

# Summit Medical Urban Stream Enhancement to Stabilize a Building: Knoxville, Tennessee

Ken Barry, PE, D. WRE: Knoxville

National Stream Restoration Conference



# Thanks

- ▶ Summit Medical Group and Summit Medical Group, Deane Hill
- ▶ City of Knoxville
- ▶ Regulators
- ▶ Shamrock Environmental, Inc.
- ▶ S&ME Colleagues



# Outline

- ▶ Background
- ▶ Permitting and Design Challenges
- ▶ Construction



# Outline

- ▶ **Background**
- ▶ Permitting and Design Challenges
- ▶ Construction



# How it all began...

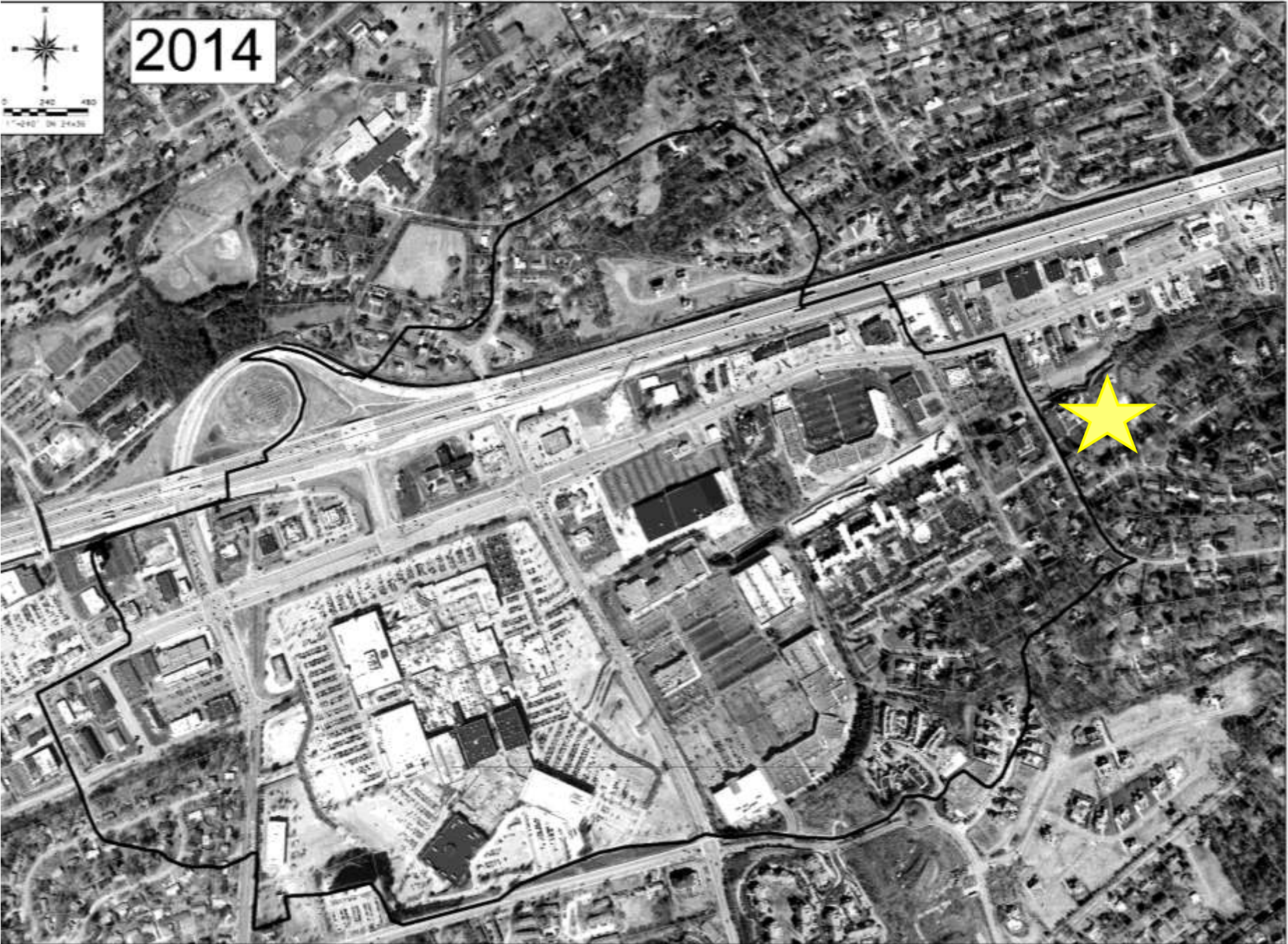


# How it all began...





2014



PROJECT FOR: SHIMMIE MEDICAL GROUP, PLLC  
SHIMMIE MEDICAL GROUP - PHYSICIAN  
DAYNE HILL, LLC  
301 W. 10TH ST., SUITE 100, IN 47134

DATE: 01-28-14

A2  
2014  
KG15



ALL THAT STORMWATER...





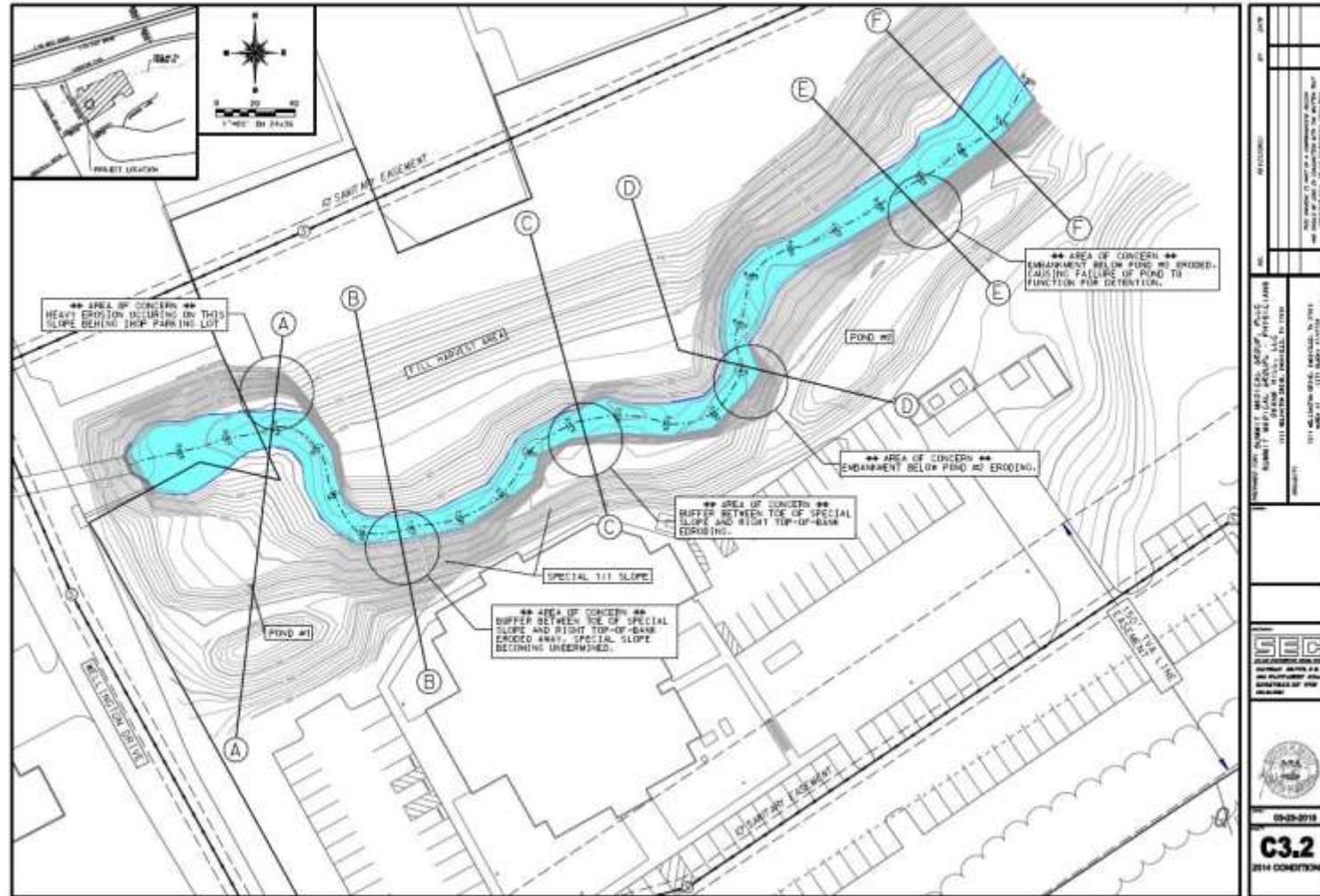
# The Result...

Knoxville's Grand Canyon

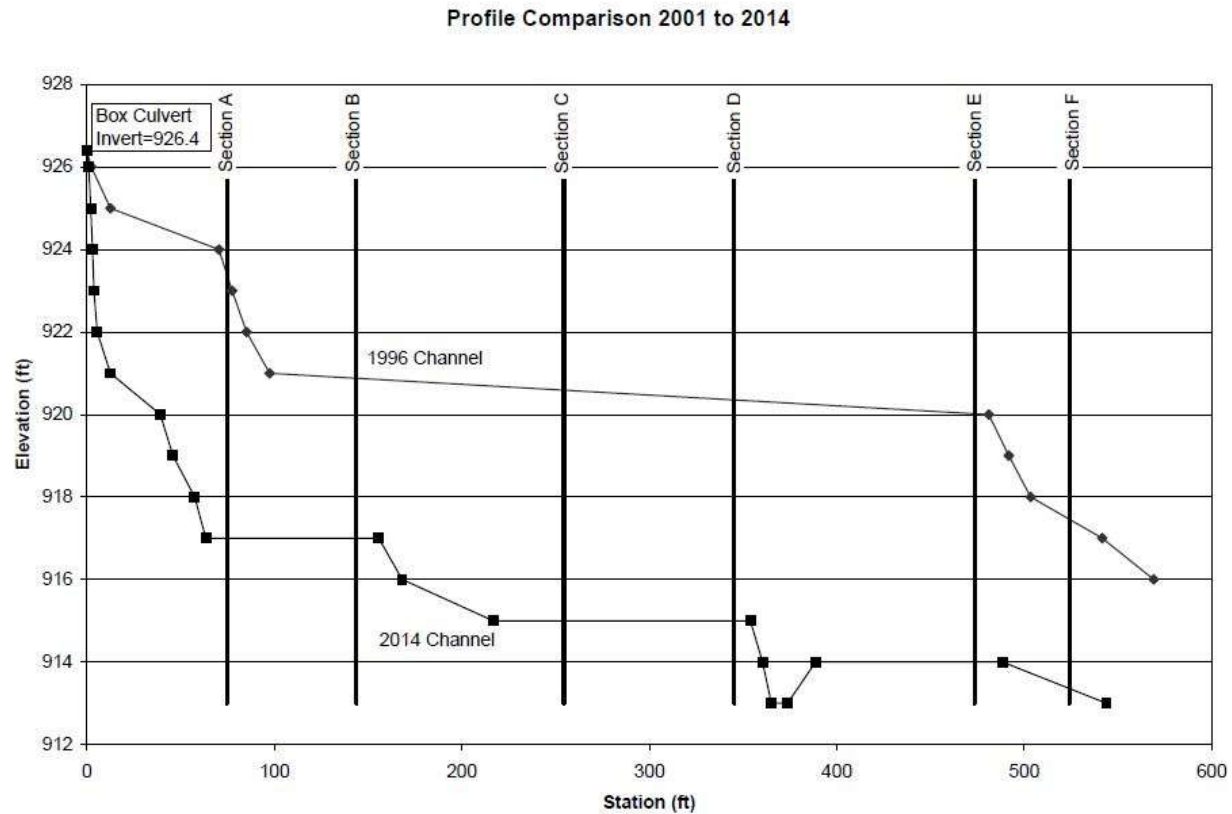




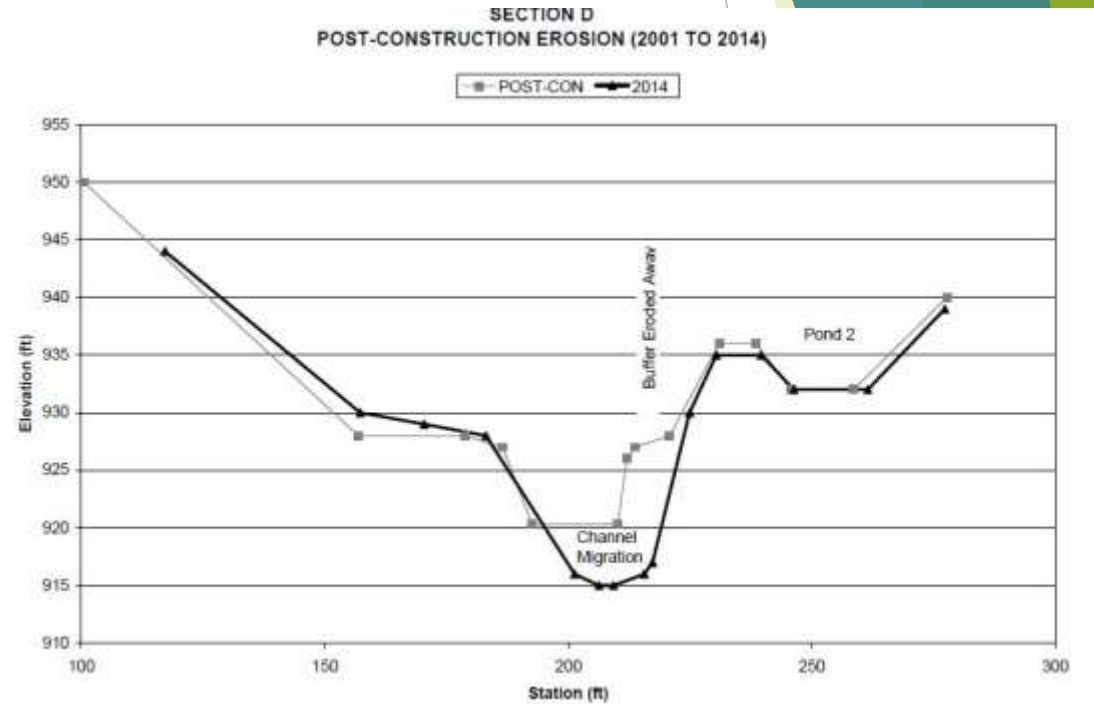
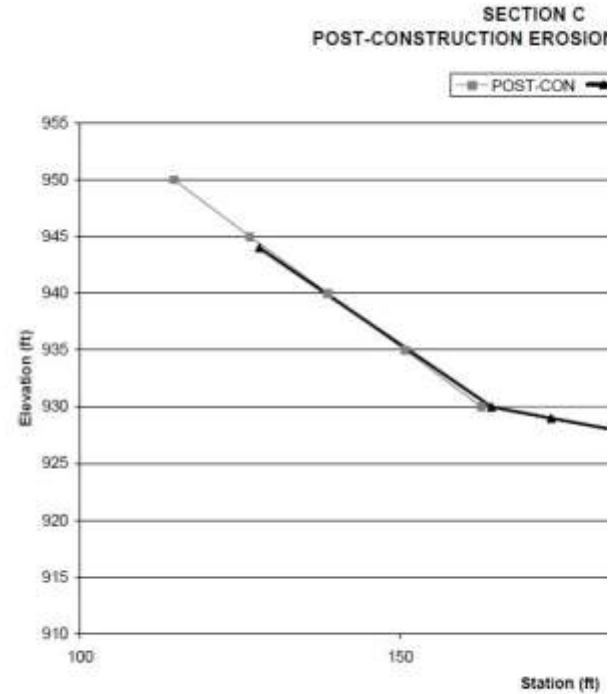
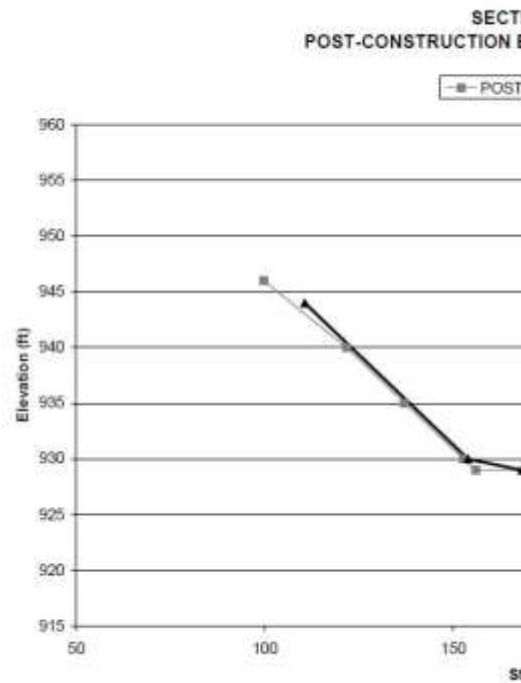
# Site Basics - Channel Migration



# Site Basics - Channel Migration



# Site Basics - Channel Migration



# Outline

- ▶ Background
- ▶ **Permitting and Design Challenges**
- ▶ Construction



# Permitting Challenges

## Two Agencies

- ❖ Tennessee Department of Environment and Conservation (TDEC)
- ❖ US Army Corps of Engineers (USACE)

Building Owner (Client) didn't create the problem, but they were forced to address it to preserve their building

## Regulatory expectations

- ❖ Additional Mitigation Requirements (> \$150,000 minimum)

National Flood Insurance Program “no-rise” required



# No. 1 Pollutant Source in the City of Knoxville

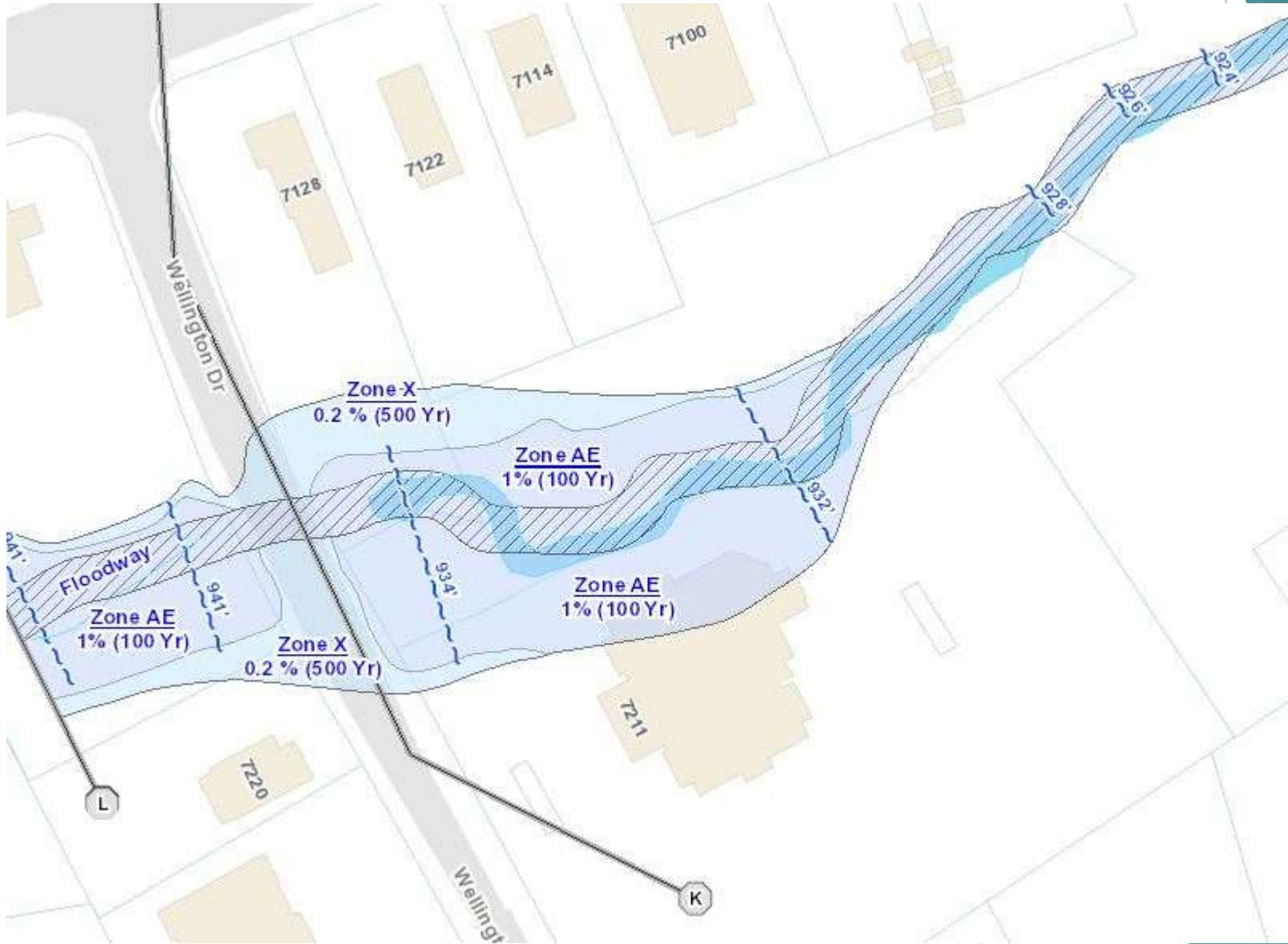




# But still a jurisdictional water..



# NFIP



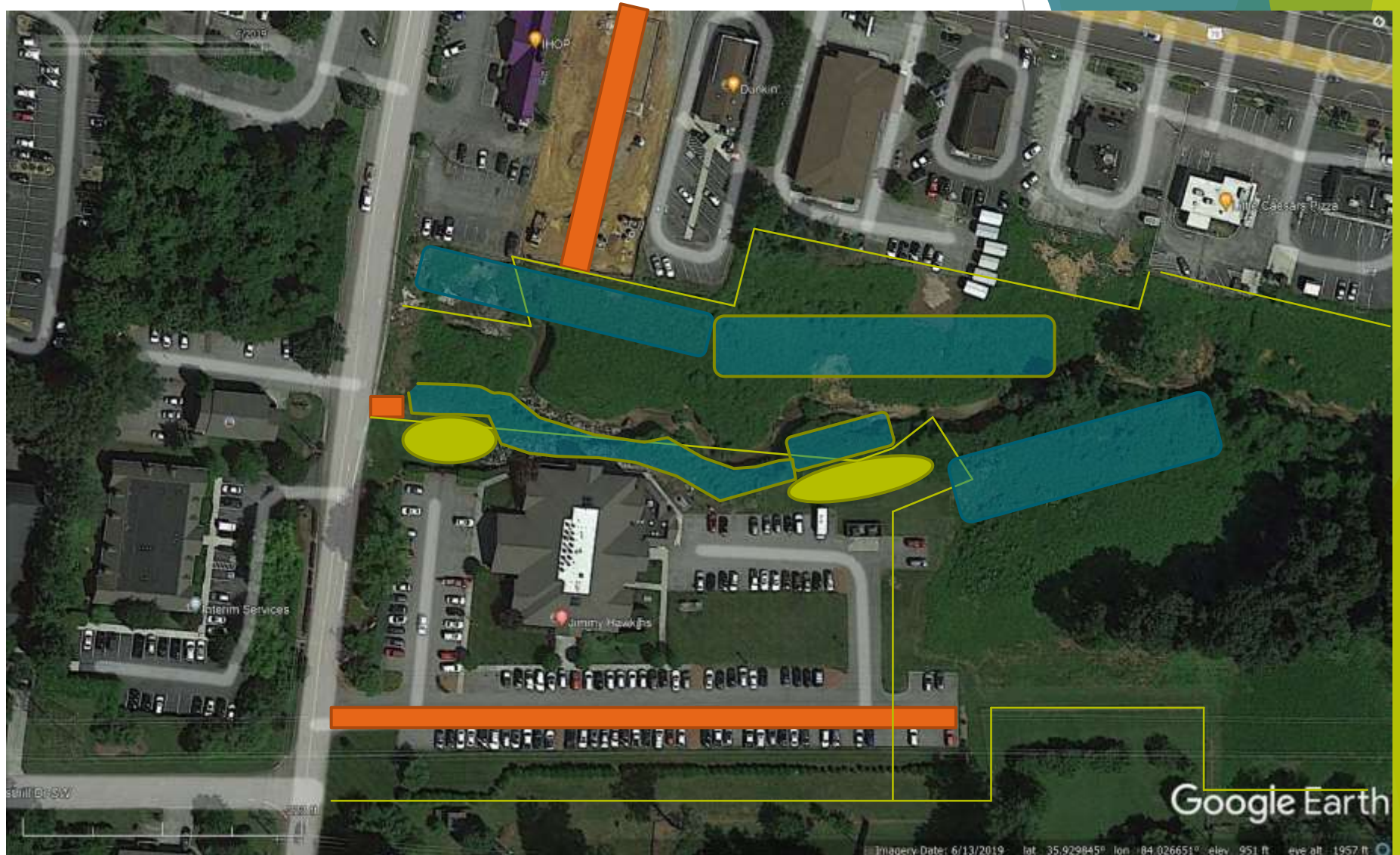
# Engineering Challenges

- ❖ Significant storm flow in an otherwise almost dry channel
- ❖ No-Rise NFIP requirement
- ❖ Geotechnical considerations
- ❖ Regulatory opposition to riprap
- ❖ Mitigation cost
- ❖ Site covered in kudzu
- ❖ Continued erosion of the bank!



# Site Constraints

- ❖ Disruption to operations
- ❖ Repair of stormwater treatment basin
- ❖ Site access and logistics
- ❖ NFIP "no rise"

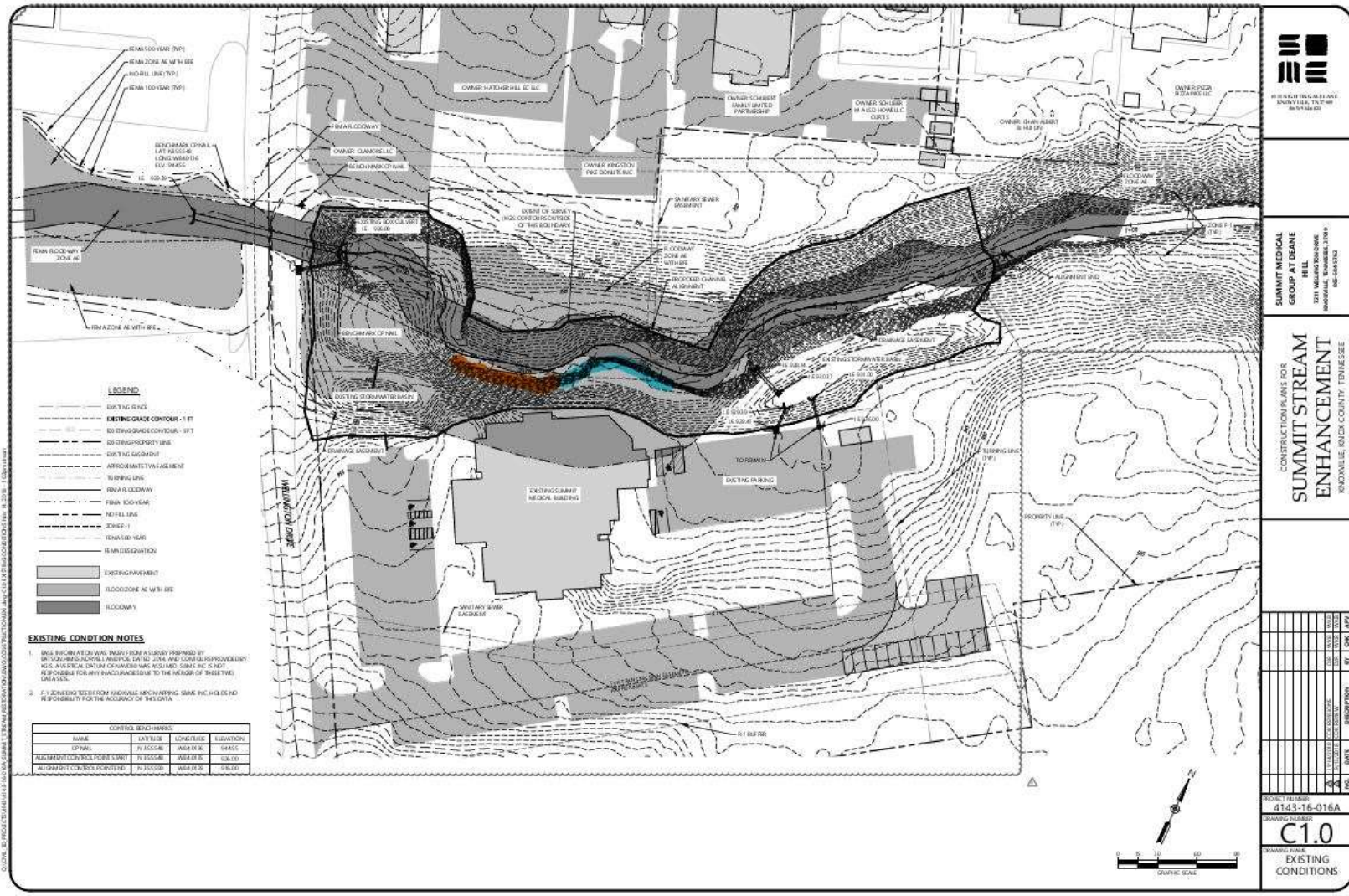


# Design

- ❖ Survey
  - Used existing from 2014
  - Filled in with KGIS LiDAR
- ❖ Geotechnical Exploration
- ❖ Alternative Analyses
- ❖ Detailed Design



# Survey



# Geotechnical Exploration

- Six Borings
- Lab Analysis
- Stability Analysis
- Alternatives
  - Soil Nails
  - Retaining Wall
  - Buttress
  
- Implemented a building monitoring program



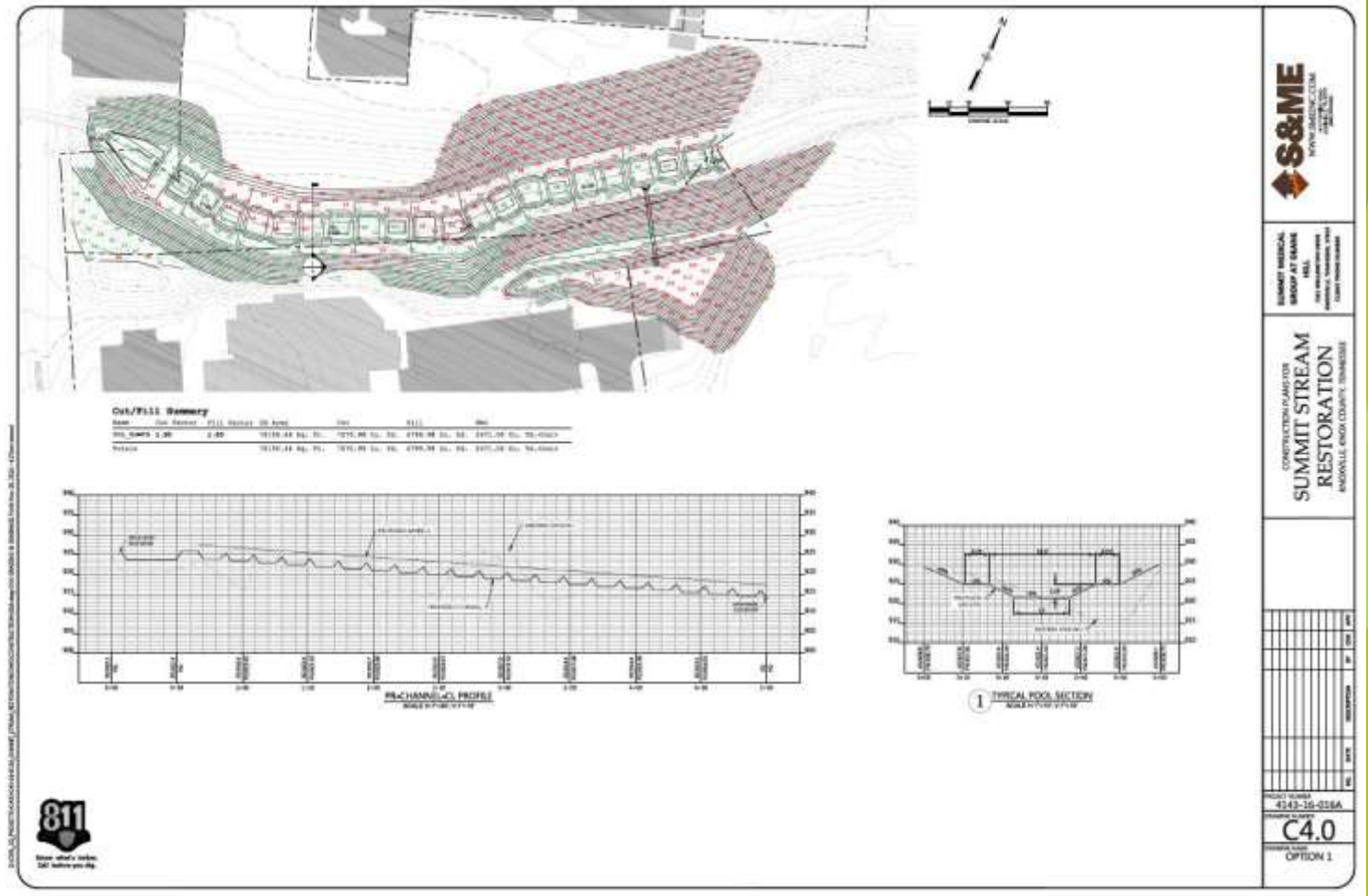
# Step Pool Option

Pros:

- Could possibly be considered for mitigation credit
- “Easy” no-rise

Cons:

- Cost
- Disruption from delivery of hundreds of truckloads of rock





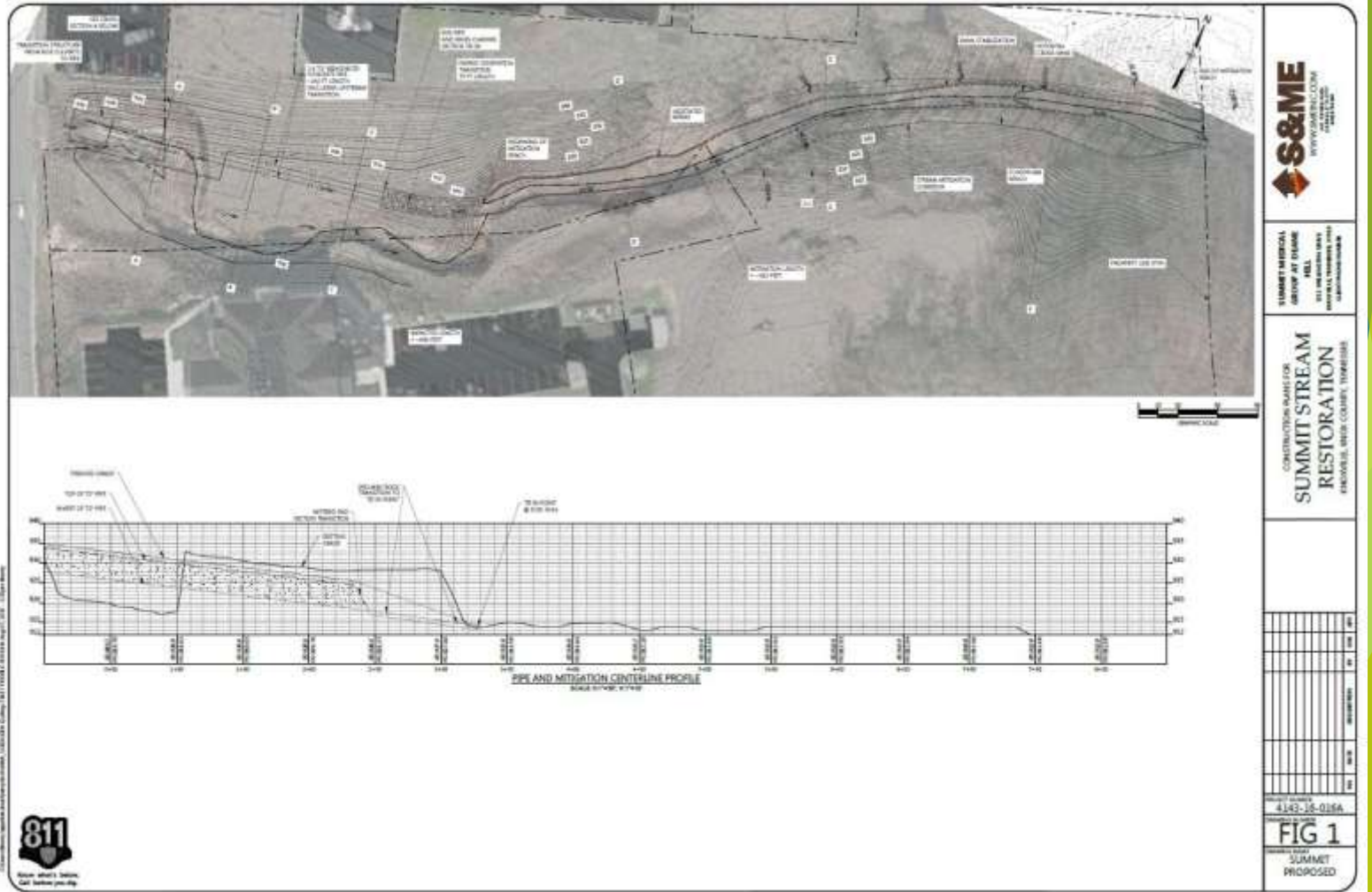
# Pipe Option 1

## Pros:

- Channel stability concerns addressed
- Possible mitigation corridor downstream of pipe

## Cons:

- Cost (3-72" dia. barrels due to no-rise considerations)
- Disruption from delivery of pipe
- Logistics of pipe placement



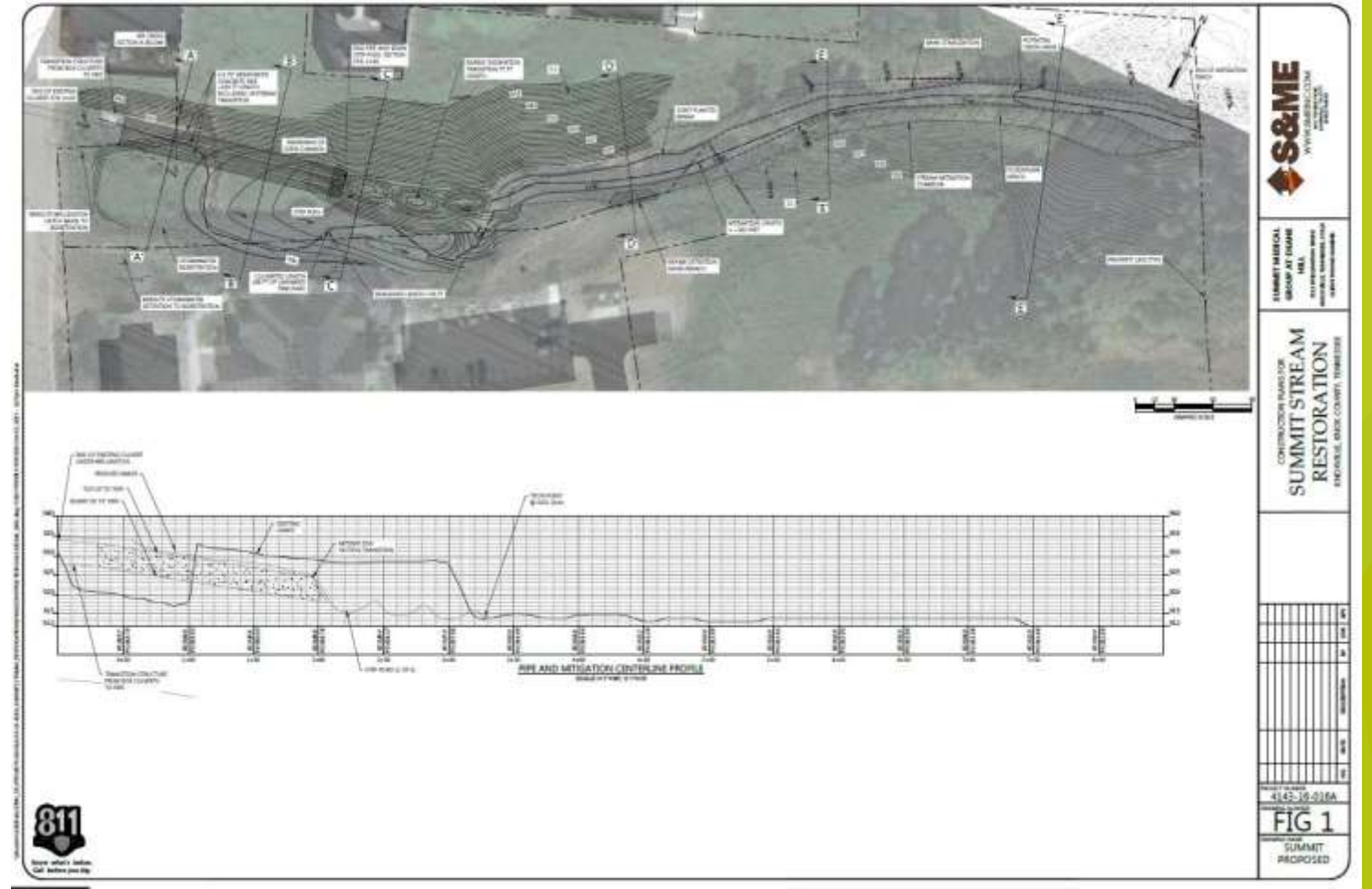
# Pipe Option 2

## Pros:

- Channel stability concerns addressed
- potential for mitigation credit downstream
- Less pipe required

## Cons:

- Cost still high
- Disruption from delivery of pipe and rock
- Logistics of material placement



# TRM Option

## Pros:

- Channel stability concerns addressed
- Potential for mitigation credit

## Cons:

- Vulnerability during grow in



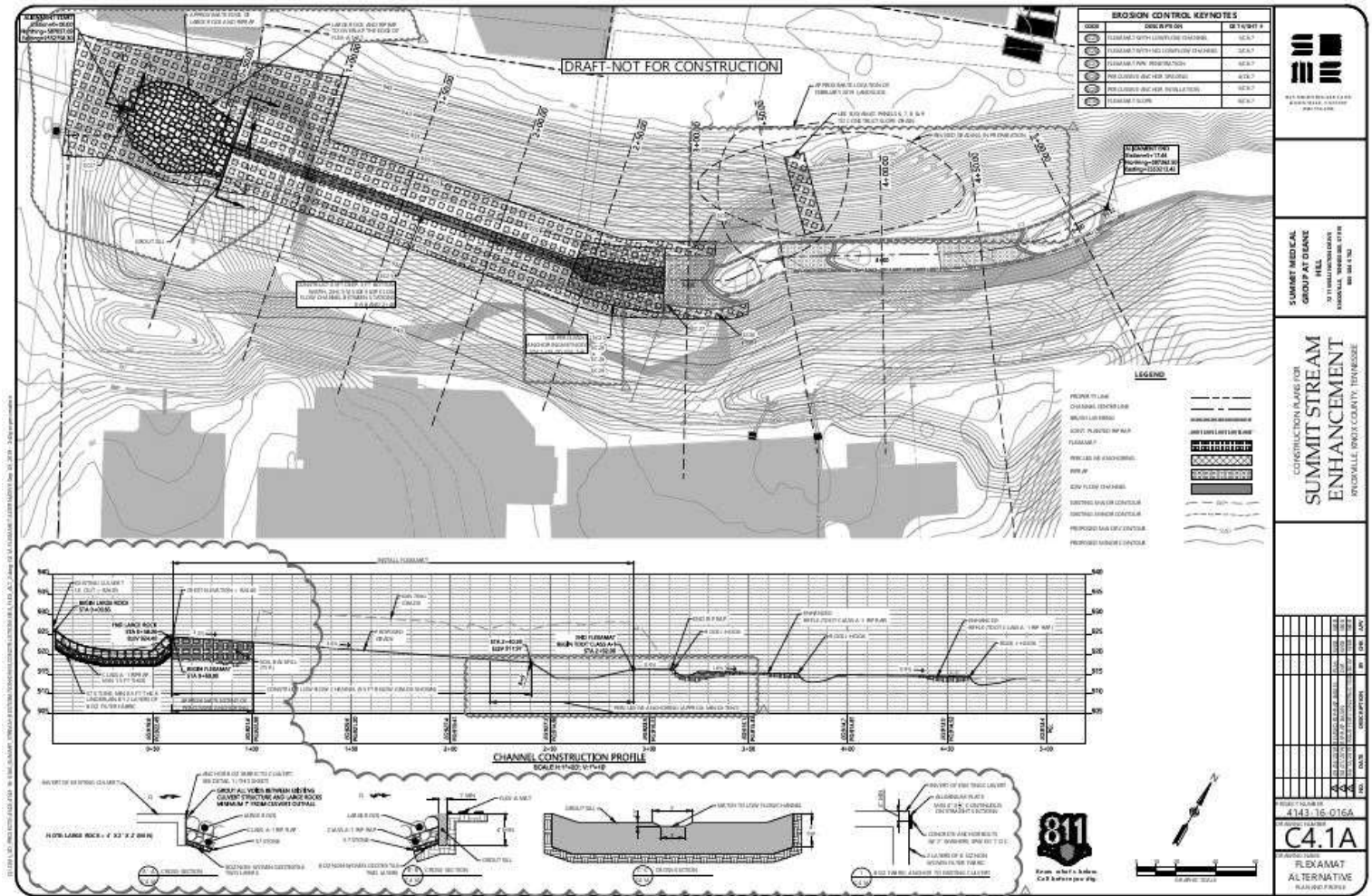
## Components:

- Riprap stilling basin
- Tied Concrete Block Mat for steep section (Flexamat®)
- Stream enhancement reach
- Bio-retention basin receives mitigation credit
- Bionic soil enhancement medium/high performance hydraulic mulch (Profile ProFlex®)

## Pros:

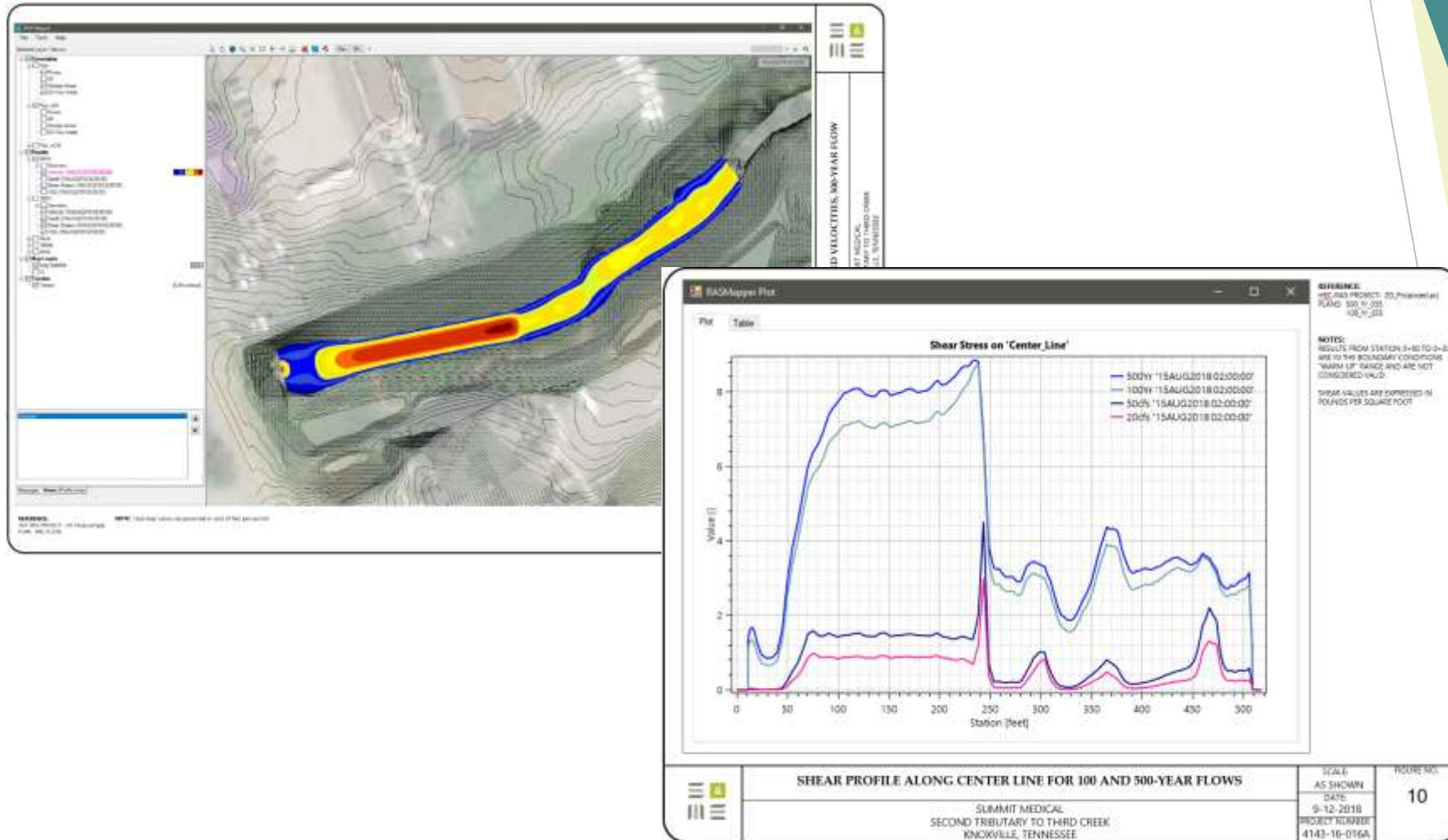
- Channel stability concerns addressed
- Full mitigation credit on site
- Minimize disruption from deliveries

# Constructed Alternative

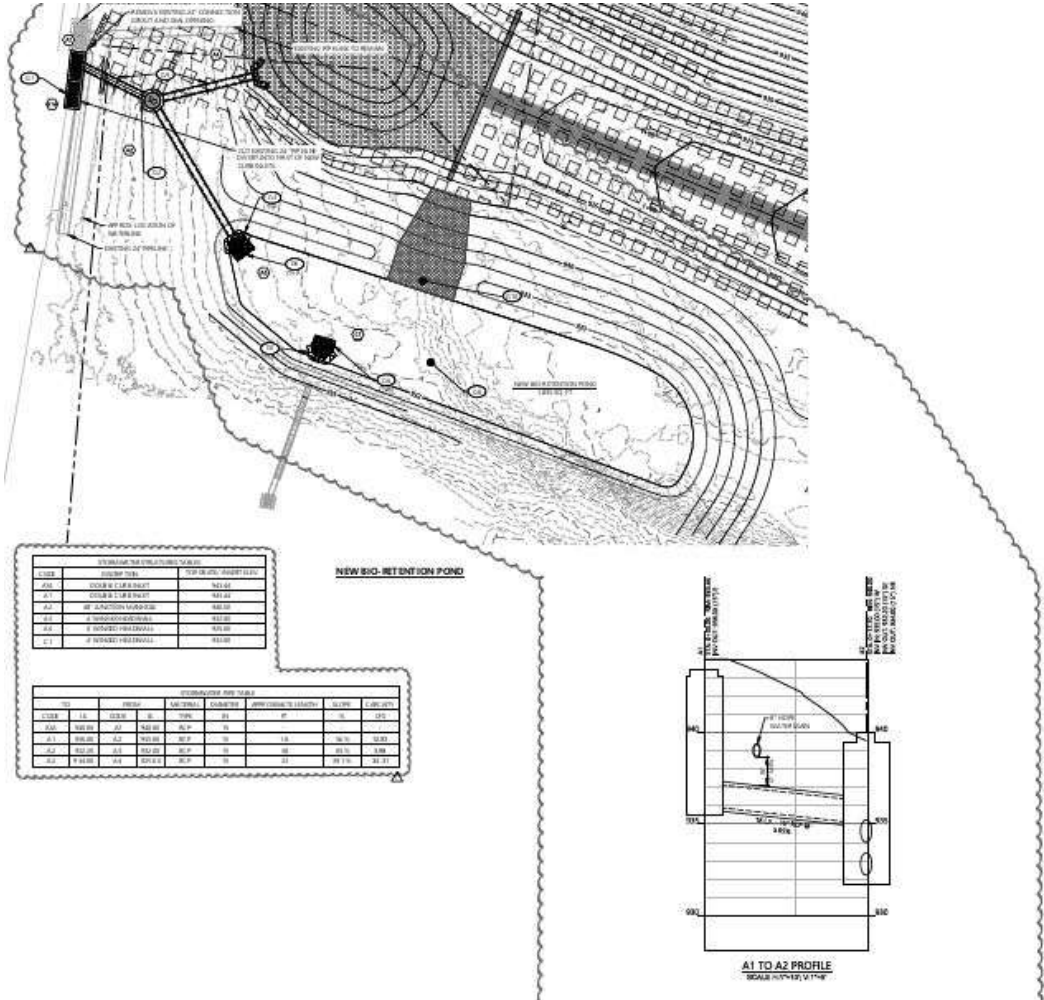


# Engineering Challenges

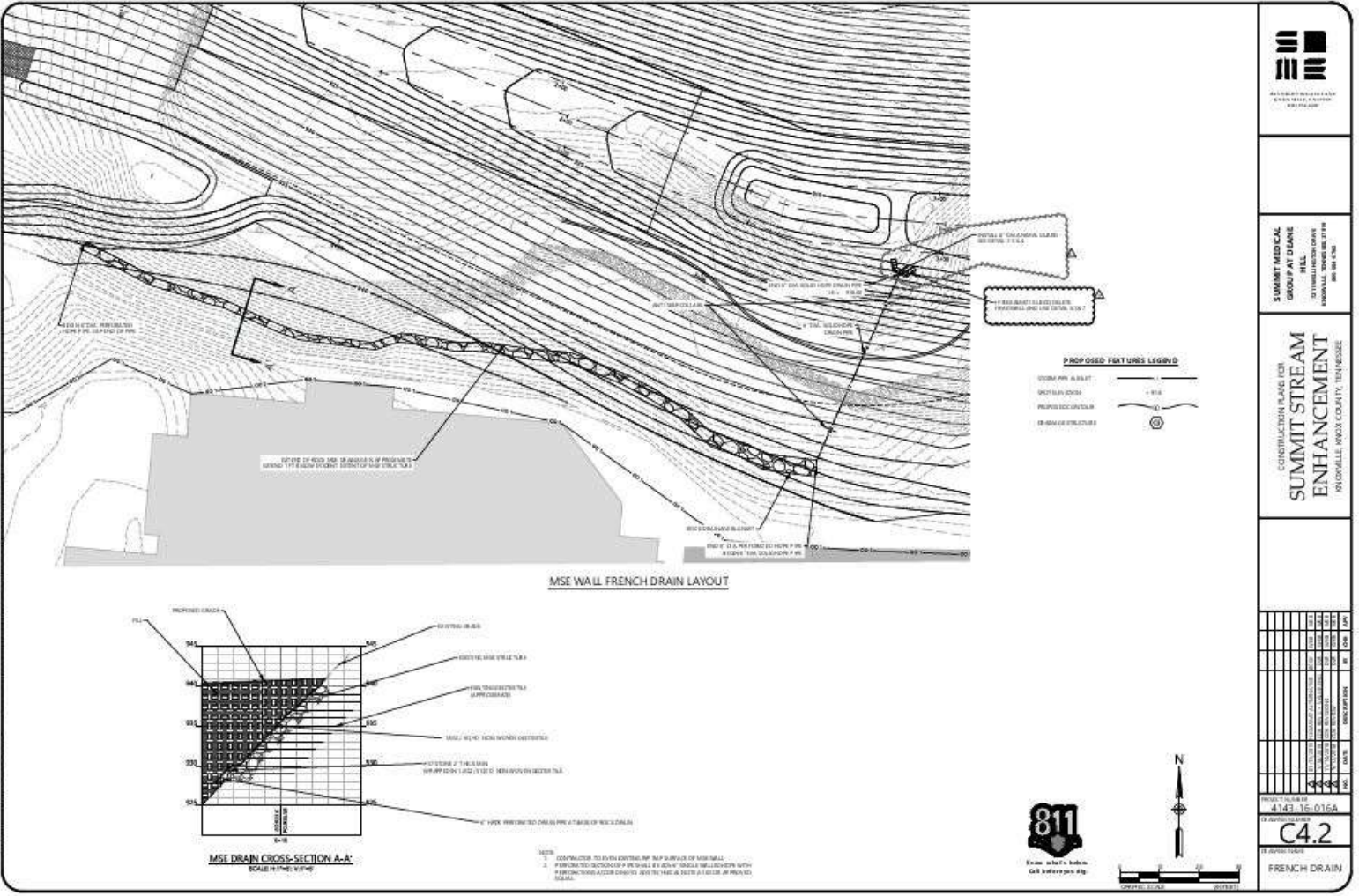
- ❖ 20 calculations for hydrology, hydraulics, geotech, cost, erosion control, detention basins, rock sizing, mitigation credit, etc.



# Bio-Retention Area



# French Drain



**SUMMIT MEDICAL GROUP AT DIANE HILL**  
11111 SUMMIT HILL DRIVE  
KNOXVILLE, TENNESSEE 37921  
800.848.1111

**CONSTRUCTION FLAG FOR SUMMIT STREAM ENHANCEMENT**  
KNOXVILLE, KNOX COUNTY, TENNESSEE

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PROJECT NUMBER: 4143-16-016A  
DRAWING NUMBER: C4.2

FRENCH DRAIN

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# Site Logistics



# Stormwater Bypass



# Lots of Precast



# Unknown Conflicts



# Landslide above Enhancement Reach



# Delete French Drain



# Flexamat®



# Anchor Trench and Flexamat Staged





# First Deployment



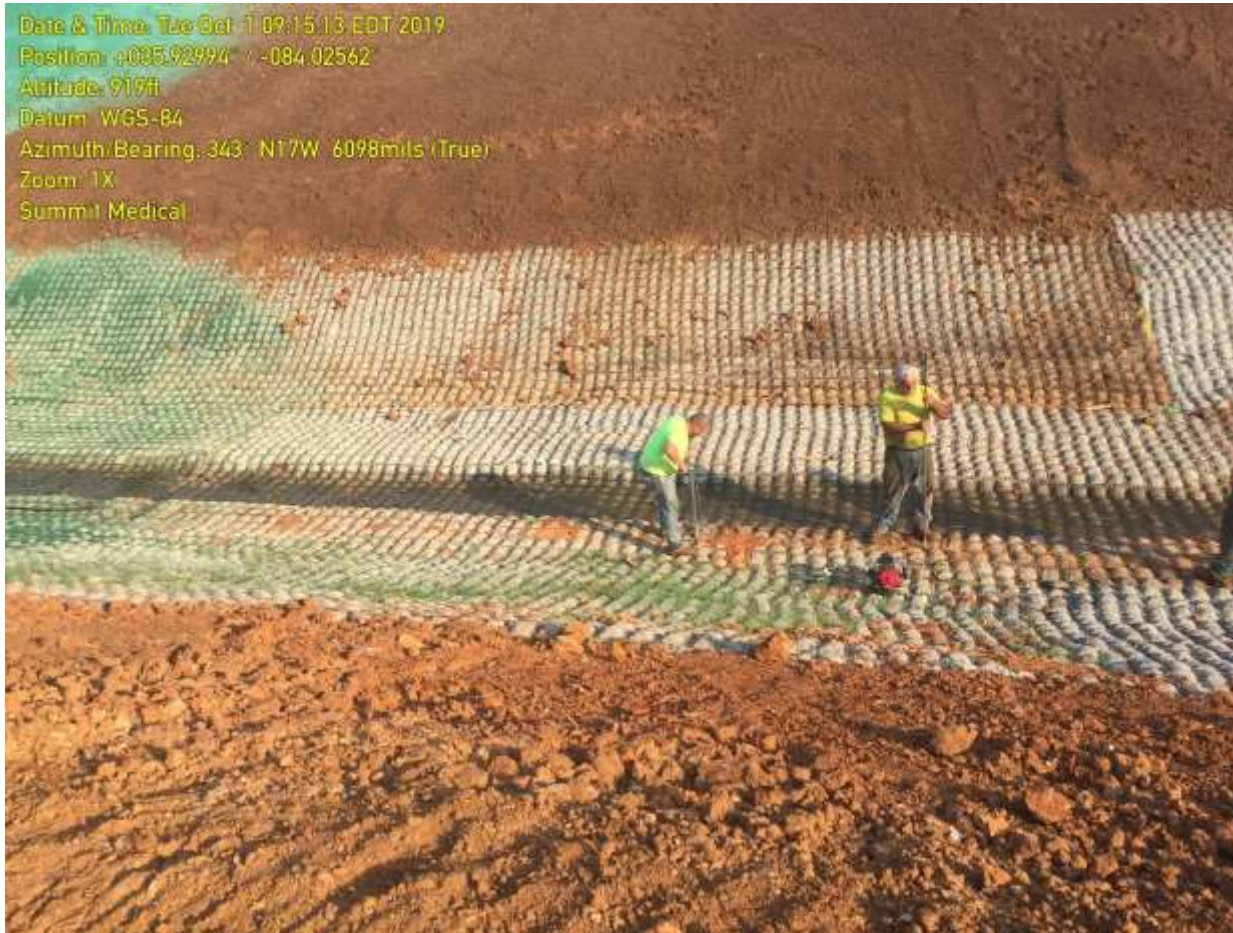
# Second Deployment



# Third Deployment



# Installing Anchors



# Cross Plate Anchor



# General View of Construction

Sept. 18, 2019



# Proganics® /Flexterra®



# Proganics® /Flexterra®

## ProGanics™ Calculator

Use the ProGanics™ Calculator to discover the possible cost savings ProGanics BSM can offer when used in place of Topsoil or Compost.



[VIEW CALCULATOR](#)





# ProFlex®

Date & Time: Fri Aug 16 12:28:23 EDT 2019  
Position: +035.92990° / -084.02450°  
Altitude: 951ft  
Datum: WGS-84  
Azimuth/Bearing: 341° N19W 6062mils (True)  
Zoom: 1X  
Summit



# ProFlex®

Date & Time: Mon Nov 25 11:33:52 EST 2019

Position: 035° 55' 47.7" N / 084° 01' 30.3" W

Altitude: 289m

Datum: WGS-84

Azimuth/Bearing: 034° N34E 0604mils (True)

Zoom: 1X

SR-174



# ProFlex®

Date & Time: Mon Sep 30 16:35:49 EDT 2019  
Position: +035.92975° / -084.02582°  
Altitude: 947ft  
Datum: WGS-84  
Azimuth/Bearing: 342° N18W 6080mils (True)  
Zoom: 1X  
Summit Medical



# ProFlex® - Nov 25, 2019

Date & Time: Mon Nov 25 17:08:30 EST 2019  
Position: 035°55'47.6"N / 084°01'35.6"W  
Altitude: 286m  
Datum: WGS-84  
Azimuth/Bearing: 087° N87E 1547mils (True)  
Zoom: 1X  
SR=174



# ProFlex® -Jan 16, 2020



# ProFlex® -April 20, 2020



June 24, 2022



June 24, 2022





July 18, 2022



# On Reflection

- ▶ A contractor experienced in this work is crucial.
- ▶ Alternative Project Delivery Option.
- ▶ An up-to-date survey would have been helpful.
- ▶ New technologies helped in achieving project goals.



# Questions



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