

Penn Branch Improvement Project

An Ultra Urban Stream Stabilization Project



What to Discuss?

- Modeling and FEMA Floodway
- Stream Stabilization Design
- Constructability and Access
- Public Engagement and Covid
- Emergency Break Out Projects
- Permitting



Let's Look at The Good, The Bad, and The Ugly

Let's Set the Scene



The Project

- Develop the hydrology and hydraulics
- Design alternatives to repair or replace failing masonry walls and for natural stream bank stabilization
- Final design, permitting, easements and preparation of construction and bid documents



Project Limits

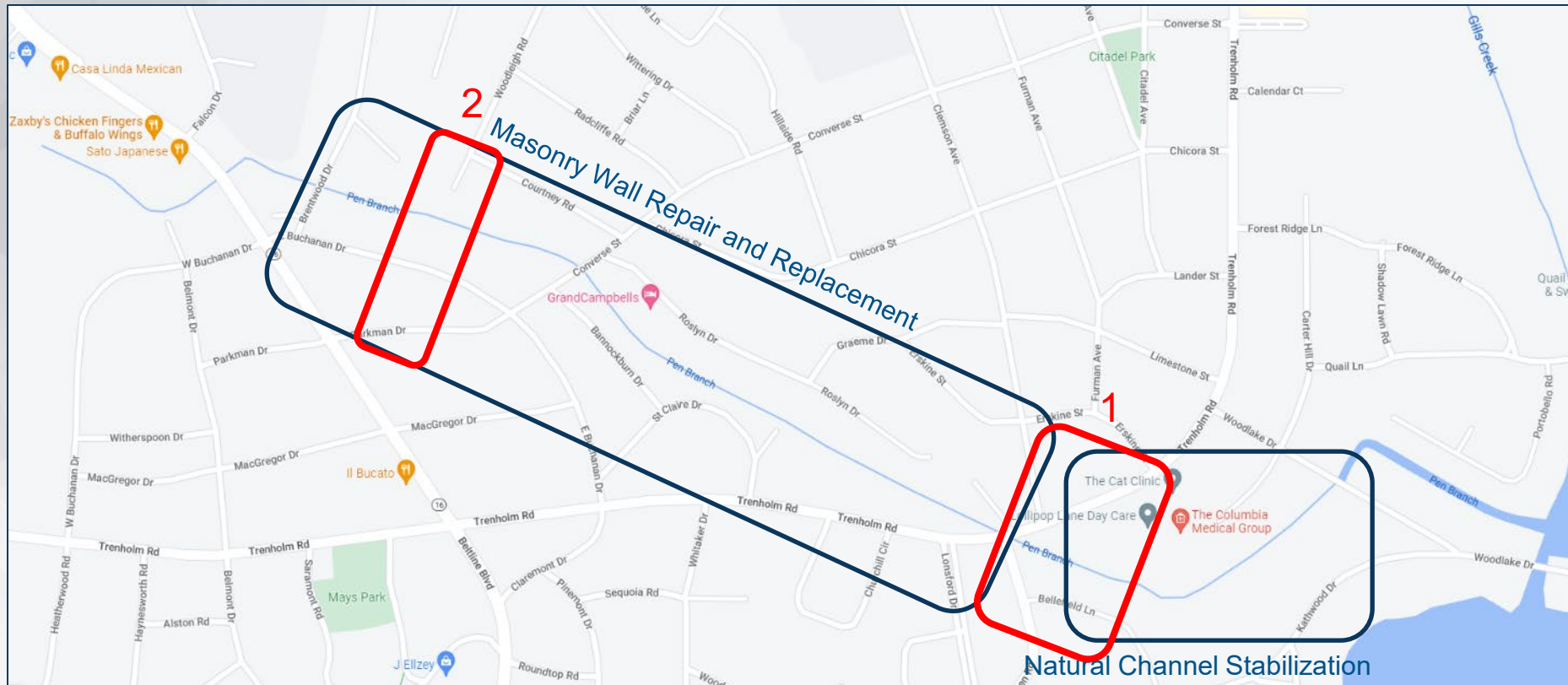
1 Project became 3 Projects



EMERGENCY PACKAGE 1 & 2



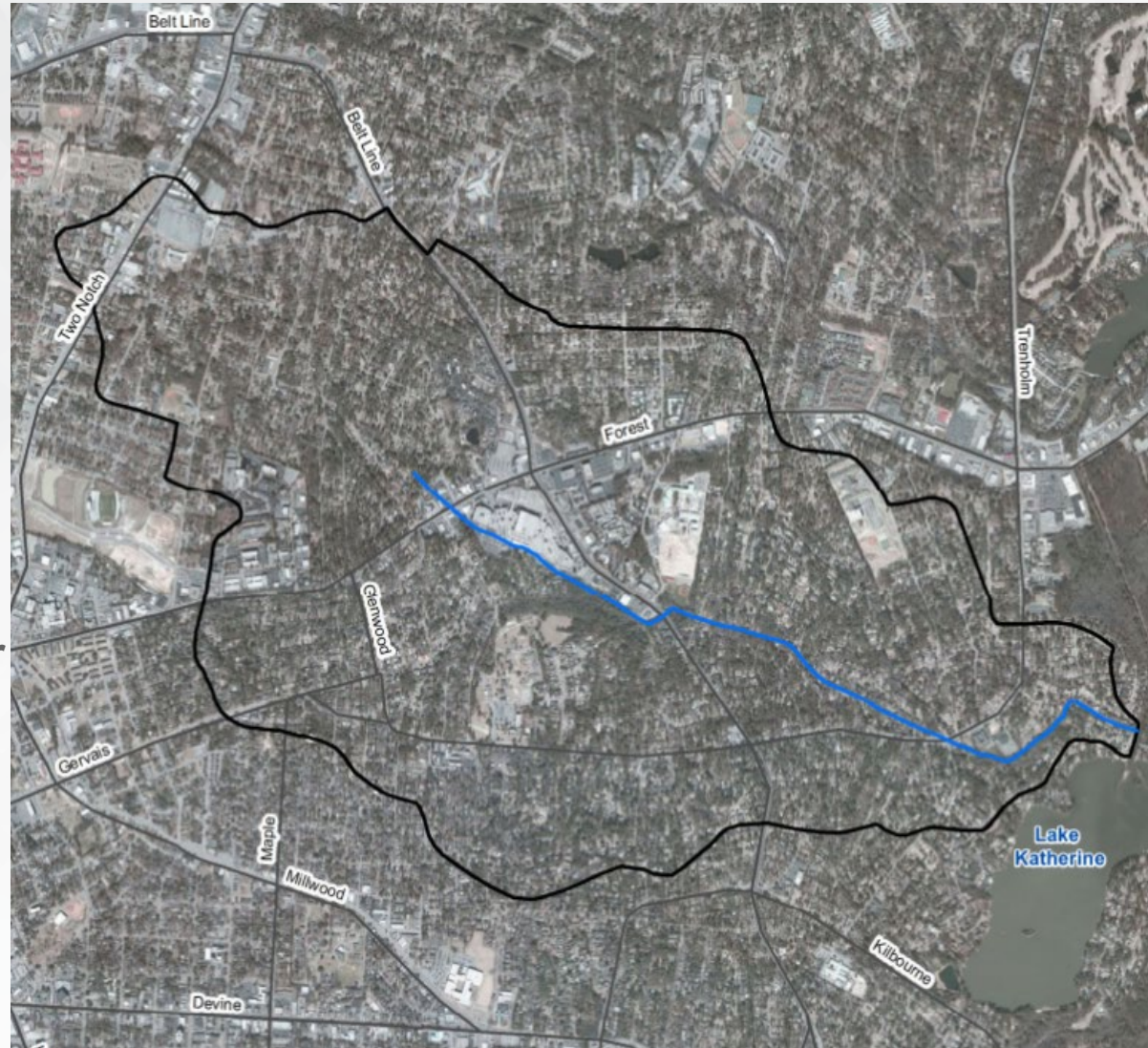
ADVERTISED BID PACKAGE



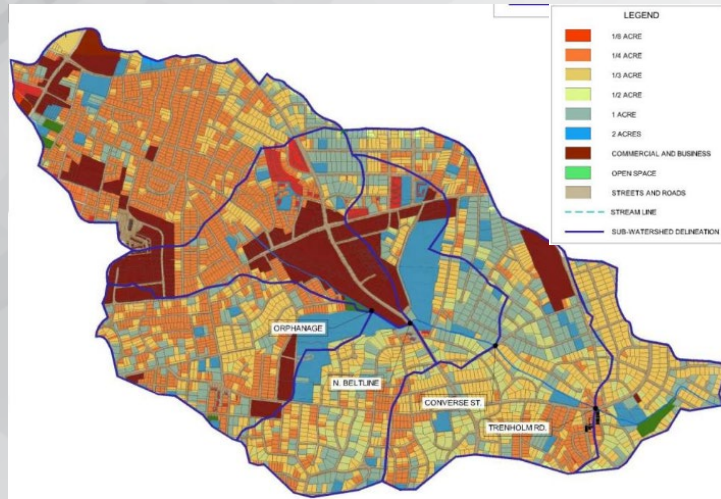
6,000 LF of Channel: 4,500 Walled; 1,500 Natural Bank

The Watershed

- Originates within the City of Forest Acres
- Drainage area is 3.14 square miles
- Approximately 8,000 feet long, of which 6,500 feet are within the City of Columbia
- Discharges into Lake Katherine just south of Woodlake Drive
- Approximately 4,500 linear feet of stacked cement masonry walls (old sidewalk panels)
- Remainder of channel is steep earthen banks
- Falls within FEMA Special Flood Hazard Zone

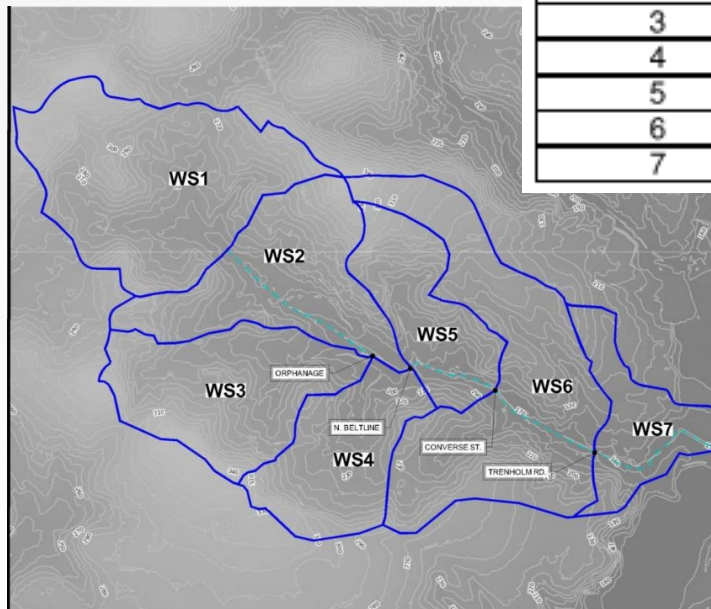
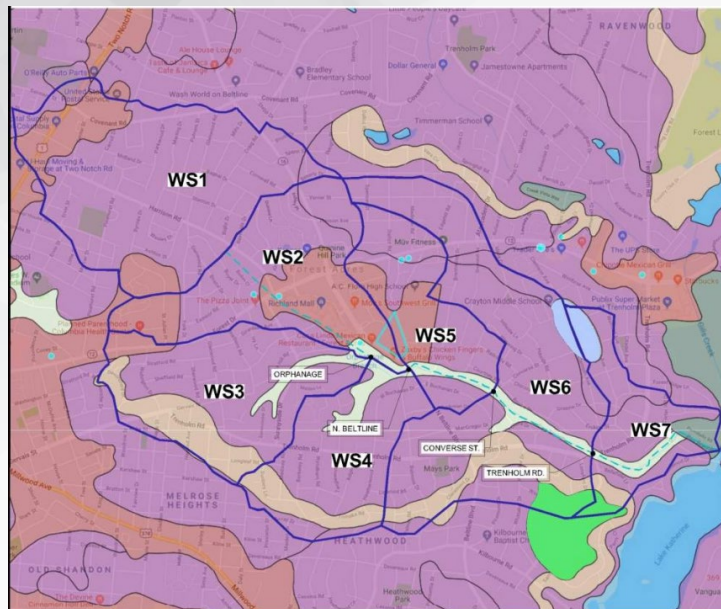


Project Hydrology



	Peak Discharges						
Junction Locations	2-yr (cfs)	5-yr (cfs)	10-yr (cfs)	25-yr (cfs)	50-yr (cfs)	100-yr (cfs)	500-yr (cfs)
Lake Katherine	2189	3040	3812	4875	5760	6740	9652
Trenholm Rd.	2119	2922	3642	4642	5466	6378	9093
Converse	1693	2332	2905	3696	4342	5070	7214
Beltline Blvd.	1553	2117	2623	3321	3892	4525	6415

Sub-Watershed Areas	
Sub-Watershed	Area (acres)
1	148.6
2	461.2
3	181.5
4	211.4
5	286.3
6	289.0
7	451.9



The Assessment



The Ugly: Masonry Wall Assessment



The Ugly: Masonry Wall Assessment

Photo No: 3612A Location: Sta 16+75 Right Wall Direction: Downstream Description: 36" from top of original wall toe protection to stream bank due to stream bottom erosion downstream of culvert under Brentwood Drive.		Photo No: 3612B Location: Sta 16+75 Left Wall Direction: Downstream Description: Undermining of 20 ft of wall downstream of culvert under Brentwood Drive.	
Repair Priority: 2		Repair Priority: 2	
Photo No: 3612H Location: Sta 16+75 Right Wall Direction: Downstream Description: Undermining of 20 ft of wall. Large cracks full height of wall downstream of culvert under Brentwood Drive.		Photo No: 3612K (Defect 3613) Location: Sta 16+75 Left Wall Direction: Downstream Description: Concrete slope protection failure. Large cracks and broken pieces in stream channel.	
Repair Priority: 2		Repair Priority: 3	

The Ugly: Masonry Wall Assessment



The Ugly: Masonry Wall Assessment

Photo No:
4015A
Location:
Sta 21+10
Right Wall
Direction:
Downstream
Description:
Undermining of 60 ft of
wall.



Repair Priority: 2

Photo No:
4016A
Location:
Sta 21+60
Right Wall
Direction:
Downstream
Description:
Continuous
undermining from
location 4015.



Repair Priority: 2

Photo No:
4018C
Location:
Sta 22+50
Right Wall
Direction:
Downstream
Description:
Overgrowth of
vegetation in stream
channel for 40 ft.



Repair Priority: 3

Photo No:
4018B
Location:
Sta 22+50
Right Wall
Direction:
Downstream
Description:
Large crack in wall for
full height of wall.
Undermining for 15 ft
of wall.



Repair Priority: 2

The Ugly: Masonry Wall Assessment

5049 Courtney Rd.



+50

24+00

+50

25+00

+50

26+00

+50

27+00

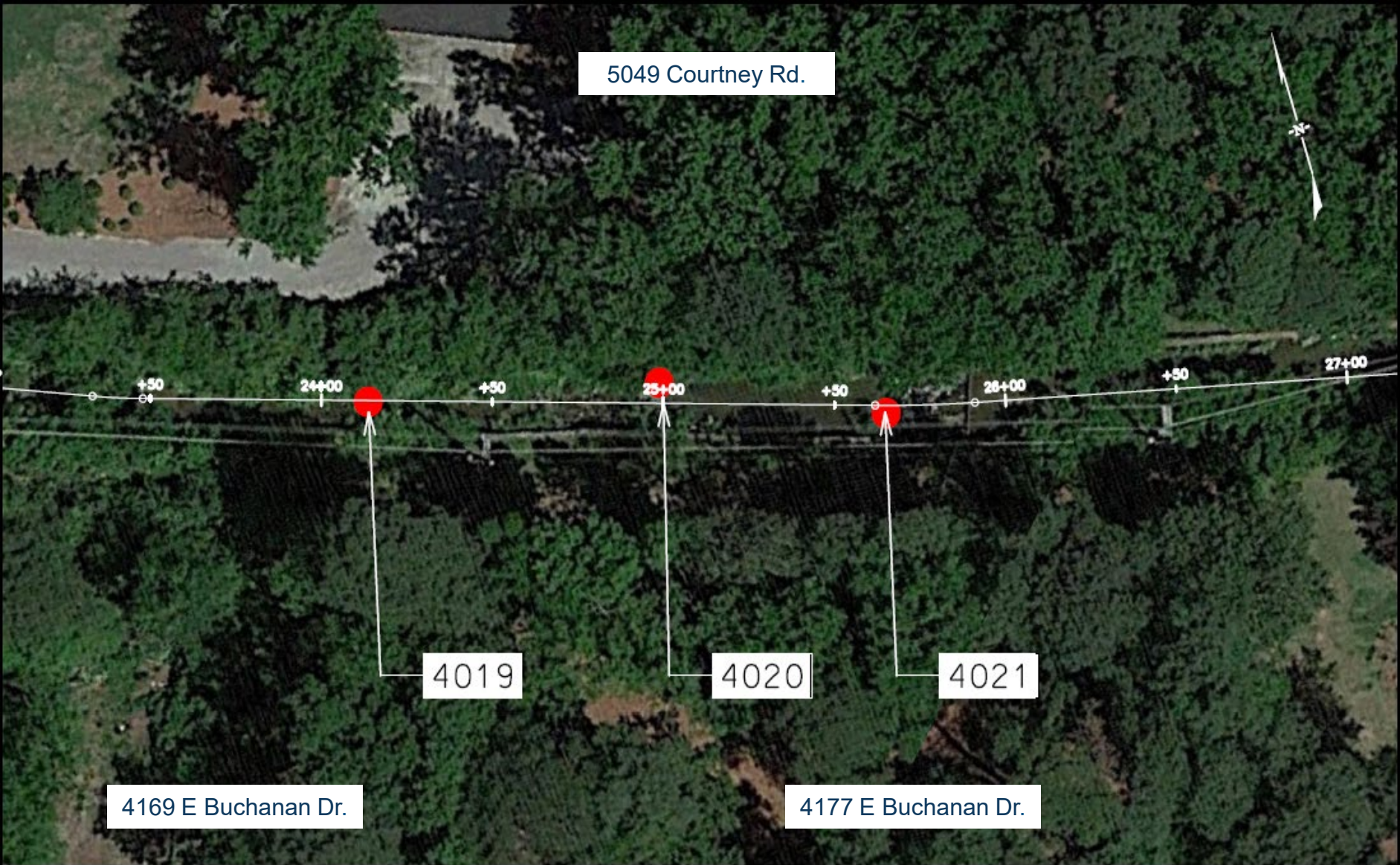
4019

4020

4021

4169 E Buchanan Dr.

4177 E Buchanan Dr.



The Ugly: Masonry Wall Assessment

Photo No:
4019C

Location:
Sta 24+15
Right Wall

Direction:
Downstream

Description:
Undermining of wall
for 25 ft.

Repair Priority: 2



Photo No:
4021A

Location:
Sta 25+60
Left Wall

Direction:
Downstream

Description:
Exposed utility and
debris build-up.
Undermining for 10 ft
of wall.

Repair Priority: 2



Photo No:
4020D

Location:
Sta 25+00
Right Wall

Direction:
Downstream

Description:
Undermining of wall
for 20 ft.

Repair Priority: 2



Photo No:
4021B

Location:
Sta 25+60
Right Wall

Direction:
Downstream

Description:
Exposed utility. Local
undermining of pipe
support.

Repair Priority: 2



The Ugly: Masonry Wall Assessment



The Ugly: Masonry Wall Assessment

Photo No:
4022A

Location:
Sta 27+40
Right Wall

Direction:
Downstream

Description:
Undermining for 30 ft
of wall.



Repair Priority: 2

Photo No:
4023D

Location:
Sta 29+20
Right Wall

Direction:
Downstream

Description:
Undermining of 40 ft of
wall.



Repair Priority: 2

The Ugly: Masonry Wall Assessment



The Ugly: Masonry Wall Assessment

Photo No: 4024A Location: Sta 32+30 Left Wall Direction: Downstream Description: Wall failure. Undermining of wall for 100 ft downstream of concrete stream bottom protection		Photo No: 4024H Location: Sta 32+30 Left Wall Direction: Upstream Description: Wall failure. Undermining of wall for 100 ft downstream of concrete stream bottom protection	
Repair Priority: 1		Repair Priority: 1	
Photo No: 4024D Location: Sta 32+30 Left Wall Direction: Downstream Description: Wall failure. Undermining of wall for 100 ft downstream of concrete stream bottom protection.		Photo No: 4024I Location: Sta 32+30 Left Wall Direction: Upstream Description: Wall failure. Undermining of wall for 100 ft downstream of concrete stream bottom protection	
Repair Priority: 1		Repair Priority: 1	

The Ugly: Masonry Wall Assessment

Photo No: 4024J Location: Sta 32+30 Left Wall Direction: Upstream Description: Wall failure. Undermining of wall for 100 ft downstream of concrete stream bottom protection		Photo No: 4027A Location: Sta 34+00 Right Wall Direction: Downstream Description: Undermining of 30 ft of wall both sides after check dam.	
Repair Priority: 1		Repair Priority: 2	
Photo No: 4025D Location: Sta 32+35 Right Wall Direction: Upstream Description: Undermining of wall for 100 ft downstream of concrete stream bottom protection.		Photo No: 4027B Location: Sta 34+00 Both Walls Direction: Downstream Description: Undermining of 30 ft of wall both sides after check dam.	
Repair Priority: 2		Repair Priority: 2	

The Ugly: Masonry Wall Assessment



The Ugly: Masonry Wall Assessment

Photo No: 3614E		Photo No: 3614B	
Location: Sta 36+75 Right Wall		Location: Sta 36+75 Both Walls	
Direction: Downstream		Direction: Downstream	
Description: Undermining of 10 ft of wall below stormwater outfall..		Description: Exposed utility with debris build-up.	
Repair Priority: 2		Repair Priority: 3	

Photo No: 4029B	
Location: Sta 37+00 Right Wall	
Direction: Downstream	
Description: Wall failure along 10ft. of wall. Large crack in wall for full height with undermining for 20 ft of wall.	
Repair Priority: 1	

The Ugly: Masonry Wall Assessment

Photo No: 4029D Location: Sta 37+00 Right Wall Direction: Upstream Description: Wall failure along 10ft. of wall. Large crack in wall for full height with undermining for 20 ft of wall.		Photo No: 4031B Location: Sta 37+50 Right Wall Direction: Upstream Description: Undermining for 40 ft of wall.	
Repair Priority: 1		Repair Priority: 2	
Photo No: 4030C Location: Sta 37+20 Right Wall Direction: Description: Large crack in wall for full height with undermining for 20 ft of wall.		Photo No: 4031E Location: Sta 37+50 Right Wall Direction: Downstream Description: Undermining for 40 ft of wall.	
Repair Priority: 2		Repair Priority: 2	

The Ugly: Masonry Wall Assessment

Photo No:
4032A

Location:
Sta 37+ 75
Right Wall

Direction:
Downstream

Description:
Undermining for 30 ft
of wall.

Repair Priority: 2



Photo No:
4032G

Location:
Sta 37+75
Right Wall

Direction:
Downstream

Description:
Large crack for full
height of wall.
Undermining for 30 ft
of wall.

Repair Priority: 2



Photo No:
4032B

Location:
Sta 37+75
Left Wall

Direction:
Downstream

Description:
Wall failure for 20ft.
Riprap placed to
stabilize bank.

Repair Priority: 1



Photo No:
4033A

Location:
Sta 40+25
Left Wall

Direction:
Downstream

Description:
Large crack for full
height of wall.
Undermining for 70 ft
of wall.

Repair Priority: 2



The Ugly: Masonry Wall Assessment



The Ugly: Masonry Wall Assessment

Photo No: 4034A	
Location: Sta 41+75 Right Wall	
Direction: Downstream	
Description: Undermining for 50 ft of wall.	
Repair Priority: 2	
Photo No: 4035A	
Location: Sta 43+05 Left Wall	
Direction: Downstream	
Description: Wall failure for 50 ft.	
Repair Priority: 1	

The Ugly: Masonry Wall Assessment



The Ugly: Masonry Wall Assessment

Photo No: 4036A

Location:
Sta 46+75
Right Wall
Direction:
Upstream
Description:
Undermining for 20 ft
of wall.



Repair Priority: 2

Photo No: 4037D

Location:
Sta 47+30
Right Wall
Direction:
Downstream
Description:
Undermining of
stormwater apron. Wall
Failure above pipe.



Repair Priority: 1

Photo No:
4037F

Location:
Sta 47+30
Left Wall
Direction:
Upstream
Description:
Wall Bulging over 20
ft. Soil behind wall
subsiding. Trees
leaning over wall.



Repair Priority: 2

Photo No:
4038A

Location:
Sta 47+50
Left Wall
Direction:
Downstream
Description:
Undermining of 15 ft
of wall.



Repair Priority: 2

The Ugly: Masonry Wall Assessment



The Ugly: Masonry Wall Assessment

Photo No: 4040C	
Location: Sta 51+00 Left Wall	
Direction: Downstream	
Description: Overgrowth of vegetation for 100 ft of wall.	
Repair Priority: 3	

Photo No: 4041A	
Location: Sta 51+75 Right Wall	
Direction: Downstream	
Description: Undermining of 30 ft of wall.	
Repair Priority: 2	

The Ugly: Masonry Wall Assessment



The Ugly: Masonry Wall Assessment

Photo No:
4042A
Location:
Sta 54+15
Right Wall
Direction:
Upstream
Description:
Undermining for 40 ft
of wall.

Repair Priority: 2



Photo No:
4043A
Location:
Sta 54+60
Right Wall
Direction:
Upstream
Description:
Undermining for 30 ft
of wall.

Repair Priority: 2



Photo No:
4044D
Location:
Sta 55+15
Left Wall
Direction:
Downstream
Description:
Cracks in culvert
headwall upstream
from Trenholm Rd
Culvert.

Repair Priority: 3



The Ugly: Masonry Wall Assessment



The Ugly: Masonry Wall Assessment



The Ugly: Masonry Wall Assessment

Photo No:
4045A
Location:
Sta 57+50
Left Wall

Direction:
Downstream

Description:
Bulging wall for 110 ft
of wall downstream of
Trenholm Rd. culvert.
Wall appears to have
been add to in height at
location of crack/bulge.



Repair Priority: 1

Photo No:
4045G

Location:
Sta 57+50
Left Wall

Direction:
Downstream

Description:
Bulging wall for 110 ft
of wall downstream of
Trenholm Rd. culvert.
Wall appears to have
been add to in height at
location of crack/bulge.



Repair Priority: 1

Photo No:
4045D

Location:
Sta 57+50
Left Wall

Direction:
Downstream

Description:
Exposed utility with
erosion around pipe
where it projects
through the wall.



Repair Priority: 2

Photo No:
4045B

Location:
Sta 57+50
Left Wall

Direction:
Downstream

Description:
Crack for full height of
wall.



Repair Priority: 2

The Bad: Natural Bank Segment Assessment



The Bad: Natural Bank Segment Assessment



The Bad: Natural Bank Segment Assessment



The Bad: Natural Bank Segment Assessment



The Challenges

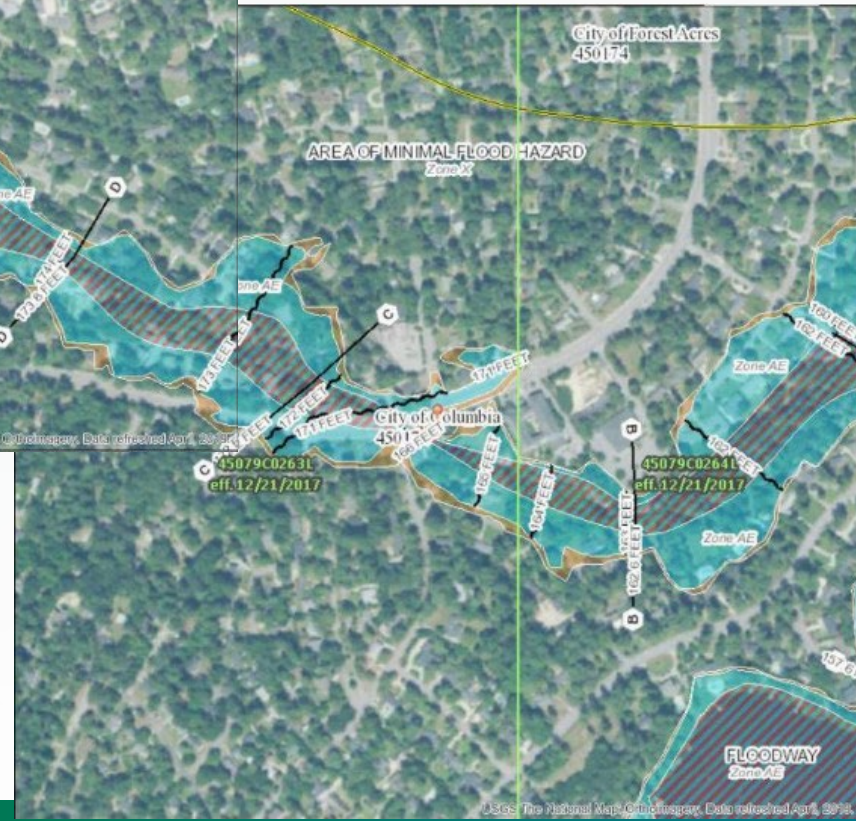


The Good: MODELING APPROACH



- No Impact Certification
- Could not raise walls higher than today,
- Walls were uneven and not uniform

- HECRAS 1D Model
- FEMA Floodway
- Frequent flooding during small storm events
- Extremely flashy channel





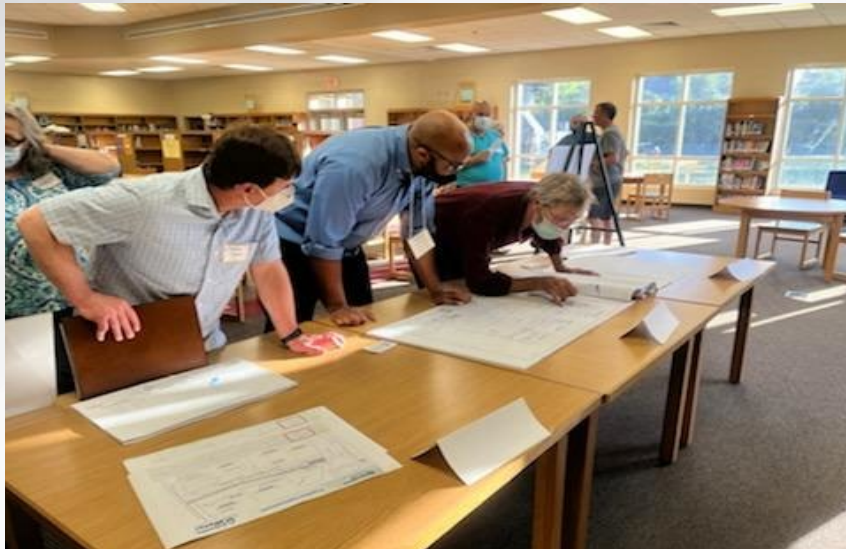
An important stormwater project is continuing to progress in your neighborhood!

THE PENN BRANCH PROJECT INITIATIVE

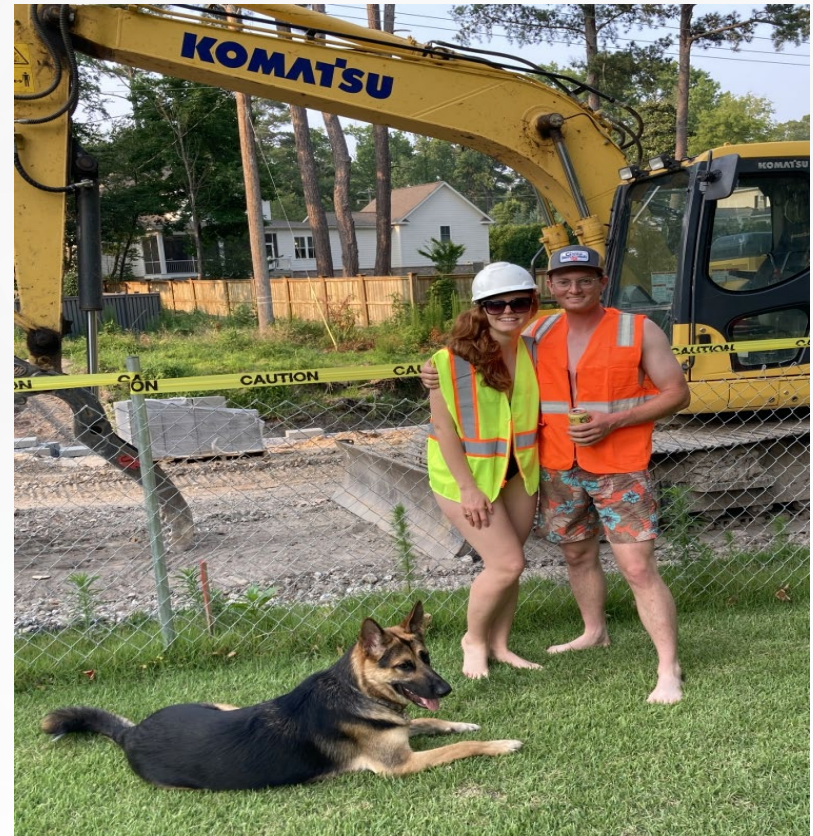
The City of Columbia has contracted with the consulting engineering firm of McCormick Taylor to provide wall and slope stabilization design for sections of Penn Branch extending from Brentwood Drive to Woodlake Drive. The stream is comprised of rock gravity walls from Brentwood Drive to Trenholm Road and natural vegetated earthen banks south of Trenholm Road to Woodlake Drive. The project also includes identification of potential stormwater retention and green infrastructure alternatives within the watershed to reduce flooding within Penn Branch.

McCormick Taylor engineering crews and sub-consultants will be in your area completing field work that may include surveying, identification of wetland areas, in-stream studies, inspection of rock walls and soil borings. We appreciate your cooperation and patience during this design process.

For questions or more information about this project, please call (803) 545-5275 or email: Wesley.Harrison@columbiawater.gov

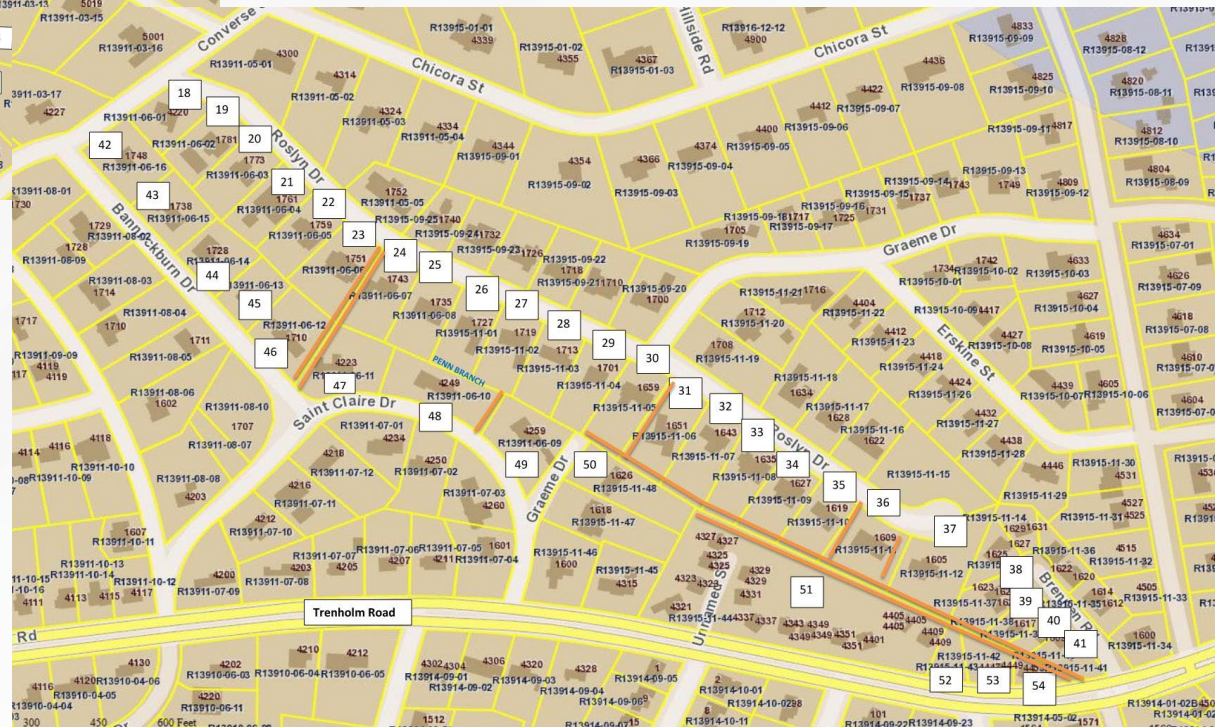
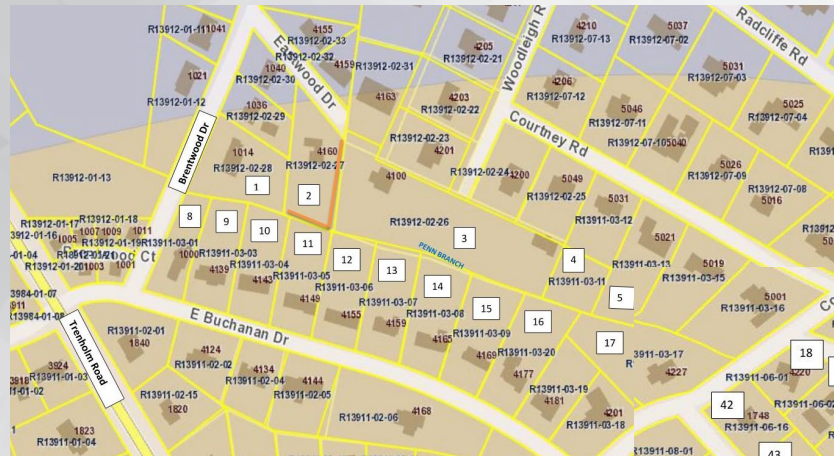


Is this going to prevent my house from flooding??



The Ugly: RIGHT OF WAY AND PROPERTY ACCESS

- ROW acquisition commenced just as COVID started
- Multiple 1 on 1 property owner meetings
- Standardized easements quickly were abandoned
- Individual Lot negotiated terms

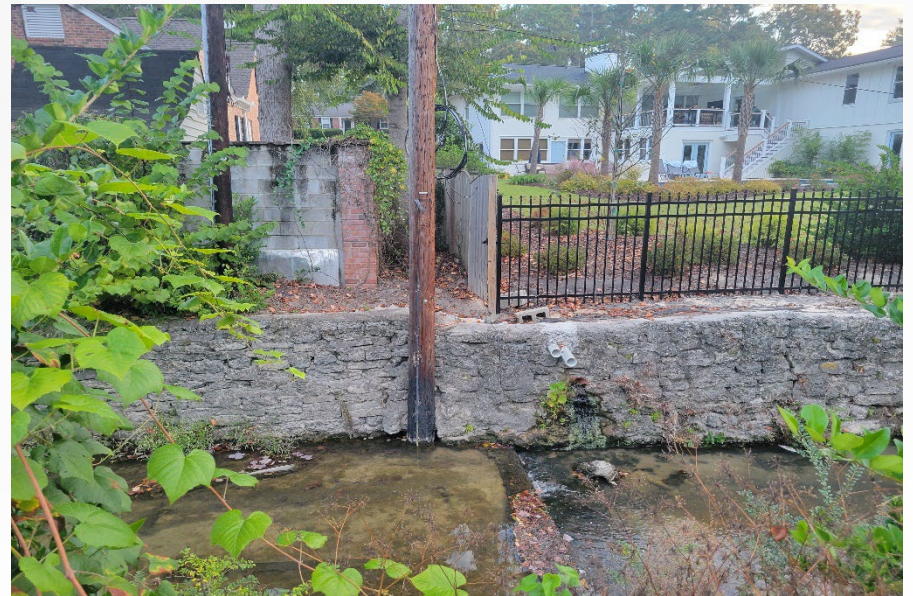


- 70 PARCELS
- Majority of project extent had no prior easements or ROW
- Ex and PR Easements to consider
- 20 easements acquired



- ROW acquisition commenced just as COVID started
- Multiple 1 on 1 property owner meetings
- Standardized easements widths were not going to work
- Show me the money \$\$\$\$
- Individual Lot negotiated terms

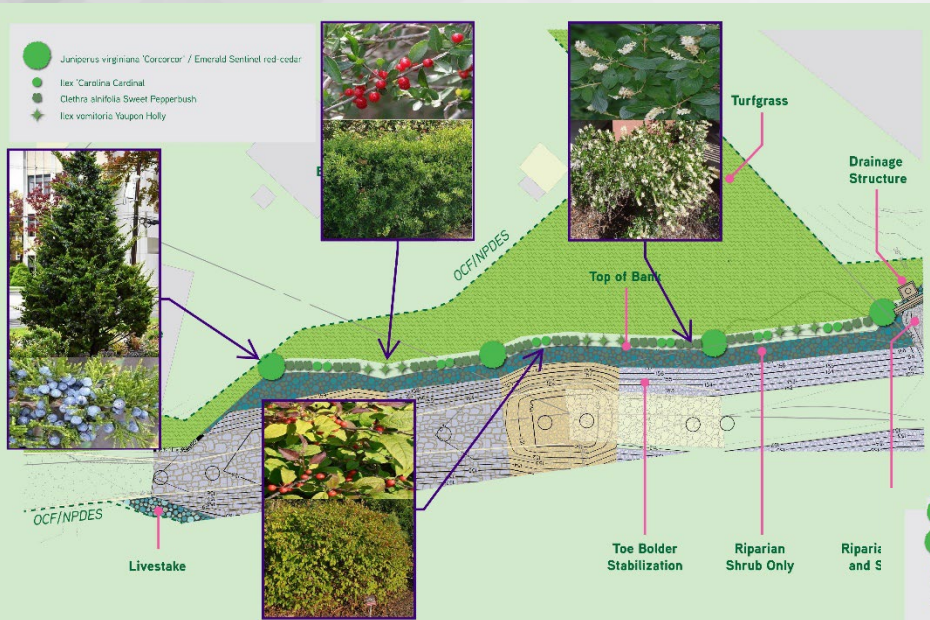
The Ugly Property Access



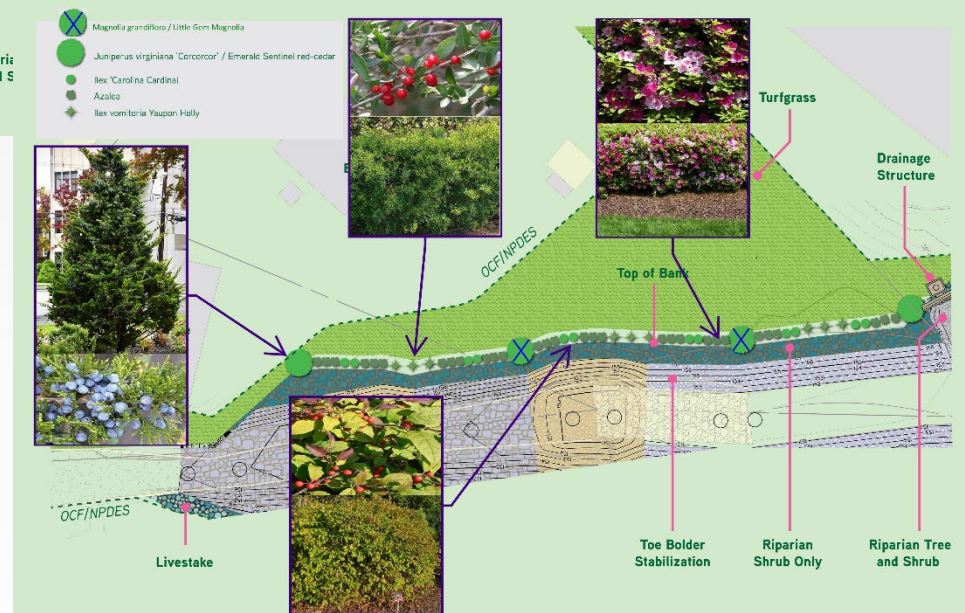
The Ugly Property Access



- Mature trees and extensive landscaping
- Temporary fences were required
- Outbuildings within work area
- Anticipating the Contractor's means and methods

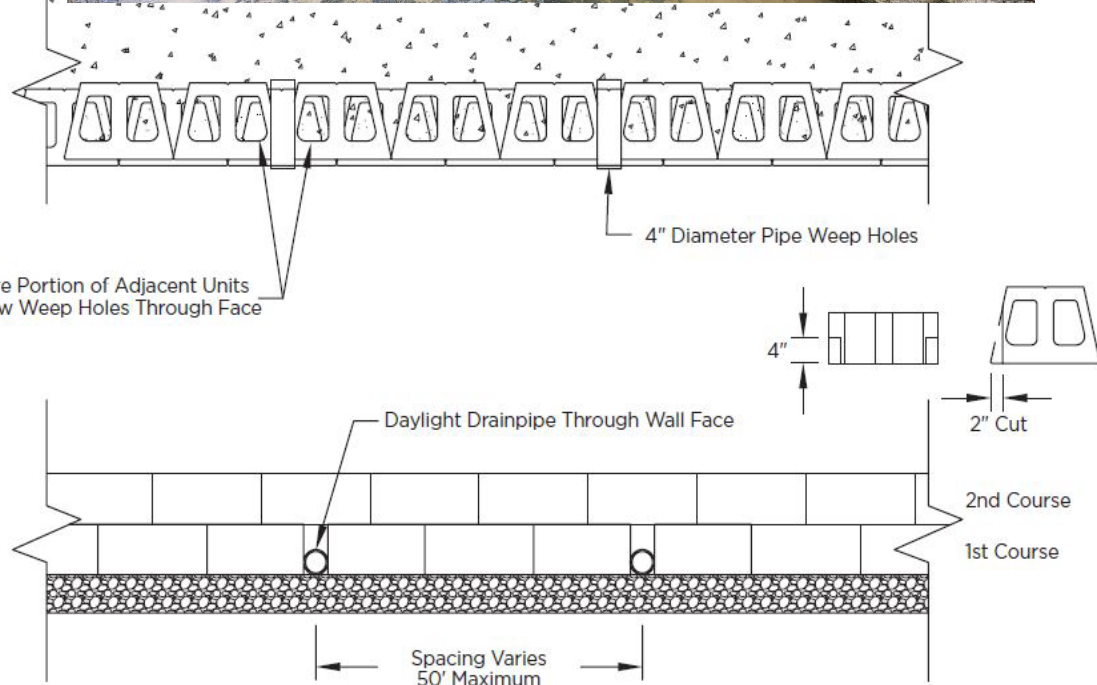
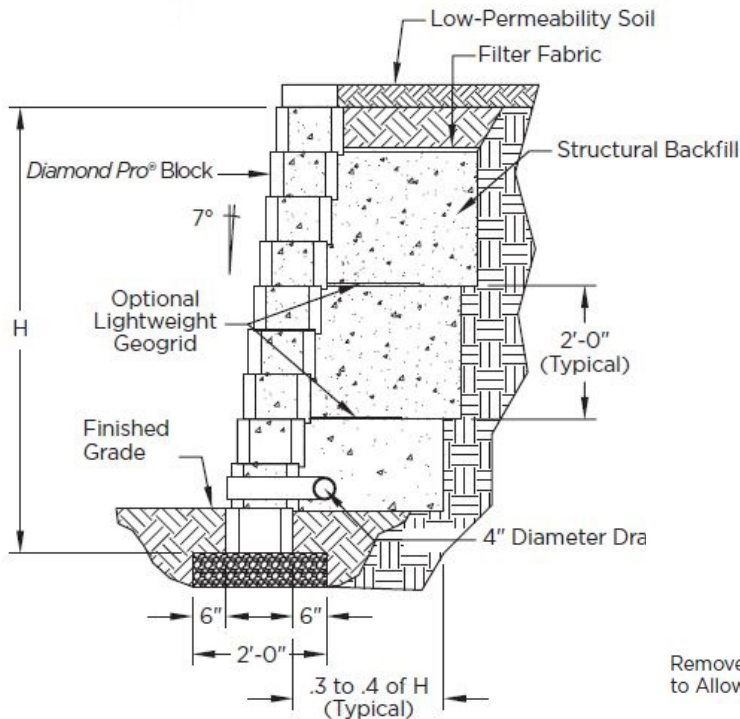


- One on One negotiations
- Several dozen individual landscape plans
- Unique Plants for each parcel
- Extensive pre-construction species survey
- \$



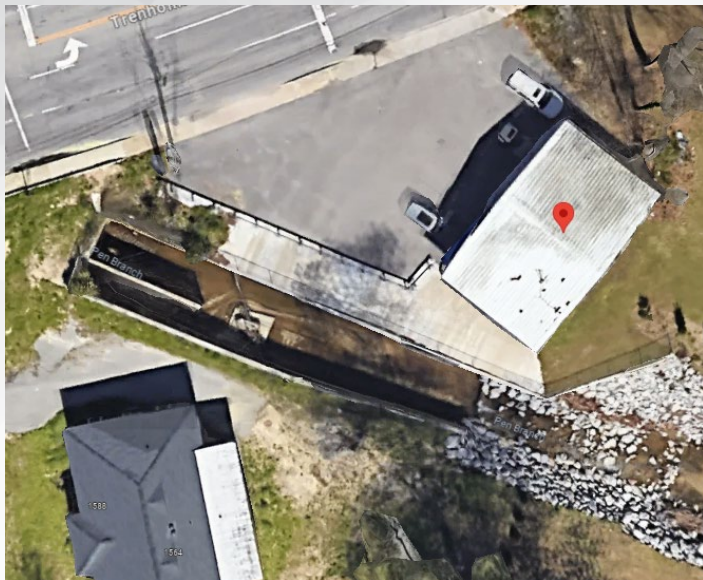
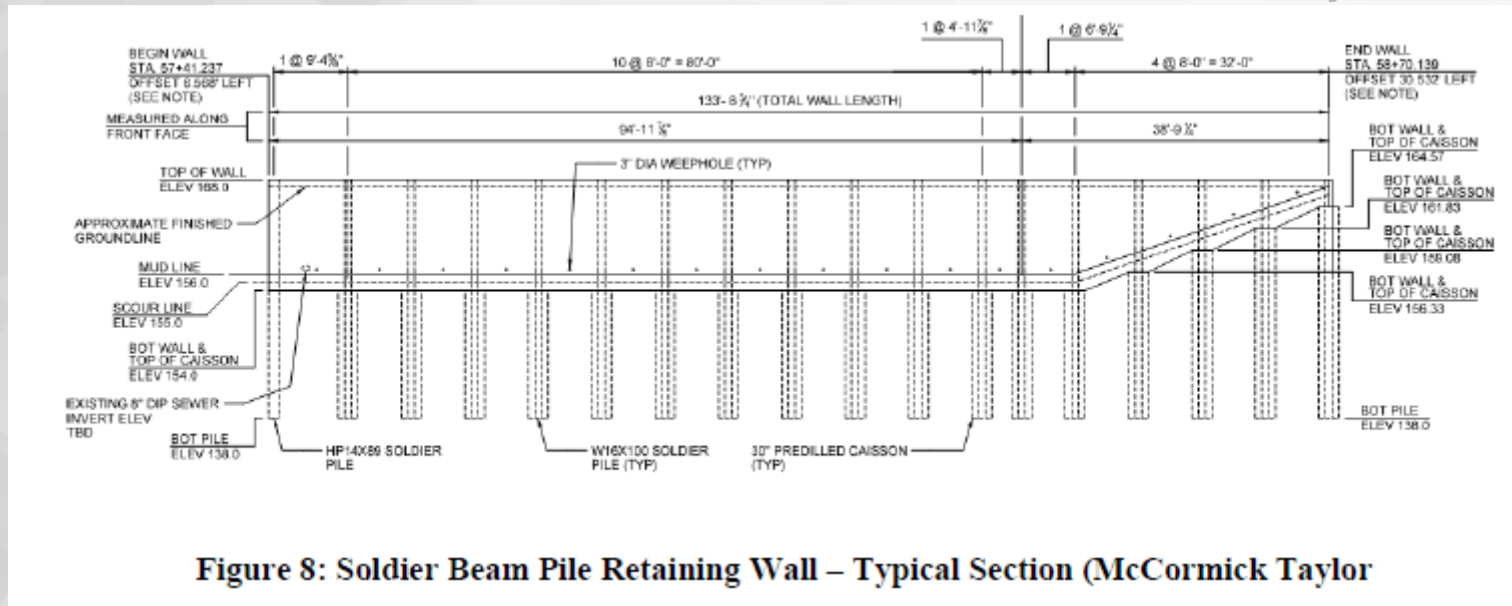
The Good: Masonry Wall Replacement

Diamond Pro Modular Block Wall (Anchorwall.com)

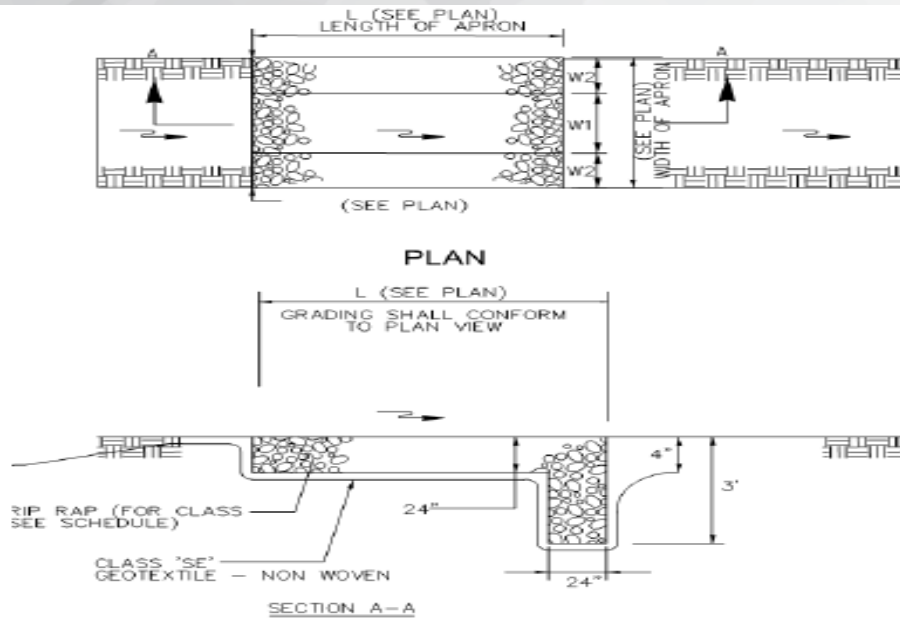


- Easy to maneuver and set
- Joints allowed for hydrostatic back pressure to be relieved
- Gravel was used as structural backfill

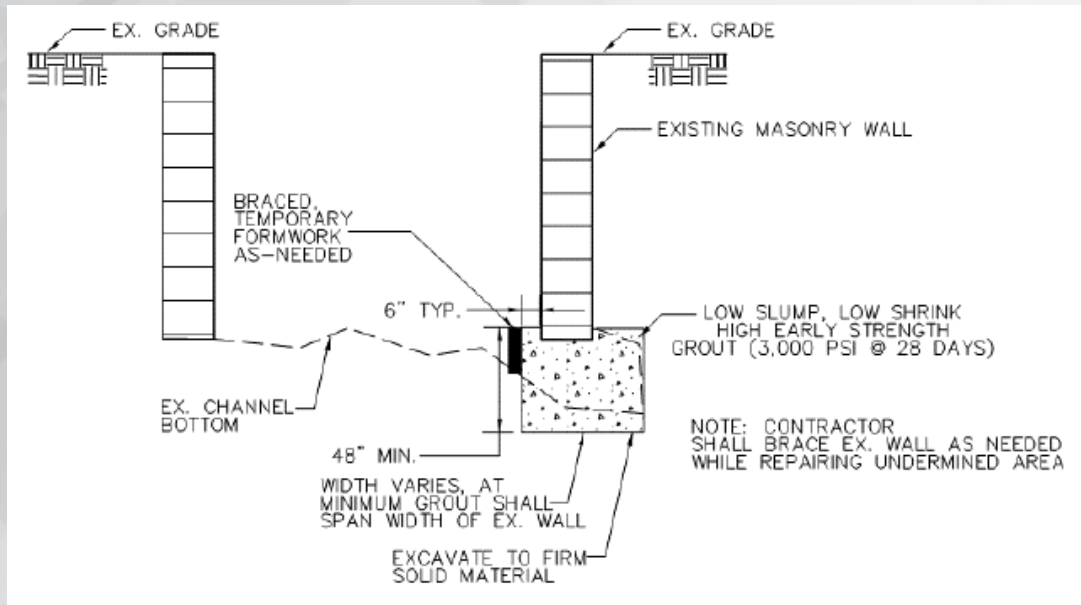
The Good: Masonry Wall Replacement



The Good: Channel Scour Repair



The Good: Wall Scour Repair



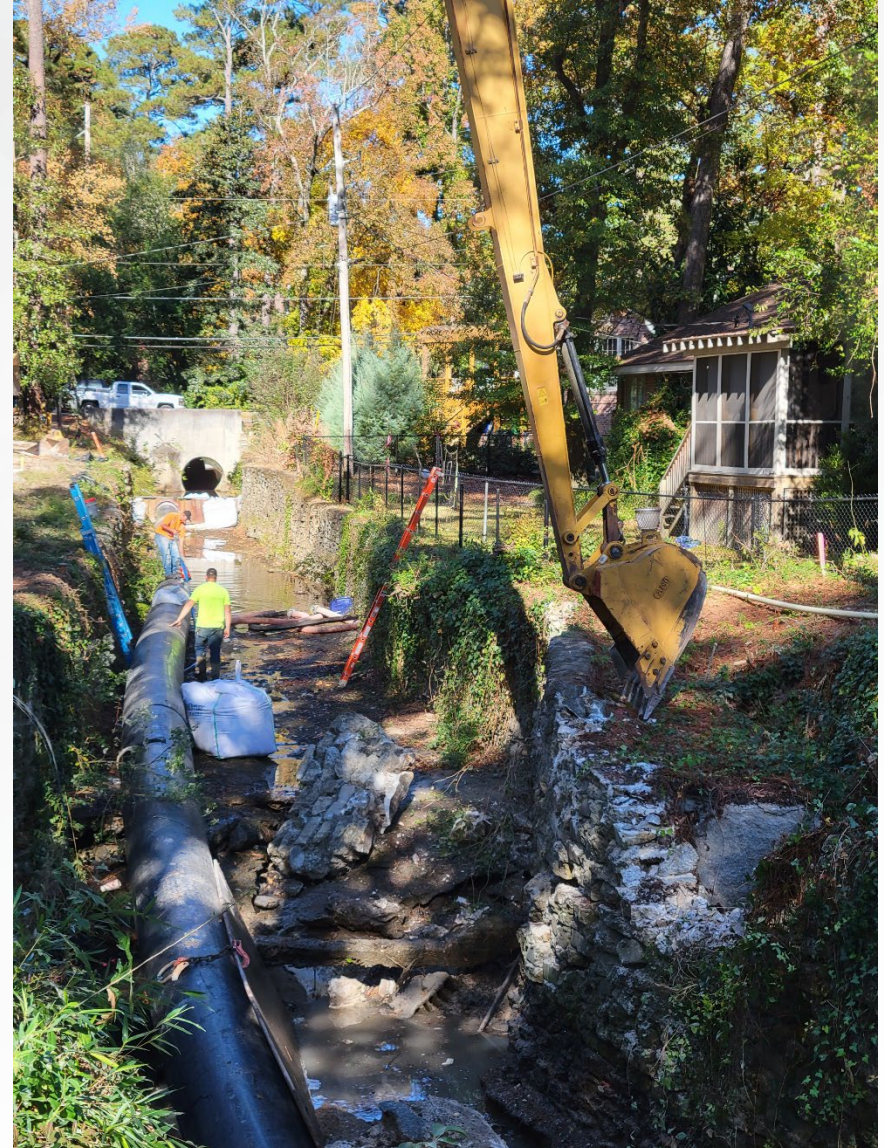
The Ugly: CONSTRUCTION CONSIDERATIONS



The Ugly: CONSTRUCTION CONSIDERATIONS



The Ugly: CONSTRUCTION CONSIDERATIONS



The Good: Project Completion



The Good: Project Completion



The Good: Project Completion



The Good: Project Completion



The Good: Project Completion



The Good: Project Completion



The Good: Project Completion



Thanks!

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