbush
 - Silky Dogwood
 - Possumhaw
 - Spicebush
 - Southern Arrowwood
 - American Beautyberry
 - Ironwood
 - Flowering Dogwood
 - Which Hazel



What did we learn....

- It's never too early to coordinate with regulators on permits
 - Ask the right questions & reconfirm your discussions
- Time construction for planting in dormant season (Nov 15 thru March 15 in Chattanooga)
- Excavator with GPS makes life easy
- Awarded City of Chattanooga, Sustainability Award for 2017
- Stream restoration and stream stabilization combined can make for a successful project





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Questions?

