55 Ivan Allen Jr. Boulevard, Suite 850
Atlanta, GA 30308
T: 678.336.7740

September 4, 2024

Hameed Malik, Ph.D, P.E
Director - Augusta Engineering Department
452 Walker St., Suite 110
Augusta, GA 30901

Subject: **Task Order #2 – 2505 Blueberry Drive**
Phase 2 - Proposal to Provide Stream Stabilization Engineering & Environmental Services
City of Augusta, Georgia

Dr. Malik,

Pond is pleased to deliver this scope of work and fee estimate to provide a topographic and environmental survey, streambank stabilization design, and environmental permitting for the proposed stabilization of the unnamed perennial tributary to Rocky Creek located behind the home at 2505 Blueberry Drive. The project area considered in this proposal totals approximately 130 linear feet of streambank. Based on recommendations of the concept design completed during Phase 1 of this project, workspace and streambank stabilization activities may extend to adjacent properties including 2507, 2505, and 2503 Blueberry Drive, and 1821 and 1914 Lumpkin Drive to provide the proper tie-in extent of the bio-engineered streambank stabilization solution. Pond's understanding of the intent of this project is to stabilize active erosion in the existing streambank location. This project is not intended to identify or remedy the contributing factors to streambank erosion in these locations, nor consider streambank conditions up or downstream of the stabilization extent. This project will not address flooding, sedimentation, or the condition/proximity of private landowner structures.

Pond proposes to deliver this scope of work with the following tasks:

Task 1 – Project Administration

- Project kick-off meeting
- Project administration throughout the life of the project
- Ad hoc discussions, client calls, teleconferences
- Monthly project communications and progress memo

Task 2 – Existing Conditions Survey

- Environmental delineations
  - State/federal waters and protected species habitat
  - GIS mapping of delineated resources
  - Necessary field data for submittal of applicable permits
  - Desktop screen of cultural resources (necessary for USACE permitting)
- Topographic and SUE Survey
  - Existing conditions topographic survey
  - Tree survey for all trees greater than 4" DBH
  - SUE-B utility survey
  - Survey to be completed within the limits provided in **Attachment 2**
- Property Boundary Surveys
  - True boundary survey of property boundaries located within survey limits to provide accurate temporary construction easements (TCEs) and permanent maintenance easements

Task 3 – Streambank Stabilization Design & H&H Modeling

- Hydrologic and Hydraulic Modeling/Study
  - Floodplain modeling to demonstrate no-rise condition and comply with USACE, FEMA, and LIA requirements for work within floodplains
  - Evaluate the proposed design solution capacity/discharge characteristics to document no downstream streambank implications
- 60% (issued for review) design plans for client review (to include limits of disturbance, streambank stabilization design, typical cross sections, longitudinal profiles, notes, and details)
- 90% (issued for bid) design plans for client review, incorporating client comments from 60% design set (to include limits of disturbance, streambank stabilization design, typical cross sections, longitudinal profiles, notes, details, and erosion control plan)
- 100% (issued for construction) design plans incorporating client comments on 90% design set
- Development of TCEs and maintenance easements. TCEs and maintenance easements to be provided to the City of Augusta for negotiation and acquisition. One round of City comments is included in the easements.

Task 4 – Local, State, and Federal Environmental Permitting

- Pre-application coordination via email with USACE for project establishment and awareness ahead of permit submittal
- Preparation and submittal of applicable Clean Water Act Section 404 permit
  - Assumes NWP 13 – Bank Stabilization
- GA Environmental Protection Division (EPD) programmatic buffer variance coverage review and letter to file
  - Assumes project will qualify for coverage under City of Augusta active programmatic buffer variance
- Coordination with Local Issuing Authority for proposed clearing, land disturbance, and work within FEMA regulated floodplain/regulatory floodway

Task 5 – Public Outreach

- One (1) in-person meetings with the City of Augusta and/or neighborhood residents
- Pond to provide up to two staff as well as large-scale project printouts and/or PowerPoint presentation

Subsequent Phases of The Project

- **Phase 3 – Construction Support**: Would include construction phase assistance and inspections. Associated fee, conditions, and schedule would be developed and provided at the completion of Phase 2.

Schedule

Below is a proposed schedule based on a Notice to Proceed date of September 9, 2024 and assuming no significant regulatory delays.

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Task Name	Duration	Start	Finish
Assumed Notice to Proceed	1 day	Mon 9/9/24	Mon 9/9/24
Land Survey	45 days	Tue 9/10/24	Mon 11/11/24
Environmental Survey	30 days	Tue 9/10/24	Mon 10/21/24
60% Design	30 days	Tue 11/12/24	Mon 12/23/24
60% Design Submittal and City of Augusta Review	2 wks	Tue 12/24/24	Mon 1/6/25
90% Design	30 days	Tue 1/7/25	Mon 2/17/25
90% Design Submittal and City of Augusta Review	2 wks	Tue 2/18/25	Mon 3/3/25
Environmental Permitting	30 days	Tue 3/4/25	Mon 4/14/25
100% Design	30 days	Tue 3/4/25	Mon 4/14/25
Contractor Bid Process	14 days	Tue 4/15/25	Fri 5/2/25
Bid Review	7 days	Mon 5/5/25	Tue 5/13/25
Contractor Selection	1 day	Wed 5/14/25	Wed 5/14/25
Agency Permit Review	120 days	Tue 4/15/25	Mon 9/29/25
Permits Received	1 day	Tue 9/30/25	Tue 9/30/25
Construction	4 wks	Wed 10/1/25	Tue 10/28/25
Final Restoration/Planting	2 wks	Wed 10/29/25	Tue 11/11/25

Design and Permitting Fees

Pond has prepared the below fee in accordance with the services listed above.

Task	Fee
Task 1: Project Administration	$3,500.00
Task 2 Existing Conditions Survey	$22,931.10
Task 3: Streambank Design	$47,120.00
Task 4: Local, State, and Federal Permitting	$9,170.00
Task 5: Public Outreach	$5,557.50
Total Cost	**$88,278.60**

Conditions of Service

1. This fee includes: delineation of waters and protected species habitat; development of environmental electronic files for incorporation into design; a Section 404 NWP application; a GA EPD Buffer Variance letter to file; up to one (1) on-site meetings with the City of Augusta/stakeholder; a desktop screening of cultural resources in the project vicinity.
2. This scope assumes the total disturbance associated with this project will be less than one (1) acre; therefore, a land disturbance permit and state erosion control permit will not be required.
3. This scope and fee assume no FEMA-regulated floodplain coordination or submittals would be required. Pond will complete H&H modeling sufficient to demonstrate a no-rise/no-net change in floodplain volume sufficient to document FEMA compliance for LIA and USACE requirements. No additional FEMA modeling or permitting is included.

4. This fee does not include species-specific surveys for protected species; Phase I/II Environmental Site Assessment; permit fees; or purchase of mitigation credits or mitigation design. If necessary, Pond can provide these services under separate scope and fee.
5. This fee does not include ecological monitoring of streambank stabilization. This is not typically required under NWP13. Should USACE require ecological monitoring, this would be completed as a change.
6. This fee does not include land or easement acquisition or public coordination outside of those described above. Should these services be required, they would be provided as an additional service.
7. Temporary construction easements/maintenance easements are to be typical plan-style exhibits and will not include any legal descriptions or filing assistance.
8. One temporary construction easement and one maintenance easement will be provided for each lot.
9. Utility coordination/relocation is expected to be minimal and located entirely within the limits of survey.
10. This fee does not include any construction phase site inspections. A separate proposal will be prepared for phase 3 of this project associated with construction support services.
11. Retaining wall, shoring, or dewatering design and permitting is excluded from this scope and fee.
12. This fee does not include cost estimating, written technical specifications or subsequent value engineering processes.
13. Services not specifically included in the proposal, or material changes requested after professional services have commenced, will be considered additional/out of scope services and will be approved via a contract change order prior to commencement of the additional work.

We appreciate your time and consideration in reviewing our proposal. If you have any questions or require further information, please contact me at (470) 387-8899 or DarrA@PondCo.com.

Sincerely,
Pond & Company

Kenneth A. Darr

Alex Darr, CPESC, CERP
Associate Principal | Project Manager
Environment + Water Resources

Glenn L. Martin

Glenn Martin, PWS, CE
Vice President | Program Manager
Environment + Water Resources

Attachments:
Attachment 1 – Fee Breakdown
Attachment 2 – Proposed Land Survey Boundary
Attachment 3 – Concept Design Report

ATTACHMENT 1
FEE BREAKDOWN

City of Augusta

COST PROPOSAL

Project: **2505 Blueberry Drive Streambank Stabilization Design**

Date: **27-Aug-2024**

Pond & Company

Discipline: **Environmental/Engineering**

Hours & Cost Estimate

Phase	Description	Assumptions / Notes	Total Hours	Total Cost	Total Other Direct Costs	Direct Labor Cost				
		TOTALS ==>	**500**	**$ 88,278.60**	**$ 15,428.60**	**$ 72,850.00**				
1	**Project Administration**		**20**	**$ 3,500.00**	$ -	$ 3,500.00				
2	**Existing Conditions Survey**		**62**	**$ 22,931.10**	$ 14,961.10	$ 7,970.00				
3	**Design**		**314**	**$ 47,120.00**	$ -	$ 47,120.00				
4	**Permitting**		**74**	**$ 9,170.00**	$ -	$ 9,170.00				
5	**Public Outreach**		**30**	**$ 5,557.50**	$ 467.50	$ 5,090.00				

Project Level Summary - Labor

				Staff Type / Project Hourly Rates / Hours						
			Total Hours	Principal	Project Manager	Sr. Scientist/Engineer	Mid Level Scientist/Engineer	Jr. Scientist/Engineer	Administrative Assistant	
				$260.00	$175.00	$165.00	$140.00	$100.00	$80.00	
	TOTAL HOURS ==>		**500**	**4**	**98**	**92**	**222**	**84**		
	TOTAL DIRECT LABOR COST==>		**$ 72,850**	**$ 1,040**	**$ 17,150**	**$ 15,180**	**$ 31,080**	**$ 8,400**	**$ -**	**$ -**

Project Level Summary - Other Direct Costs

				Other Direct Costs						
			Total Other Direct Costs	Express/Mail /Courier	Lodging	Meals	Mileage	Shipping	Equipment	Subconsultant
	TOTALS ==>		**$ 14,026**	**$ -**	**$ -**	**$ 374**	**$ 402**	**$ -**	**$ -**	**$ 13,250**

Task Level Summary - Labor

				Staff Type / Project Hourly Rates / Hours						
Phase	Description		Total Hours	Principal	Project Manager	Sr. Scientist/Engineer	Mid Level Scientist/Engineer	Jr. Scientist/Engineer	Administrative Assistant	
				$260.00	$175.00	$165.00	$140.00	$100.00	$80.00	
	TOTALS ==>		**500**	**4**	**98**	**92**	**222**	**84**		
1	**Project Administration**		**20**		20					
2	**Existing Conditions Survey**		**62**		8	18		36		
3	**Design**		**314**	4	48	40	222			
4	**Permitting**		**74**		8	18		48		
5	**Public Outreach**		**30**		14	16				

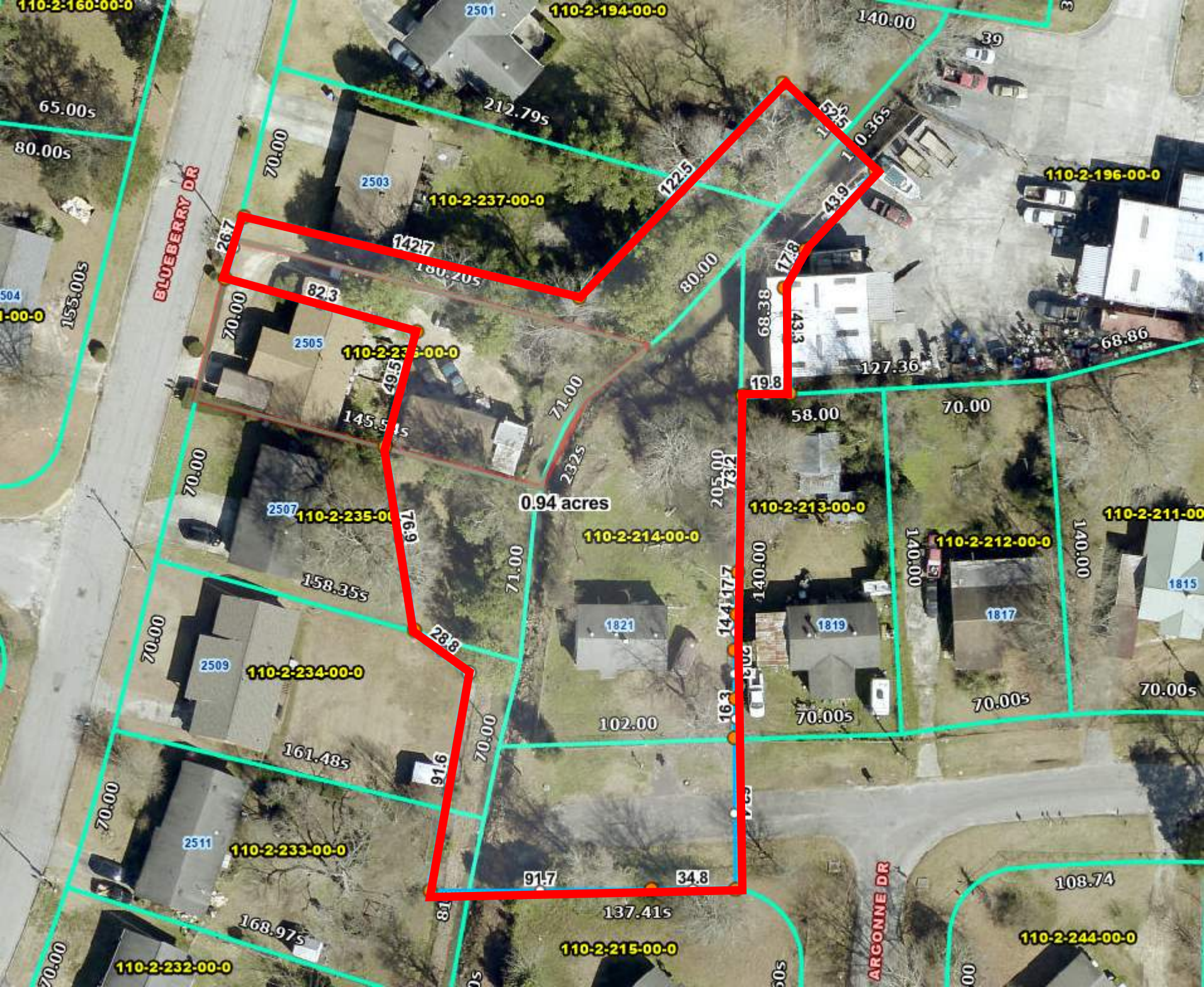
Task Level Summary - Other Direct Costs

				Other Direct Costs						
Phase	Description		Total Other Direct Costs (@ 10% markup)	Express/Mail /Courier	Lodging	Meals	Mileage	Shipping	Equipment	Subconsultant
	TOTALS ==>		**$ 15,429**	**$ -**	**$ -**	**$ 374**	**$ 402**	**$ -**	**$ -**	**$ 13,250**
1	**Project Administration**		$ -							
2	**Existing Conditions Survey**		$ 14,961			$ 150	$ 201			$ 13,250
3	**Design**		$ -							
4	**Permitting**		$ -							
5	**Public Outreach**		$ 468			$ 224	$ 201			

Task Level Breakdown - Labor

			Total Hours	Principal	Project Manager	Sr. Scientist/Engineer	Mid Level Scientist/Engineer	Jr. Scientist/Engineer	Administrative Assistant	Total Cost
1	**Project Administration**	**Assumptions**	**20**		**20**					**3,500**
	Project Administration	see proposal	**20**		20					3,500
			Total Hours	Principal	Project Manager	Sr. Scientist/Engineer	Mid Level Scientist/Engineer	Jr. Scientist/Engineer	Administrative Assistant	Total Cost
2	**Existing Conditions Survey**	**Assumptions**	**62**		**8**	**18**		**36**		**22,931**
	Waters Delineation & Report	see proposal	**62**		8	18		36		22,931
			Total Hours	Principal	Project Manager	Sr. Scientist/Engineer	Mid Level Scientist/Engineer	Jr. Scientist/Engineer	Administrative Assistant	Total Cost
3	**Design**	**Assumptions**	**314**	**4**	**48**	**40**	**222**			**47,120**
	Design	see proposal	**314**	4	48	40	222			47,120
			Total Hours	Principal	Project Manager	Sr. Scientist/Engineer	Mid Level Scientist/Engineer	Jr. Scientist/Engineer	Administrative Assistant	Total Cost
4	**Permitting**	**Assumptions**	**74**		**8**	**18**		**48**		**9,170**
	USACE NWP	see proposal	**58**		6	12		40		
	GAEPD BV	see proposal	**7**		1	2		4		
	LIA Coordination	see proposal	**9**		1	4		4		
			Total Hours	Principal	Project Manager	Sr. Scientist/Engineer	Mid Level Scientist/Engineer	Jr. Scientist/Engineer	Administrative Assistant	Total Cost
5	**Public Outreach**	**Assumptions**	**30**		**14**	**16**				**5,558**
	Neighborhood Meetings (1)	see proposal	**30**		14	16				5,558

ATTACHMENT 2
PROPOSED LAND SURVEY BOUNDARY


0.94 acres
BLUEBERRY DR
ARGONNE DR
2501
2503
2505
2507
2509
2511
1815
1817
1819
1821
110-2-160-00-0
110-2-194-00-0
110-2-237-00-0
110-2-196-00-0
110-2-235-00
110-2-214-00-0
110-2-213-00-0
110-2-212-00-0
110-2-211-00
110-2-234-00-0
110-2-233-00-0
110-2-232-00-0
110-2-215-00-0
110-2-244-00-0
65.00s
80.00s
155.00s
212.79s
140.00
39
70.00
122.5
0.36s
43.9
17.8
142.7
180.20s
82.3
80.00
68.38
43.3
68.86
127.36
19.8
58.00
70.00
49.5
145.54s
71.00
232s
205.00
73.2
76.9
158.35s
288
71.00
140.00
140.00
140.00
14.41
77
16.3
102.00
70.00s
70.00s
161.48s
91.6
70.00
91.7
34.8
137.41s
168.97s
108.74
81

ATTACHMENT 3
CONCEPT DESIGN REPORT

55 Ivan Allen Jr. Boulevard, Suite 850
Atlanta, GA 30308
T: 678.336.7740

July 10, 2024

Hameed Malik, Ph.D., P.E.
Director, Engineering & Environmental Services
City of Augusta
452 Walker St., Suite 100
Augusta, GA 30901

SUBJECT: ***Environmental Summary Report***
2505 Blueberry Drive Streambank Stabilization Project
City of Augusta, Richmond County, Georgia

Dr. Malik,

This report was prepared to summarize environmental findings during the initial project site visit as well as findings from a desktop screening conducted to identify environmental, permitting, and project execution-related constraints. This concept-level review provides an overview of the necessary actions if the proposed stream stabilization concept design for Blueberry Drive were to advance to full design, permitting, and construction. A review of pertinent geographic information systems (GIS) and other publicly available data resources was conducted to identify environmentally sensitive areas (e.g., jurisdictional waters, protected species habitat, environmental liabilities, and cultural resources) that may be present within the immediate area of the proposed project. Sources of these data included but were not limited to:

- United State Geological Survey (USGS) National Hydrography Dataset (NHD)
- USGS Topographic Quadrangles
- United States Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI)
- USFWS Information for Planning and Consultation (IPaC)
- United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey
- Georgia's Natural, Archeological, and Historic Resources GIS (GNAHRGIS)
- United States National Register of Historic Places (NRHP)
- United States Environmental Protection Agency (USEPA) NEPAssist

Additionally, a streambank assessment, including Bank Erosion Hazard Index (BEHI) and Near Bank Stress (NBS), was completed to collect baseline resource information necessary to inform concept design and permitting constraints considerations. A reference reach geomorphic survey was performed on an upstream and downstream reach deemed appropriate for reference reach consideration due to its geomorphic similarity to the stable target conditions (**Attachment A**).

Jurisdictional Waters of the US Assessment
Prior to the execution of full design for the stabilization of the Rocky Creek tributary at Blueberry Drive, a formal stream and wetland delineation would be required to identify jurisdictional features within the proposed project area. The stream and wetland delineation would provide the necessary information for the permitting phase of the proposed project. Jurisdictional waters (streams & wetlands), as well as state-regulated riparian buffers, may require permitting through the U.S. Army Corps of Engineering and the Georgia Department of Environmental Protection prior to construction.

Protected Species Habitat Assessment

Under provisions of the Endangered Species Act (ESA) of 1973 (as amended), federal law requires that any action likely to adversely affect a species classified as federally threatened or endangered be subject to review by the USFWS. A list of threatened and endangered species was obtained from the USFWS IPaC online database. Three (3) federally listed species and one (1) candidate species were found to potentially occur within Richmond County near the project area, according to the IPaC database. Pending the design phase of this project, Pond ecologists would conduct a detailed field survey to identify and locate the presence of potentially suitable habitat for listed species within the proposed project area.

Table 1. Federal Threatened and Endangered Species Summary

Common Name	Scientific Name	Federal Status	Habitat Requirements	Potential Presence within Project Area
Fauna				
Tricolored Bat	*Perimyotis subflavus*	PE*	Forested habitats primarily among leaves of live or recently dead deciduous hardwood trees; Can also be found in Spanish moss, pine trees, and human structures	Suitable habitat **is** anticipated; to be confirmed during field survey.
Monarch Butterfly	*Danaus plexippus*	C*	Primarily in prairies, grasslands, and along roadsides	Suitable habitat **is** anticipated; to be confirmed during field survey.
Flora				
Ocmulgee Skullcap	*Scutellaria ocmulgee*	T	Moist hardwood forests on stream terraces, slopes, and bluffs, usually with a northern or eastern aspect and in a calcium-rich soils along the Oconee, Ocmulgee, and Savannah Rivers and their tributaries	Suitable is **not** anticipated; to be confirmed during field survey.
Relict Trillium	*Trillium reliquum*	E	Mature hardwood forests in rich ravines and on stream terraces over calcium-rich bedrock.	Suitable is **not** anticipated; to be confirmed during field survey.

PE=Proposed Endangered E=Endangered; C=Candidate; T=Threatened

**Proposed Endangered, Experimental Population-Non-Essential, and Candidate species receive no statutory protection under the ESA (Endangered Species Act). The USFWS encourages cooperative conservation efforts for these species because they are, by definition, species that may warrant future protection under the ESA.*

Environmental Liabilities

A desktop review of NEPAssist was conducted to identify potential environmental liabilities within the vicinity that may present a concern for the proposed project. The review identified several nearby Resource Conservation and Recovery Act (RCRA) hazardous waste sites within the immediate vicinity of the project area associated with automotive and industrial waste products. One (1) of these businesses is immediately adjacent to the stream corridor. Further property loss due to erosion and streambank instability may damage the building's foundation. This review does not constitute a Phase I Environmental Site Assessment (ESA).

Cultural Resources

A desktop screening was conducted to evaluate the presence of known cultural and historical resources within the subject project boundary. A review of the GNAHRGIS and NRHP website indicated the presence of one (1) cultural or historic resource within the vicinity of the project area. The GNAHRGIS database identified an undetermined historical home (ID# 55944); however, this site is not within the project area and is not anticipated to be impacted by the proposed project. If the project is to proceed to full design, an archeologist may need to review the Georgia Archeological Site Files to determine if a Phase I Cultural Resource Survey is recommended.

Desktop Land Use Review

A review of historical aerial imagery and topographical maps ranging from current data to 1981 was completed to understand changes in the watershed and land use over time that may have affected the conditions of the stream adjacent to Blueberry Drive. Much of the development within the catchment area has historically been residential. No significant changes in watershed and/or land use within the residential portion of the catchment were observed in the past 20 years.

According to the USGS Stream Stats Report (**Attachment C**) approximately 89% of the catchment area consists of developed urban land with almost 31% of that being impervious surface area. Over time, as the catchment area has developed, increased impervious surface has resulted in increased stormwater runoff, higher stage flash-flow conditions during storm events, and has resulted in accelerated erosion, incision, and streambank instability.

Project Cost and Implementation Constraints Review

The primary constraint in implementing a streambank stabilization solution adjacent to Blueberry Drive is access, available workspace, and adjacent landowner structures (**Attachment A**). To provide a long-term solution to the erosion and bank instability, the City of Augusta may need to coordinate additional property access and/or drainage easements along the stream to provide for the proposed concept design. Approximately 20-50 feet of workspace, measured perpendicularly along the stream channel, would be needed temporarily to facilitate the construction effort. This width of workspace would likely require the removal of residential structures. Additionally, it is recommended that fence lines, sheds, and other private landowner structures be offset from the proposed streambank stabilization solution to prevent recurring streambank degradation.

Streambank improvements at Blueberry Drive have been recommended based on many factors including existing streambank characteristics and constraints such as private property access, and nearby infrastructure/property impacts. A bio-engineered or structural streambank stabilization system may be employed as a reinforced stability measure involving encapsulated soil layer lifts and mechanically stabilized earth systems to provide a natural functioning solution. We recommend utilizing a combination of toe rock protection, Envirolok Geobags, reinforcing geogrid and/or earth anchors, live-stake plantings, and riparian seed to stabilize the streambank. The goal is to achieve bank stability without extensive channel grading that will protect both the water resource and the adjacent landowners' properties. Additionally, systems such as these are easily incorporated with vegetative plantings to further promote naturalization over time. **Attachments A** and **D** include standard specifications and typical details of the recommended repair/stabilization solution that may be utilized to address the stability concerns along the stream. Refer to **Table 2** below for a rough order of magnitude cost estimate for this stabilization solution.

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Table 2: Project Implementation Cost Evaluation

Category	Workspace	Value	Estimated Unit Cost*	Estimated Total Cost*
Concept 1a – Preferred Extent; Streambank Stabilization Using Bioengineering Methods	Within Private Property, Existing, and Proposed Easements.	138 Linear Feet of Stream	~$850 - $1,000 Per Linear Foot	$117,300 – $138,000
Concept 1b – 2505 Blueberry Drive Only; Streambank Stabilization Using Bioengineering Methods	Within Private Property, Existing, and Proposed Easements	75 Linear Feet of Stream	~$850 - $1,000 Per Linear Foot	$63,750 – $75,000

*Note: Cost estimations provided include a rough approximation of construction implementation. The estimate does not include design, survey, permitting, permitting fees, property acquisition, utility relocation, or the replacement of landowner property (fences, buildings, landscaped areas, etc.). Easements may need to be acquired for workspace during construction and to ensure proper offset of landowner structures from the proposed streambank stabilization solution. Detailed cost information would be provided during the design, permitting, and construction services Request for Proposal (RFP) and/or bidding process.

Permitting Considerations

- **Section 404 of the Clean Water Act (CWA)**: Due to the presence of jurisdictional waters on site, a Section 404 CWA permit would be required to impact Waters of the U.S. (WOTUS). A Nationwide Permit (NWP) 13 is typically used for streambank stabilization projects that would impact WOTUS. A pre-construction notification (PCN) is required for temporary/permanent impacts in excess of 0.1 acres of wetland or 0.01 acres of stream, projects greater than 100 linear feet in length, and those proposing fill greater than one (1) cubic yard per linear foot. Impacts greater than 500 linear feet would require the district engineer's approval for the use of NWP 13. Compensatory mitigation may be required by the district's engineer if the project results in the loss of greater than 0.1 acres of wetland or 0.01 acres of stream. The final permitting approach would be confirmed as the design progresses.
- **Buffer Requirements**: State buffers are located within the project area. A buffer variance may be required from the Georgia Environmental Protection Division for disturbance within the 25-foot buffer. The final permitting approach would be confirmed as the design progresses.
- **Local Buffer Requirements:** Prior to construction, coordination with the City of Augusta, Planning and Development Department, may be required for the use of construction equipment and encroachment within 50 feet of the subject stream.
- **Local Development Permit Requirements:** Prior to construction, coordination with the City of Augusta, Planning and Development Department, may be required to facilitate plan review and approval.
- **National Pollutant Discharge Elimination System (NPDES) Requirements:** If the proposed construction activities result in over one (1) acre of land disturbance, then coverage under the GAR100001 or GAR100002 permit would be required. The final permitting approach would be confirmed as the design progresses.
- **FEMA Floodplain Coordination:** The project is located within a FEMA Special Flood Hazard Area (SFHA). Coordination with the City of Augusta Floodplain Administrator to confirm FEMA regulatory compliance is anticipated for this project.

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SUMMARY AND CONCLUSIONS

This assessment was completed to establish baseline conditions of an unnamed tributary to Rocky Creek adjacent to Blueberry Drive. Findings detailed in this report suggest that immediate repair is required for streambanks in this reach due to actively deteriorating conditions, erosion, and concerns of further property loss. The confined nature of the stream and the highly developed surrounding land and properties have contributed to the poor condition of the stream system. Continued deterioration of the streambanks would have implications for further property loss, downstream sedimentation, and potentially further watershed impairment downstream due to sediment loss and increased turbidity. Debris removal, streambank repair, and streambank plantings are recommended to improve the concerns for infrastructure and property along the stream. Pond recommends a bioengineered reinforcement system, such as a mechanically stabilized earth system soil layer lifts (**Attachment A** and **D**). A bioengineered structural system ensures maximum stability of adjacent property while minimizing the loss of native bed material and creating channel relief during high flows. Additionally, Pond recommends not only the streambank at 2505 Blueberry Drive be addressed, but also the opposite bank adjacent to the downstream building be stabilized to prevent continued streambank loss and mitigate potential damage to its foundation.

Sincerely,
Pond & Company Environment + Water Resources

Kenneth A. Darr

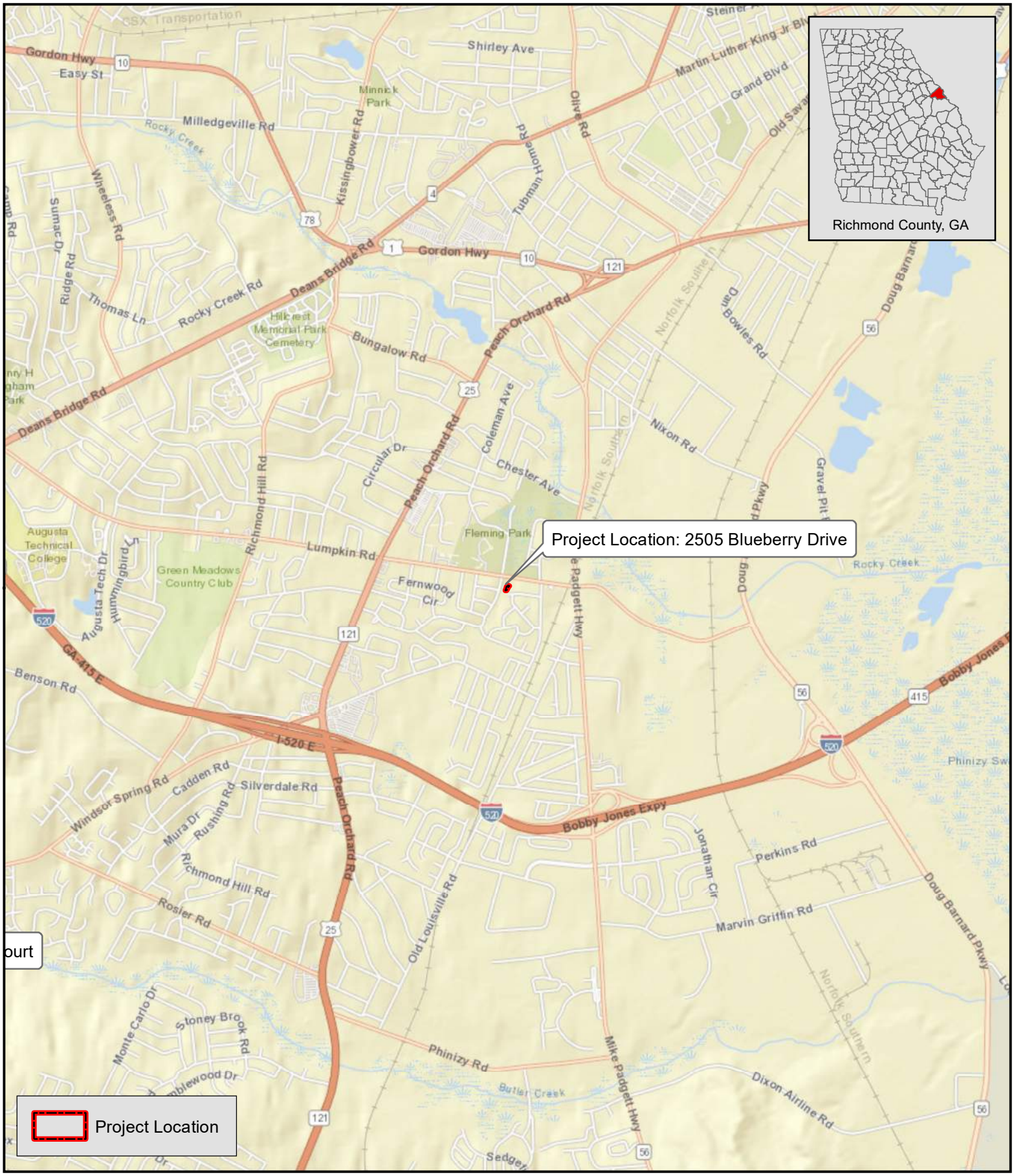
Alex Darr, CPESC, CERP
Associate | Project Manager
Darra@Pondco.com; (470) 387-8899

Madison Wichmann

Madison Wichmann, EIT
Water Resource Engineer II
Madison.Wichmann@Pondco.com

ATTACHMENTS:
Attachment A: Project Figures
Attachment B: Photograph Log
Attachment C: USGS Stream Stats Report
Attachment D: Bank Repair Option Typical Details

ATTACHMENT A
PROJECT FIGURES



Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Figure 1
Project Location Map

POND

0 3,000 6,000 Feet
0 1,000 2,000 Meters

1 in = 3,000 ft

2505 Blueberry Drive
Richmond County, GA
July 2024
Pond Project #: 1240319
Map Author: KAD

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Figure 2
Project Area Map - Aerial

POND

0 75 150 Feet
0 25 50 Meters

1 in = 75 ft

2505 Blueberry Drive
Richmond County, GA
July 2024
Pond Project #: 1240319
Map Author: KAD

Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed

Figure 3
Project Area Map - Topography

POND

0 500 1,000 Feet
0 170 340 Meters

1 in = 500 ft

2505 Blueberry Drive
Richmond County, GA
July 2024
Pond Project #: 1240319
Map Author: KAD

Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Figure 4
NRCS Soil Survey Map

POND

0 75 150 Feet
0 25 50 Meters

1 in = 75 ft

2505 Blueberry Drive
Richmond County, GA
July 2024
Pond Project #: 1240319
Map Author: KAD

Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

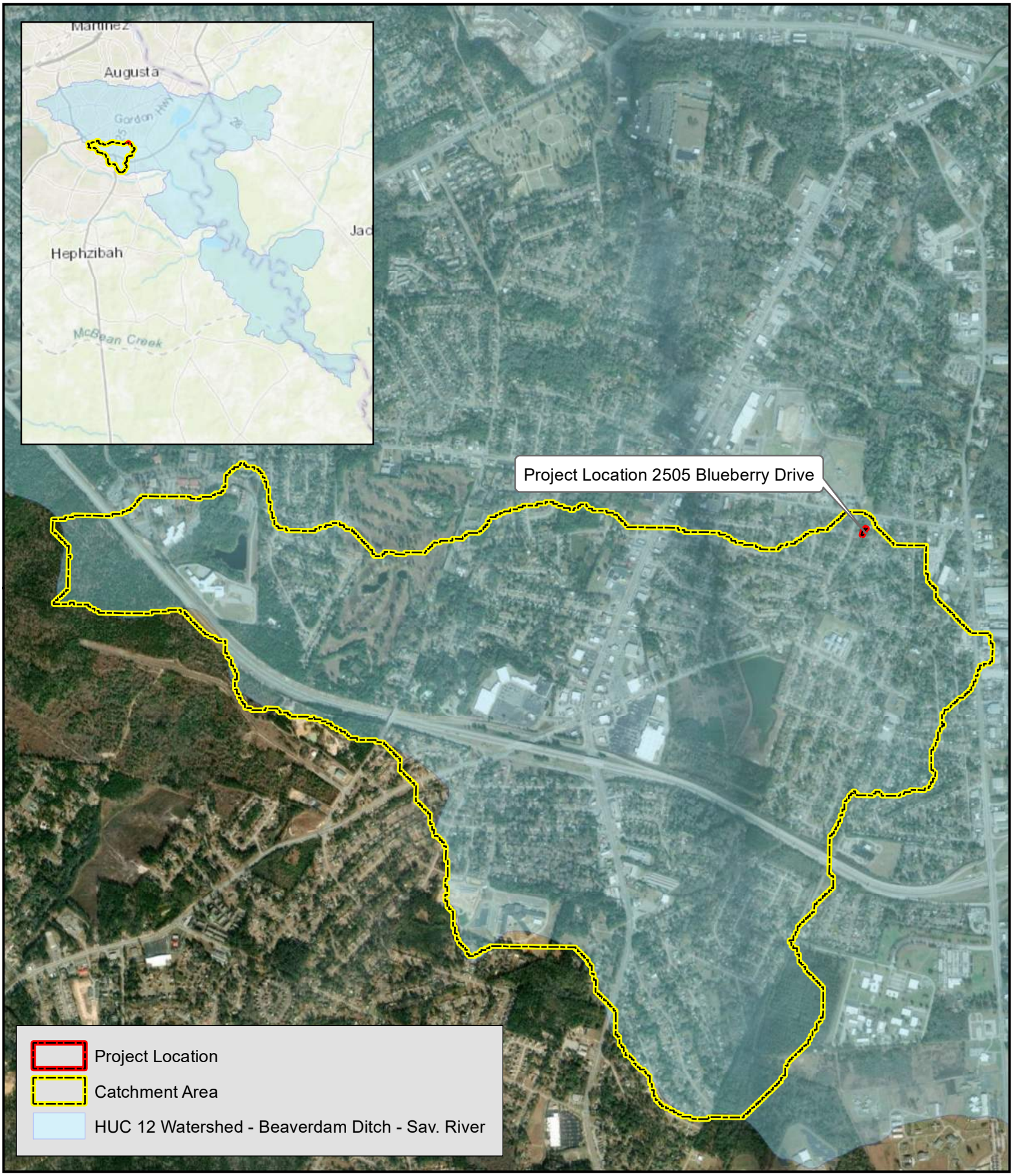
Figure 5
FEMA NFHL Floodplain Map

POND

0 1,000 2,000 Feet
0 345 690 Meters

1 in = 1,000 ft

2505 Blueberry Drive
Richmond County, GA
July 2024
Pond Project #: 1240319
Map Author: KAD



Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors,

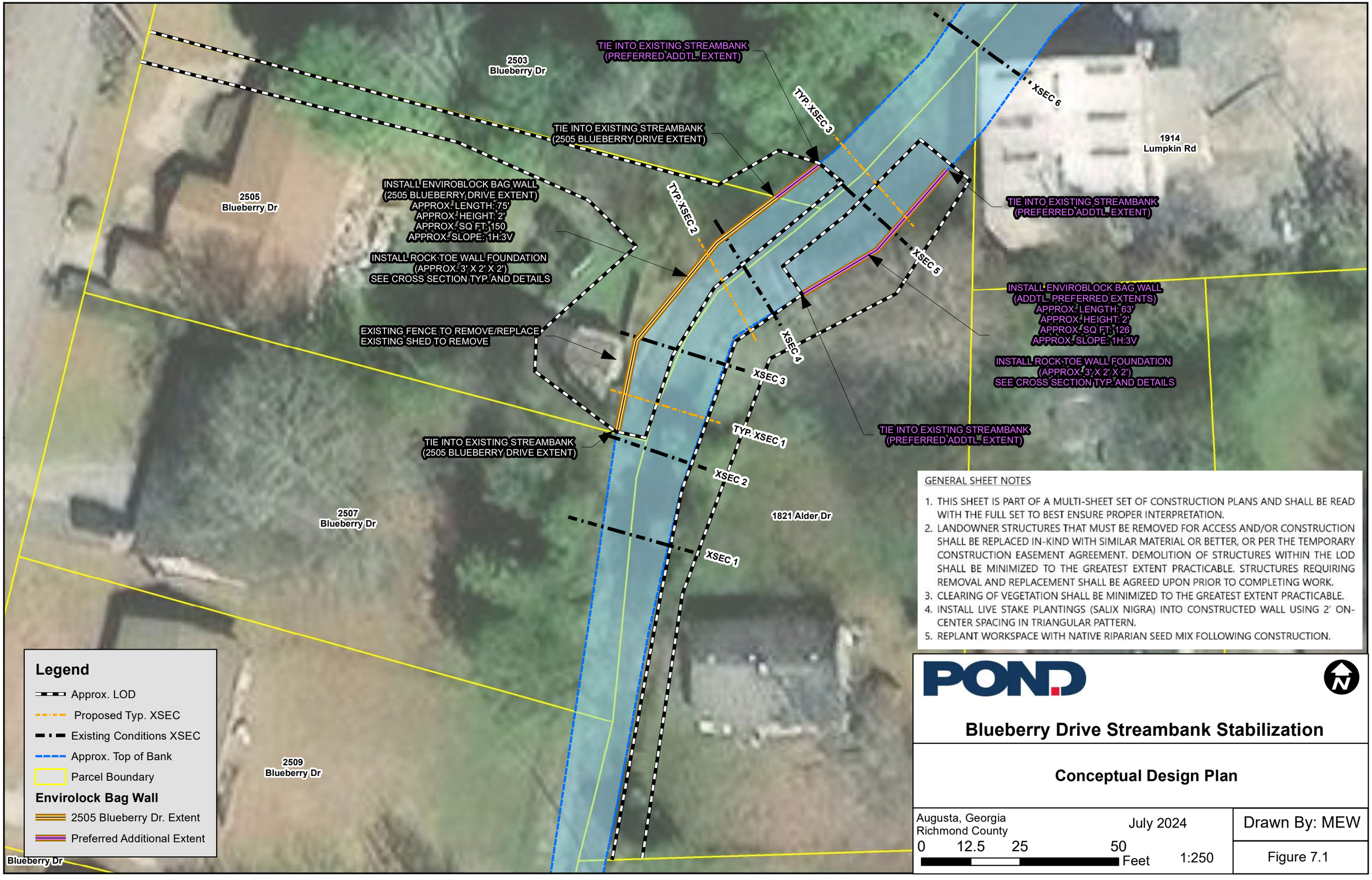
Figure 6
Watershed Map

POND

0 2,000 4,000 Feet
0 650 1,300 Meters

1 in = 2,000 ft

2505 Blueberry Drive
Richmond County, GA
July 2024
Pond Project #: 1240319
Map Author: KAD



Legend

- Approx. LOD
- Proposed Typ. XSEC
- Existing Conditions XSEC
- Approx. Top of Bank
- Parcel Boundary

Envirolock Bag Wall

- 2505 Blueberry Dr. Extent
- Preferred Additional Extent

GENERAL SHEET NOTES

1. THIS SHEET IS PART OF A MULTI-SHEET SET OF CONSTRUCTION PLANS AND SHALL BE READ WITH THE FULL SET TO BEST ENSURE PROPER INTERPRETATION.
2. LANDOWNER STRUCTURES THAT MUST BE REMOVED FOR ACCESS AND/OR CONSTRUCTION SHALL BE REPLACED IN-KIND WITH SIMILAR MATERIAL OR BETTER, OR PER THE TEMPORARY CONSTRUCTION EASEMENT AGREEMENT. DEMOLITION OF STRUCTURES WITHIN THE LOD SHALL BE MINIMIZED TO THE GREATEST EXTENT PRACTICABLE. STRUCTURES REQUIRING REMOVAL AND REPLACEMENT SHALL BE AGREED UPON PRIOR TO COMPLETING WORK.
3. CLEARING OF VEGETATION SHALL BE MINIMIZED TO THE GREATEST EXTENT PRACTICABLE.
4. INSTALL LIVE STAKE PLANTINGS (SALIX NIGRA) INTO CONSTRUCTED WALL USING 2' ON-CENTER SPACING IN TRIANGULAR PATTERN.
5. REPLANT WORKSPACE WITH NATIVE RIPARIAN SEED MIX FOLLOWING CONSTRUCTION.

POND

Blueberry Drive Streambank Stabilization

Conceptual Design Plan

Augusta, Georgia
Richmond County

July 2024

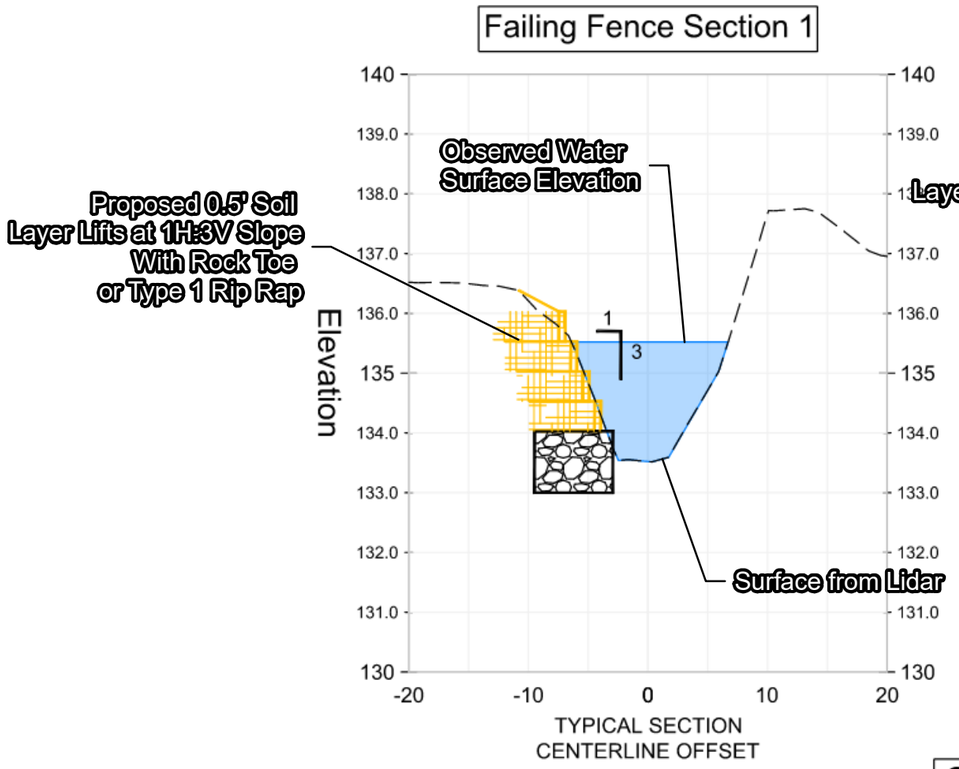
0 12.5 25 50 Feet

1:250

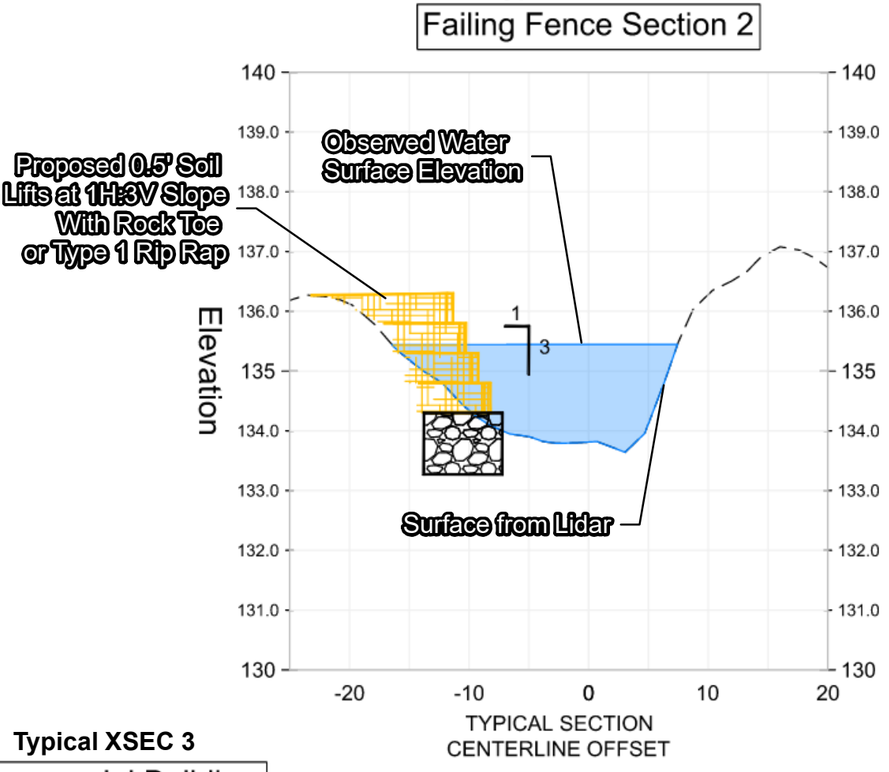
Drawn By: MEW

Figure 7.1

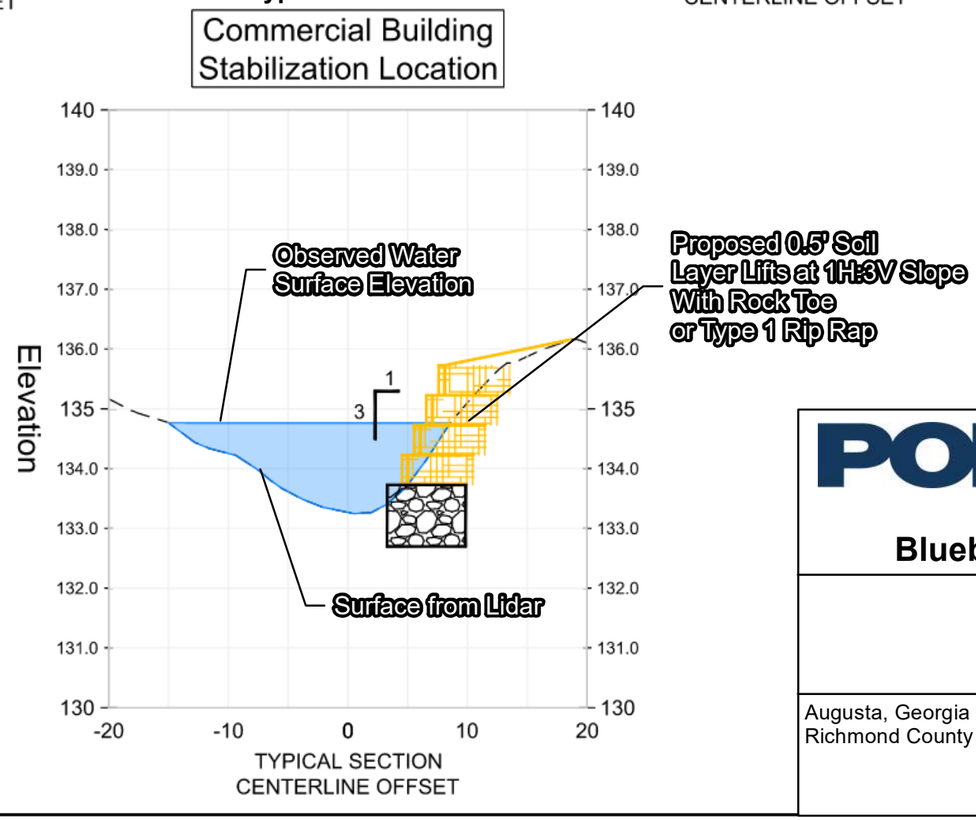
Typical XSEC 1



Typical XSEC 2



Typical XSEC 3



POND

Blueberry Drive Streambank Stabilization

Conceptual Design Plan

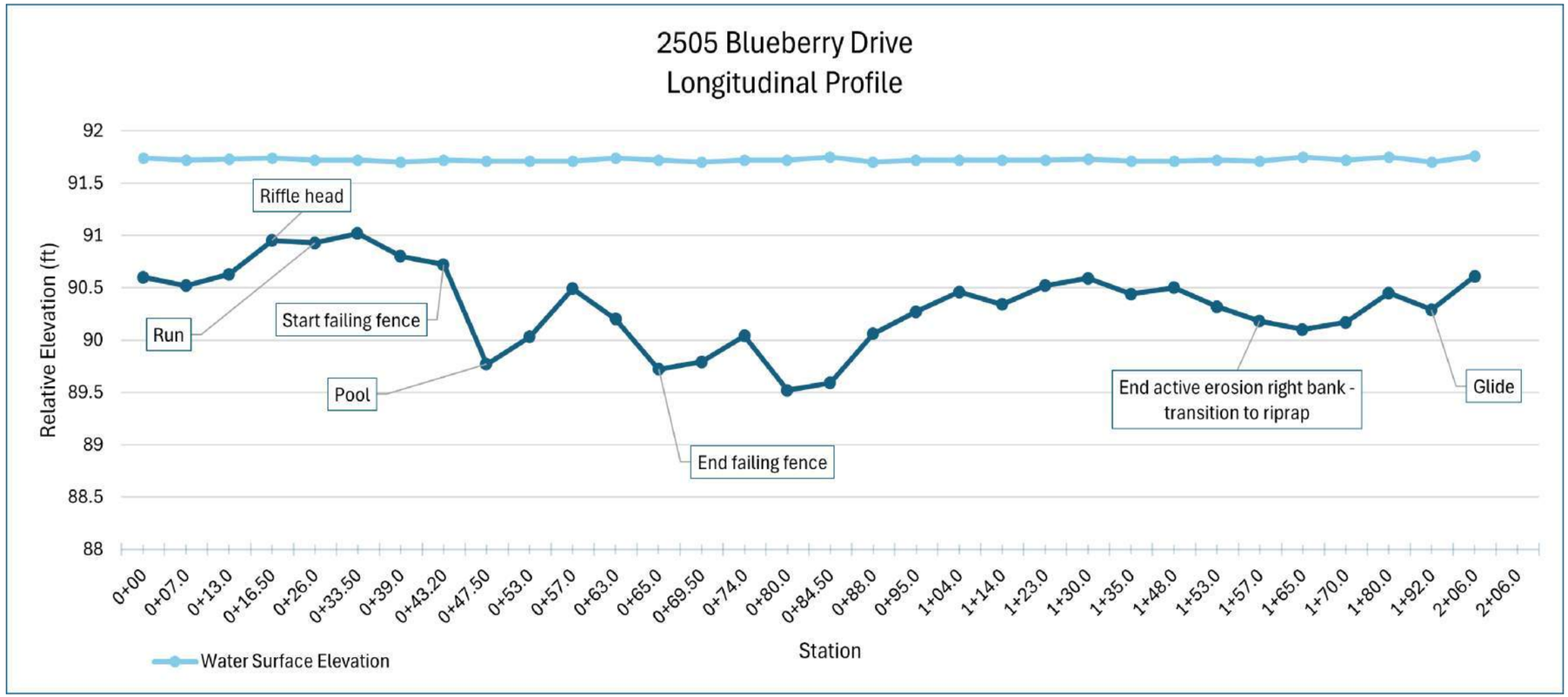
Stabilization Profiles

Augusta, Georgia
Richmond County

July 2024

Drawn By: MEW

Figure 7.2

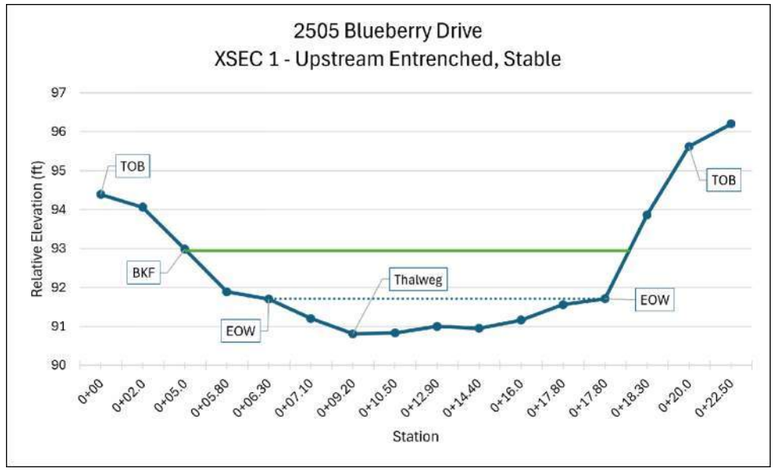


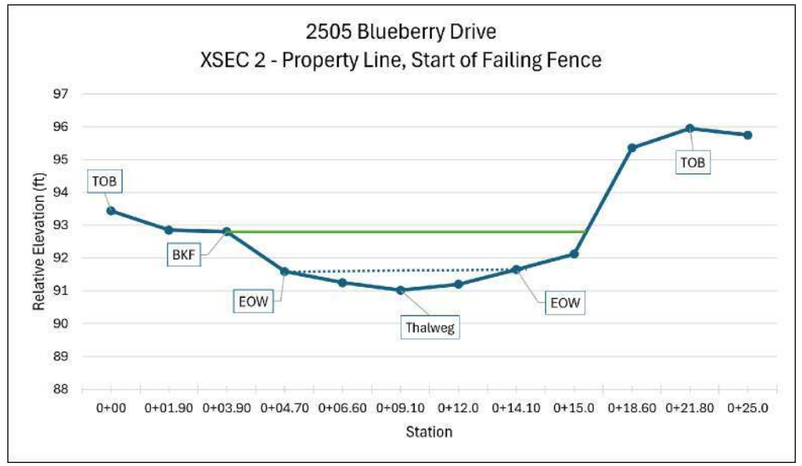
Blueberry Drive Streambank Stabilization

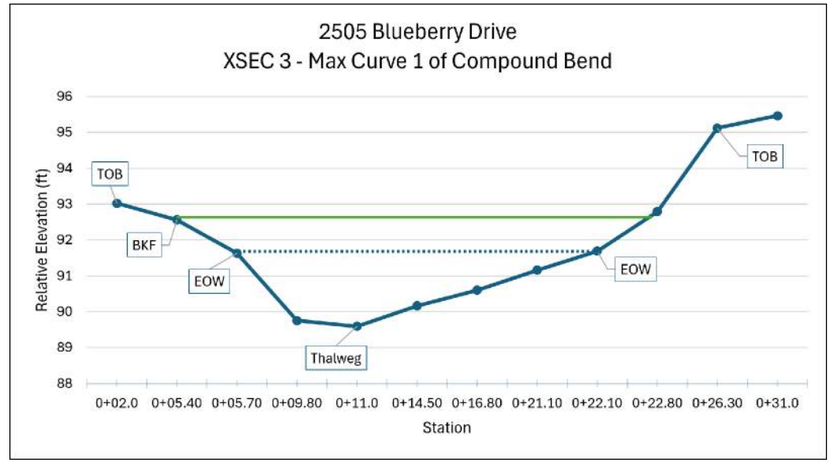
Conceptual Design Plan

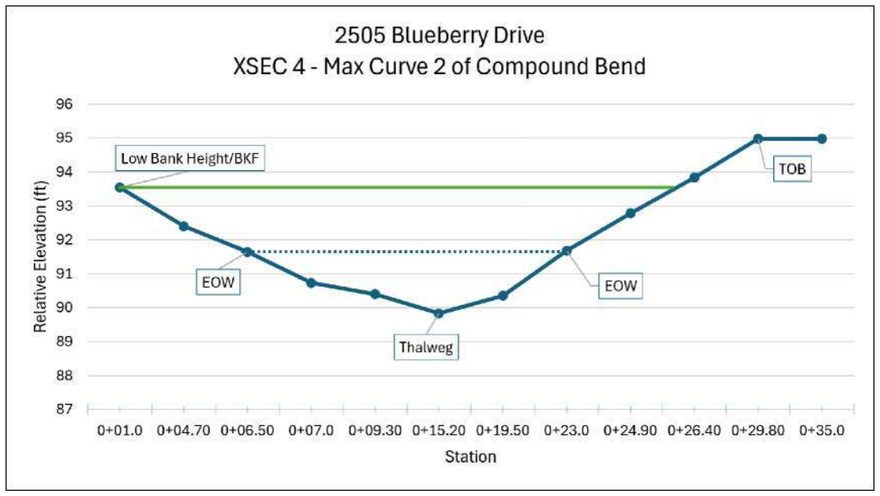
Longitudinal Profile

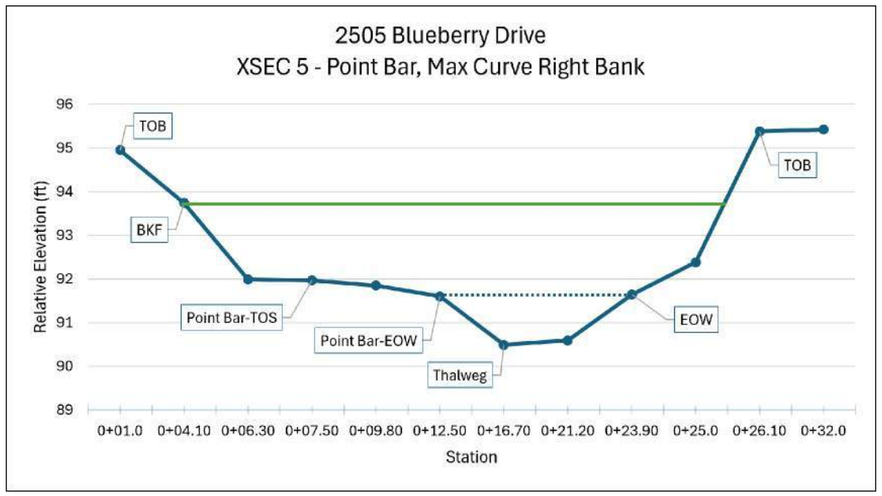
Augusta, Georgia Richmond County	July 2024	Drawn By: MEW
		Figure 7.3

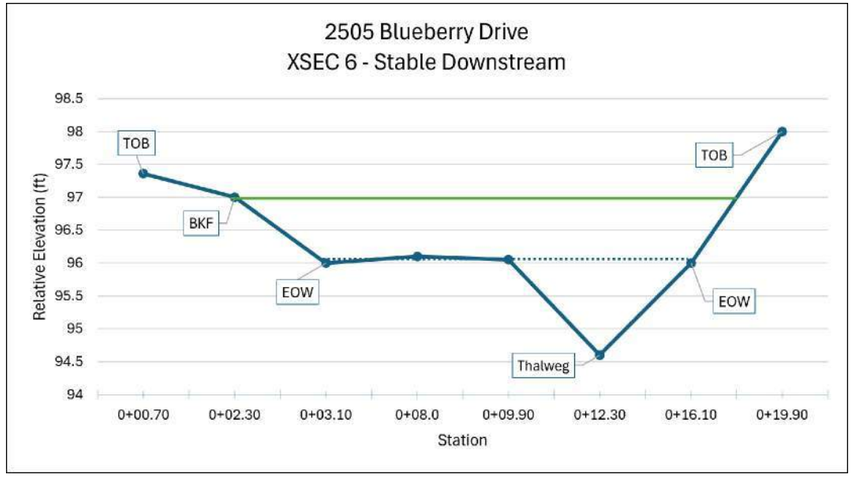












POND

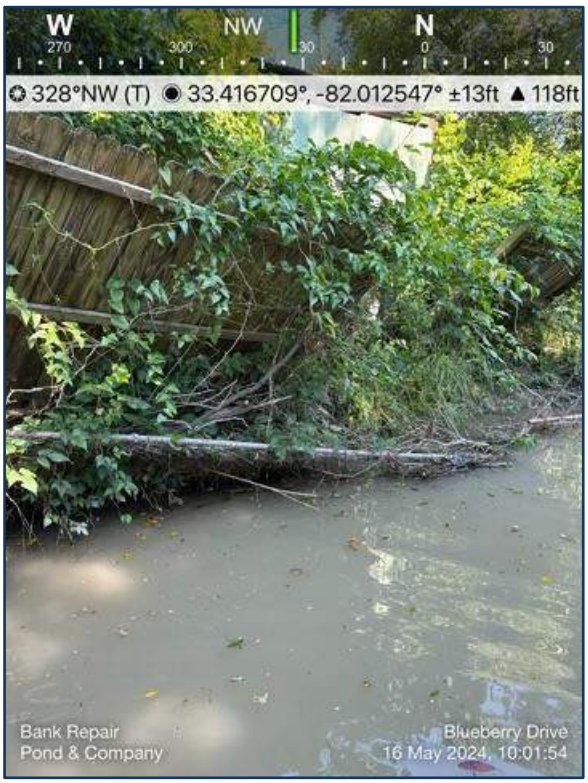
Blueberry Drive Streambank Stabilization

Conceptual Design Plan

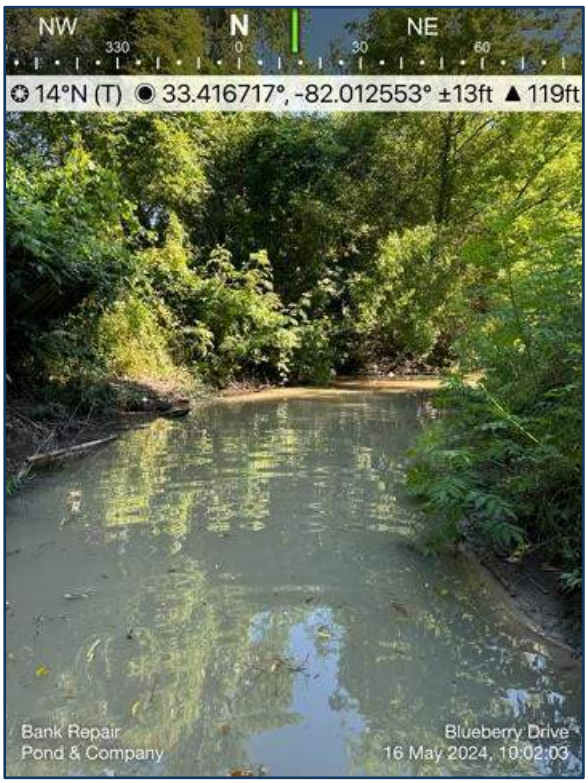
Existing Conditions Cross-Sections

Augusta, Georgia Richmond County	July 2024	Drawn By: MEW
		Figure 7.4

ATTACHMENT B
PHOTOGRAPH LOG

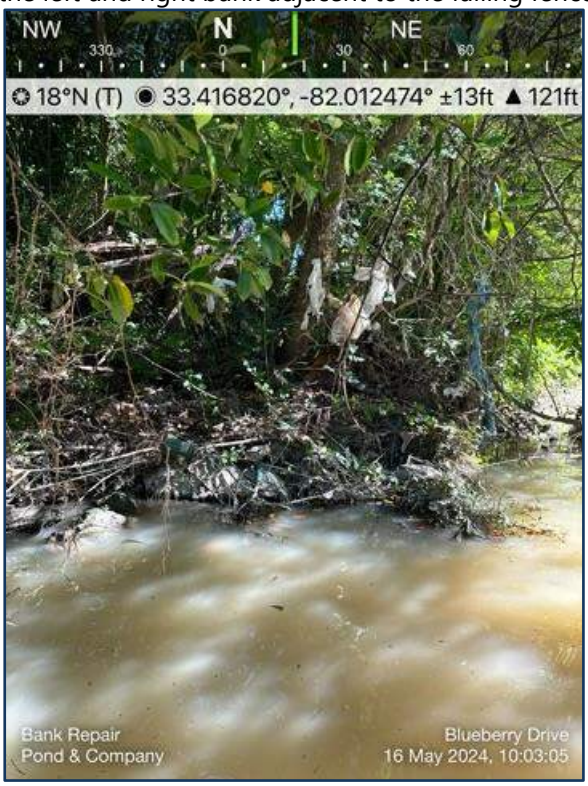


Photograph 1: 2505 Blueberry Drive, looking downstream at the left bank adjacent to the failing fence line.

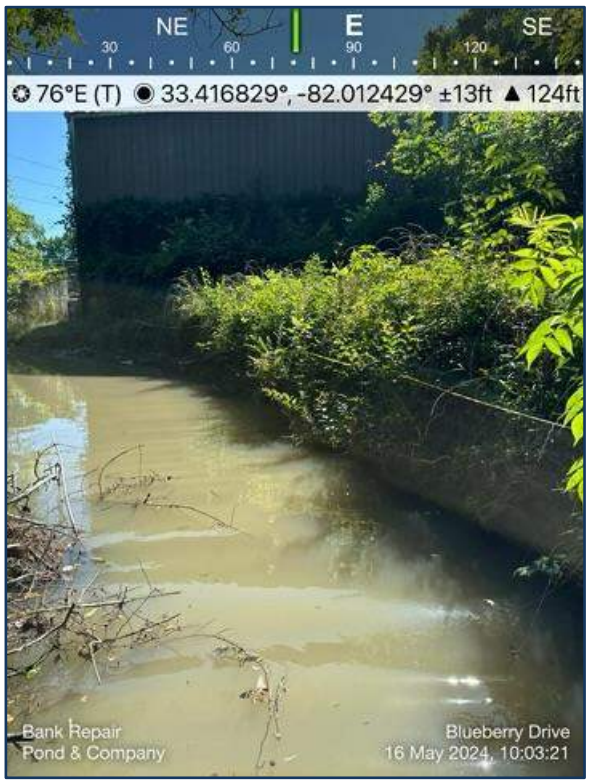


Photograph 2: 2505 Blueberry Drive, looking downstream at the left and right bank adjacent to the failing fence line.

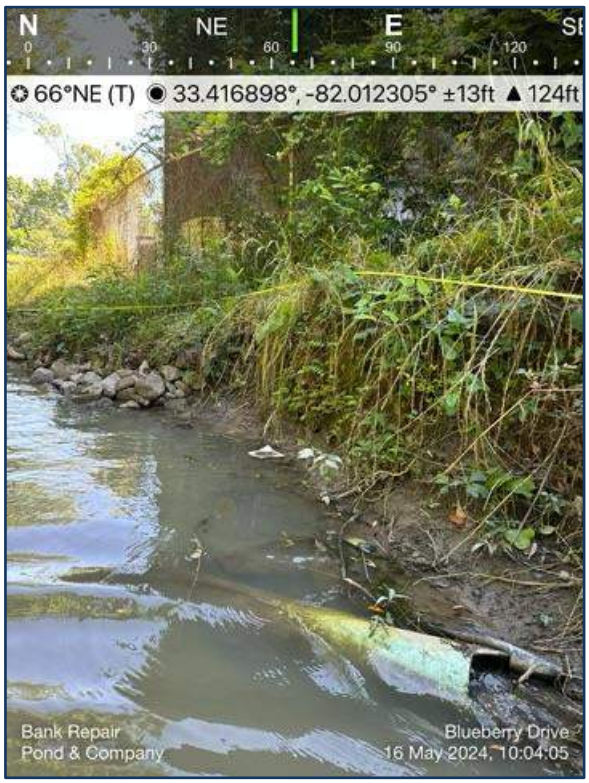
Photograph 3: 2505 Blueberry Drive, looking downstream at the left bank adjacent to the failing fence line.



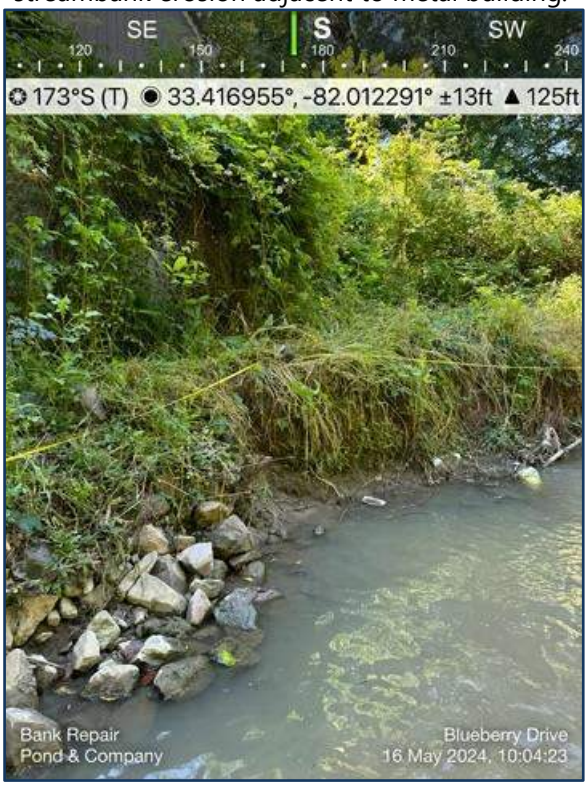
Photograph 4: Looking downstream at left bank just beyond 2505 Blueberry Drive.



Photograph 5: Looking downstream at right bank; active streambank erosion adjacent to metal building.



Photograph 6: Looking downstream at right bank; active streambank erosion adjacent to metal building.



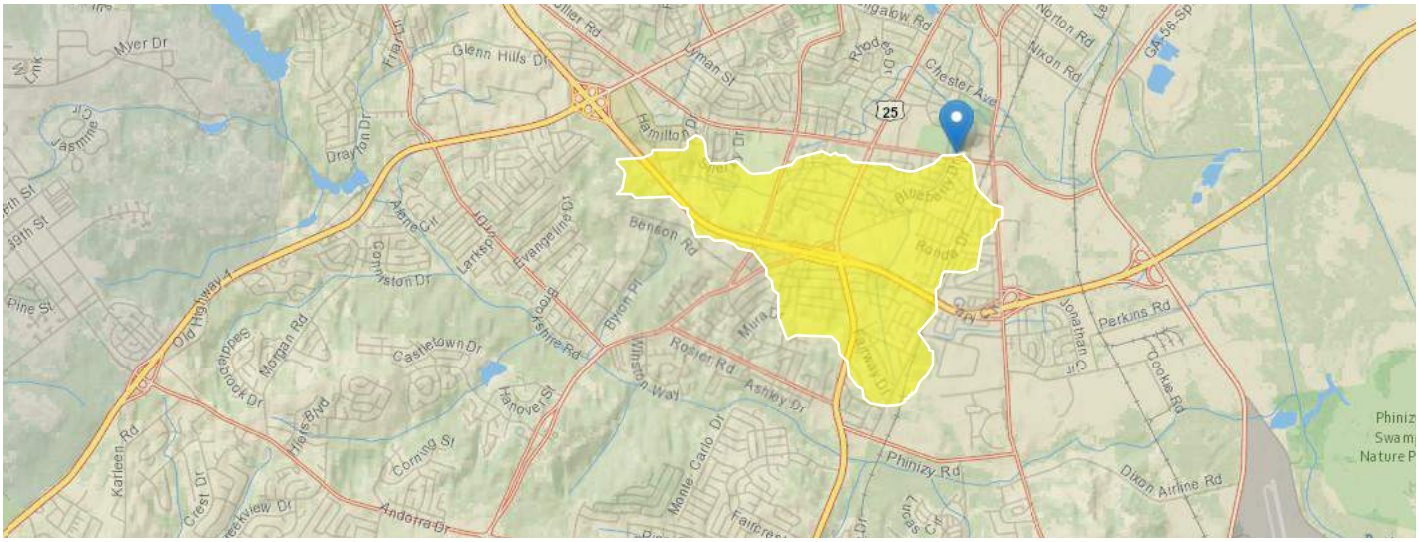
Photograph 7: Looking upstream at right bank; active streambank erosion adjacent to metal building.

Photograph 8: Looking upstream at right bank; downstream of active erosion adjacent to metal building.

ATTACHMENT C
USGS STREAM STATS REPORT

2505 Blueberry Dr. StreamStats

Region ID: GA
Workspace ID: GA20240501134708155000
Clicked Point (Latitude, Longitude): 33.41785, -82.01172
Time: 2024-05-01 09:47:33 -0400



Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLDEM10M	Mean basin slope computed from 10 m DEM	3.588	percent
CSL10_85	Change in elevation divided by length between points 10 and 85 percent of distance along main channel to basin divide - main channel method not known	90.9	feet per mi
DRNAREA	Area that drains to a point on a stream	2.68	square miles
ELEV	Mean Basin Elevation	227	feet
ELEVMAX	Maximum basin elevation	452	feet
GWHEAD	Mean basin elevation minus minimum basin elevation	90.5	feet
I24H100Y	Maximum 24-hour precipitation that occurs on average once in 100 years	7.91	inches
I24H10Y	Maximum 24-hour precipitation that occurs on average once in 10 years	4.89	inches
I24H25Y	Maximum 24-hour precipitation that occurs on average once in 25 years	5.96	inches
I24H50Y	Maximum 24-hour precipitation that occurs on average once in 50 years	6.89	inches
LC06AGRI	Percent agriculture computed as total of grass, pasture, and crops, NLCD classes 71, 81 and 82	1.696	percent
LC06DEV	Percentage of land-use from NLCD 2006 classes 21-24	88.651	percent
LC06FOREST	Percentage of forest from NLCD 2006 classes 41-43	5.865	percent
LC06IMP	Percentage of impervious area determined from NLCD 2006 impervious dataset	30.85	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	89.3	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	31.4	percent
MINBELEV	Minimum basin elevation	137	feet
PCTREG1	Percentage of drainage area located in Region 1 - Piedmont / Ridge and Valley	0	percent
PCTREG2	Percentage of drainage area located in Region 2 - Blue Ridge	0	percent
PCTREG3	Percentage of drainage area located in Region 3 - Sandhills	100	percent
PCTREG4	Percentage of drainage area located in Region 4 - Coastal Plains	0	percent

Parameter Code	Parameter Description	Value	Unit
PCTREG5	Percentage of drainage area located in Region 5 - Lower Tifton Uplands	0	percent
PRECPRIS00	Basin average mean annual precipitation for 1971 to 2000 from PRISM	47.7	inches
RELIEF	Maximum - minimum elevation	316	feet
RRMEAN	Relief ratio defined as (ELEV-MINBELEV)/(ELEVMAX-MINBELEV)	0.287	dimensionless

Peak-Flow Statistics

Peak-Flow Statistics Parameters [Peak Southeast US GA 2023 5006]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
PCTREG1	Percent Area in Region 1	0	percent	0	100
PCTREG2	Percent Area in Region 2	0	percent	0	100
PCTREG3	Percent Area in Region 3	100	percent	0	100
PCTREG5	Percent Area in Region 5	0	percent	0	100
DRNAREA	Drainage Area	2.68	square miles	0.08	8902
PCTREG4	Percent Area in Region 4	0	percent	0	100

Peak-Flow Statistics Flow Report [Peak Southeast US GA 2023 5006]

PIL: Lower 90% Prediction Interval, PIU: Upper 90% Prediction Interval, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PIL	PIU	ASEp
50-percent AEP flood	78.4	ft^3/s	42.7	144	36.8
20-percent AEP flood	140	ft^3/s	78.2	251	35.8
10-percent AEP flood	191	ft^3/s	106	345	36.3
4-percent AEP flood	261	ft^3/s	138	492	38.4
2-percent AEP flood	325	ft^3/s	171	619	39.8
1-percent AEP flood	387	ft^3/s	198	755	41.3
0.5-percent AEP flood	453	ft^3/s	227	905	42.8
0.2-percent AEP flood	540	ft^3/s	264	1110	44.4

Peak-Flow Statistics Citations

Feaster, T.D., Gotvald, A.J., Musser, J.W., Weaver, J.C, Kolb, K.R., Veilleux, A.G., and Wagner, D.M.2023, Magnitude and frequency of floods for rural streams in Georgia, South Carolina, and North Carolina, 2017—Results: U.S. Geological Survey Scientific Investigations Report 2023-5006, 75 p. (https://pubs.er.usgs.gov/publication/sir20235006)

Bankfull Statistics

Bankfull Statistics Parameters [Atlantic Plain D Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.68	square miles	0.30888	1086.8715

Bankfull Statistics Parameters [USA Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.68	square miles	0.07722	59927.7393

Bankfull Statistics Flow Report [Atlantic Plain D Bieger 2015]

Statistic	Value	Unit
Bieger_D_channel_width	14.7	ft
Bieger_D_channel_depth	1.47	ft
Bieger_D_channel_cross_sectional_area	20.9	ft^2

Bankfull Statistics Flow Report [USA Bieger 2015]

Statistic	Value	Unit
Bieger_USA_channel_width	17.5	ft
Bieger_USA_channel_depth	1.49	ft
Bieger_USA_channel_cross_sectional_area	29.1	ft^2

Bankfull Statistics Flow Report [Area-Averaged]

Statistic	Value	Unit
Bieger_D_channel_width	14.7	ft
Bieger_D_channel_depth	1.47	ft
Bieger_D_channel_cross_sectional_area	20.9	ft^2
Bieger_USA_channel_width	17.5	ft
Bieger_USA_channel_depth	1.49	ft
Bieger_USA_channel_cross_sectional_area	29.1	ft^2

Urban Peak-Flow Statistics

Urban Peak-Flow Statistics Parameters [Region 3 Urban 2014 5030]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.68	square miles	0.14	459
LC06DEV	Percent Developed from NLCD2006	88.651	percent	2.8	98.5

Urban Peak-Flow Statistics Flow Report [Region 3 Urban 2014 5030]

PIL: Lower 90% Prediction Interval, PIU: Upper 90% Prediction Interval, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PIL	PIU	ASEp
Urban 50-percent AEP flood	694	ft^3/s	299	1610	42.5
Urban 20-Percent AEP flood	906	ft^3/s	353	2320	47.6
Urban 10-percent AEP flood	1040	ft^3/s	380	2850	51.2
Urban 4-percent AEP flood	1230	ft^3/s	416	3630	56
Urban 2-percent AEP flood	1350	ft^3/s	427	4270	59.7
Urban 1-percent AEP flood	1510	ft^3/s	452	5050	63.5
Urban 0.5-percent AEP flood	1640	ft^3/s	455	5910	67.4
Urban 0.2-percent AEP flood	1820	ft^3/s	463	7150	73.3

Urban Peak-Flow Statistics Citations

Feaster, T.D., Gotvald, A.J., and Weaver, J.C.,2014, Methods for estimating the magnitude and frequency of floods for urban and small, rural streams in Georgia, South Carolina, and North Carolina, 2011 (ver. 1.1, March 2014): U.S. Geological Survey Scientific Investigations Report 2014–5030, 104 p. (http://pubs.usgs.gov/sir/2014/5030/)

Maximum Probable Flood Statistics

Maximum Probable Flood Statistics Parameters [Southeast US MPF blw FallLine medium 2023 5006]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.68	square miles	0.3201	168

Maximum Probable Flood Statistics Parameters [Crippen Bue Region 3]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.68	square miles	0.1	10000

Maximum Probable Flood Statistics Flow Report [Southeast US MPF blw FallLine medium 2023 5006]

Statistic	Value	Unit
Maximum Flood Southeastern US	1870	ft^3/s

Maximum Probable Flood Statistics Flow Report [Crippen Bue Region 3]

Statistic	Value	Unit
Maximum Flood Crippen Bue Regional	10100	ft^3/s

Maximum Probable Flood Statistics Flow Report [Area-Averaged]

Statistic	Value	Unit
Maximum Flood Southeastern US	1870	ft^3/s
Maximum Flood Crippen Bue Regional	10100	ft^3/s

Maximum Probable Flood Statistics Citations

Crippen, J.R. and Bue, Conrad D.1977, Maximum Floodflows in the Conterminous United States, Geological Survey Water-Supply Paper 1887, 52p. (https://pubs.usgs.gov/wsp/1887/report.pdf)
Feaster, T.D., Gotvald, A.J., Musser, J.W., Weaver, J.C, Kolb, K.R., Veilleux, A.G., and Wagner, D.M.2023, Magnitude and frequency of floods for rural streams in Georgia, South Carolina, and North Carolina, 2017—Results: U.S. Geological Survey Scientific Investigations Report 2023-5006, 75 p. (https://pubs.er.usgs.gov/publication/sir20235006)

Application Version: 4.20.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.1

ATTACHMENT D
BANK REPAIR OPTION TYPICAL DETAILS

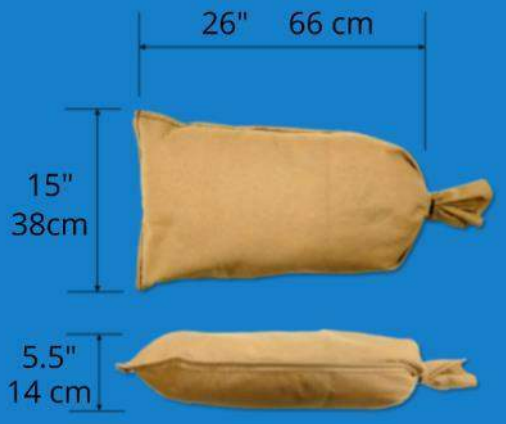
Envirolok®
Designed For Nature...Engineered For Life

GN1-21
DESIGN AND ENGINEERING MANUAL

Envirolok Bags

Filled unit size:
26"L x 15"W x 5.5"H
66cm L x 38cm W x 14cm H

Calculated unit fill:
1.25 cu ft
0.0354 m^3/unit
Note: *Unit size may vary based on actual fill*

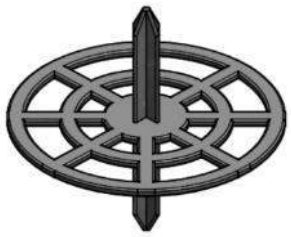


- **Face Area: 1 SF***
- **Mattress Face Area 2.7 SF***
- **+-1.25 cf/ bag ***
- **80-90 lbs. Carrying Weight***

The following notes are provided as a general overview for design and engineering. Refer to complete product specifications, design software and training videos available at www.envirolok.com or www.caddetails.com. Please contact our engineering / technical team at 608.226.2565 or ecosolutions@envirolok.com with any questions or design assistance.

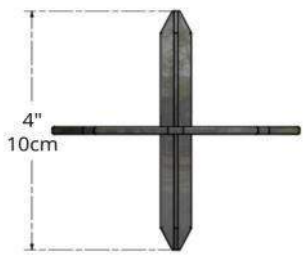
Envirolok Unit

One (1) Envirolok bag
Two (2) Connector Pins (Spikes)
One (1) UV Resistant Tie



Envirolok Spikes

- 2 spikes shall be installed for each bag.
- Spikes shall be a minimum of 4" from all edges of the bag.
- Spikes should be placed in base course material or foundation soil prior to installing the foundation course if possible.
- Do not place spikes in the top of the coping unit.



WATERWAYS | SLOPES | LIVING SHORELINES

Envirolok Bag-Fill

Bag-fill volume: 1.25 cf (.3054 m^3)

Bag weight: 80-90 lbs (36 kg- 41 kg)

Bag-fill content:

60-80% granular sand / **20-40%** topsoil.

⇒ 3/4" clear gravel may be substituted for embedded bags

⇒ See Envirolok bag-fill specifications for full details **(Document BF-20)**

Contact the Envirolok team or local distributor for recommendations on bag-filling methods.

Collaborative Design Approach

Contact the Envirolok engineering / technical team at ecosolutions@envirolok.com for design, engineering, estimate of probable cost and / or material quantities. Services are provided at no charge, unless stamped engineered plans are requested. To get started, our team will need the following:

- **Project Description**
- **Project location**
- **Site plan or topographic map (if available)**
- **Site photos**
- **Length and height of the slope**
- **General soil type (soils report, geotechnical report or a simple picture will do)**
- **Design software can also be downloaded at www.envirolok.com**

Design Tips

Global Stability: Consult with the Envirolok Engineering & Technical Team or download the Envirolok design software to ensure proper strength global stability are achieved.

Toe Protection Recommendations: For projects where scouring is a concern, consult the Envirolok team or see detail sheets **SW2-20 through SW13-20.**

Note: Gravel setting base / leveling course may be required in clay or wet soils.

Design Criteria

Flow Rate: 6m / sec

Mannings Value: 0.025

Drainage Recommendations:

- Control surface water by diverting overland flow from wall. Consult with an engineer for recommendations.
- Do not discharge runoff into backfill zone.
- Inspect site for indications of wet soils or seeps at wall base and backfill zone.
- See drainage detail sheets **D1-20 through D4-20** for recommended drainage systems.
- Consult with a local engineer for site specific recommendations.

Envirolok Applications

Slope Applications (>2H:1V)

Face Area: 1 Unit = + - 1 sf
Total Unit Calculation:
(Slope Ht. x L) / .9 = Total Units*
***For preliminary total purposes only.**

Mattress Applications (<2H:1V)

Face Area: 1 Unit = + - 2.7sf
Total Unit Calculation:
Slope Area (L x W) / 2.5= Total Units*
***For preliminary total purposes only.**

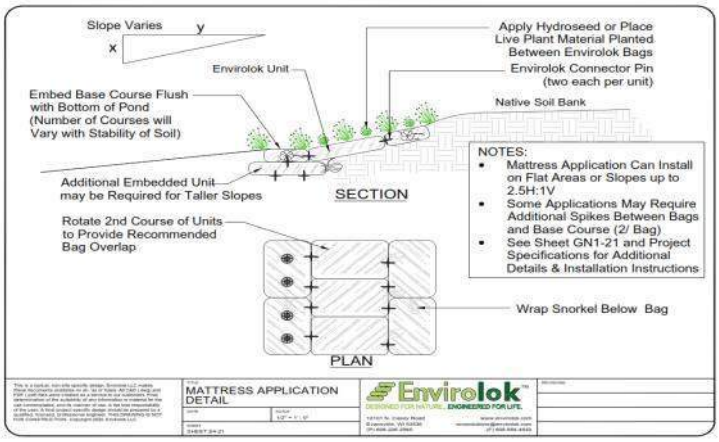
Slope Heights < 4' (1.2 m)

- Embed a min of ½ unit for the foundation course.
- Place coping course in the tie-back position **(S8-20 & S9-20).**
- Tie-back reinforcement can be used for additional reinforcement.
- Alternative reinforcement, such as geogrid layering or earth anchors may be required for projects adjacent to waterways.

Slope Heights > 4' (1.2 m)

- Embed a min of 1 unit for the foundation course for every 10 feet in height.
- Place foundation course and coping course in the tie -back position.
- Reinforcement, such as geogrid layering, earth anchors or rock anchors may be required. See detail sheets **RD3-20** through **RD8-20.**
- Slope setbacks > 1:1 typically reduce the length of reinforcement (geogrid or earth anchors).
- Consider terracing tall walls for ease of construction on slopes above 8' in height.

- Embed a min of ½ unit for the foundation course
- Alternate the installation pattern to ensure proper overlap of 6" between bags is achieved.
- Alternative reinforcement, such as geogrid layering or earth anchors may be required for projects adjacent to waterways or subject to routine flooding



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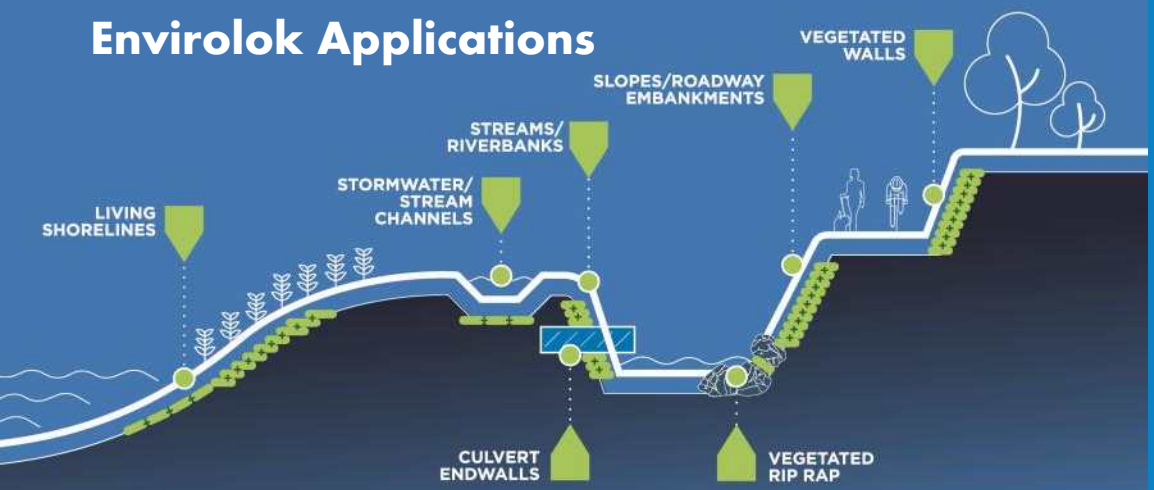
WATERWAYS | SLOPES | LIVING SHORELINES

Envirolok Applications



Envirolok Design Flow Chart

The Flow Chart included as an overall guideline for general design guidelines. We encourage you to connect with Envirolok's Engineering & Technical Support Team for design and construction recommendations.

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Design Flow Chart

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1 **Is your slope >2H:1V?**
- If yes, use slope application details SD (1-3)-20 & SD (6-14) — Go to #2
- If no, use mattress application details SD(4-6)-20 — Go to #7

2 **Is there runoff onto the slope or are the existing soils wet?**
- If yes, use details D(1-4)-20 — Go to #3
- If unsure, consult the Envirolok Team

3 **Does the slope height exceed 4'?**
- If yes, advanced reinforcement is necessary — Go to #4
- If no, use tie-back reinforcement RD(1-2)-20 — Go to #6

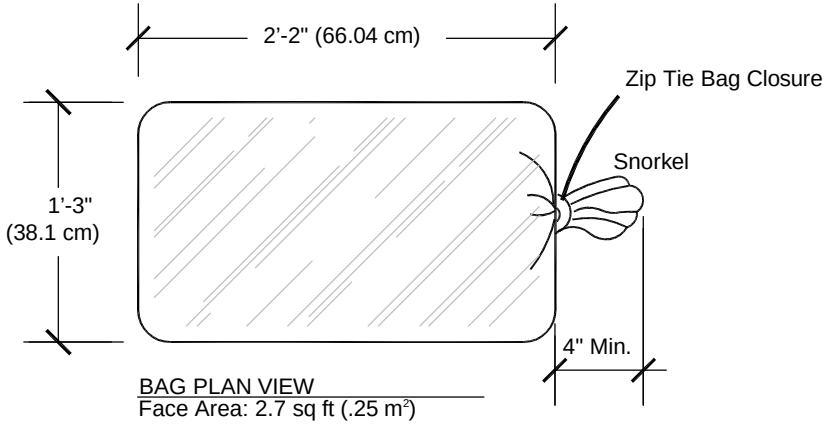
4 **Can the area be excavated?**
- If yes, use details RD (3-6)-20
- If no, Go to #5

5 **Retained Material**
- If retained material is soil, use details RD(6-7)-20 — Go to #6
- If retained material is bedrock, use detail RD(8)-20 — Go to #6

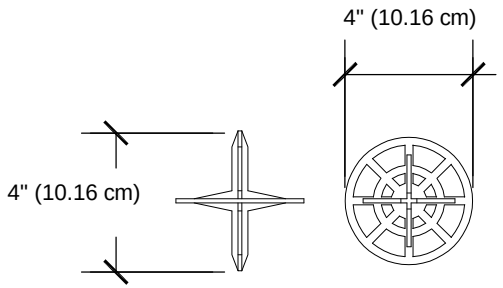
6 **Does your slope application project include a waterway or shoreline?**
- For low energy water conditions, see detail SW (3)-20 — Go to #8
- For high energy water conditions, see detail SW (4-11)-20 — Go to #8

7 **Does your mattress application project include a waterway or shoreline?**
- For low energy water conditions, see detail SW (1)-20 — Go to #8
- For high energy water conditions, see detail SW (2)-20 — Go to #8
- For stream and stormwater channels, see details LF (1-4)-20 — Go to #8

8 **Vegetation Methods**
- For plug plantings or hydroseeding, see detail VD 1-20
- For brush layering / bare roots see details VD 2-20
- For live stakes see detail VD 3-20
- For sod / sedum mats / vegetated mats see detail VD 4-20



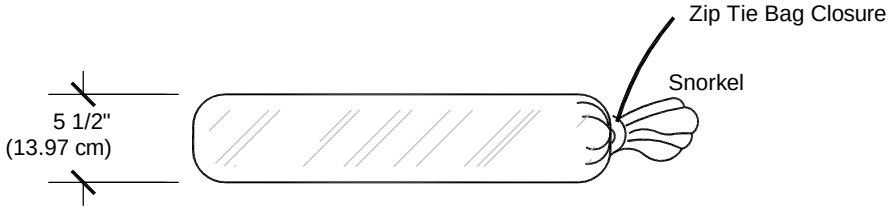
BAG PLAN VIEW
Face Area: 2.7 sq ft (.25 m^2)



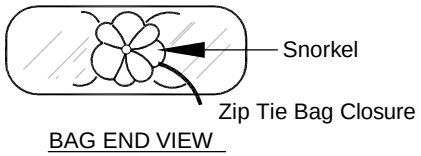
ENVIROLOK CONNECTOR PIN (SPIKES)
SCALE: 1/2" = 1' - 0"

NOTE:

- Two Connector Pins shall be installed per bag, interconnecting the bags vertically
- Connector Pins shall be used to connect the first row of bags to the base setting course.
- Connector Pins shall penetrate each bag and/ or base course minimum of 2".
- Pin locations will vary with the slope of the structure and should be placed in the center of the bag contact area between courses.



BAG ELEVATION
Face Area: 1 sq ft (.093 m^2)



BAG END VIEW

ENVIROLOK BAG SPECIFICATION:

- Calculated Unit Fill: 1.25 cu ft (.0354 m^3)/unit
- Face Area (Slope Application): 1 sq ft (.093 m^2)
- Face Area (Mattress Application): 2.7 sq ft (.25 m^2)/unit

ENVIROLOK BAG-FILL SPECIFICATION:

- Bag-Fill Volume: 1.25 cf (.0354 m^3)/unit
- Bag-Fill Content: 80% Granular Sand / 20% Topsoil.
- 3/4" Clear Gravel may be Substituted as Bag-Fill for Embedded Bags
- See Sheet GN1-20 And Project Specifications for Additional Notes.

NOTE:

- Quantities required vary based on unit filling and design layout
- See Sheet GN1-20 and Project Specifications for Additional Details & Installation Instructions
- One Envirolok Unit consists of:
  - One (1) Envirolok Bag
  - Two (2) Connector Pins
  - One (1) Zip Tie Bag Closure

TITLE
STANDARD UNIT DETAIL

DATE
JANUARY 2020

SCALE
1" = 1' - 0"

SHEET
SHEET S1-21

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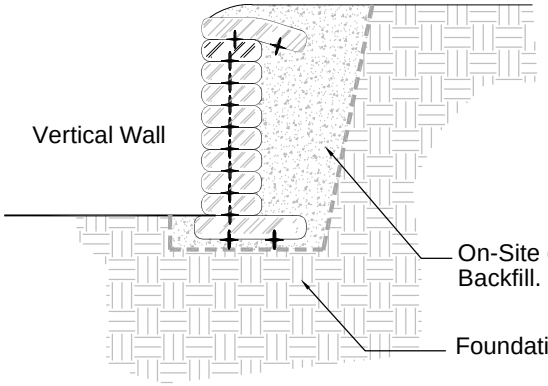
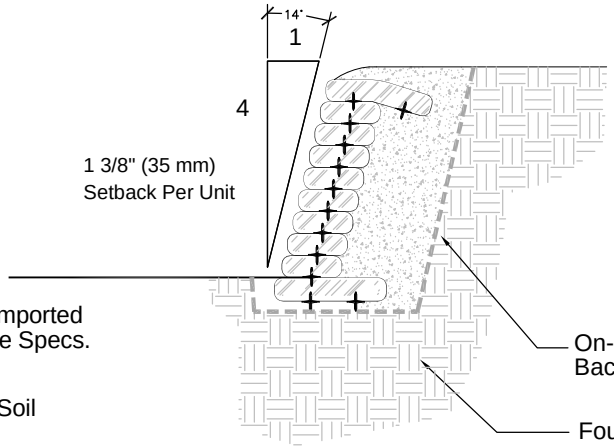
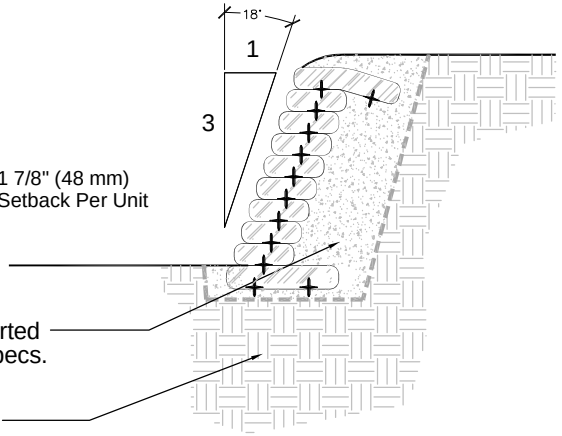


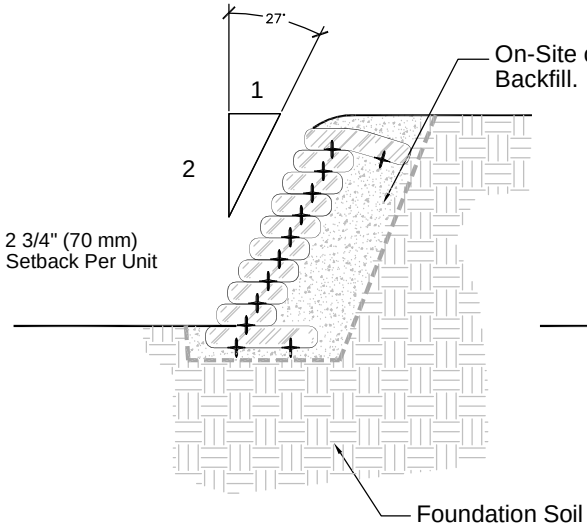
0:1 SETBACK SLOPE



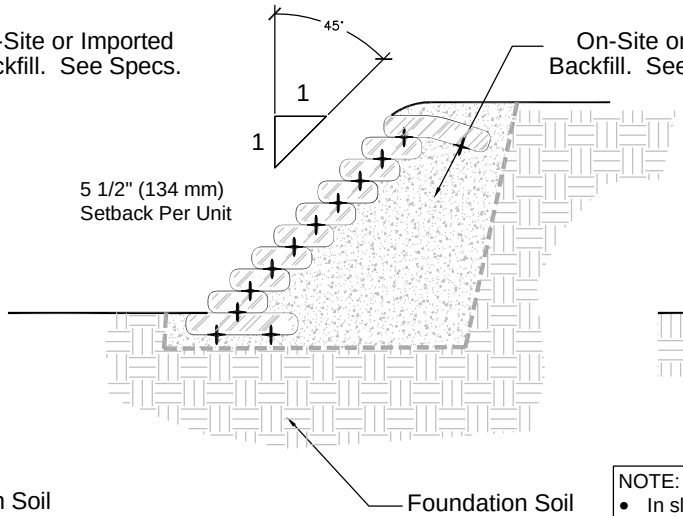
1:4 SETBACK SLOPE



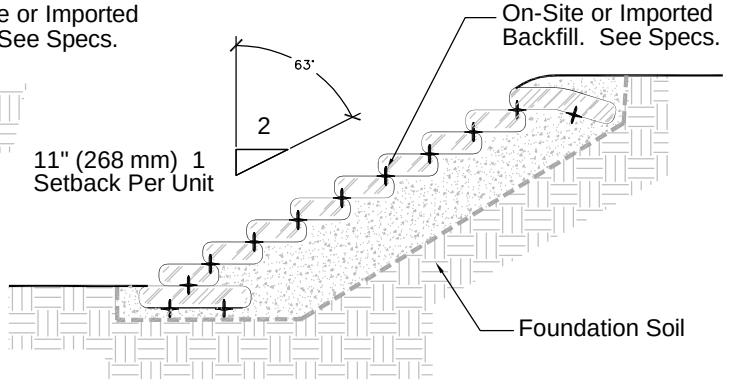
1:3 SETBACK SLOPE



1:2 SETBACK SLOPE



1:1 SETBACK SLOPE



2:1 SETBACK SLOPE

NOTE:
- In slope applications, the normal force is the weight of the bag over the shear connectors. In flat slopes, the normal force is minimal.
- Additional Reinforcement may be Required for Site Specific Applications
- See Sheet GN1-21and Project Specifications for Additional Details & Installation Instructions
- Min. of 4" (10 cm) Bag Overleap Required for Proper Spike Connection
- See Sheets SD 3.21 & 4.21 for Slopes < 2H:1V

TITLE
STANDARD SETBACKS FOR SLOPE APPLICATIONS

DATE: MARCH 2021
SCALE: 1/4" = 1' - 0"
SHEET: SHEET S2.21

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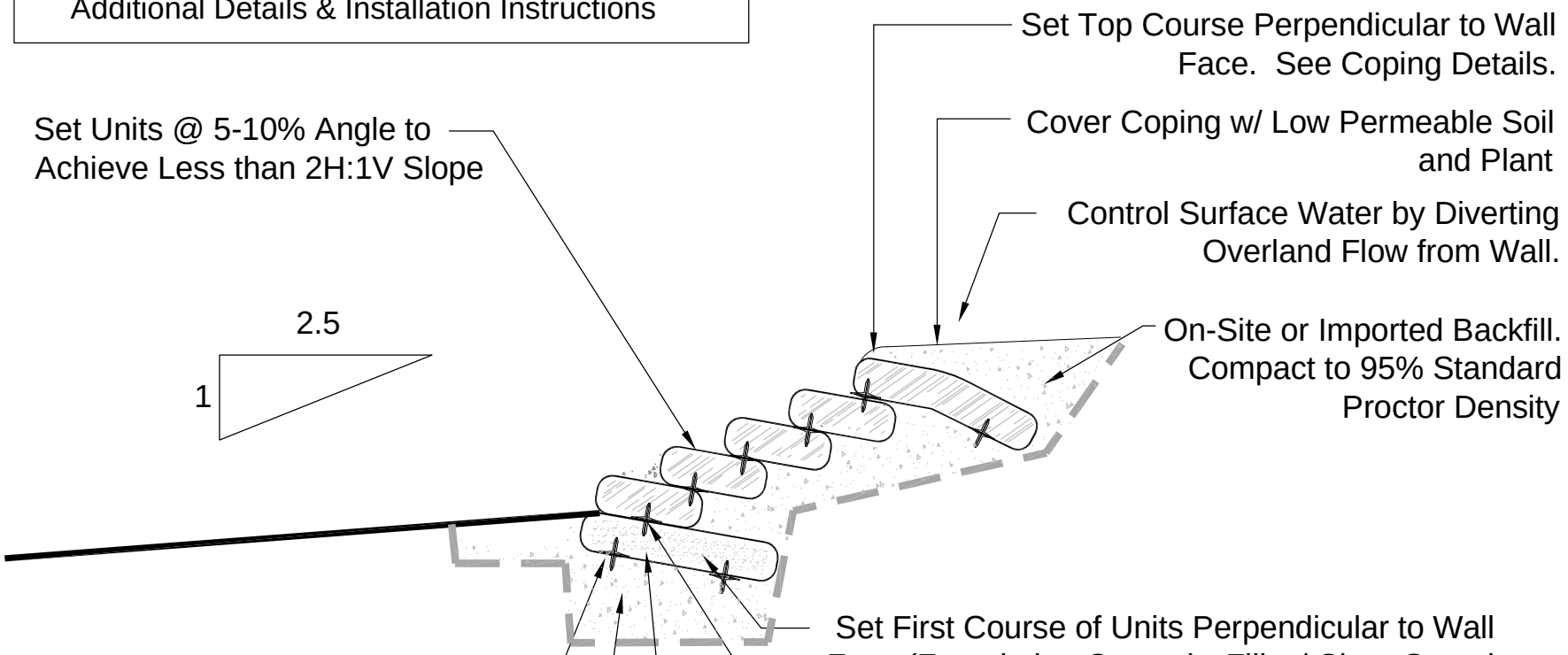
NOTE:
- See Sheet GN1-21 and Project Specifications for Additional Details & Installation Instructions



NOTE: MINIMUM OF 4" (10 cm) OVERLAP REQUIRED FOR PROPER SPIKE CONNECTION.

TITLE
STANDARD SETBACK DETAIL 1V:2.5H

DATE
MARCH 2021

SCALE
1/2" = 1' - 0"

SHEET
SHEET S3-21

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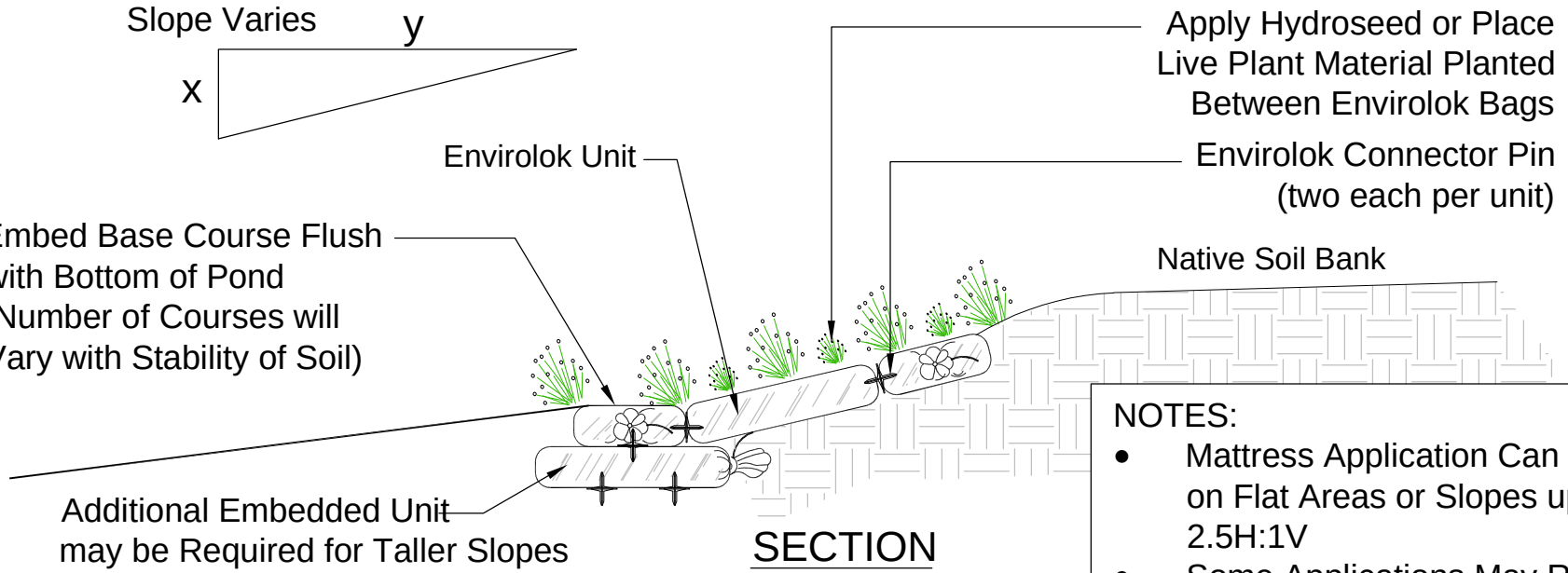
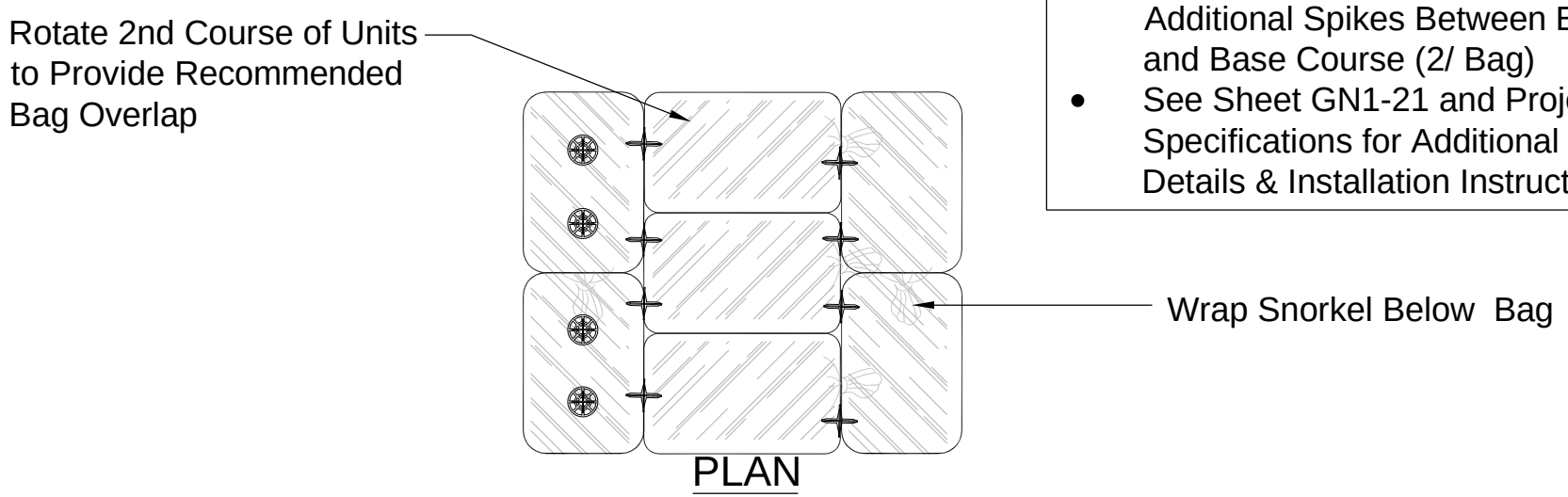


SECTION

NOTES:

- Mattress Application Can Install on Flat Areas or Slopes up to 2.5H:1V
- Some Applications May Require Additional Spikes Between Bags and Base Course (2/ Bag)
- See Sheet GN1-21 and Project Specifications for Additional Details & Installation Instructions



PLAN

TITLE
MATTRESS APPLICATION DETAIL

DATE

SCALE
1/2" = 1' - 0"

SHEET
SHEET S4-21

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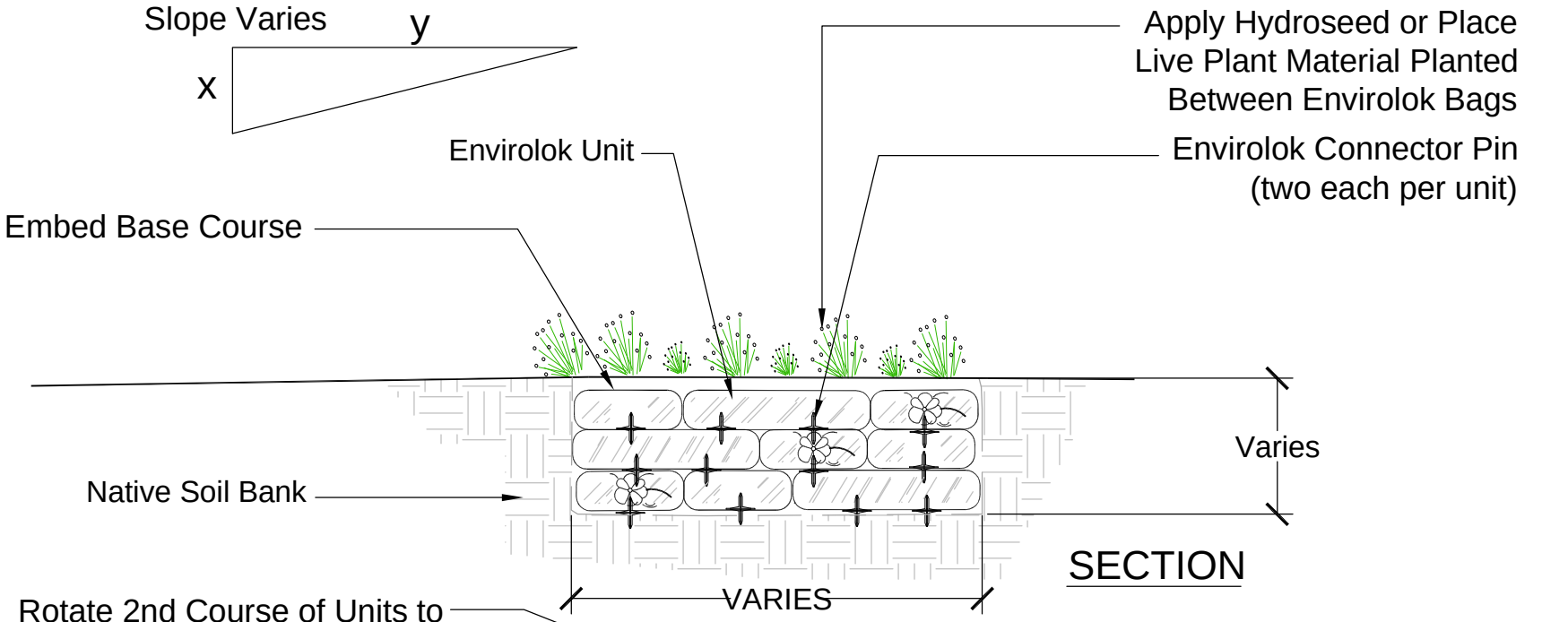
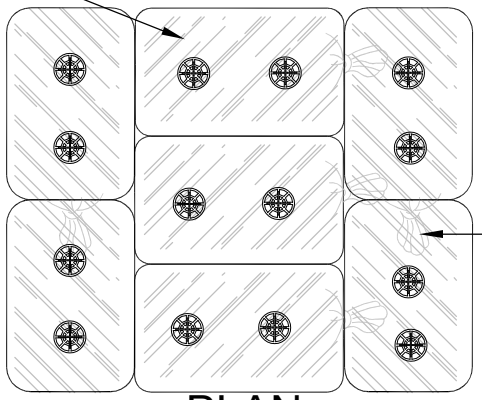


Rotate 2nd Course of Units to
Provide Recommended Bag Overlap



NOTES:

- Mattress Application Can Install on Flat Areas or Slopes up to 2.5H:1V
- Some Applications May Require Additional Spikes Between Bags and Base Course (2/ Bag)
- See Sheet GN1-21 and Project Specifications for Additional Details & Installation Instructions

TITLE
MATTRESS STACKING DETAIL

DATE

SCALE
1/2" = 1' - 0"

SHEET
SHEET S4B-21

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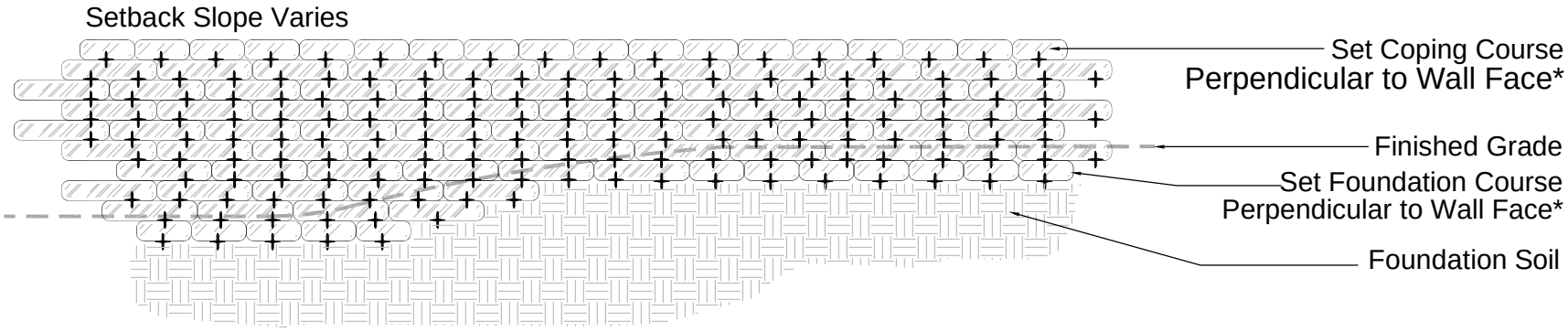
REVISIONS

NOTE:

- Limit Changes in Foundation Course Elevation to Two Courses per Step to Avoid Differential Settling
- Install Steps as Needed to Minimize Number of Buried Units and Maintain Required Minimum Embedment
- Initial Foundation Course and Coping Course may be set Perpendicular to Face of Wall for Larger or More Complex Installations. Consult an Engineer for Walls over 48" in Exposed Height.*
- See Sheet GN1-21 and Project Specifications for Additional Details & Installation Instructions



ELEVATION

TITLE
STEPPED FOUNDATION COURSE DETAIL

DATE
MARCH 2021

SCALE
1/4" = 1' - 0"

SHEET
SHEET S5-21

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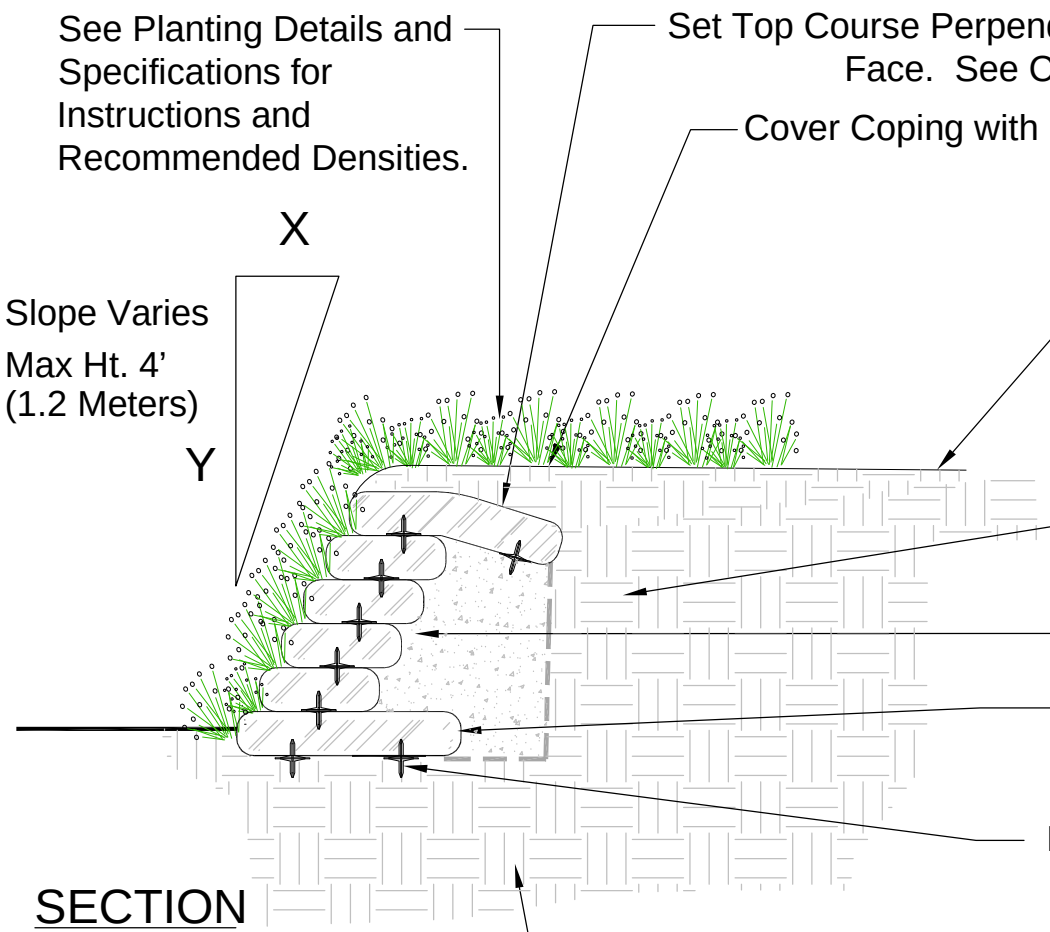
REVISIONS

NOTE:
- See Sheet GN1-21 and Project Specifications for Additional Details & Installation Instructions



TITLE
STANDARD SLOPE DETAIL 1 OF 2

DATE
MARCH 2021

SCALE
1/2" = 1' - 0"

SHEET
SHEET S6-21

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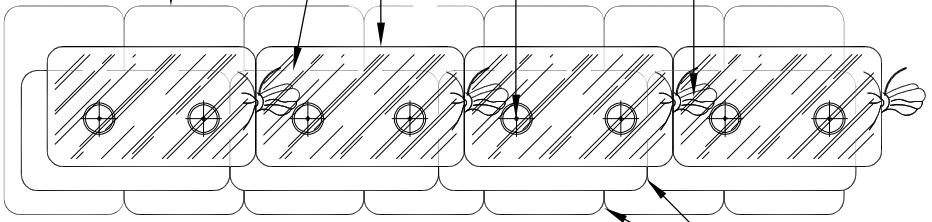
REVISIONS

Set Additional Courses Parallel to the Slope with Seam Facing Outward.

Envirolok Connector Pin (two per bag)

Foundation Course may be Set Perpendicular to Slope with Snorkel Facing Inward

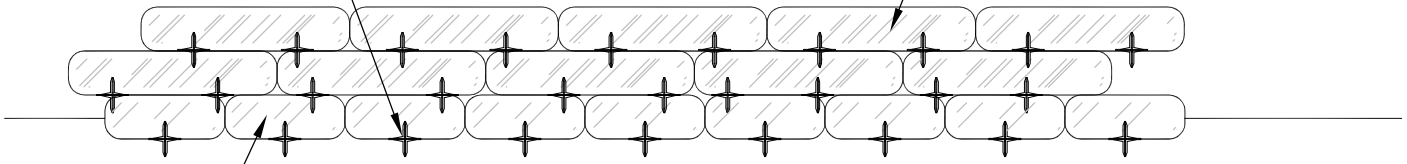
Set Bags with Snorkel Facing Out To Allow 'Snorkel' to be Tucked Below Adjoining Unit



PLAN VIEW

Stagger Bag Units Between Consecutive Rows

Install Connector Pins in Base Setting Course Prior to Setting Foundation Course (two per bag)



ELEVATION

Foundation Course to be Embedded a Minimum of 3" (7.5 cm), or as Specified by Project Designer or Engineer.

NOTE:

- See Sheet GN1-21 and Project Specifications for Additional Details & Installation Instructions

TITLE
STANDARD SLOPE DETAIL 2 OF 2

DATE
MARCH 2021

SCALE
1/2" = 1' - 0"

SHEET
SHEET S7-21

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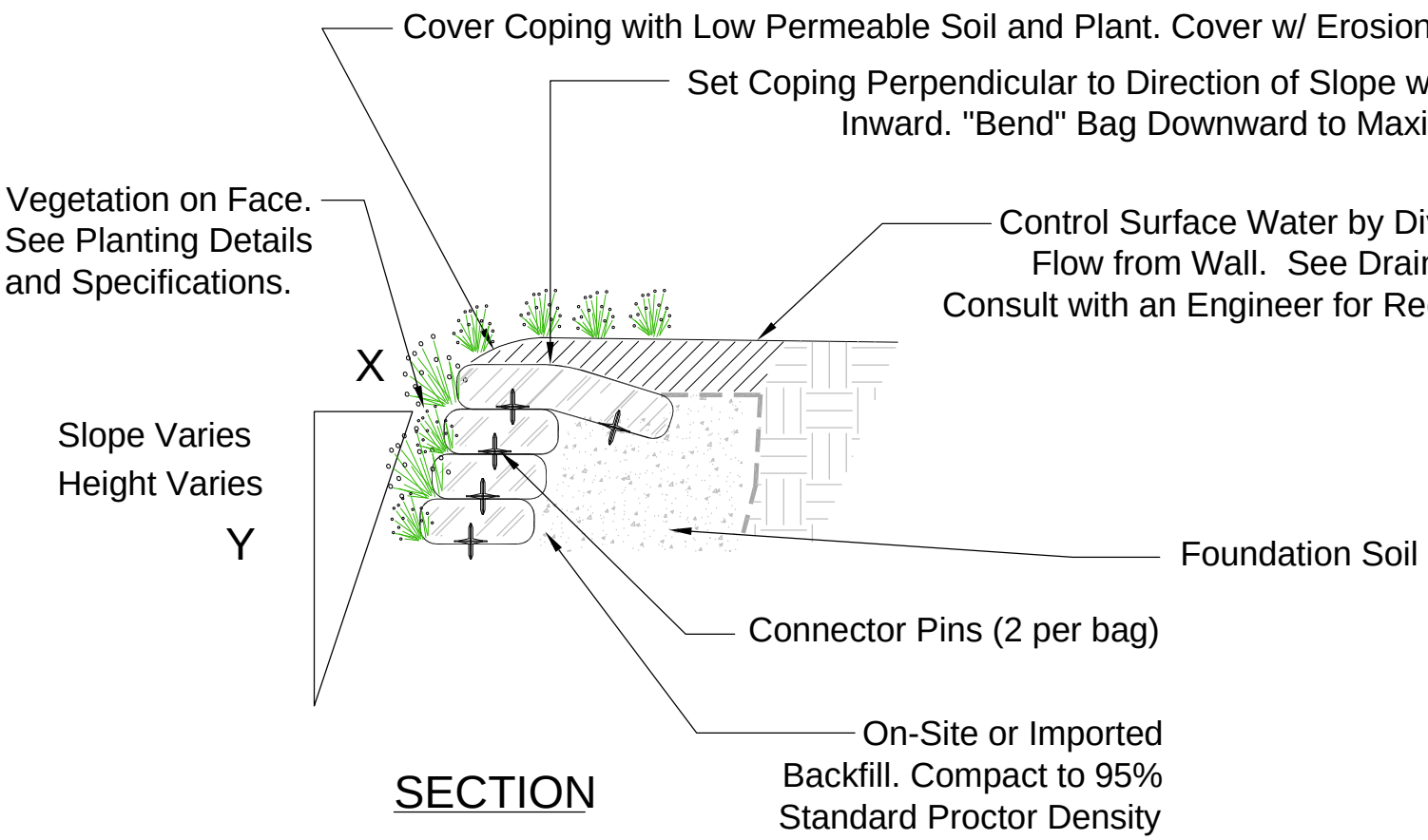

SECTION

NOTE:

- See Sheet GN1-21 and Project Specifications for Additional Details & Installation Instructions

TITLE
COPING COURSE
DETAIL 1 OF 2

DATE
MARCH 2021

SCALE
1/2" = 1' - 0"

SHEET
SHEET S8-21

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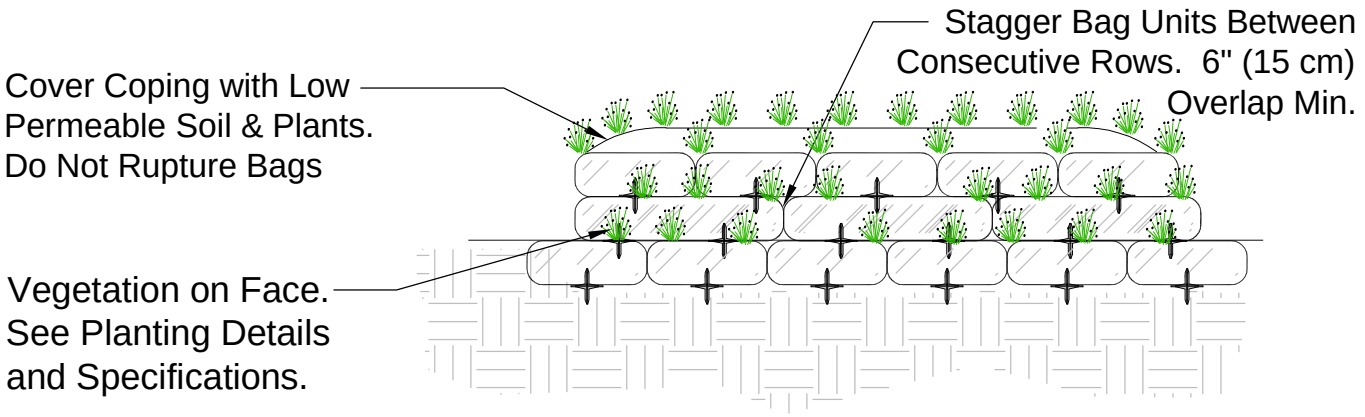
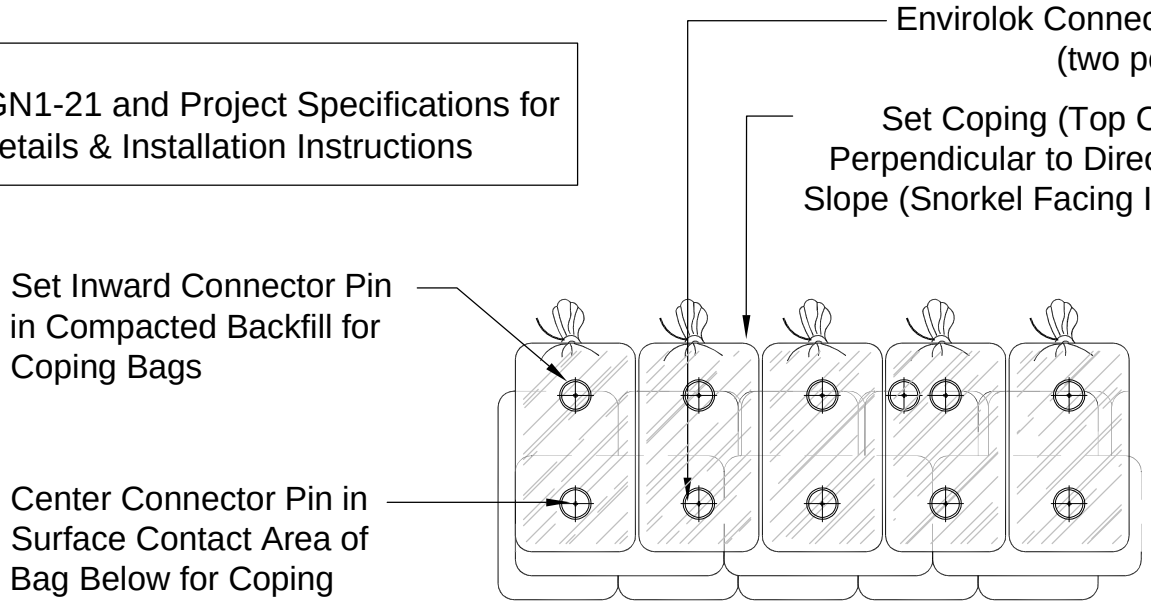


ELEVATION

NOTE:

- See Sheet GN1-21 and Project Specifications for Additional Details & Installation Instructions



PLAN VIEW

TITLE
COPING COURSE DETAIL 2 OF 2

DATE
MARCH 2021

SCALE
1/2" = 1' - 0"

SHEET
SHEET S9-21

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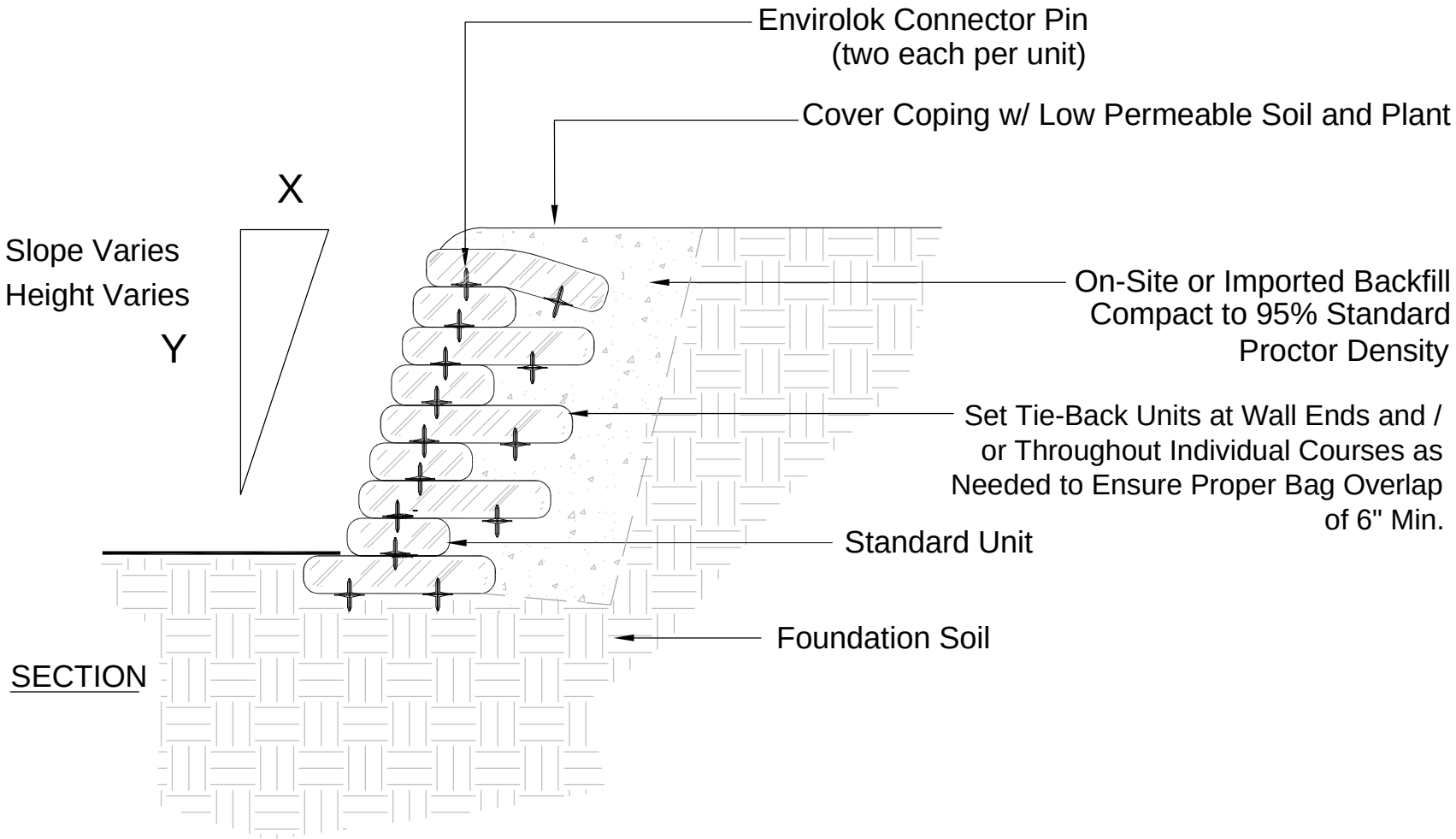
NOTE:

- See Sheet GN1-21 and Project Specifications for Additional Details & Installation Instructions



SECTION

TITLE
TIE-BACK UNIT
DETAIL 1 OF 2

DATE
MARCH 2021

SCALE
1/2" = 1' - 0"

SHEET
SHEET S10-21

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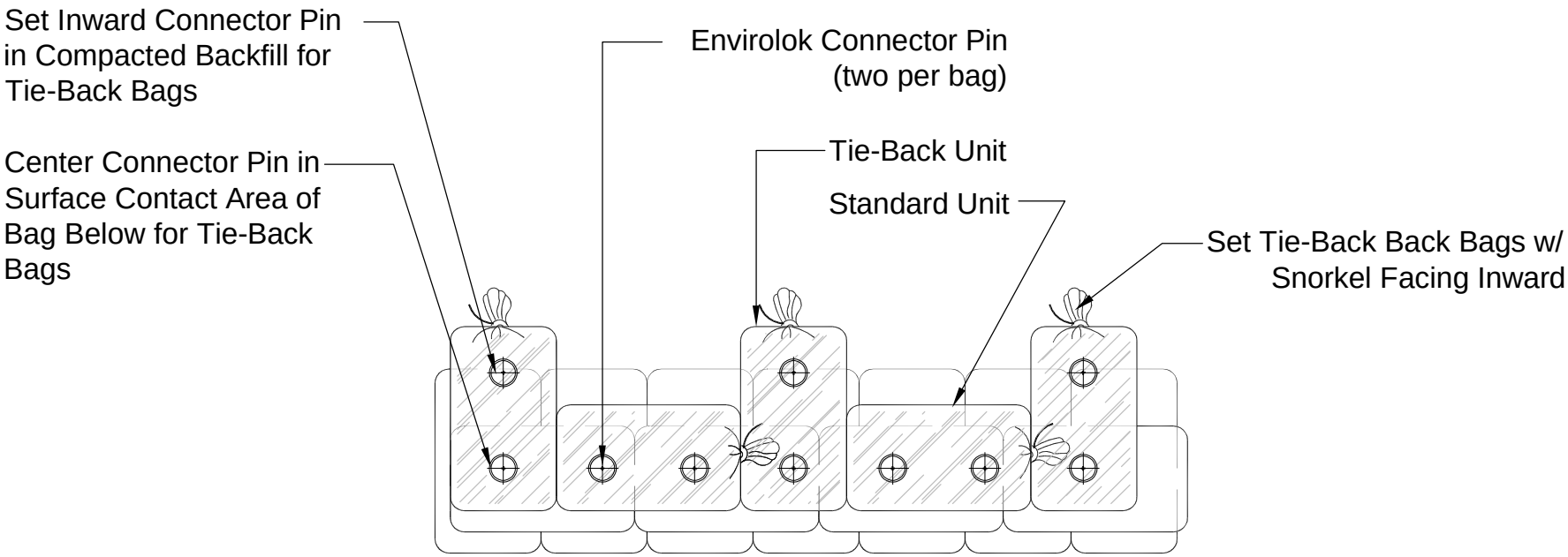
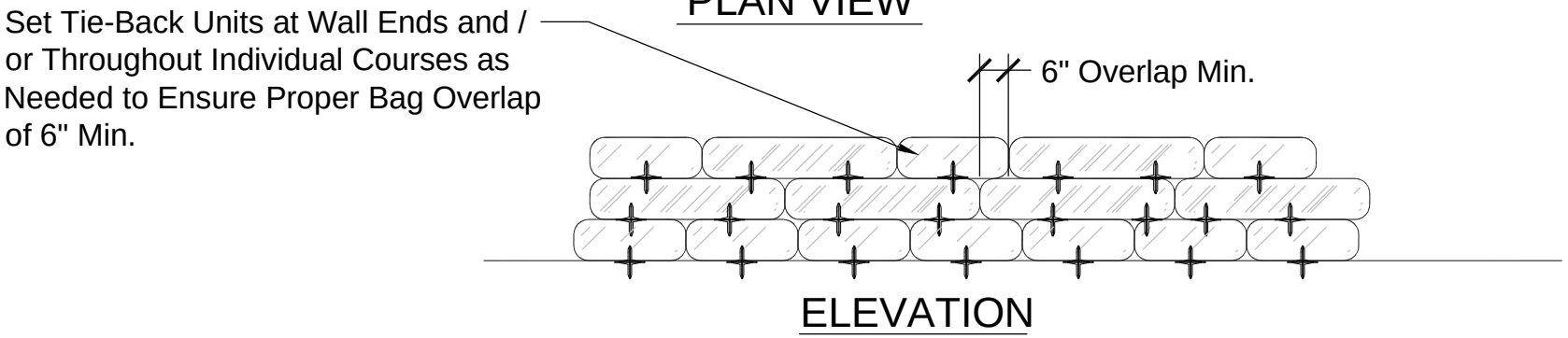


PLAN VIEW



ELEVATION

NOTE:

- See Sheet GN1-21 and Project Specifications for Additional Details & Installation Instructions

TITLE
TIE-BACK UNIT
DETAIL 2 OF 2

DATE
MARCH 2021

SCALE
1/2" = 1' - 0"

SHEET
SHEET S11-21

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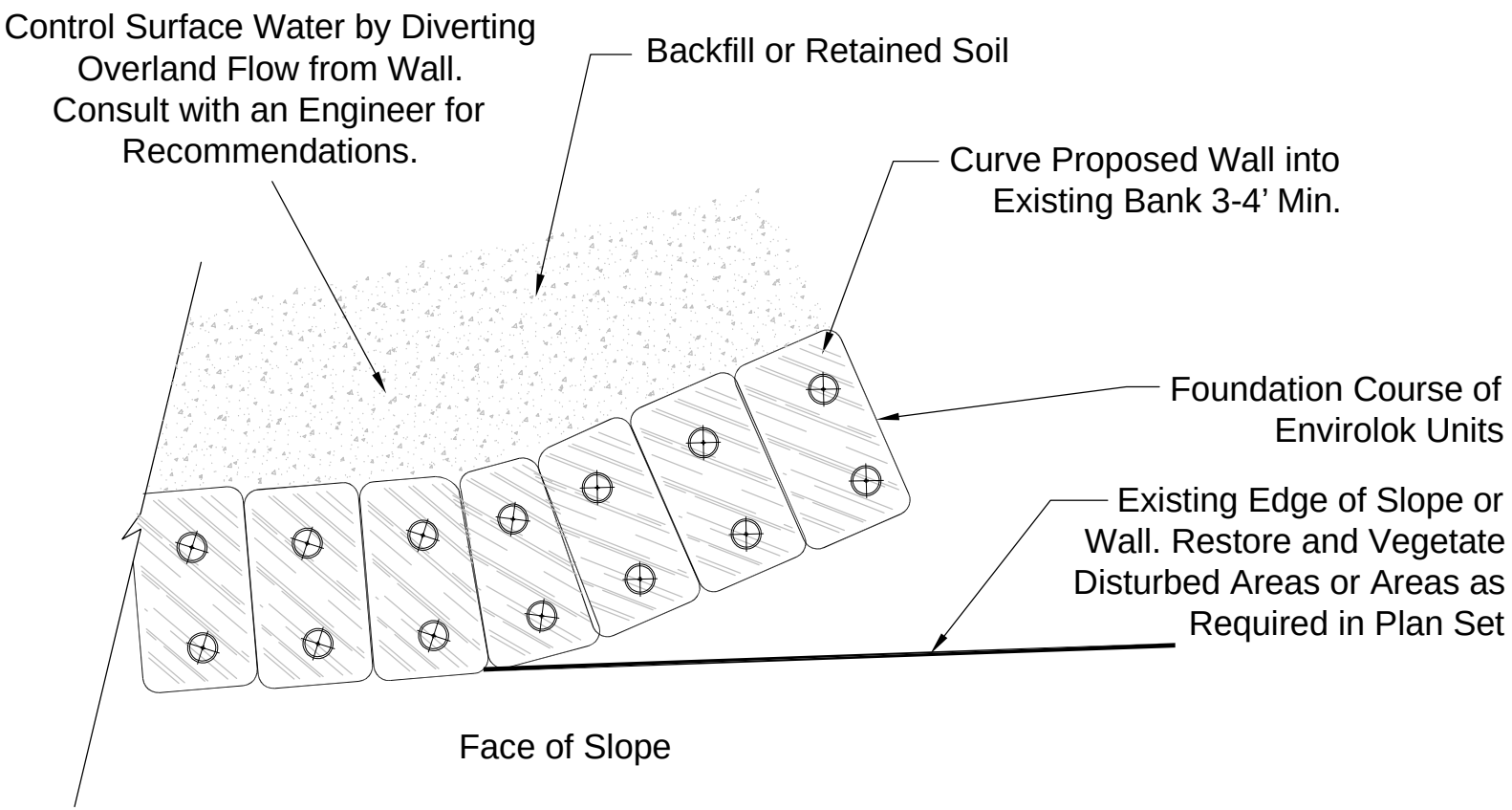

Plan View

NOTE:

- See Sheet GN1-21 and Project Specifications for Additional Details & Installation Instructions

TITLE
STANDARD WALL END DETAIL

DATE
MARCH 2021

SCALE
1/2" = 1' - 0"

SHEET
SHEET S12-21

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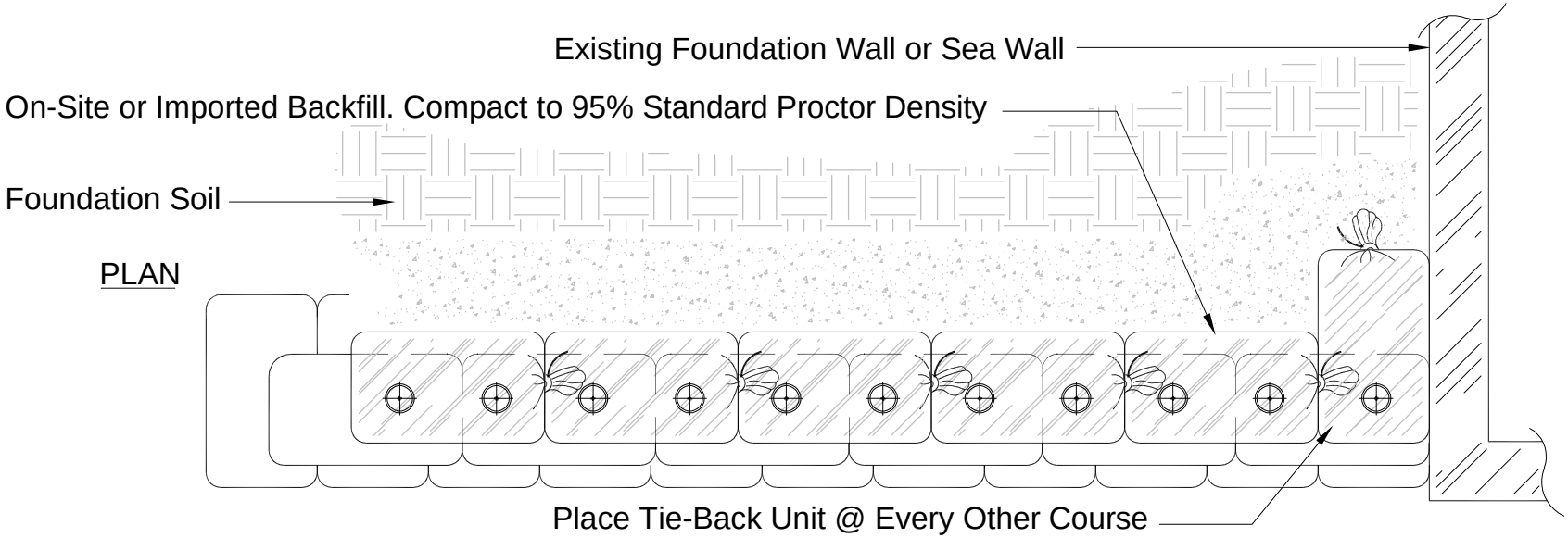
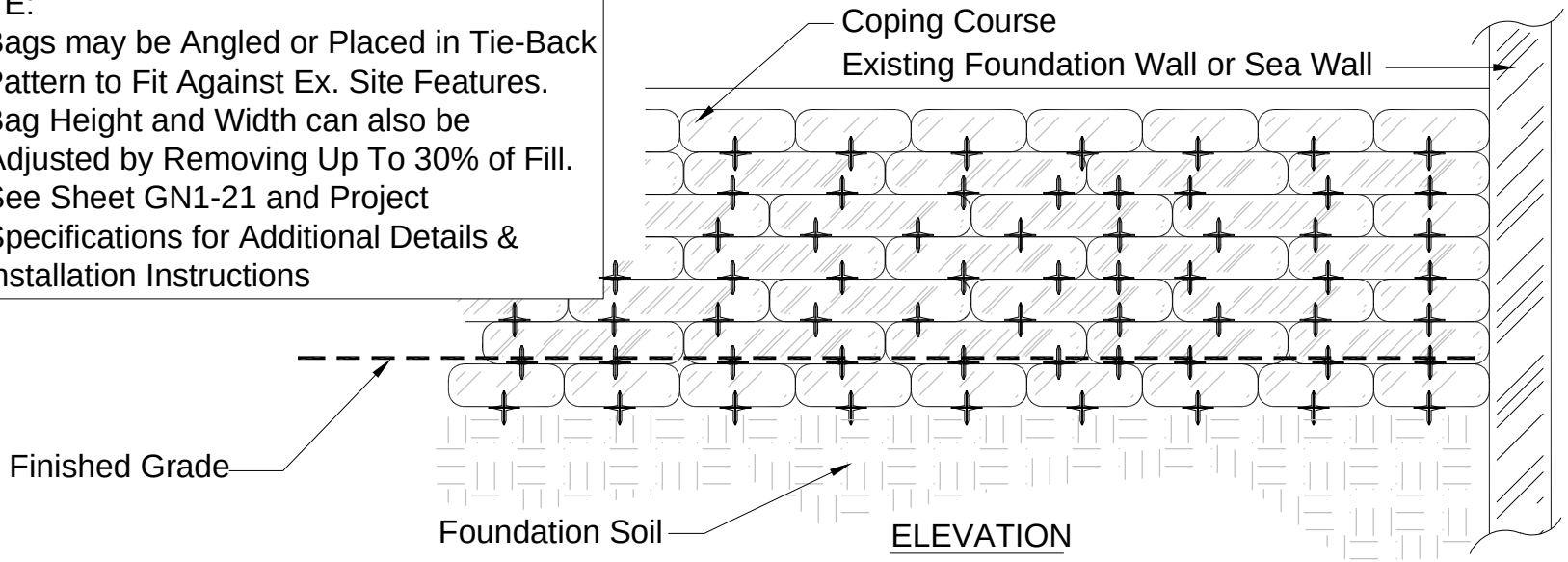


NOTE:

- Bags may be Angled or Placed in Tie-Back Pattern to Fit Against Ex. Site Features.
- Bag Height and Width can also be Adjusted by Removing Up To 30% of Fill.
- See Sheet GN1-21 and Project Specifications for Additional Details & Installation Instructions



TITLE
WALL ABUTMENT DETAIL

DATE
MARCH 2021

SCALE
1/2" = 1' - 0"

SHEET
SHEET S13-21

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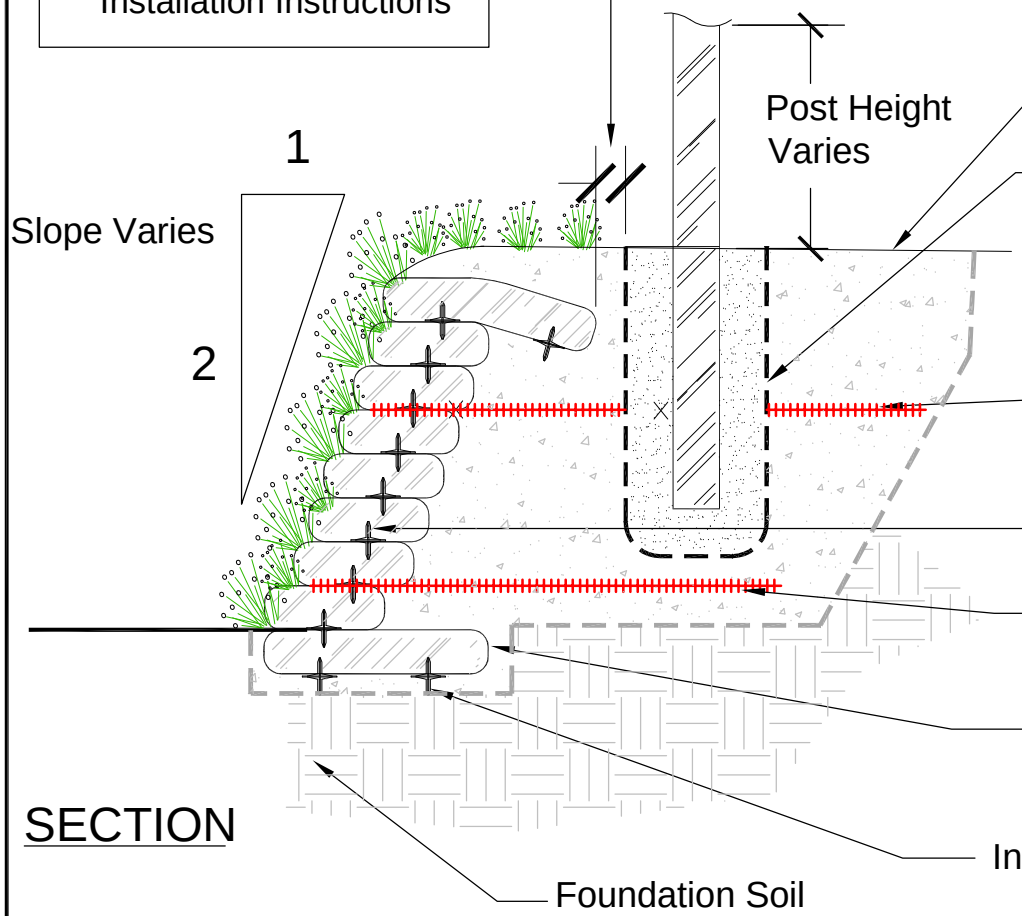
NOTE:

- See Sheet GN1-21 and Project Specifications for Additional Details & Installation Instructions



1'-0" (.3 meters) Min. Offset From Back of Bag, Unless Approved by Engineer or Project Designer

Post Height Varies

Control Surface Water by Diverting Overland Flow from Wall. Consult with an Engineer for Recommendations.

Concrete or Gravel Post Footing. Dimensions Vary. See Geogrid Manufacturer's Specifications For Installation Instructions

Uni-Axial Geogrid Reinforcement As Required by Engineer

Connector Pins (2 per bag)

On-Site or Imported Backfill. Compact to 95% Standard Proctor Density

Set First Course of Units Perpendicular to Wall Face (Foundation Course)

Install Connector Pins (2/ bag) Into the Base Course Material Prior to Installing the Foundation Course

Foundation Soil

SECTION

TITLE
FENCE POST / RAILING INSTALLATION DETAIL

DATE
MARCH 2021

SCALE
1/2" = 1' - 0"

SHEET
SHEET S14-21

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DESIGNED FOR NATURE...ENGINEERED FOR LIFE.
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REVISIONS