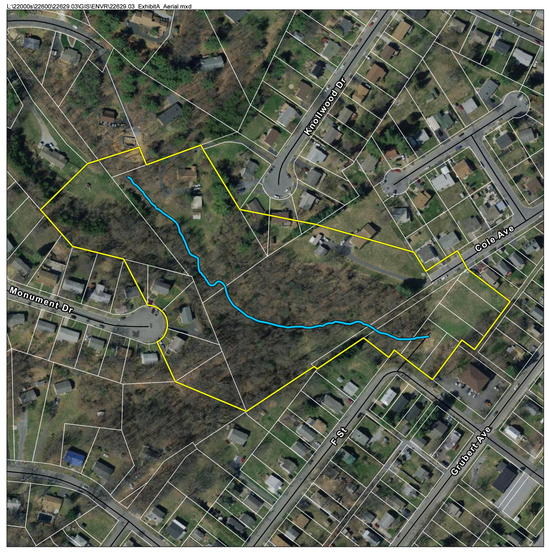
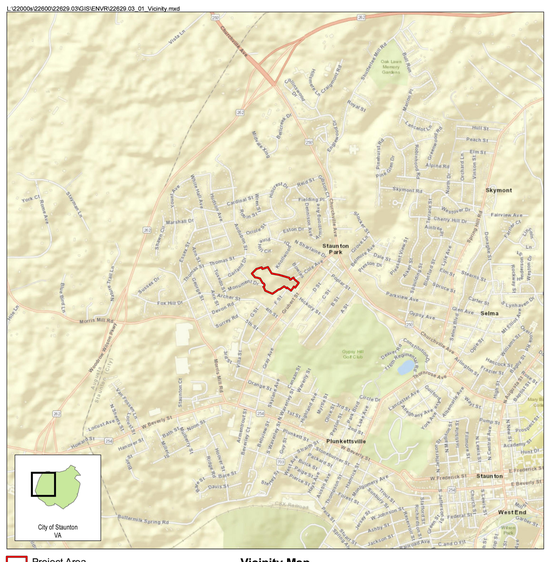
IMAGERY AND VICINITY MAP



Wetland Studies and Solutions, Inc.
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Exhibit B



Source: World Street Map - ESRI

Wetland Studies and Solutions, Inc.
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Exhibit 1

CITY OF STAUNTON
ENGINEERING DIVISION

CITY HALL
116 W BEVERLEY ST
STAUNTON, VA 24401

COLE AVENUE STREAM RESTORATION

APRIL 19, 2024

STREAM RESTORATION DESIGN

STAUNTON™ VIRGINIA

City of Staunton Bid # D00124

COMMONWEALTH OF VIRGINIA
NATHAN A. STALEY
Lic. No. 047145
04/19/2024
PROFESSIONAL ENGINEER

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REVISIONS

No.	Date	Remarks	By

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COLE AVE STREAM RESTORATION
FINAL DESIGN
CITY OF STAUNTON, VA

CITY PROJ. NUMBER

PLAN REVIEWER

SHEET 1 OF 27

Design Narrative

I. Background

The Cole Avenue Stream Restoration Project is located in the City of Staunton, Virginia, and includes approximately 1,100 linear feet of channel restoration. Approximately 1,000 linear feet of restoration will occur on the main channel, with an additional 100 linear feet of an tributary eroded tributary draining south from the western terminus of Cole Avenue. The site lies north of the corner of Hickory Street and F Street, east of Monument Drive, and southwest of Cole Avenue.The stream flows to the southeast through large lot residential properties, with the riparian corridor being a mix of managed lawn areas and low quality woodlands.

The restoration reach begins approximately 650 feet southeast of the culvert outlet along Garland Drive. (Areas nearer to Garland Drive are heavily constrained by residential properties and do not show signs of significant erosion or downcutting.) The start of the restoration reach lies at an existing sanitary sewer crossing where concrete encasement has resulted in erosion just downstream of the crossing. Channel conditions continue to deteriorate when progressing in the downstream direction from the concrete crossing, with signs of past straightening, likely associated with the establishment of the sanitary sewer network. Approximately 200 feet downstream of the upper sanitary crossing the channel has been pushed to the river right side of the valley, diving over a bedrock shelf against a steep bank. Past channel manipulation has resulted in extreme erosion at this location with vertical eroding banks more than 11 feet in height. Further downstream, the channel enters a wider floodplain area, but vertical, eroded banks of approximately five feet continue. Midway down the reach the stream can be observed eating around a manhole, and near the downstream end of the reach another sanitary crossing is exposed in the stream bed. The reach ends at an existing 60-in culvert with a rebar trash rack. The tributary channel enters the main channel from the north in the immediate vicinity of the culvert inlet. Evidence of frequent debris build up is seen and local staff report various instances of flow overtopping the culvert embankment and flooding the properties of downstream landowners.

The project area lies on private properties, with the majority of the project area owned by two property owners. A third property owner holds property around the downstream culvert and proposed access corridor.

Overall topography for the design reach is characterized by moderate to steep slopes and significant floodplain disconnection. The upstream portion of the channel flows through a residential yard and past channel disturbance is exacerbating flooding. A mound of fill material is seen between what is believed to be the historic channel area (on the left side of the valley) and the new channel. This channel reconfiguration has pushed flows against a very steep bank and resulted in extreme erosion.

The ~275-acre contributing drainage area for the watershed is dominated by residential land uses, with minor contributions from commercial, and forested areas. The drainage area can best be categorized as a suburban watershed. Watershed slopes are moderate to steeply sloped, transitioning to a piped, flatter, broad floodplain downstream with heavy development pressure within the historic drainage pathway. Flow contributions from areas upstream of the restoration reach are conveyed largely through an existing piped network. Little sediment supply is expected from the contributing drainage area.

II. Hydrologic Analysis

A GIS-based assessment of site hydrology was performed. The contributing drainage area is estimated at approximately 275 acres. Impervious cover in the watershed is estimated at approximately 29%. This information was used to estimate bankfull flow based on the published USGS Non-Urban Regional Curves for the Valley and Ridge Physiographic Province of Maryland, Virginia, and West Virginia (Figure 1). These curves were developed to predict bankfull characteristics for streams with low watershed imperviousness (typically less than 5%) and may require adjustment to more accurately represent the effects of watershed development on stream hydrology. Additional flow information for larger storms (2-yr, 10-yr and 100-yr) was determined through development of a preliminary hydrologic model for sizing of the proposed multi-stage riser structure.

Subshed	Impervious area, (%)	Drainage Area (ac)	Valley and Ridge (Non-Urban)		NC Urban		MD Urban		Valley and Ridge w/ Enlargement Factor			TR-55 CN Analysis Discharge (cfs)		
			Bankfull X-sec Area (ft^2)	Bankfull Flow (cfs)	Bankfull X-sec Area (ft^2)	Bankfull Flow (cfs)	Bankfull X-sec Area (ft^2)	Bankfull Flow (cfs)	EF	Bankfull X-sec Area (ft^2)	Bankfull Flow (cfs)	2 YR	10 YR	100 YR
Main Channel	29.0	276.60	7.07	22.22	34.98	180.85	24.05	34.76	2.71	19.13	60.16	353.00	653.00	1212.00
Tributary	28.9	4.88	0.38	0.90	2.54	14.21	1.55	35.76	2.70	1.03	2.43	N/A	N/A	N/A

III. Channel Sizing

Given enough time, a stream will respond to increased storm flow caused by watershed development by forming a new stable cross section. This process typically involves downcutting, then widening, followed by the building in of a stable floodplain at lower elevation. The Center for Watershed Protection published a report on the impact of watershed development on channel size (Figure 2). In this report it is estimated that ultimate channel enlargement can take 50-75 years or longer from the time the watershed is fully developed. As the new stable channel evolves, depositional features within the channel scar may indicate initial formation of the new cross section. Based on imperviousness in the Cole Avenue stream watershed, a multiplier of roughly 2.7 would be appropriate, resulting in an adjusted bankfull flow of ~60 cfs.

The constraints at this site require careful consideration of a wide range of flow events and make flow depth predictions using Mannings open channel flow equation difficult due to the transitions in slope throughout the design reach. Though it is beneficial to allow flood flows access to a broad floodplain, the extreme slope seen at this site has the potential to cause instability if the flashy urban flows access the floodplain too often and overbank velocities are beyond those suitable for vegetated conditions. Experience has shown that strict application of the enlargement factor in highly urban watersheds may result in a channel that is over-widened. WSSI has demonstrated success in application of a reduced enlargement factor in such cases, allowing more frequent overbank flow across a floodplain or floodplain bench. Therefore, the design team initially sized the channel to convey twice the flow, as indicated by the rural regional curve. This is slightly below the flow as indicated when strictly applying the urban channel enlargement factor, but will allow storm events to spread thinly across the available floodplain, reducing system stresses and maximizing ecological lift.

Reach	Design Flow (cfs)	Approximate Station Range	Sizing Slope	Bankfull Width (ft)	Bankfull Max Depth (ft)	Cross Sectional Area (ft^2)
Main Channel	*44.0*	16+45' - 26+30'	3.00%	11.00	1.20	8.31
Tributary	*2.0*	N/A	20.00%	8.00	1.00	4.80

IV. Discussion of Design Alternatives and Design Narrative

When considering the Cole Avenue stream design reach in the context of Rosgen's channel classification system, the channel exhibits characteristics of a G (entrenched, but not yet widened) channel. Much of the design channel has already downcut severely and is now disconnected from the overbank area. It is anticipated that as the channel evolves the stream will continue widening to reform a floodplain within the widened entrenched channel. Left unchecked, the design reach is likely to see continued erosion as the stream widens, and may further downcut in some areas. This progression cannot be left unmanaged due to the proximity of the stream to existing sanitary infrastructure.

Implementation of a Priority 1 (P1) restoration (Figure 3) would involve reconstructing the stream channel with a size appropriate for the current and predicted watershed conditions, but at an elevation which allows better connection with the adjacent floodplain. A P1 restoration provides the highest degree of channel stability and ecological benefit while limiting disturbance to the existing floodplain corridor. This design option can result in adverse effects on adjacent infrastructure due to elevated floodplain flows. The highly disturbed nature (large quantities of fill and major channel realignment) and steep slopes at this site make implementing a true Priority 1 design difficult. This approach typically involves significant quantities of fill and/or excavation and installation of grade control structures to establish a stable channel pattern and profile.

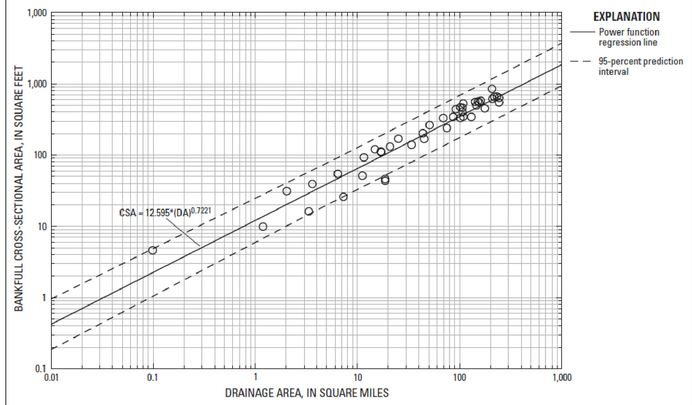
A Priority 2 (P2) restoration involves excavation of floodplain material in order to create a bankfull floodplain at a lower elevation where floodplain connectivity is not otherwise seen. This approach often involves major excavation and haul off, as well as significant disturbance to the surrounding riparian vegetation/trees. Project costs for this strategy are dominated by earthwork costs including possible material disposal. Flooding concerns and existing infrastructure often make this approach the most stable feasible strategy. Due to the severity of erosion at this site and steep valley slope, the additional disturbance associated with a P2 design may be necessary to allow wholescale re-creation of a suitable floodplain. The width of the grading corridor will be limited to the greatest extent practical, with access areas being converted to floodplain benches as part of the construction effort. Periodic use of in-stream grade control structures is recommended with this approach to enhance long-term stability, especially during larger, infrequent storms (e.g. 100-yr) where greater flow depths may be experienced.

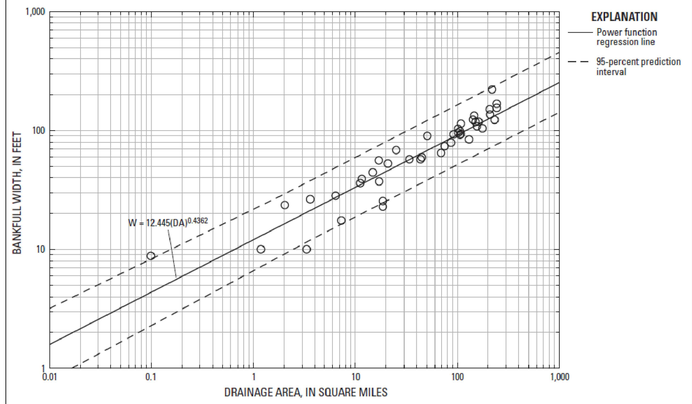
A Priority 3 restoration involves the creation of a limited bankfull bench and isolated bank grading to reduce shear stresses and bank erosion. This approach does not seek to achieve long-term stability for the reach as a whole, but rather focuses resources on areas of highest erosion, thus presenting a more cost-sensitive alternative. However, this strategy is inconsistent with stated project goals and is not applicable on this site.

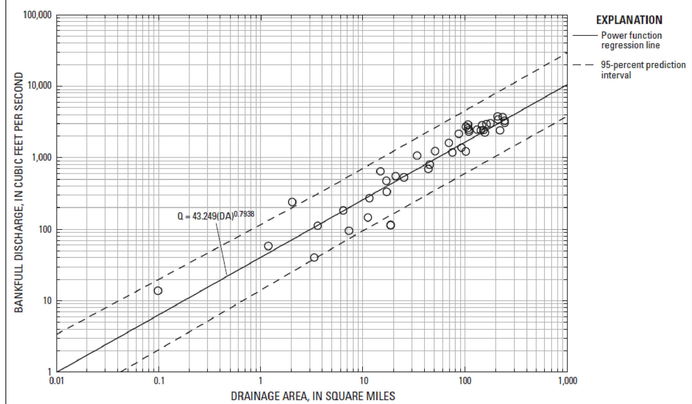
The goals of this project necessitate use of a design strategy that re-creates a stable channel form, improves overbank connectivity, enhances stream habitat, and reestablishes an enhanced riparian corridor. The major factor limiting the implementation of a P1 approach is the highly disturbed nature of the site and steep valley slopes. Instead, the restoration utilizes a blended approach which better connects the channel by elevating the bed and importing a carefully sized reinforced bed material, while utilizing bankfull benches, or terracing where steep valley slopes prevent full elevation and reconnection. This approach works with surrounding valley elements and existing bedrock to create a stable channel in the altered valley, helping to maximize long-term stability and minimize disturbance of large trees while driving habitat enhancement.

All disturbed slopes will be stabilized via coir blanket matting and an aggressive seeding and planting plan consisting of various riparian species will be implemented, adding additional ecological uplift. Further stability will be afforded via stream edge plantings of black willow live-stakes.

Figure 1. *Non-Urban Valley and Ridge Regional Curves for Select Geomorphic Parameters in Maryland, Virginia, and West Virginia*

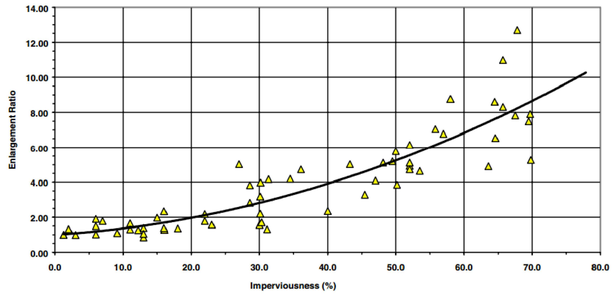






Adapted from: Keaton, Messinger, and Doheny. 2005, Development and Analysis of Regional Curves for Streams in the Non-Urban Valley and Ridge Physiographic Province, Maryland, Virginia, and West Virginia. U.S. Geological Survey Scientific Investigations Report 2005–5076, p. 14-15.

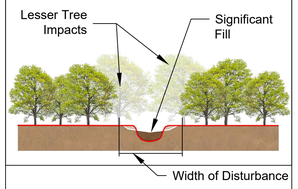
Figure 2. *Stream Restoration Design Priority*



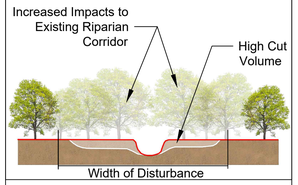
"Ultimate" Channel Enlargement as a Function of Impervious Cover in Alluvial Streams in Maryland, Vermont and Texas (MacRae and DeAndrea, 1999; Brown and Claytor, 2000)

Figure 3. *Stream Restoration Design Priority*

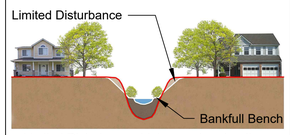
Priority 1 Restoration - Raise and Reconnect to Floodplain



Priority 2 Restoration - Excavate Floodplain at Lower Elevation



Priority 3 Restoration - Bankfull Bench (Confined Valley)



-Limited Disturbance, higher post-restoration stress, lower ecological lift

Source: Wetland Studies and Solutions, Inc. Graphic

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COLE AVE STREAM RESTORATION
FINAL DESIGN
City Of Staunton, Virginia

Design Narrative

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COMMONWEALTH OF VIRGINIA
NATHAN A. STALEY
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04/19/2024
PROFESSIONAL ENGINEER

REVISIONS

No.	Date	Description	Rev. By	App. By

SCALE: N/A

DATE: APRIL 2024

Horizontal Datum: N/A

Vertical Datum: N/A

Boundary and Topo Source: N/A

Design	Draft	Approved
NAS	JTS	NAS

Sheet # 2 of 27

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SEDIMENT SIZING CALCULATIONS

An analysis of shear stress is necessary to understand bed mobility. To achieve the desired threshold condition, the size (D_{50}) of the large rock ("armor") portion of the reinforced bed mix is determined by first calculating the "mean depth" boundary shear stress (i.e. Shield's Equation) for each proposed channel using the hydraulic radius (approximately the mean depth, Equation 1). The "mean depth" boundary shear stress value is then inserted into a regression equation developed by Rosgen (2006) using data from Leopold et. al. (1964) to determine the particle size D_{50} needed to achieve a stable stream bed (Equation 2). A Factor of Safety greater than or equal to 1.3 is desired and is based on the ratio of the computed rock size versus provided rock size (Equation 3). As a check, the above process is repeated using the "maximum" boundary shear stress (Equation 4). The term "maximum" boundary shear stress is used because typically, boundary shear stress calculations are performed using the hydraulic radius (approximately the mean riffle depth, refer to Equations 1 and 2). Using the "maximum" boundary shear stress as a check of the initial calculation provides a conservative estimate of the required D_{50} for the "armor" rock. For this conservative estimate, a Factor of Safety greater than or equal to 1.0 is desired and is based on the ratio of the computed rock size versus provided rock size (Equation 6). Calculations are presented for the maximum riffle slope and depth utilized in the main channel.

STEP 1: "ARMOR" SIZE DETERMINATION

Based on the calculations herein (at right), the D_{50} particle size needed to achieve a stable stream channel for the Cole Avenue stream restoration project (using maximum riffle slope) is **10.3 inches**. This indicates bed mobility in areas not founded on bedrock and highlights the potential for continued and severe bank erosion. These calculations show the need for import of an appropriately sized reinforced bed mixture, one which will resist erosion while riparian vegetation is reestablished on channel banks. Class I rock (D50 = 13.2) exceeds the target Factors of Safety and is therefore of sufficient size to be used as the stable armor component in the reinforced bed mixture, where applicable. The reinforced bed mixture shall be prepared as specified in the Reinforced Bed Mixture Specifications provided in the construction details sheets (Sheet 15).

			Main Channel
EQUATION 1 (MEAN DEPTH BOUNDARY SHEAR STRESS)			
$t_0 = \gamma_f * R * S$			
WHERE:			
γ_f = SPECIFIC WEIGHT OF WATER	(LB/FT^3)	=	62.4
R = HYDRAULIC RADIUS (A_{BKF}/WP)	(FT)	=	0.7
A_{BKF} = BANKFULL AREA	(FT^2)	=	8.31
WP = WETTED PERIMETER	(FT)	=	11.3
D_{BKF} = BANKFULL MEAN DEPTH (A_{BKF}/W_{BKF})	(FT)	=	0.76
W_{BKF} = BANKFULL WIDTH	(FT)	=	11.0
S = MAXIMUM RIFFLE SLOPE	(FT/FT)	=	0.0425
THEREFORE:			
t_0 = BOUNDARY SHEAR STRESS	(LB/FT^2)	=	2.0
EQUATION 2 ("ARMOR" PORTION PARTICLE SIZE)			
$D_{50} = 3.07 * T_0^{1.042}$			
WHERE:			
t_0 = MEAN DEPTH BOUNDARY SHEAR STRESS (FROM EQ. 1)	(LB/FT^2)	=	2.0
THEREFORE:			
D_{50} = STABLE MEAN DIAMETER OF THE "ARMOR" ROCK	(IN)	=	6.2
EQUATION 3 (FACTOR OF SAFETY)			
$FS = D_{50\text{-Actual}}/D_{50}$			
WHERE:			
$D_{50\text{-Actual}}$ = ACTUAL MEAN DIAMETER OF THE "ARMOR" ROCK (FROM QUARRY)	(IN)	=	13.2
D_{50} = STABLE MEAN DIAMETER OF THE "ARMOR" ROCK (FROM EQ. 2)	(IN)	=	6.2
THEREFORE:			
FS = FACTOR OF SAFETY		=	2

MEAN DEPTH FACTOR OF SAFETY, MUST BE > 1.3

STEP 2: CONSERVATIVE ESTIMATE OF STABLE "ARMOR" ROCK (CALCULATE THE BOUNDARY SHEAR STRESS USING THE MAXIMUM RIFFLE DEPTH)

			Main Channel
EQUATION 4 (MAXIMUM DEPTH BOUNDARY SHEAR STRESS)			
$t_{0\text{-MAX}} = \gamma_f * D_{MAX} * S$			
WHERE:			
γ_f = SPECIFIC WEIGHT OF WATER	(LB/FT^3)	=	62.4
D_{MAX} = MAXIMUM RIFFLE DEPTH	(FT)	=	1.2
S = MAXIMUM RIFFLE SLOPE	(FT/FT)	=	0.0425
THEREFORE:			
$t_{0\text{-MAX}}$ = MAXIMUM DEPTH BOUNDARY SHEAR STRESS	(LB/FT^2)	=	3.2
EQUATION 5 ("ARMOR" PORTION PARTICLE SIZE)			
$D_{50} = 3.07 * T_{0\text{-MAX}}^{1.042}$			
WHERE:			
$t_{0\text{-MAX}}$ = MAXIMUM DEPTH BOUNDARY SHEAR STRESS (FROM EQ. 4)	(LB/FT^2)	=	3.1824
THEREFORE:			
$D_{50\text{-MAX}}$ = STABLE MEAN DIAMETER OF THE "ARMOR" ROCK	(IN)	=	10.3
EQUATION 6 (FACTOR OF SAFETY)			
$FS = D_{50\text{-Actual}}/D_{50}$			
WHERE:			
$D_{50\text{-Actual}}$ = ACTUAL MEAN DIAMETER OF THE "ARMOR" ROCK (FROM QUARRY)	(IN)	=	13.2
$D_{50\text{-MAX}}$ = STABLE MEAN DIAMETER OF THE "ARMOR" ROCK (FROM EQ. 5)	(IN)	=	10.3
THEREFORE:			
FS = FACTOR OF SAFETY		=	1.3

MAX DEPTH FACTOR OF SAFETY, MUST BE > 1.0

Utilization of Fine Particles

The shear stress computations presented on this sheet represent the force required to initiate movement of non-imbricated particles. The reinforced bed mix used in this project shall have fine-grained particles (i.e. gravel, sand, and topsoil) mixed with the "armor" material to fill the void spaces in the rocks (see the reinforced bed mixture specifications on the detail sheets). The mixing of the fine grain substrate material with the armor rock will promote imbrication, further enhancing the reinforced bed material stability. In addition to providing enhanced stability, this smaller substrate material will encourage water to flow along the surface of the stream bed as it would in a naturally occurring stream system. Without fines flow would be primarily subsurface until natural detritus buildup could replace the smaller particle size fractions. Further, the variety of substrate particle sizes will increase species diversity by providing aquatic macroinvertebrates, fish, and amphibians with a larger number of niches to colonize. Finally, the smaller bed material fractions will improve the aesthetic properties of the restored stream by allowing "sorting" to occur during the significant flow events following construction. Smaller particles may move out of the riffles and deposit on or form point bars (and other depositional features) and/or deposit in pools. The result is a variety of stream facets and natural gradation of particle sizes created by varying energy environments of the stream system. This creates a more natural appearance than could be practicably graded during construction.

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Maidment, David R., ed. Handbook of Hydrology. McGraw-Hill, Washington D.C., 12.16 - 12.20, 1993.

Rosgen, Dave. Watershed Assessment of River Stability and Sediment Supply (WARSSS). Wildland Hydrology, Fort Collins, 5-129 - 5-136, 2006.

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COLE AVE STREAM RESTORATION
FINAL DESIGN
City Of Staunton, Virginia

Sediment Sizing

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04/19/2024
PROFESSIONAL ENGINEER

No.	Date	Description	Rev. By	App. By
REVISIONS				

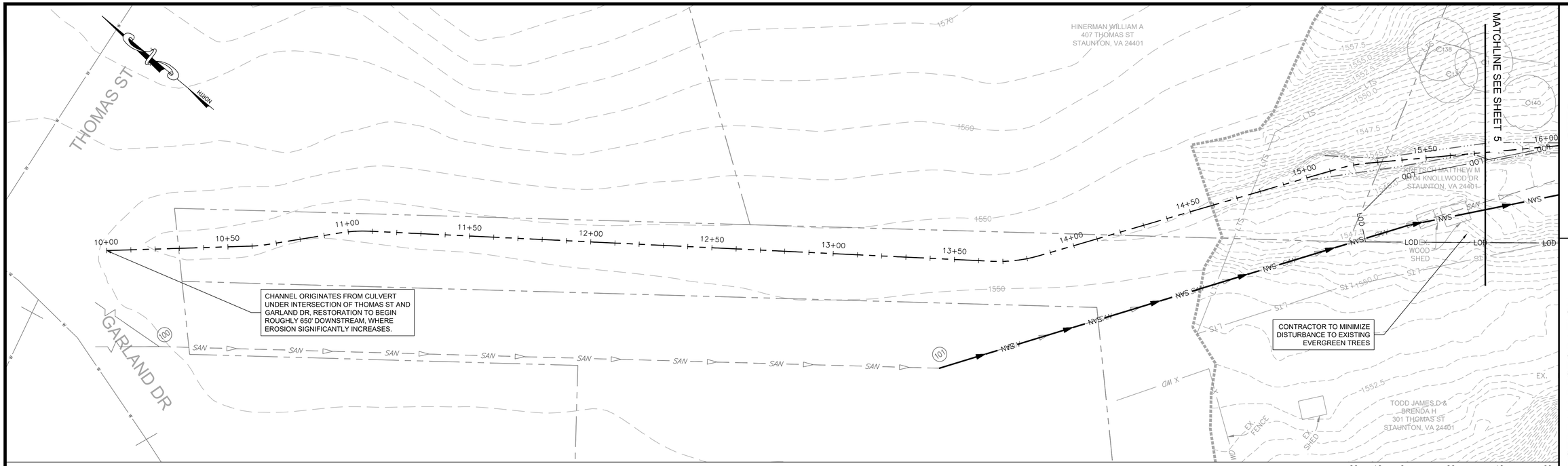
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DATE: APRIL 2024

Horizontal Datum: VCS NAD 83
Vertical Datum: NAVD 88
Boundary and Topo Source: WSSI and City of Staunton Digital Data

Design	Draft	Approved
JTS	JTS	NAS

Sheet # 3 of 27

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20 10 0 20 40 60

SCALE: 1"=20'

GRADING LEGEND

- TEMPORARY ACCESS
- TEMPORARY STOCKPILE
- BOULDER POOL WITH ROCK SILL
- MODIFIED CROSS VANE
- LOG VANE
- ROCK STEP
- IN STREAM HABITAT LOG SILL
- 2000 — PROPOSED GRADING
- PROPOSED CENTERLINE
- PROPOSED BANKFULL
- SAN — PROP. SANITARY REALIGNMENT
- LOD — LIMIT OF DISTURBANCE

EXISTING CONDITIONS LEGEND

- 750 — SURVEYED 0.5' CONTOURS
- 750 — GIS 2.0 CONTOURS'
- BOUNDARY SURVEYED TOPO.
- SAN — EXISTING SANITARY SEWER
- 1010 — SANITARY MANHOLE
- PARCEL BOUNDARY
- INTERMITTENT STREAM (R4)
- EPHEMERAL STREAM (R6)
- LTS — LIMIT TREE SURVEY
- EP — EDGE OF PAVEMENT
- OH — UTIL — OVERHEAD UTILITY
- X — X WD — WOOD BOARD FENCE
- EXISTING BUILDING
- W — WATER LINE (GIS)
- EXISTING BEDROCK
- EXISTING CONCRETE
- t24 — SURVEYED TREE (DBH 18"+)
- t24 — TREE TO BE REMOVED

SANITARY TABLE - COLE AVENUE STREAM RESTORATION

POINT #	MANHOLE #	RIM ELEVATION	INVERT (IN)	PIPE SIZE*	INVERT (IN)	PIPE SIZE*	INVERT (IN)	PIPE SIZE*	INVERT (OUT)	PIPE SIZE*	COMMENTS
1004	112**	1518.37	N/A						N/A		Need Traffic Control
1001	111**	1519.42	1515.72 (from 110)	8 in.					1515.63 (to 112)	10 in.	
1020	110**	1523.56	1517.02 (from 109)	10 in.					1516.93 (to 111)	10 in.	
1023	109**	1525.79	1517.16 (from 108)	10 in.					1517.17 (to 110)	10 in.	Rim not level
1061	108**	1524.32	1518.20 (from 107)	10 in.					1518.16 (to 109)	10 in.	
1064	107**	1525.96	1518.60 (from 106)	10 in.					1518.55 (to 108)	10 in.	
1201	106**	1537.75	1528.80 (from 105)	10 in.					1528.77 (to 107)	10 in.	
1257	105**	1543.18	1533.73 (from 104)	10 in.	1533.03 (from 103)	10 in.			1533.13 (to 106)	10 in.	
1260	104**	1561.80	1552.41 (from NE)	8 in.	1557.05 (from NE) Drop Inlet	10 in.			1552.38 (to 105)	10 in.	
1376	103**	1543.88	1535.86 (from 101)	10 in.	1536.78 (from 102)	10 in.			1535.80 (to 105)	10 in.	
1255	102**	1555.97	1549.34 (from SW)	10 in.	1553.64 (from SW)	4 in.	1553.52 (from SW)	4 in.	1549.30 (to 103)	10 in.	
1364	101**	1551.85	1542.95 (from 100)	10 in.					1542.91 (to 103)	10 in.	
1367	100**	1556.18	1549.58 (from NW)	10 in.	1549.33 (from N)	10 in.			1549.28 (to 101)	10 in.	

Notes:
* All pipe sizes are approximate based on field observations.
** All manhole numbers are project generated and not associated with county data.

SEQUENCE OF CONSTRUCTION

1. NO IN-STREAM WORK SHALL BEGIN UNTIL ALL E&S CONTROLS HAVE BEEN PROPERLY INSTALLED (PERIMETER SILT FENCE, DECK MATS, ETC.) AND THE SPECIFIED STABILIZATION SEED MIXES AND NATURAL FIBER EROSION CONTROL MATTING ARE ON SITE.
2. SITE ACCESS AND MOBILIZATION SHALL BE FROM THE CORNER OF HICKORY AND F STREET.
3. ACCESS WITHIN THE STREAM CORRIDOR SHALL BE VIA THE SOUTH SIDE OF THE STREAM (RIGHT BANK), ALONG THE PROPOSED ALIGNMENT, WORK SHALL BE BE PERFORMED FROM TOP OF BANK OR IN CHANNEL (PROVIDED A PUMP AROUND DIVERSION IS INSTALLED DURING THE EVENT OF FLOW). AT APPROXIMATELY STATION 19+50' AND UPSTREAM ACCESS SHALL SHIFT TO THE LEFT BANK VIA A TEMPORARY STREAM CROSSING BRIDGE.
4. WORK SHALL PROGRESS FROM UPSTREAM TO DOWNSTREAM (UNLESS OTHERWISE AUTHORIZED BY CITY STAFF).
5. ALL WORK SHALL OCCUR IN THE DRY. IF FLOW IS PRESENT THE CONTRACTOR SHALL SHALL CONSTRUCT A PUMP AROUND DIVERSION AS SPECIFIED IN THE EROSION AND SEDIMENT CONTROL DETAILS.
6. TREES PROPOSED TO BE REMOVED SHALL BE CUT AS NECESSITATED BY PROPOSED GRADING. TREES SHOULD BE FELLED SUCH THAT DAMAGE TO SURROUNDING TREES IS MINIMIZED. IN AREAS WHERE GRADING IS NOT REQUIRED BUT TREES ARE SIGNIFICANTLY IMPACTED TREES SHOULD BE FLUSH CUT AND THE ROOT BALL LEFT IN PLACE. DISTURBANCE TO TREES (NOT PROPOSED TO BE REMOVED) ADJACENT TO ACCESS AREAS SHALL BE MINIMIZED VIA PLACEMENT OF DECK MATS.
7. FINAL GRADES OUTSIDE OF THE CHANNEL SHALL BE ACHIEVED THROUGH THE PLACEMENT OF 4 INCHES (MINIMUM) OF TOPSOIL (SALVAGED OR IMPORTED, SEE SPECIFICATION BOOK AND DETAILS).
8. ALL DISTURBED AREAS SHALL BE SEEDED WITH RIPARIAN SEED MIX UNLESS OTHERWISE SPECIFIED IN THE PLANTING PLAN. NATURAL FIBER MATTING SHALL BE PLACED PER THE TYPICAL RIFFLE DETAIL AND AS OTHERWISE INDICATED IN THE PLAN, STAKED TO MANUFACTURERS SPECIFICATIONS USING BIODEGRADABLE STAKES. (NOTE: SEED MUST BE SOWN IMMEDIATELY PRIOR TO MATTING PLACEMENT.)
9. ONCE ALL PROPOSED GRADING IS COMPLETE THE CONTRACTOR SHALL RESTORE ALL STAGING/STOCKPILE AND ACCESS AREAS TO PRE-EXISTING CONDITIONS USING THE APPROPRIATE SEED MIX WHERE INDICATED AS WELL AS STRAW MULCH OR MATTING PER LOCAL REQUIREMENTS AND THE VIRGINIA E&S HANDBOOK. PLANTINGS SHALL BE INSTALLED PER THE PLANTING PLAN AND SPECIFICATIONS AND ADHERING TO THE SPECIFIED TIME OF YEAR PLANTING WINDOWS.
10. THE CONTRACTOR SHALL ASSESS THE POST-CONSTRUCTION CONDITIONS OF EXISTING INFRASTRUCTURE, REPAIRING ANY DAMAGE NOT OTHERWISE SPECIFIED IN THESE PLANS TO PRE-EXISTING CONDITIONS OR BETTER.
11. CONTRACTOR SHALL REMOVE E&S MEASURES AND RETURN ANY REMAINING DISTURBED AREAS TO A PRE-CONSTRUCTION CONDITION.
12. CONTRACTOR TO FOLLOW ALL APPLICABLE OSHA REQUIREMENTS.

Tree #	DBH (Diameter at 4.5 feet above grade)	Common Name	Botanical Name	Condition Rating %	Condition Rating	Dead Tree (Y/N)	Number of Stems	TPZ Tree Protection Zone (radius) in Feet (Pith to Pith)	SRZ Structural Critical Root Zone (radius) in Feet	CRZ Critical Root Zone Radius in Ft (1 ft radius/in DBH)	CRZ Critical Root Zone Radius in Ft (1.5 ft radius/in DBH)	Priority (1-4)	Removal	Additional Notes	Condition Notes
37	24	oak, white	Quercus alba	55%	Fair	NO	1	20	11	24	36	3		nails	Hardware
38	26	oak, white	Quercus alba	55%	Fair	NO	1	22	12	26	39	0			
39	24	oak, white	Quercus alba	55%	Fair	NO	1	20	11	24	36	2			One Sided, Branch Decay
40	23	oak, white	Quercus alba	55%	Fair	NO	1	19	10	23	35	0			One Sided, Branch Decay
41	21	oak, white	Quercus alba	65%	Good	NO	1	18	9	21	32	0			
46	22	cherry, black	Prunus serotina	55%	Fair	NO	1	18	10	22	33	3			
47	19	cherry, black	Prunus serotina	55%	Fair	NO	1	16	9	19	29	2			
48	22	cherry, black	Prunus serotina	30%	Poor	NO	1	18	10	22	33	3			Narrow Crown, Large DW (3"+), Serious Decline
49	27	oak, northern red	Quercus rubra	55%	Fair	NO	1	23	12	27	41	2			Full Crown
50	20	oak, northern red	Quercus rubra	50%	Fair	NO	1	17	9	20	30	3		leaning	Narrow Crown
51	22	oak, northern red	Quercus rubra	35%	Poor	NO	1	18	10	22	33	3			Basal Decay, Large DW (3"+), Broken Limbs
52	18	cherry, black	Prunus serotina	20%	Critical	NO	1	15	8	18	27	0			Excessive Lean, Stressed, Vines
53	26	osage-orange	Maclura pomifera	30%	Poor	NO	1	22	12	26	39	3			Basal Decay, Large DW (3"+), Small DW (1-2"), Broken Limbs, Branch Decay
54	19	walnut, black	Juglans nigra	55%	Fair	NO	1	16	9	19	29	2			
55	18	ash, green	Fraxinus pennsylvanica	0%	Dead	YES	1	15	8	18	27	4		remove	
56	22	elm, slippery	Ulmus rubra	50%	Fair	NO	1	18	10	22	33	3			Surface Roots, Vines, Stream Erosion
57	19	oak, white	Quercus alba	30%	Poor	NO	1	16	9	19	29	3			Narrow Crown, One Sided, Surface Roots, Small DW (1-2"), Branch Decay, Stream Erosion
58	32,28	sycamore, American	Platanus occidentalis	30%	Poor	NO	2	35	19	43	64	4			Surface Roots, Basal Decay, Co-Dominant Stems, Broken Limbs, Stream Erosion
59	26	walnut, black	Juglans nigra	50%	Fair	NO	1	22	12	26	39	3			Small DW (1-2"), Broken Limbs
60	24	cherry, black	Prunus serotina	45%	Fair	NO	1	20	11	24	36	3			Small DW (1-2"), Broken Limbs
61	25	oak, northern red	Quercus rubra	55%	Fair	NO	1	21	11	25	38	2			Full Crown, Small DW (1-2")
62	18, 10	maple, silver	Acer saccharinum	40%	Poor	NO	2	17	9	21	31	3			Basal Decay, Trunk Decay, Co-Dominant Stems, Branch Decay
63	25	walnut, black	Juglans nigra	50%	Fair	NO	1	21	11	25	38	2			Vines
64	21	walnut, black	Juglans nigra	50%	Fair	NO	1	18	9	21	32	2			Full Crown, Broken Limbs

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COLE AVE STREAM RESTORATION
FINAL DESIGN
City Of Staunton, Virginia

Grading Plan and Longitudinal Profile

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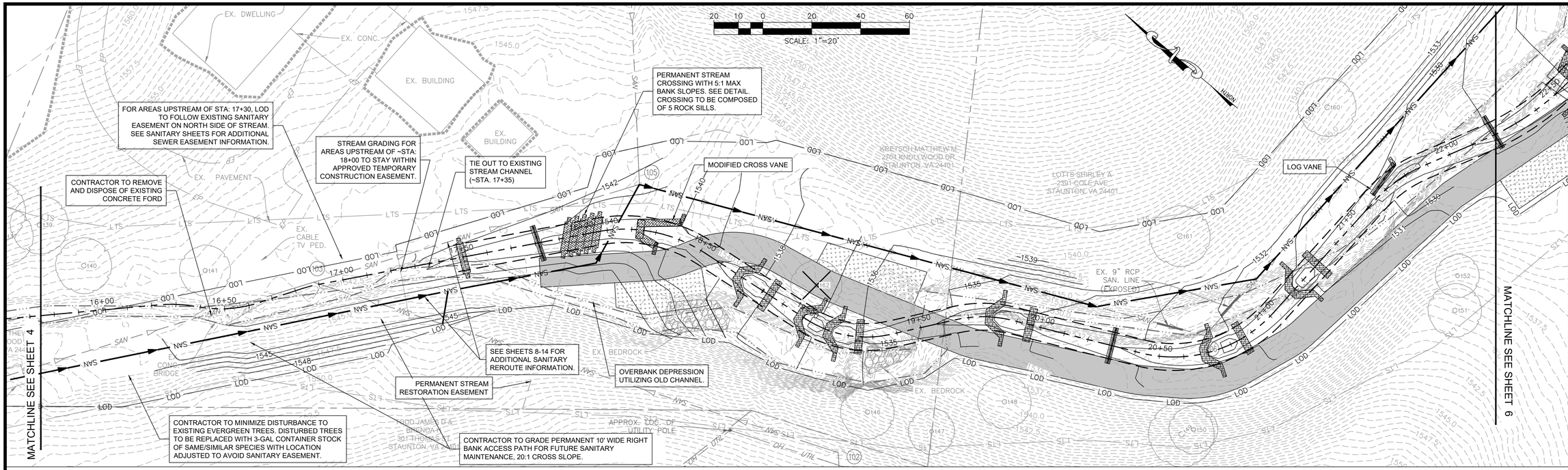
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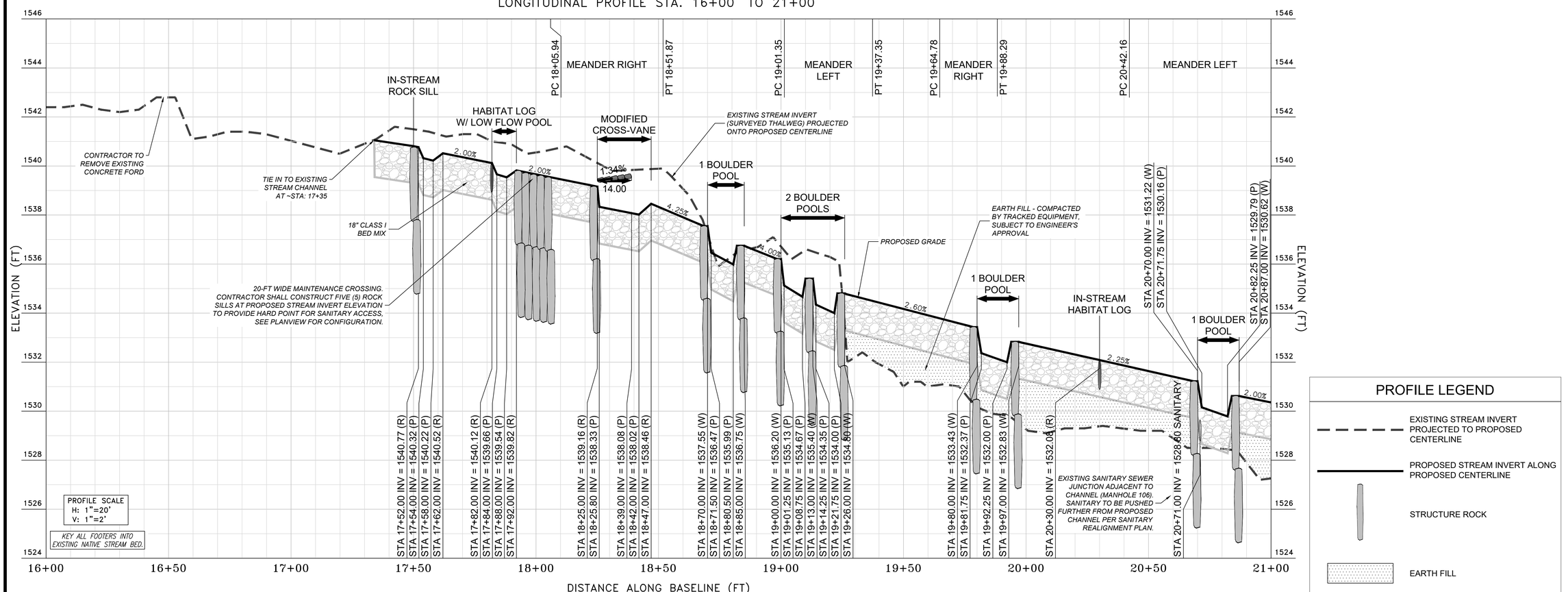
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LONGITUDINAL PROFILE STA. 16+00' TO 21+00'



PROFILE LEGEND

- EXISTING STREAM INVERT PROJECTED TO PROPOSED CENTERLINE
- PROPOSED STREAM INVERT ALONG PROPOSED CENTERLINE
- STRUCTURE ROCK
- EARTH FILL
- CLASS 1 REINFORCED BED MIX

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COLE AVE STREAM RESTORATION FINAL DESIGN

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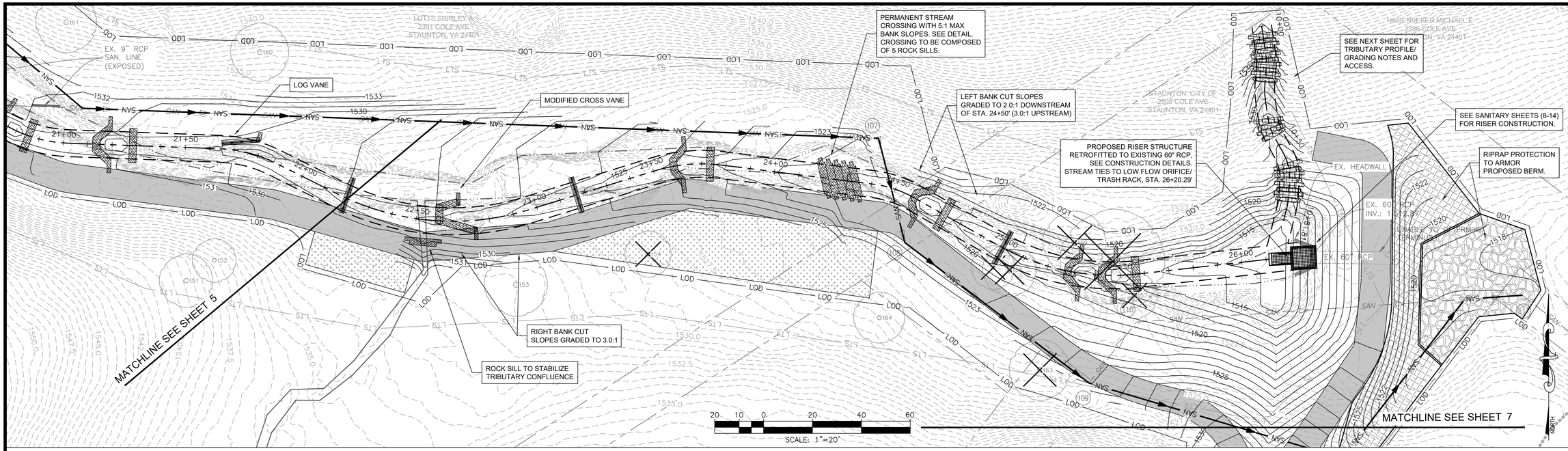
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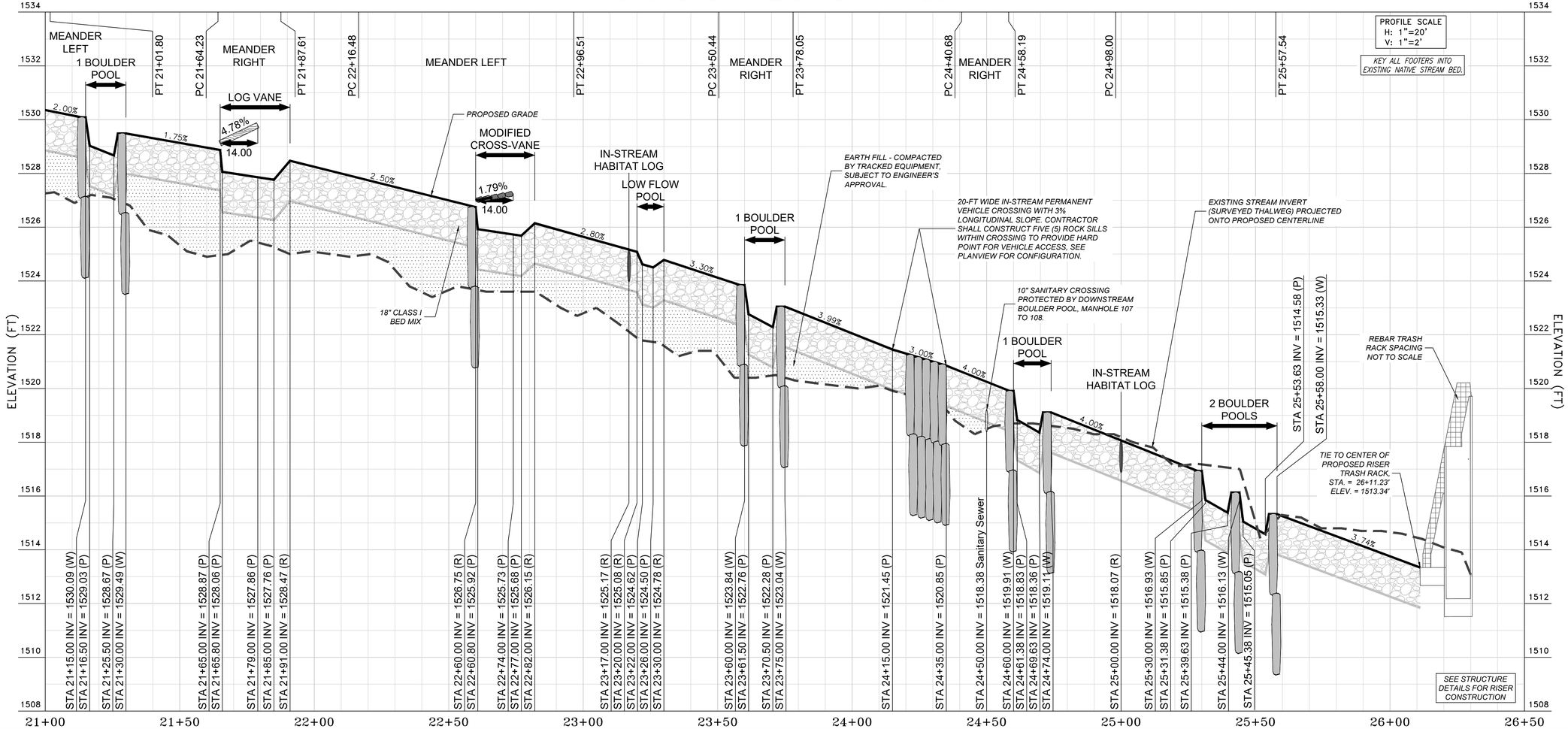
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LONGITUDINAL PROFILE STA. 21+00' TO END



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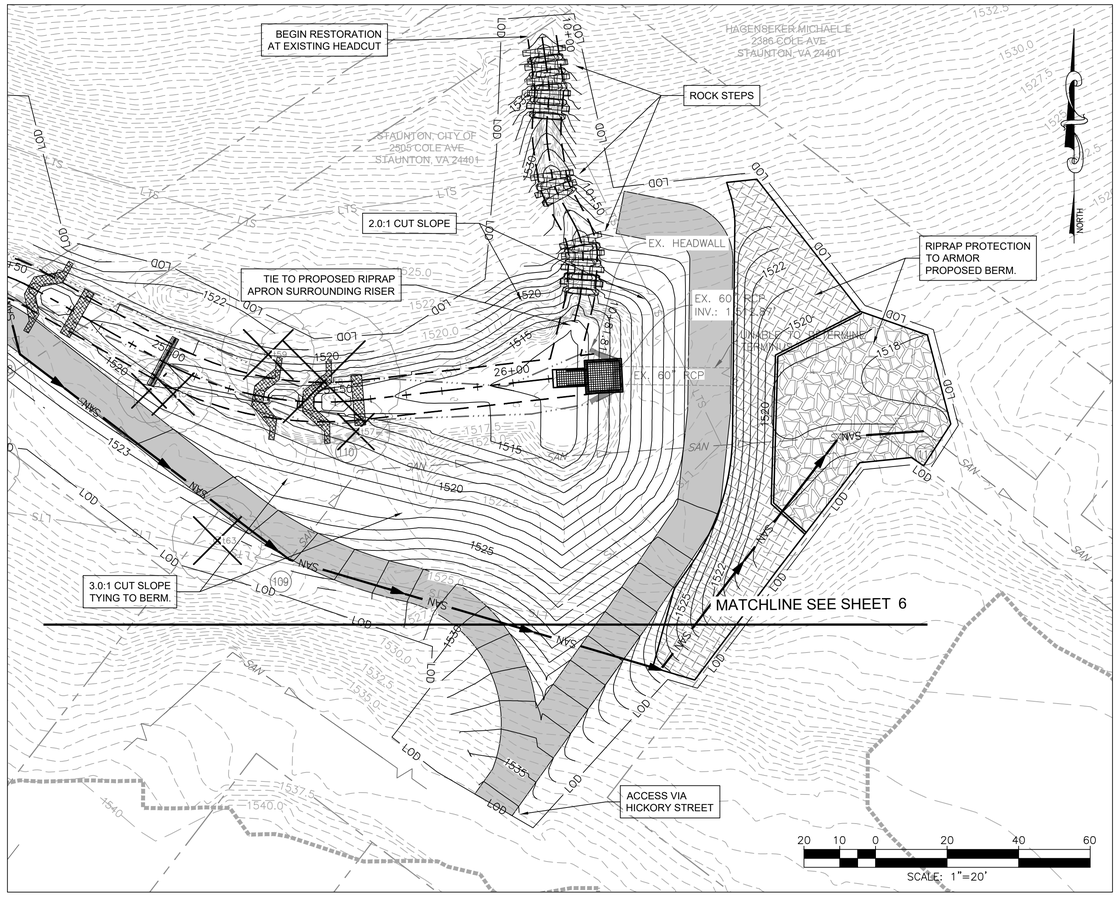
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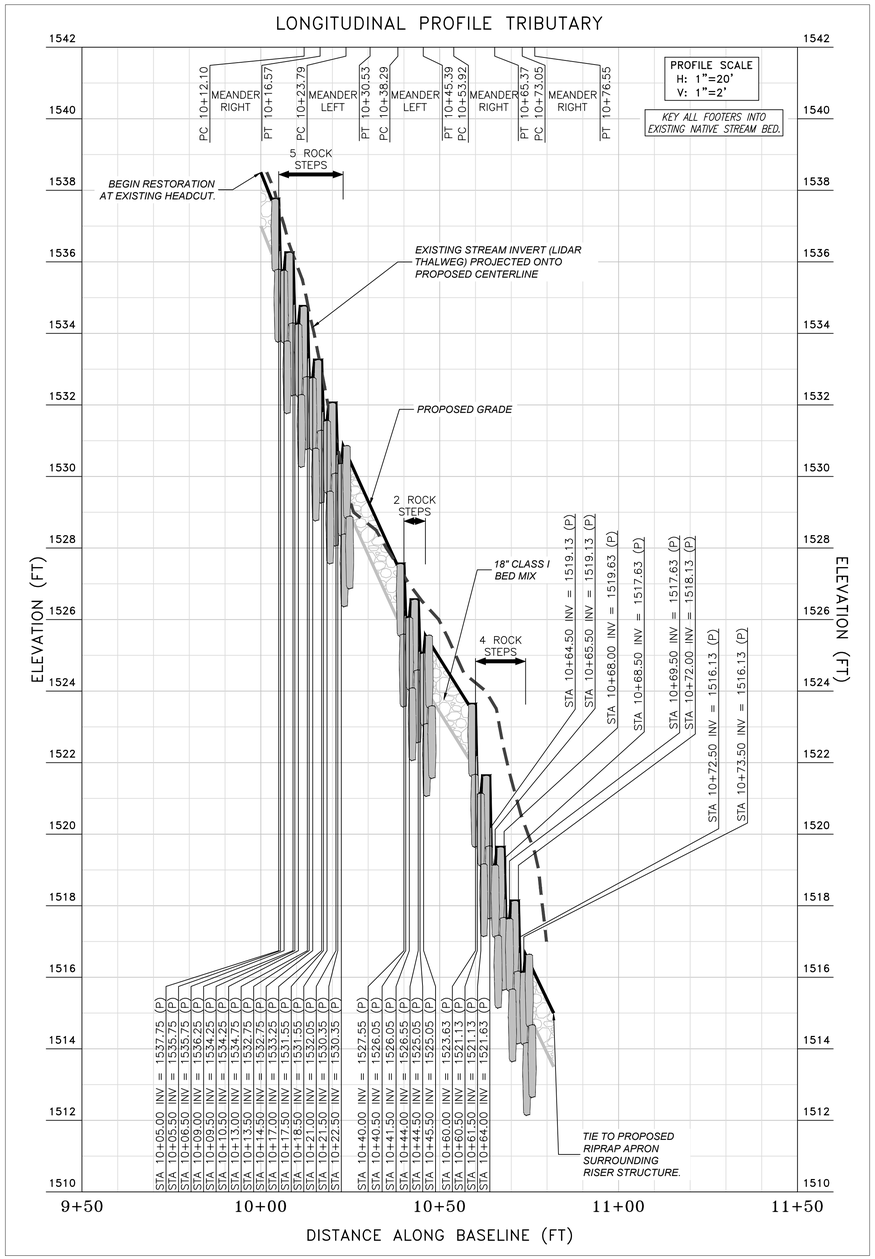
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SURVEY NOTES:

1. THIS MAP HAS BEEN HORIZONTALLY REFERENCED TO THE VIRGINIA COORDINATE SYSTEM OF 1983, NORTH ZONE, (NAD83) AND VERTICALLY TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88) BASED ON RTN GPS. HORIZONTAL AND VERTICAL VALUES ARE EXPRESSED IN U.S. SURVEY FEET. AERIAL AND FIELD LOCATIONS WERE COMPLETED ON DECEMBER 9, 2022.
2. CONTOUR INTERVAL: 2 FOOT.
3. NO UNDERGROUND UTILITIES WERE MARKED OR SURVEYED DURING THIS TOPOGRAPHIC SURVEY.

GENERAL NOTES:

1. THE CONTRACTOR SHALL BE FULL LIABLE FOR ANY DAMAGES TO PUBLIC OR PRIVATE PROPERTY CAUSED BY CONSTRUCTION OPERATION AND SHALL RESTORE DAMAGED PROPERTY TO EXISTING OR BETTER CONDITION AT NO ADDITIONAL COST TO OWNER.
2. ALL AREAS DISTURBED BY CONSTRUCTION SHALL BE SEEDED AND PROTECTED WITH EROSION CONTROL PRACTICES.
3. VEGETATIVE AND STRUCTURAL EROSION AND SEDIMENT CONTROL DEVICES SHALL BE CONSTRUCTED AND MAINTAINED FOR ALL DISTURBED AREAS IN ACCORDANCE WITH ALL LOCAL REQUIREMENTS AND THE LATEST EDITION OF THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK. ALL EROSION AND SEDIMENT CONTROL DEVICES SHALL BE INSTALLED BEFORE EXCAVATION BEGINS.
4. THE CONTRACTOR SHALL REPLACE ALL DISTURBED SURFACES IN KIND, INCLUDING PAVEMENT, STONE, DITCHES, MAILBOXES, SHRUBS, ETC.
5. THE CONTRACTOR SHALL COMPLY WITH ALL FEDERAL, STATE, AND LOCAL CONFINED SPACE ENTRY REGULATIONS.
6. MAINTAIN OVERHEAD AND UNDERGROUND ELECTRICAL, TELEPHONE, SANITARY, AND GAS SERVICES AND ALL OTHER UNDERGROUND UTILITIES DURING ENTIRE CONSTRUCTION PERIOD. OUTAGES WILL NOT BE ALLOWED.
7. ALL AREAS SHALL BE CLASS I COMPACTED BACKFILL FOR THE ENTIRE PROJECT.

ABBREVIATIONS:

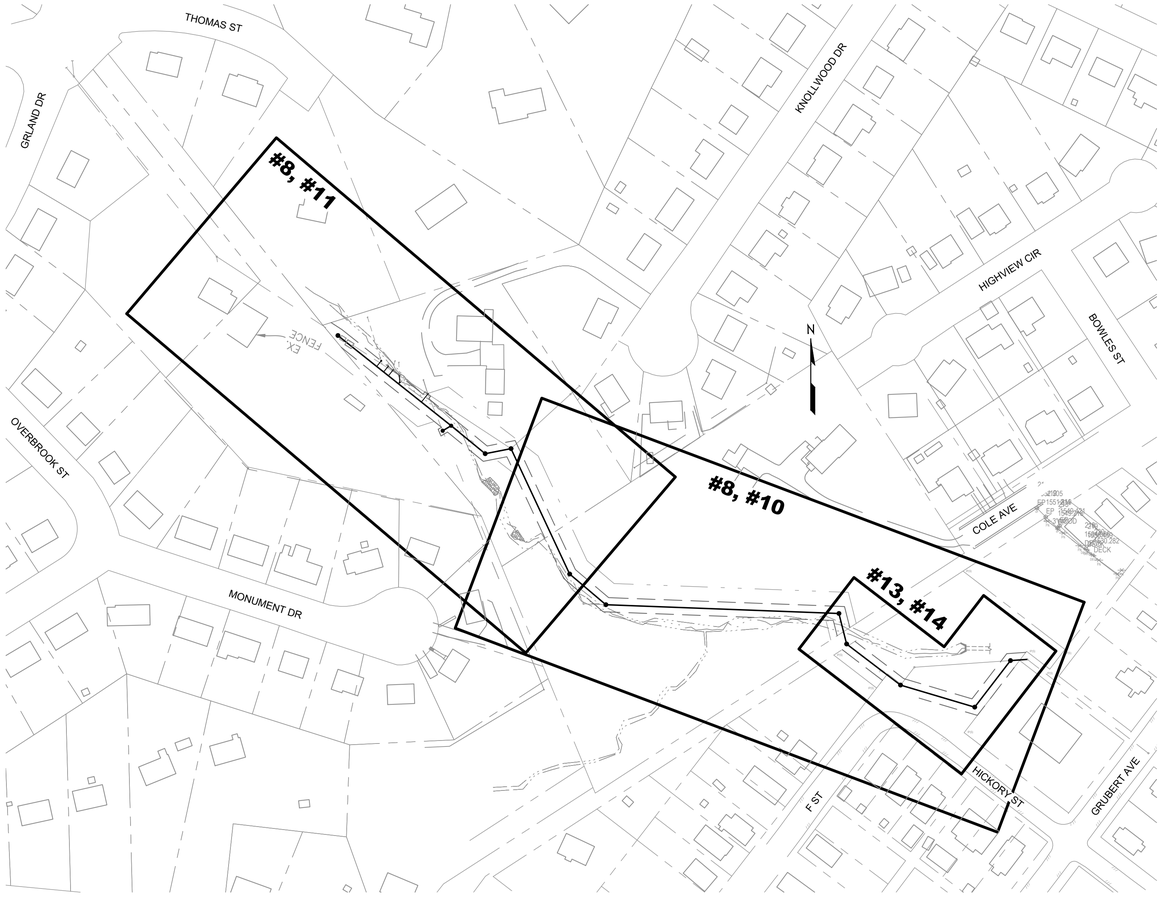
APPROX	APPROXIMATE
AVE	AVENUE
CONC	CONCRETE
DIP	DUCTILE IRON PIPE
DIA	DIAMETER
E	EASTING
EL	ELEVATION
ELEV	ELEVATION
EX	EXISTING
INV	INVERT
LF	LINEAR FEET
LOC	LOCATION
MH	MANHOLE
N	NORTHING
O.H.	OVER HEAD
PED	PEDESTAL
RCP	REINFORCED CONCRETE PIPE
REQD	REQUIRED
SAN	SANITARY
SF	SQUARE FEET
ST	STREET
STA	STATION
STD	STANDARD
SQ	SQUARE
SYD	SQUARE YARD
TBR	TO BE REMOVE
TYP	TYPICAL
WT	WATERTIGHT

LEGEND:

EXISTING	
⊠	BENCHMARK
◎	CONTROL POINT
⌖	CONTROL POINT - NAIL SET
● IPF	IRON PIN FOUND
○ PIPE	IRON PIPE FOUND
Ⓢ	SANITARY MANHOLE
⊙	SANITARY CLEANOUT

EXISTING	
	SOIL DELINEATION
	EDGE OF PAVEMENT
	FENCELINE
	LANDSCAPE AREA
1000	MAJOR CONTOURS
	MINOR CONTOURS
UGT	UNDERGROUND TELEPHONE
NG	UNDERGROUND NATURAL GAS
UGE	UNDERGROUND ELECTRIC
SS	SANITARY LINE
SD	STORM LINE
W	WATER LINE
STM	STEAM LINE
	JURISDICTIONAL WATERWAY
	PERMANENT SANITARY EASEMENT
	PERMANENT SANITARY EASEMENT
	TEMPORARY SANITARY EASEMENT
	PROPERTY LINE

PROPOSED	
	DEMO REMOVAL
SS	SANITARY LINE
# # #	REMOVE EXISTING PIPE
	LIMITS OF DISTURBANCE
X	REMOVE EXISTING MANHOLE



SEQUENCE OF CONSTRUCTION

1. CONSTRUCT THE TEMPORARY STONE CONSTRUCTION ENTRANCES.
2. INSTALL SILT FENCE PRIOR TO EXCAVATING FOR THE PLANNED UTILITY.
3. SILT FENCE THAT IS PERPENDICULAR TO THE PLANNED TRENCH EXCAVATION SHALL BE INSTALLED PRIOR TO ANY EXCAVATION UPHILL OF THE SILT FENCE LOCATION.
4. CLEAR THE PLANNED DISTURBED AREA AND REMOVE DEBRIS TO A SUITABLE LOCATION.
5. INSTALL STREAM CROSSING
6. INSTALL PLANNED UTILITY.
7. IMMEDIATELY STABILIZE THE BED AND BANKS OF THE WATERCOURSE AFTER WORK IN THE WATERCOURSE IS COMPLETE.
8. BRING GRADES TO DESIRED ELEVATION.
9. STABILIZE ALL DISTURBED AREAS WITH PERMANENT VEGETATION.
10. EROSION CONTROL DEVICES SHALL REMAIN IN PLACE UNTIL RELEASED BY THE GOVERNING AGENCY.
11. REMOVE TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES.
12. STABILIZE AREAS AFFECTED BY REMOVAL OF THE TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES.

EROSION AND SEDIMENT CONTROL LEGEND

3.02	TEMPORARY STONE CONSTRUCTION ENTRANCE	CE	
3.05	SILT FENCE	SF	X—X—X
3.24	TEMPORARY VEHICULAR STREAM CROSSING	SC	
3.31	TEMPORARY SEEDING	TS	TS
3.32	PERMANENT SEEDING	PS	PS
3.35	MULCHING	MU	MU
3.39	DUST CONTROL	DC	DC

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0 100' 200'

SCALE: 1" = 100'

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General Notes - Sanitary

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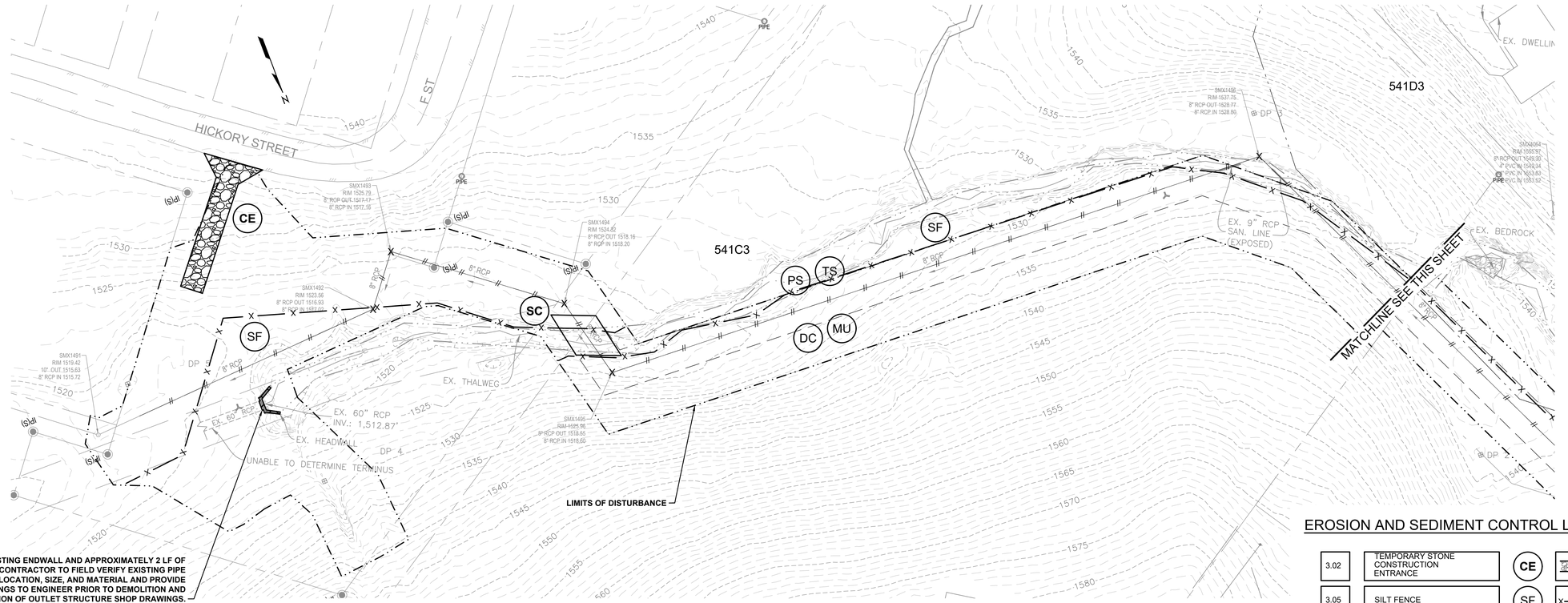
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8_GENERAL NOTES - Sanitary.dwg



EROSION AND SEDIMENT CONTROL LEGEND

3.02	TEMPORARY STONE CONSTRUCTION ENTRANCE	CE	
3.05	SILT FENCE	SF	
3.24	TEMPORARY VEHICULAR STREAM CROSSING	SC	
3.31	TEMPORARY SEEDING	TS	
3.32	PERMANENT SEEDING	PS	
3.35	MULCHING	MU	
3.39	DUST CONTROL	DC	

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0 30' 60'

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City of Staunton, Virginia

Existing Condition & Demolition Plan

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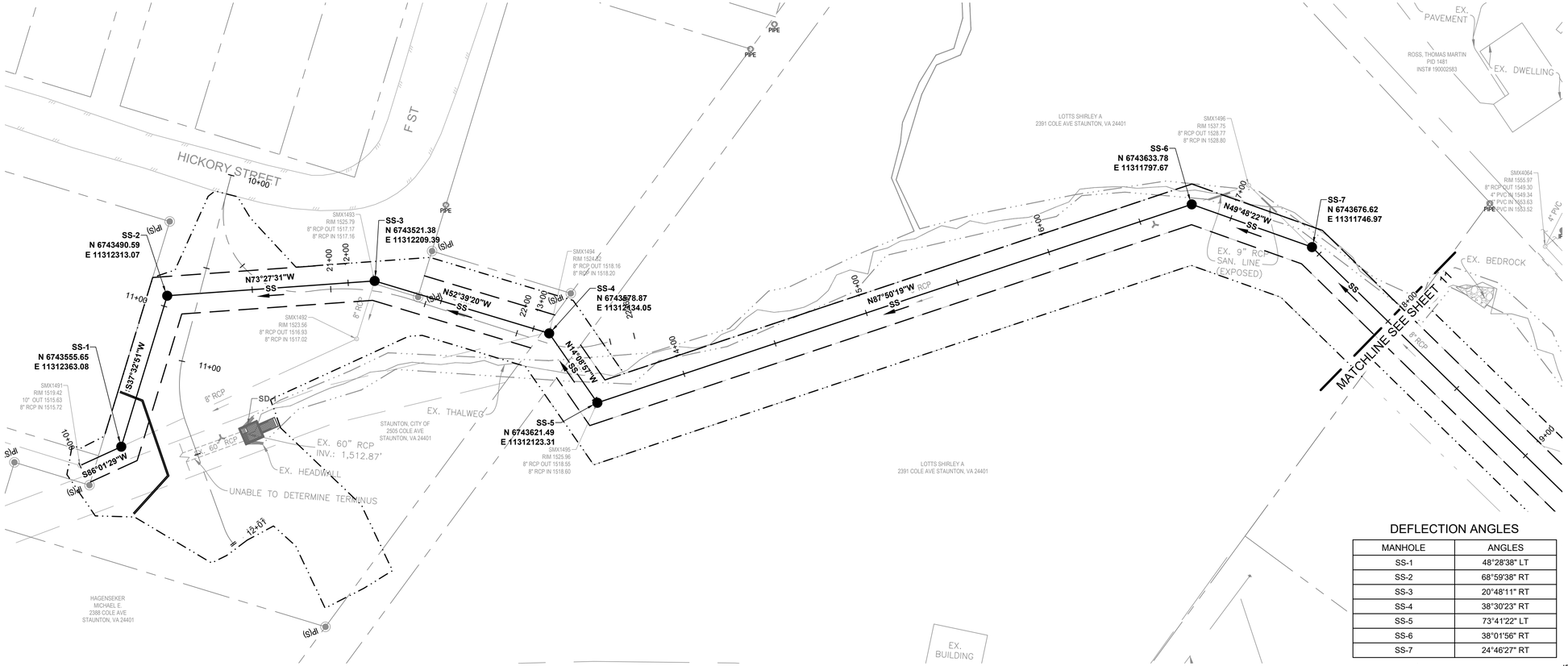
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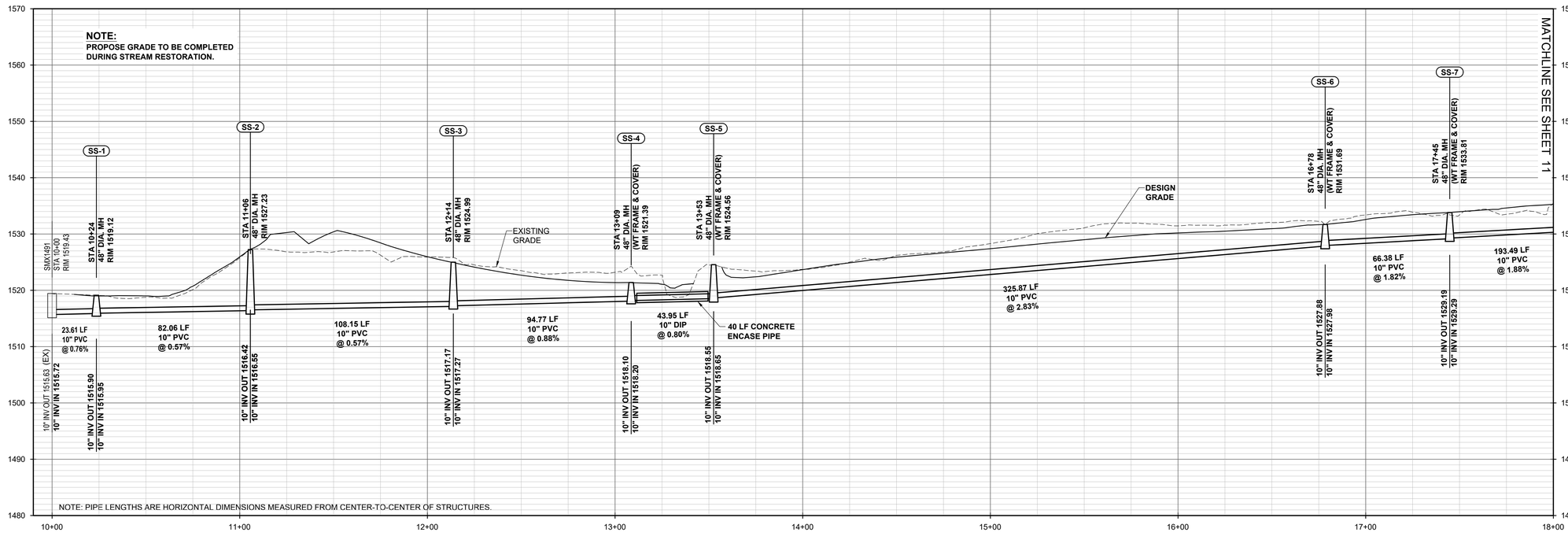


DEFLECTION ANGLES

MANHOLE	ANGLES
SS-1	48°28'38" LT
SS-2	68°59'38" RT
SS-3	20°48'11" RT
SS-4	38°30'23" RT
SS-5	73°41'22" LT
SS-6	38°01'56" RT
SS-7	24°46'27" RT

N

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VERT: 1" = 10'
0 10' 20'
0 30' 60'
HORIZ: 1" = 30'



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Plan & Profile Sta 10+00 To 18+00 - Sanitary

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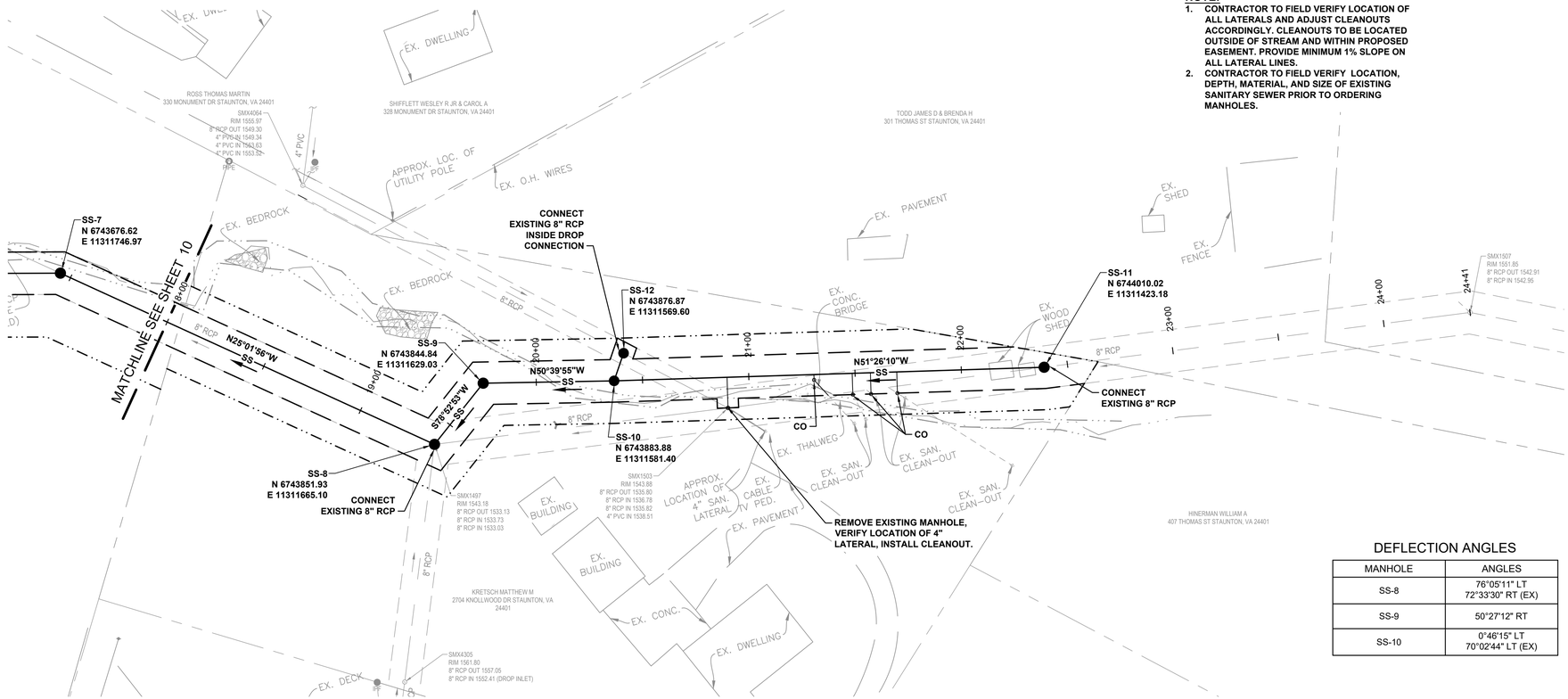
Vertical Datum: NGVD 29

Boundary and Topo Source:
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DTS	DGB	NAS

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10 of 27

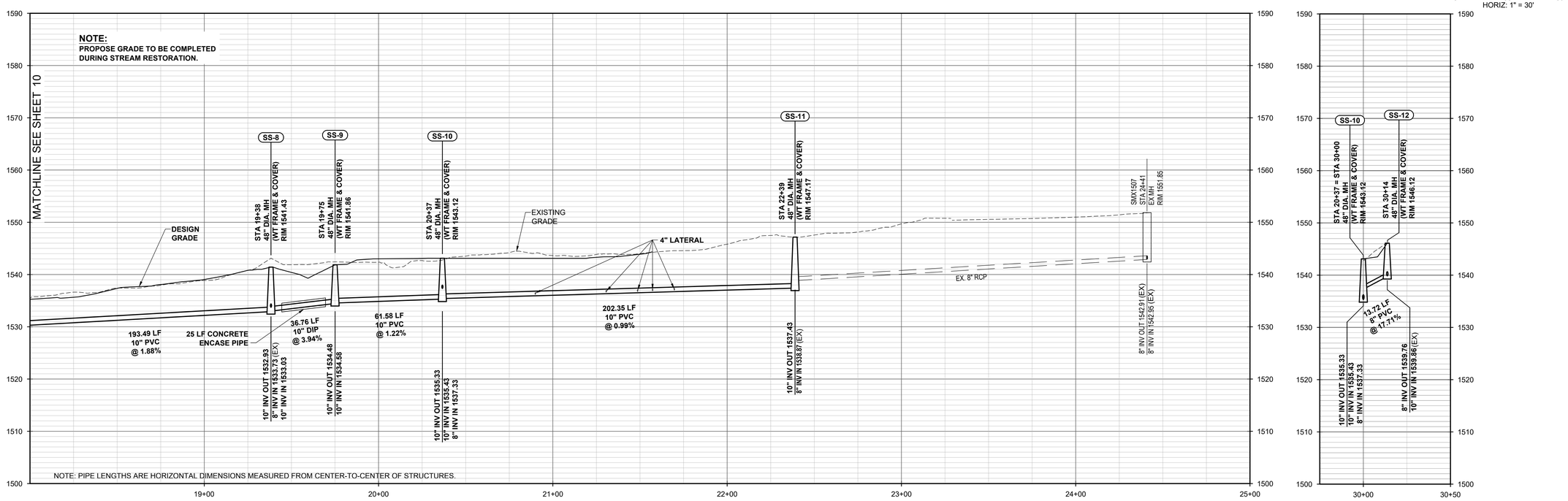
Computer File Name:
X:\2022\222196 Staunton Cole Sanitary\700 Drawings\702 Civil Sheets\10 SANIARY PLAN AND PROFILE.dwg



DEFLECTION ANGLES

MANHOLE	ANGLES
SS-8	76°05'11" LT 72°33'30" RT (EX)
SS-9	50°27'12" RT
SS-10	0°46'15" LT 70°02'44" LT (EX)

IF THIS DRAWING IS REDUCED, GRAPHIC SCALE MUST BE USED.
VERT: 1" = 10'
0 10' 20'
0 30' 60'
HORIZ: 1" = 30'



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COLE AVE SANITARY SEWER REPLACEMENT
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City of Staunton, Virginia

Plan & Profile Sta 18+00 To 23+00 - Sanitary

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PROFESSIONAL ENGINEER

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No.	Date	Description	Rec. By	App. By

SCALE: 1" = 30'H:10'V

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Vertical Datum: NGVD 29

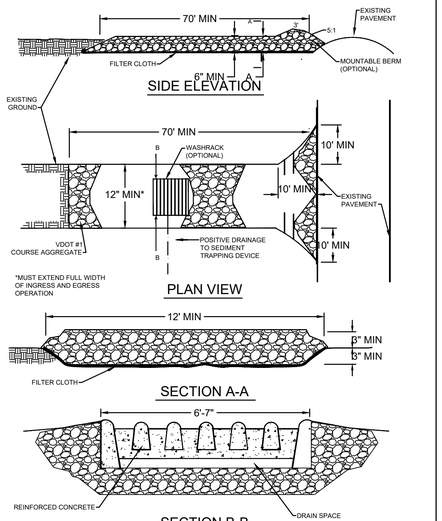
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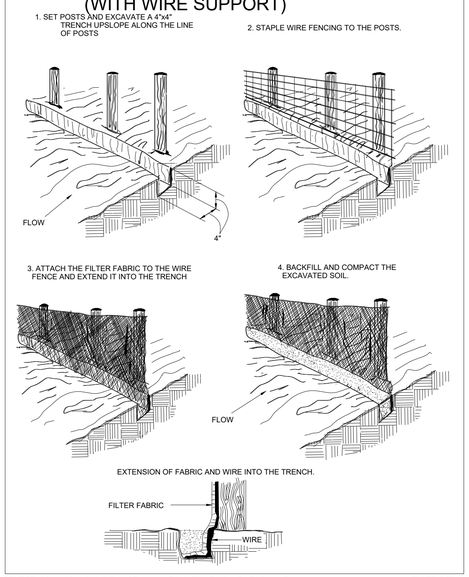
STONE CONSTRUCTION ENTRANCE



SOURCE: ADAPTED from 1983 Maryland Standards for Soil erosion and Sediment Control, and Va. DSWC

STONE CONSTRUCTION ENTRANCE (CE)
NOT TO SCALE — PLATE 3.02-1

CONSTRUCTION OF A SILT FENCE (WITH WIRE SUPPORT)

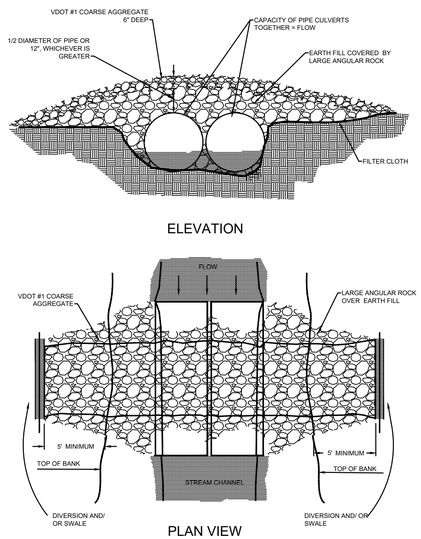


SOURCE: Adapted from Installation of Straw and Fabric Filter Barriers for Sediment Control, Sherwood & Wyant

PLATE. 3.05-1

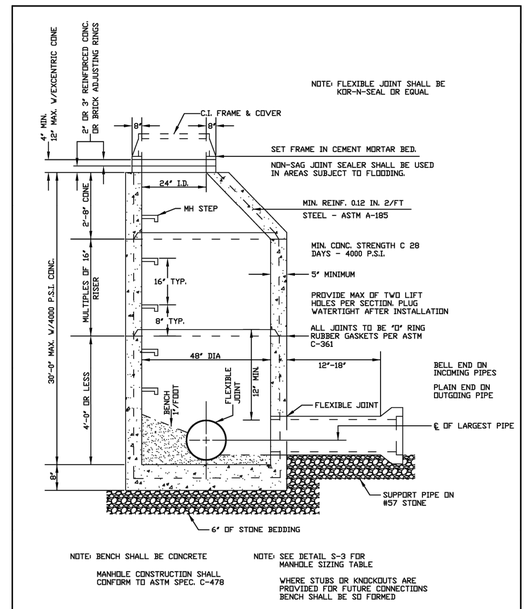
SILT FENCE (SF)
NOT TO SCALE — PLATE 3.05-1

TEMPORARY CULVERT CROSSING

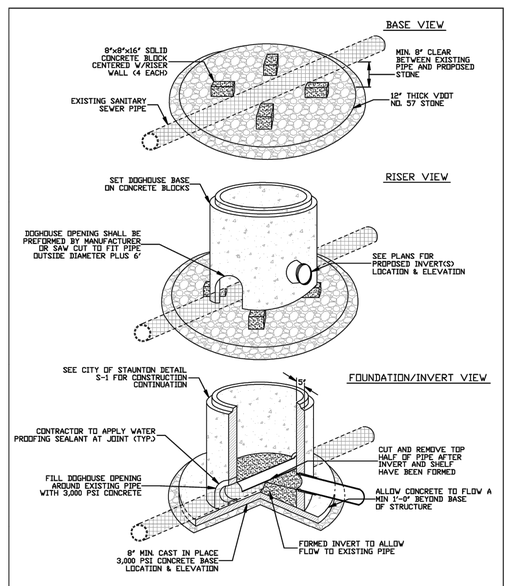


SOURCE: VA. DSWC

TEMPORARY VEHICULAR STREAM CROSSING (SC)
NOT TO SCALE — PLATE 3.24-2

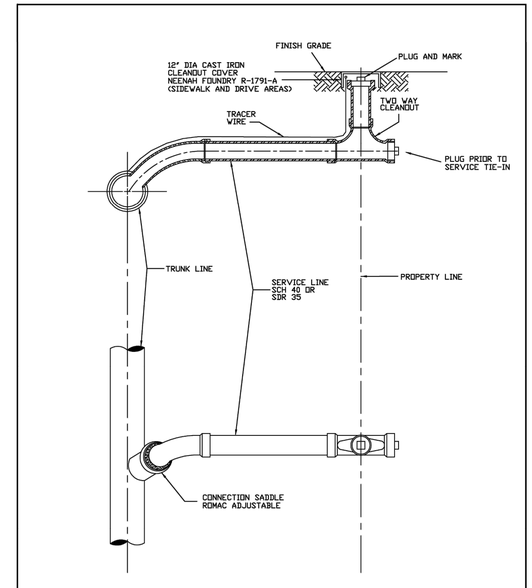


CITY OF STAUNTON, VA	**STANDARD PRECAST CONCRETE MANHOLE**	Draw No. **S-1**



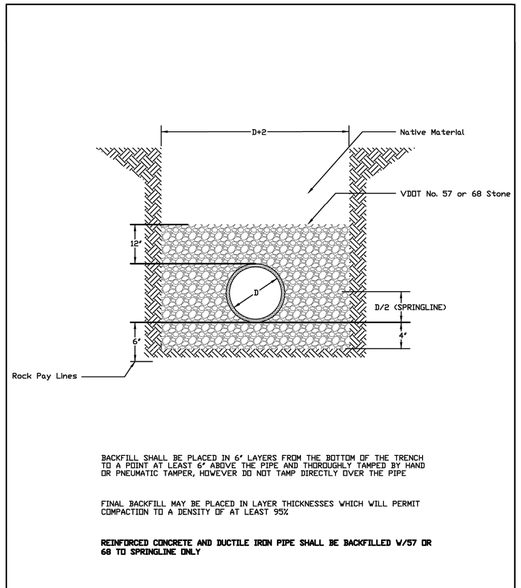
NOTE: SEE DETAIL S-3 FOR MANHOLE SIZING TABLE

CITY OF STAUNTON, VA	**STANDARD PRECAST DOGHOUSE MANHOLE**	Draw No. **S-1A**



NOTE: CLEANOUT TOP SHALL BE LEFT VISIBLE ABOVE GRADE

CITY OF STAUNTON, VA	**SEWER SERVICE CONNECTION**	Draw No. **S-7**

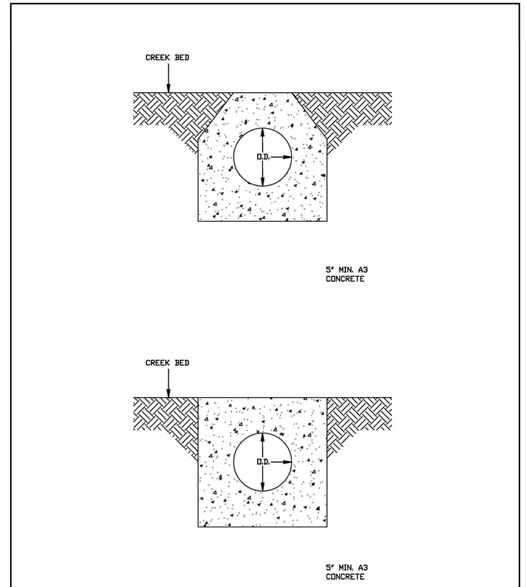


BACKFILL SHALL BE PLACED IN 6' LAYERS FROM THE BOTTOM OF THE TRENCH TO A POINT AT LEAST 6" ABOVE THE PIPE AND THOROUGHLY TAMPED BY HAND OR PNEUMATIC TAMPER, HOWEVER DO NOT TAMP DIRECTLY OVER THE PIPE

FINAL BACKFILL MAY BE PLACED IN LAYER THICKNESSES WHICH WILL PERMIT COMPACTION TO A DENSITY OF AT LEAST 95%

REINFORCED CONCRETE AND DUCTILE IRON PIPE SHALL BE BACKFILLED W/57 OR 68 TO SPRINGLINE ONLY

CITY OF STAUNTON, VA	**SEWER PIPE INSTALLATION**	Draw No. **S-8**



CITY OF STAUNTON, VA	**CONCRETE ENCASEMENTS**	Draw No. **S-9**

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DATE: APRIL, 2024

Horizontal Datum: VCS NAD 83

Vertical Datum: NGVD 29

Boundary and Topo Source: WSSI and City of Staunton Digital Data

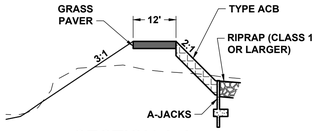
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Sheet # 12 of 27

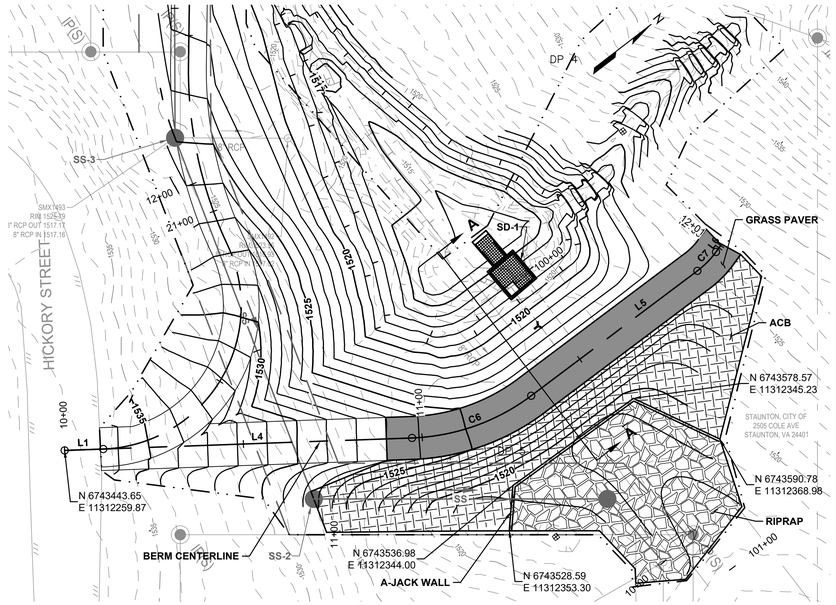
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X:\2022\222106 Staunton Cole Sanitary\700 Drawings\702 Civil\Sheets 12_DETAILS - SANITARY.dwg

LINE TABLE		
LINE	LENGTH	BEARING
L1	10.791	N35°29'27"E
L4	86.358	N35°29'27"E
L5	58.113	N0°36'52"E
L6	2.246	N16°25'20"W

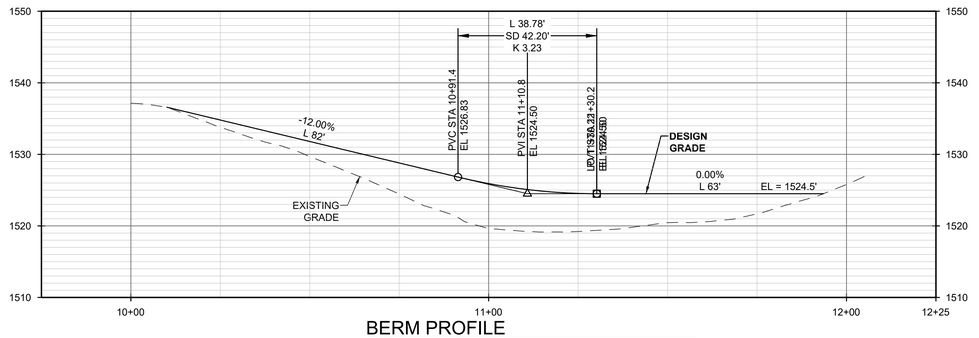
CURVE TABLE					
CURVE	DELTA	RADIUS	LENGTH	CHORD	CHORD BEARING
C6	34.8763	58.947	35.881	35.33	N18°03'10"E
C7	17.0367	25.000	7.434	7.41	N7°54'14"W



SECTION A-A
SCALE: 1" = 20'H:10'V



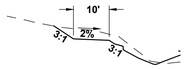
OUTLET STRUCTURE SITE PLAN
SCALE: 1" = 20'H:10'V



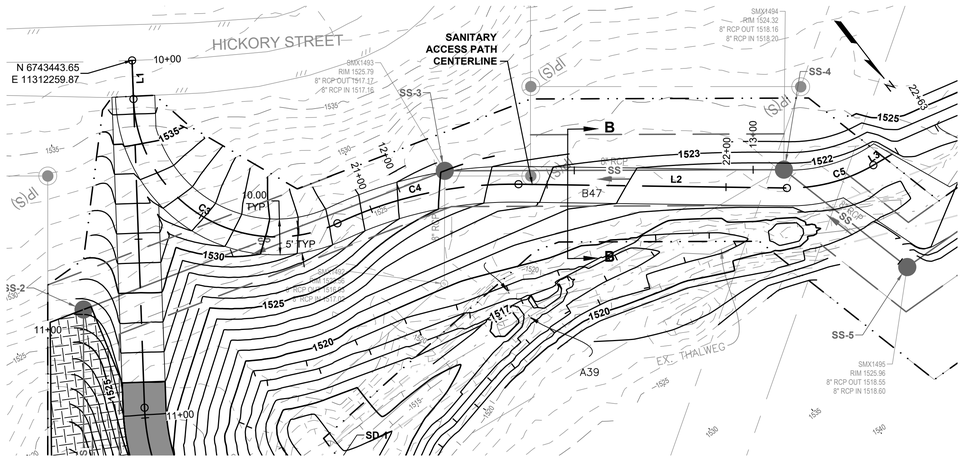
BERM PROFILE
SCALE: 1" = 20'H:10'V

LINE TABLE		
LINE	LENGTH	BEARING
L1	10.791	N35°29'27"E
L2	75.029	N51°38'32"W
L3	6.083	N82°50'24"W

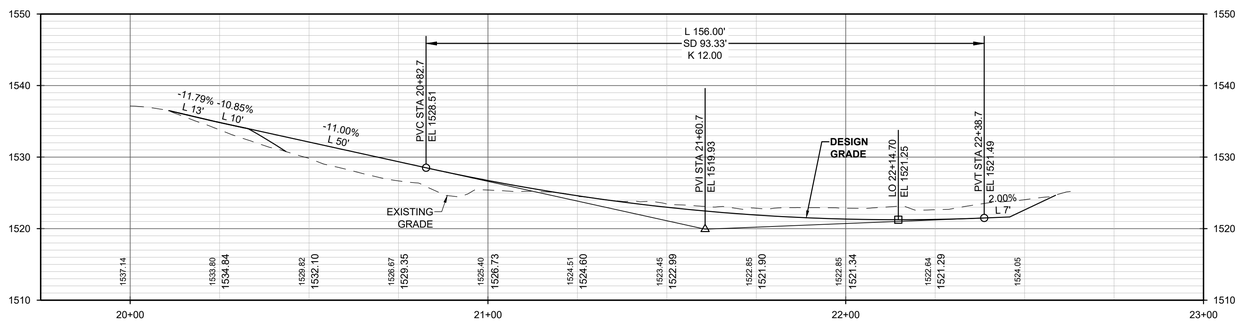
CURVE TABLE					
CURVE	DELTA	RADIUS	LENGTH	CHORD	CHORD BEARING
C3	113.1446	40.000	78.990	66.77	N21°04'53"W
C4	26.0114	115.000	52.208	51.76	N64°38'53"W
C5	31.1976	46.471	25.303	24.99	N67°14'28"W



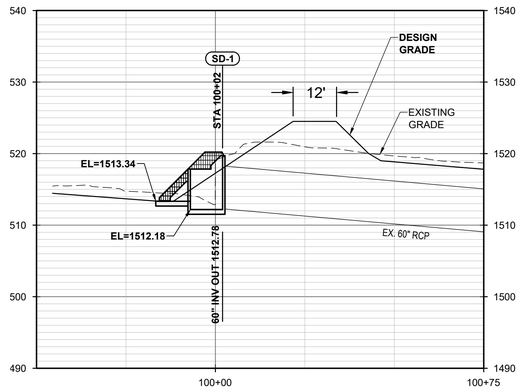
SECTION B-B
SCALE: 1" = 20'H:10'V



SANITARY ACCESS PATH SITE PLAN
SCALE: 1" = 20'H:10'V



SANITARY ACCESS PATH PROFILE
SCALE: 1" = 20'H:10'V



OUTLET STRUCTURE PROFILE
SCALE: 1" = 20'H:10'V

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VERT: 1" = 10'
0 10' 20'
0 20' 40'
HORIZ: 1" = 20'

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Details - Outlet Structure

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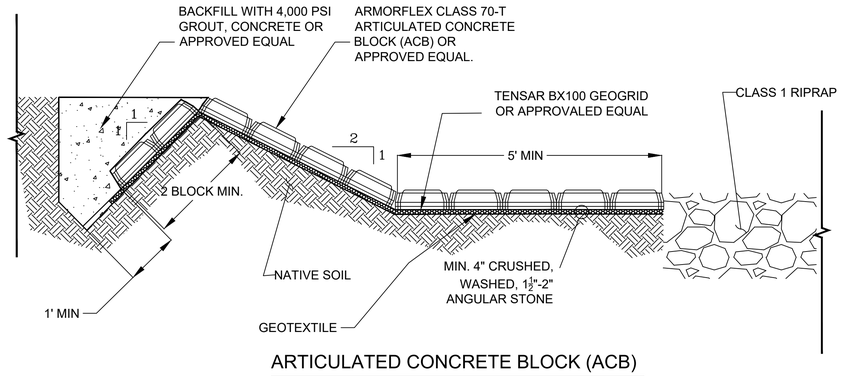
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Boundary and Topo Source:
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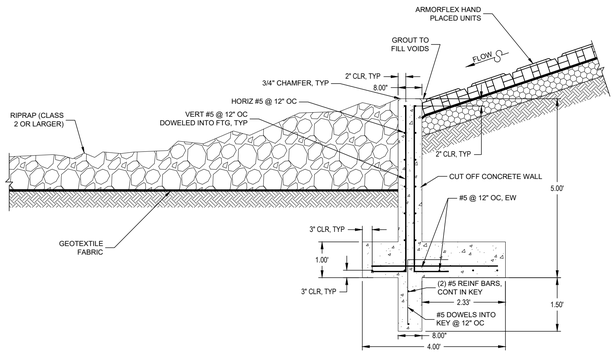
Sheet # 13 of 27

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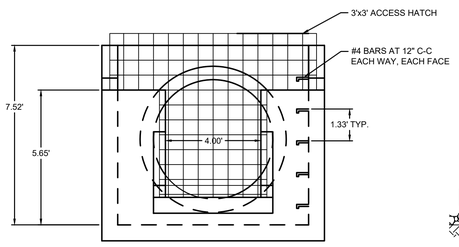
ARTICULATED CONCRETE BLOCK (ACB)

NOT TO SCALE

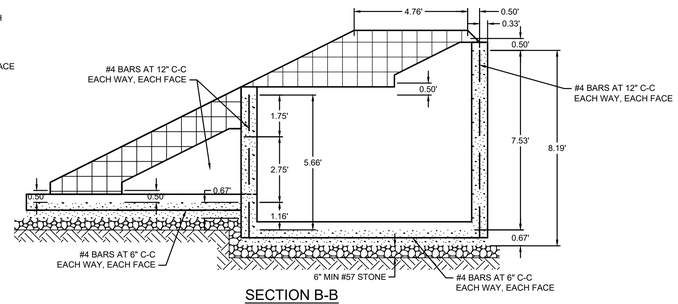


A-JACKS TRANSITION DETAIL

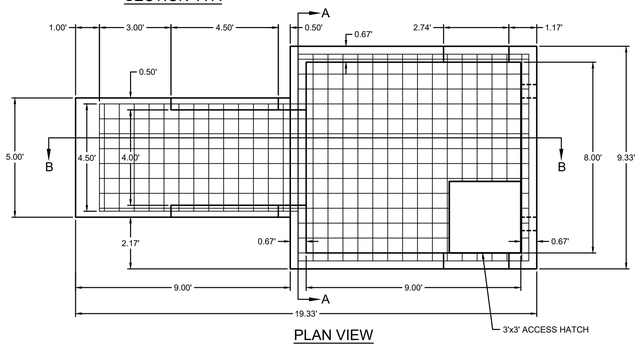
NOT TO SCALE



SECTION A-A



SECTION B-B



PLAN VIEW

OUTLET STRUCTURE DETAIL

SCALE: 1" = 3'

ACB GENERAL NOTES

1. ACB'S WILL BE ARMORFLEX CLASS 70-T OR APPROVED EQUAL. ACB'S SHALL FOLLOW ASTM STANDARDS 1262-C FOR FREEZE THAW 100 CYCLES IN 3% SALINE WITH LESS THAN 1% MASS LOSS, ASTM D6884-03 INSTALLATION OF ACB'S, D7276-08 TEST RESULT INTERPRETATION FOR ACB'S AND D7277-08 TESTING OF ACB'S. ALL CALCULATIONS FOR ACB PERFORMANCE MUST BE CLEARLY SHOWN AND BASED UPON THE SMALLEST BLOCK UTILIZED IN THE REVETMENT.
2. ACB'S PLACED WITH CABLES SHALL BE BACKFILLED WITH 4000 PSI CONCRETE AT CABLE OVERLAY.
3. INSTALL ACB'S PER MANUFACTURERS STANDARDS AND SPECIFICATIONS.

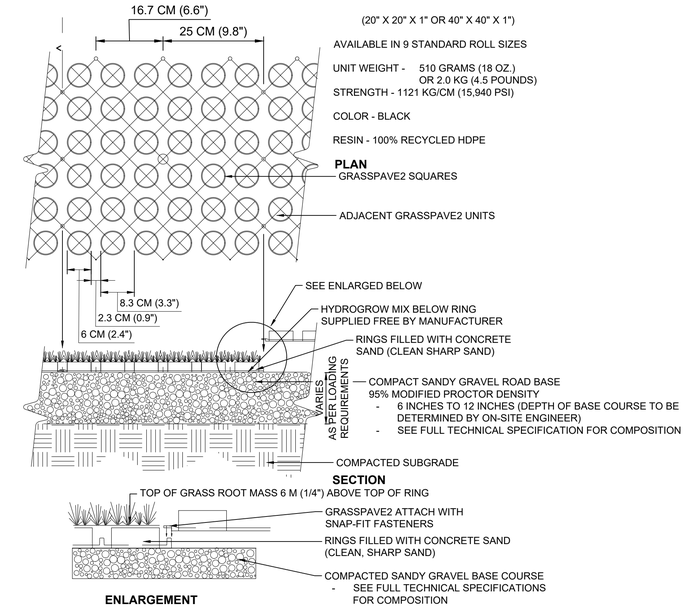
GEOTEXTILE PHYSICAL REQUIREMENTS

Physical Property	Test Procedure	Minimum Value
Grab Tensile Strength (Unaged Geotextile)	ASTM D4632	200 Lbs. (in any principal direction)
Breaking Elongation (Unaged Geotextile)	ASTM D4632	30% max. (in any principal direction)
Burst Strength	ASTM D3786	400 p.s.i
Puncture Strength	ASTM D4833	115 lbs.
% Open Area	CWO-22125-86	5%
Permittivity	ASTM D4491	0.5 sec^{-1}

Final acceptance of the filtration geotextile by the Engineer shall be dependent upon the geotextile performance when tested in accordance with ASTM D5105, Standard Test Method for Measuring the Soil–Geotextile System Clogging by the Gradient Ratio test or the Hydraulic Conductivity Ratio test.

OUTLET STRUCTURE GENERAL NOTES

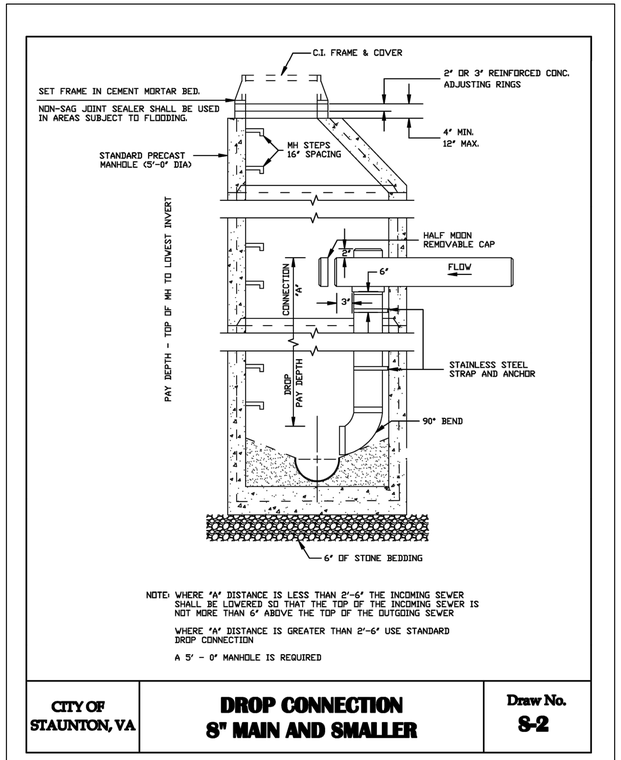
1. CONCRETE TO BE 4,000 PSI MINIMUM COMPRESSIVE STRENGTH.
2. REINFORCING STEEL IN ACCORDANCE WITH ASTM A-615 (REINFORCING BARS)
3. PIPE OPENINGS IN PRECAST STRUCTURES SHALL NOT EXCEED 4 INCHES AT ANY GIVEN POINT BETWEEN THE PIPE AND THE PRECAST UNIT
4. ¾" CHAMFER MAY BE PROVIDED ON ALL EDGES AT MANUFACTURER'S OPTION.
5. TRASH RACK TO BE PREFABRICATED GALVANIZED STEEL WITH BARS SPACED AT A MINIMUM 4". PROVIDE 4'X4' ACCESS HATCH AT TOP OF TRASH RACK.



NOTE: GRASS/PLANT TYPES SHALL BE SPECIFIED BY A LANDSCAPE ARCHITECT OR LANDSCAPE DESIGNER

GRASS PAVER DETAIL

NOT TO SCALE



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0 3' 6'

SCALE: 1" = 6'

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Details - Stormwater

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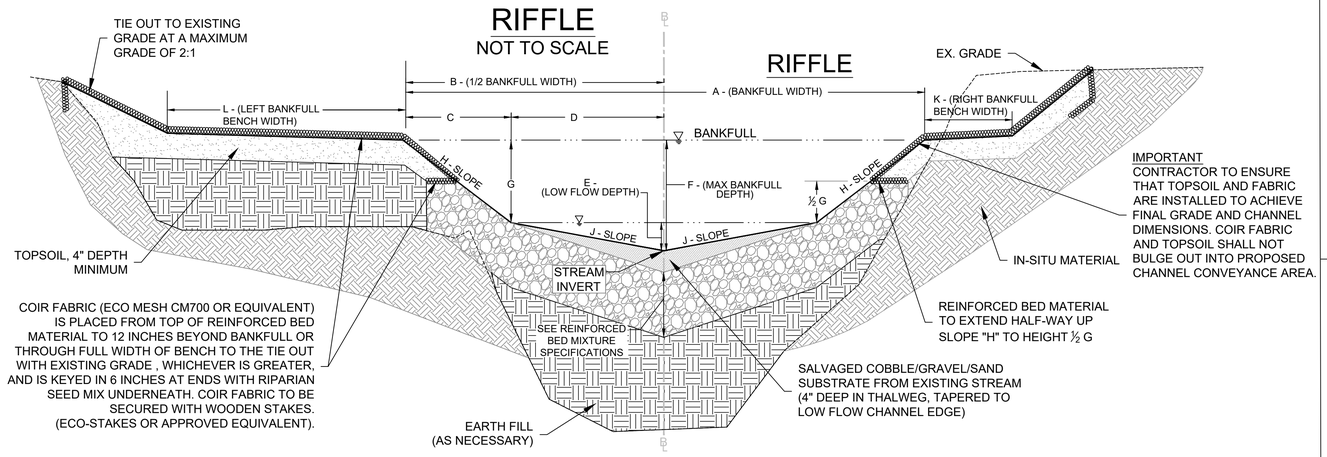
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RIFFLE
NOT TO SCALE



ORIENTATION LOOKING DOWNSTREAM

SECTION LOCATION			RIFFLE CROSS-SECTION DIMENSIONS[2]											
REACH ID	PER BASELINE STATION[1]		CROSS SECTION PARAMETER (FT)											
	FROM	TO	A	B	C	D	E	F	G	H	J[3]	K	L	NOTES
Main Channel	10+00.00	10+00.00	11.0	5.5	2.7	2.8	0.3	1.2	0.9	3.0:1	9.3:1	*	*	*VARIES – SEE GRADING PLAN
	16+30.00	18+25.00	11.0	5.5	2.7	2.8	0.3	1.2	0.9	3.0:1	9.3:1	*	*	*VARIES – SEE GRADING PLAN
	18+47.00	18+68.50	11.0	5.5	2.7	2.8	0.3	1.2	0.9	3.0:1	9.3:1	*	*	*VARIES – SEE GRADING PLAN
	18+85.75	18+98.50	11.0	5.5	2.7	2.8	0.3	1.2	0.9	3.0:1	9.3:1	*	*	*VARIES – SEE GRADING PLAN
	19+26.75	19+78.50	11.0	5.5	2.7	2.8	0.3	1.2	0.9	3.0:1	9.3:1	*	*	*VARIES – SEE GRADING PLAN
	19+97.75	20+68.50	11.0	5.5	2.7	2.8	0.3	1.2	0.9	3.0:1	9.3:1	*	*	*VARIES – SEE GRADING PLAN
	20+87.75	21+13.50	11.0	5.5	2.7	2.8	0.3	1.2	0.9	3.0:1	9.3:1	*	*	*VARIES – SEE GRADING PLAN
	21+30.75	21+65.00	11.0	5.5	2.7	2.8	0.3	1.2	0.9	3.0:1	9.3:1	*	*	*VARIES – SEE GRADING PLAN
	21+91.00	22+60.00	11.0	5.5	2.7	2.8	0.3	1.2	0.9	3.0:1	9.3:1	*	*	*VARIES – SEE GRADING PLAN
	22+82.00	23+58.50	11.0	5.5	2.7	2.8	0.3	1.2	0.9	3.0:1	9.3:1	*	*	*VARIES – SEE GRADING PLAN
	23+75.75	24+58.50	11.0	5.5	2.7	2.8	0.3	1.2	0.9	3.0:1	9.3:1	*	*	*VARIES – SEE GRADING PLAN
	24+74.75	25+28.50	11.0	5.5	2.7	2.8	0.3	1.2	0.9	3.0:1	9.3:1	*	*	*VARIES – SEE GRADING PLAN
	25+58.75	26+11.23	11.0	5.5	2.7	2.8	0.3	1.2	0.9	3.0:1	9.3:1	*	*	*VARIES – SEE GRADING PLAN
Tributary	10+00.00	10+05.00	8.0	4.0	2.4	1.6	0.2	1.0	0.8	3.0:1	8.0:1	*	*	*VARIES – SEE GRADING PLAN
	10+23.00	10+40.00	8.0	4.0	2.4	1.6	0.2	1.0	0.8	3.0:1	8.0:1	*	*	*VARIES – SEE GRADING PLAN
	10+46.00	10+60.00	8.0	4.0	2.4	1.6	0.2	1.0	0.8	3.0:1	8.0:1	*	*	*VARIES – SEE GRADING PLAN
	10+74.00	10+81.81	8.0	4.0	2.4	1.6	0.2	1.0	0.8	3.0:1	8.0:1	*	*	*VARIES – SEE GRADING PLAN

RIFFLE NOTES:

[1] REFER TO THE GRADING PLAN AND LONGITUDINAL PROFILE SHEETS FOR PLACEMENT OF ROCK STRUCTURES WITHIN THE RIFFLE SECTIONS SPECIFIED ABOVE.

[2] THE "STREAM CROSS SECTION SUMMARY" IS PROVIDED ON THE GRADING AND LONGITUDINAL PROFILE SHEETS. THIS SUMMARY SPECIFIES THE TYPE OF CROSS-SECTIONS AND STRUCTURES THAT SHALL BE CONSTRUCTED ALONG THE PROFILE.

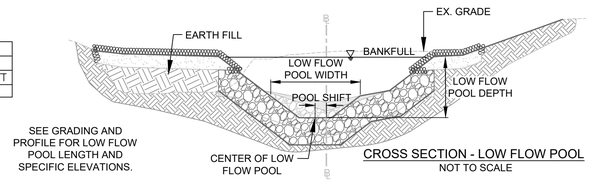
[3] J IS THE SLOPE OF THE SALVAGED SUBSTRATE. VARIABLES "H" & "J" ARE SLOPES EXPRESSED AS HORIZONTAL:VERTICAL (H:V).

[4] TYPICAL VALUES GIVEN IN TABLE ABOVE. VARIABLES MAY BE ADJUSTED TO MINIMIZE DISTURBANCE TO TREES, **BUT** THE SPECIFIED SUM OF K AND L MUST BE MET OR EXCEEDED. IF BENCH WIDTHS ARE NOT SPECIFIED OVERBANK AREAS SHOULD BE GRADED WITH A 2% CROSS SLOPE EXTENDING AS FAR AS POSSIBLE WHILE STILL ALLOWING 3:1 (MAX.) TIE OUT SLOPES.

LOW FLOW POOL
NOT TO SCALE

LOW FLOW POOL (ALL OCCURRENCES)		
CROSS SECTION PARAMETER (FT)		
LF POOL WIDTH	LF POOL DEPTH	LF POOL SHIFT
4.0	1.6	0.4

SEE GRADING AND PROFILE FOR LOW FLOW POOL LENGTH AND SPECIFIC ELEVATIONS.



CROSS SECTION - LOW FLOW POOL
NOT TO SCALE

TOPSOIL SPECIFICATIONS

1. TOPSOIL SHALL BE PLACED ON DESIGNATED AREAS WITHIN THE LOD TO A MINIMUM DEPTH OF 4 INCHES, ON TOP OF 3" (MINIMUM) OF LOOSENED SUBGRADE.
2. ALL SALVAGED SOIL SHALL BE FROM THE "O" OR "A" HORIZONS (SEE TYPICAL SOIL HORIZON DETAIL - THIS SHEET). HORIZONS "B" AND "C" SHALL ONLY BE USED FOR FILL MATERIAL.
3. SALVAGED SOIL SHALL ONLY BE HARVESTED FROM AREAS DESIGNATED TO BE GRADED. NO TOPSOIL SHALL BE REMOVED FROM THE SITE AND A SOIL HARVEST CAN HAPPEN AT ANY GIVEN TIME DURING CONSTRUCTION.
4. ALL HARVESTED SOIL MUST BE PROPERLY STORED IN A DESIGNATED STOCKPILE/STAGING AREA WITH APPROPRIATE E&S CONTROLS IN ACCORDANCE WITH THE CONSTRUCTION PLANS AND THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK (VESCH).
5. THE TOPSOIL MIXTURE SHALL BE WELL MIXED AND SEEDED PER THE PLANTING PLAN IMMEDIATELY FOLLOWING INSTALLATION AND PRIOR TO STRAW AND MATTING PLACEMENT.
6. IMPORTED TOPSOIL SHALL MEET THE REQUIREMENTS SPECIFIED IN THE CONSTRUCTION SPECIFICATIONS.

TYPICAL SOIL HORIZON PROFILE

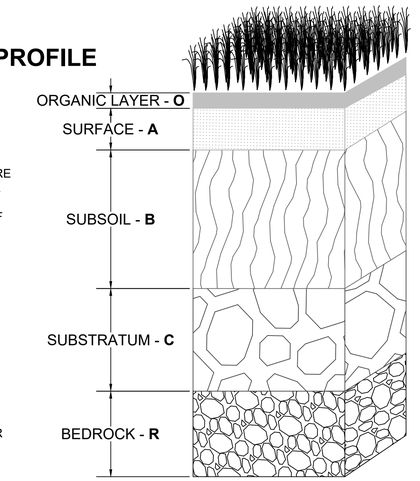
O HORIZON – THE TOP LAYER OF SOIL IS COMPOSED PRIMARILY OF ORGANIC MATERIAL, INCLUDING LEAF LITTER, HERBACEOUS PLANTS, INSECTS, AND MICROORGANISMS.

A HORIZON – REFERRED TO AS TOPSOIL, WHERE SEEDS GERMINATE AND PLANT ROOTS THRIVE. THROUGH ELUVIATION, MINERALS AND CLAYS HAVE BEEN REMOVED, LEAVING THIS LAYER OF SAND AND SILT.

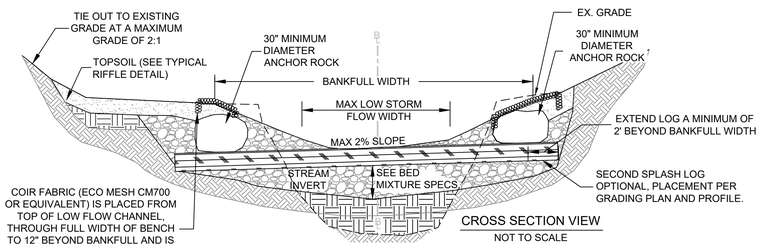
B HORIZON – REFERRED TO AS SUBSOIL. THROUGH PROCESS OF ILLUVIATION, SUBSOIL CONTAINS MINERAL DEPOSITS THAT HAVE MIGRATED FROM ABOVE SOIL HORIZON.

C HORIZON – THIS WEATHERING ROCK LAYER IS REFERRED TO AS REGOLITH AND CONSISTS OF UNCONSOLIDATED ROCKS AND LITTLE ORGANIC MATERIAL THAT INHIBIT THE GROWTH OF PLANT ROOTS

R HORIZON – THE "R" STANDS FOR ROCK AND IT REFERS TO THE UNCONSOLIDATED ROCK OR SOLID BEDROCK OF THIS HORIZON.



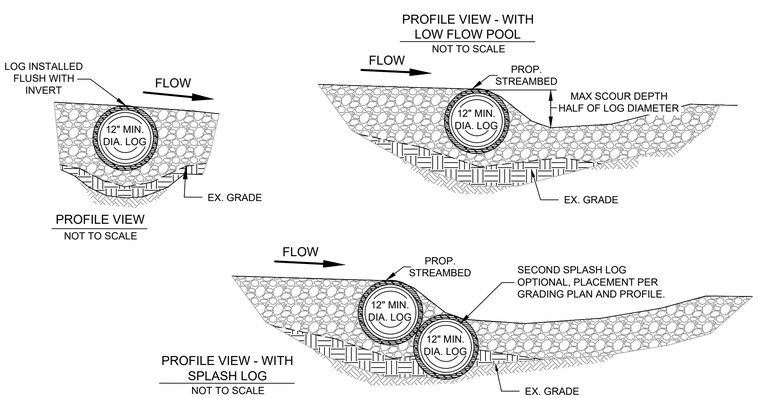
IN-STREAM HABITAT LOG SILL
NOT TO SCALE



CROSS SECTION VIEW
NOT TO SCALE

IN-STREAM HABITAT LOG SILL NOTES:

1. THIS FEATURE IS TO BE PLACED WITHIN A TYPICAL RIFFLE SECTION. CHANNEL SHAPE DEVIATES FROM THE RIFFLE ONLY WITHIN THE LOW STORM FLOW WIDTH, WHERE THE LOG IS SLOPED ALONG THE BED (MAX SLOPE OF 2%) AND THE STREAM INVERT MAY BE SHIFTED FROM BASELINE. REFER TO THE TYPICAL RIFFLE CROSS SECTION DETAIL FOR RIFFLE DIMENSIONS.
2. THE IN-STREAM HABITAT LOG SILL MAY INCLUDE AN OPTIONAL LOW FLOW POOL TO BE CONSTRUCTED IMMEDIATELY DOWNSTREAM OF THE LOG. REFER TO GRADING PLAN AND PROFILE SHEETS AND LOW FLOW POOL DETAIL FOR POOL SPECIFICATIONS.
3. SEE "STRUCTURE NOTES" FOR ADDITIONAL INFORMATION CONCERNING ALL STRUCTURES.
4. SEE GRADING PLAN AND LONGITUDINAL PROFILE FOR STATION AND INVERT ELEVATION.
5. CONTRACTOR SHALL SKEW LOG (5-20°) FROM FLOW DIRECTION. SEE GRADING PLAN FOR STRUCTURE ORIENTATION.
6. LOG SHALL BE INSTALLED WITH A MAXIMUM SLOPE OF 2%. DIRECTION OF SLOPE SHALL CORRESPOND WITH PLACEMENT OF LOW FLOW POOL (OPTIONAL).



"REINFORCED BED"[1] MIXTURE SPECIFICATIONS

THE REINFORCED BED MIXTURE SPECIFIED BELOW MUST BE APPROVED BY THE PROJECT ENGINEER PRIOR TO BEING PLACED IN THE STREAM CHANNEL.

MATERIAL	SIZE (D_{50})	PORTION	PERCENT (%)
ROCK[2]	13 in (330 mm)	2 BUCKETS	35 - 40%
BANK RUN[3] GRAVEL	0.08 - 2.5 in (2 - 64 mm)	2 BUCKETS	35 - 40%
COARSE SAND[4]	0.04 - 0.08 in (1 - 2 mm)	0.75 BUCKET	12 - 17%
TOPSOIL[5]	LOAM OR SILT LOAM WITH 3-5% ORGANIC CONTENT	0.5 BUCKET	7 - 12%

1 THE REINFORCED BED SHALL BE A MINIMUM OF **18"** IN DEPTH. PORTIONS OF THE STREAM WITH SLOPES GREATER THAN 2.0% SHALL HAVE A MINIMUM REINFORCED BED MATERIAL THICKNESS OF 1.5X THE ROCK FRACTION D_{50}. SEE LONGITUDINAL PROFILE FOR LOCATIONS AND THICKNESS.

2 THE ROCK PORTION OF THE MIXTURE SHALL CONSIST OF RIVER COBBLE (MIN. ALLOWABLE D_{50} = 12 INCHES) OF COLOR WHITE, TAN, YELLOW, OR BROWN. THE VOIDS WILL BE FILLED WITH A MIXTURE OF SAND, GRAVEL, AND TOPSOIL. THIS COMPOSITION WILL RESULT IN A VERY RESISTANT, ARMORED SUBSTRATE THAT WILL BE CAPABLE OF WITHSTANDING MUCH GREATER SHEAR STRESS THAN THE COMPUTATION OF THE REQUIRED D_{50} WOULD SUGGEST. CLASS A1 RIPRAP SHALL BE AN ACCEPTABLE ALTERNATE, SUBJECT TO CITY APPROVAL, AS LONG AS IT MEETS THE SPECIFIED SIZE REQUIREMENTS.

3 BANK RUN GRAVEL MAY INCLUDE UP TO 5% CLAY, SILT, AND/OR SAND, AND UP TO 25% COBBLE (D_{50} = 3" TO 8"). GRAVEL MUST HAVE NATURAL COLOR (WHITE, TAN, YELLOW, OR BROWN).

4 THE SAND PORTION OF THE MIXTURE SHALL CONSIST OF A WELL MIXED SAND PREDOMINANTLY 1.0 MILLIMETERS TO 2.0 MILLIMETERS IN SIZE, SUBJECT TO ENGINEER APPROVAL (I.E. WASHED CONCRETE SAND IS NOT REQUIRED). SAND MUST BE WHITE, TAN, YELLOW, OR BROWN IN COLOR.

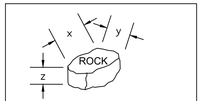
5 THE TOPSOIL PORTION OF THE MIXTURE SHALL CONSIST OF 50% SIFTED, UNWASHED COARSE SAND (WITH FINES ALLOWED), 25% COMPOSTED LEAF/BARK MULCH, 25% MINERAL SILT OR FINER MATERIAL (STONE DUST FROM ROCK CRUSHING OPERATIONS OR ANY SILT/CLAY).

GENERAL STRUCTURE NOTES

1. SEE LONGITUDINAL PROFILE AND STAKEOUT SHEETS FOR ADDITIONAL INFORMATION INCLUDING ELEVATIONS AND SPECIFICS REGARDING POOL ARMORING AND BED MATERIAL THICKNESS. (ANY PORTIONS OF THE CHANNEL WITH SLOPES GREATER THAN 2.0% SHALL HAVE A MINIMUM REINFORCED BED MATERIAL THICKNESS OF 1.5x THE BED MATERIAL ROCK FRACTION D50, UNLESS OTHERWISE SPECIFIED IN THE PROFILE.)
2. REFER TO THE TYPICAL RIFFLE CROSS-SECTION FOR PLACEMENT OF COIR FABRIC ALONG THE STREAM.
3. STRUCTURES SHALL BE UNDERLAIN WITH WOVEN OR NON-WOVEN POLYPROPYLENE GEOTEXTILE AS NOTED IN TECHNICAL SPECIFICATIONS.
4. BACKFILL BETWEEN VANES AND BANKS WITH REINFORCED BED USED IN CHANNEL.
5. ALL STRUCTURES SHALL BE KEYED INTO THE BANK, VIA SILL OR STRUCTURE ROCK PLACEMENT, A MINIMUM OF 3 FT BEYOND BANKFULL AND COMPLETELY ACROSS ANY PLACED FILL (SEE PLAN VIEW FOR DETAILS).
6. THE PLAN VIEWS OF ALL STRUCTURES LOCATED IN MEANDER BENDS ARE SHOWN AS LEFT MEANDERS (THE OUTER BANK SITUATED ON THE RIGHT LOOKING DOWNSTREAM). FOR A RIGHT MEANDER STRUCTURE (THE OUTER BANK SITUATED ON THE LEFT), THE PLAN VIEW SHOWN IS A MIRROR IMAGE OF WHAT SHOULD BE CONSTRUCTED. SEE STRUCTURE STAKEOUT SHEETS FOR STAKEOUT POINT INFORMATION.

STRUCTURE ROCK NOTES

1. ALL HEADER AND FOOTER ROCKS USED IN THE MAIN CHANNEL SHALL HAVE AN INTERMEDIATE DIMENSION OF AT LEAST **30 INCHES**.
2. SILL ROCKS SHALL HAVE AN INTERMEDIATE DIMENSION OF AT LEAST 12 INCHES.
3. THE BOTTOM OF ALL FOOTER ROCKS SHALL BE A MINIMUM OF 18 INCHES BELOW MAX POOL ELEVATION.
4. FOR NARROW STREAMS, THE VANE HEADER ROCKS MAY BE CONFIGURED TO TAKE THE PLACE OF THE CENTER HEADER ROCK AS LONG AS ALL DIMENSIONS OF THE STRUCTURE ARE MAINTAINED.
5. MORE THAN 2 ROWS OF ROCKS MAY BE NECESSARY TO ACHIEVE PROPER DIMENSIONS.
6. STRUCTURE ROCKS SHOULD BE PLACED SO AS TO MINIMIZE GAPS BETWEEN ROCKS. (THIS MAY REQUIRE MISSHAPEN ROCKS BE SET ASIDE FOR USE ELSEWHERE.) PRIORITY SHOULD BE GIVEN TO FORMING TIGHT JOINTS AT THE TOP OF ROCKS. ANY GAPS LARGER THAN FIST-SIZED MUST BE CHINKED ON THE UPSTREAM (BACK SIDE) OF THE STRUCTURE PRIOR TO PLACING FILTER FABRIC AND BACKFILLING.



3 PRIMARY DIMENSIONS OF ROCK:
x = LONGEST DIMENSION
y = INTERMEDIATE DIMENSION
z = SHORTEST DIMENSION

STRUCTURE DETAIL LEGEND

- REINFORCED BED
- IN-SITU MATERIAL
- FILL MATERIAL
- TOPSOIL (4 INCH MIN.)
- FILTER FABRIC
- COIR MATTING
- STAKEOUT/WEIR POINT
- HEADER (TOP) ROCK
- WEIR ROCK
- FOOTER ROCK
- SPLASH ROCK

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COLE AVE STREAM RESTORATION
FINAL DESIGN
City Of Staunton, Virginia

Construction Details

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COMMONWEALTH OF VIRGINIA
NATHAN A. STALEY
Lic. No. 047145
04/19/2024
PROFESSIONAL ENGINEER

REVISIONS

No.	Date	Description	Rev. By	App. By

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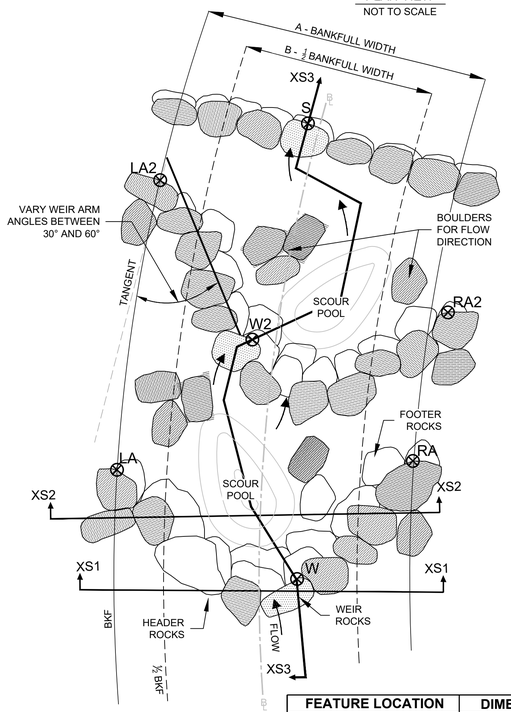
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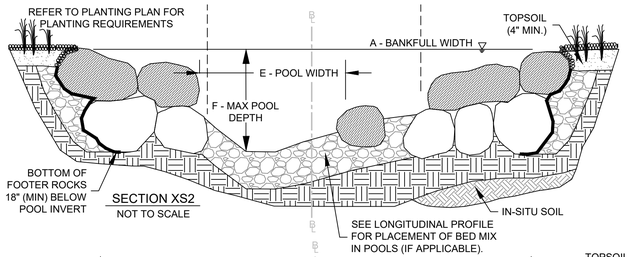
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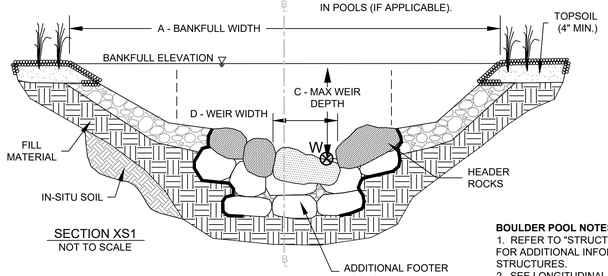
PLAN VIEW
NOT TO SCALE



FEATURE LOCATION			DIMENSIONS
REACH ID	STATION INFORMATION FROM	TO	LENGTH (FT)
MAIN CHANNEL	18+70.00	18+85.00	15
	19+00.00	19+26.00	26
	19+80.00	19+97.00	17
	20+70.00	20+87.00	17
	21+15.00	21+30.00	15
	23+60.00	23+75.00	15
	24+60.00	24+74.00	14
	25+30.00	25+58.00	28

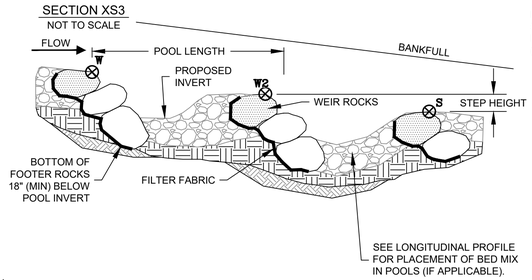
*SEE STRUCTURE STAKEOUT PLAN FOR NORTHING, EASTING, AND ELEVATION





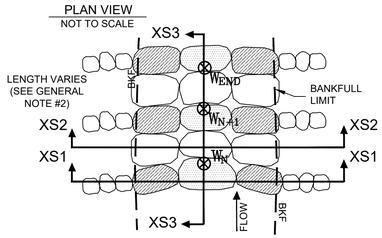
BOULDER POOL
NOT TO SCALE

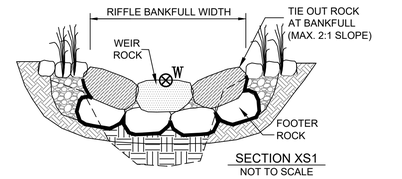
REFER TO PROFILE SHEETS FOR ADDITIONAL INFORMATION

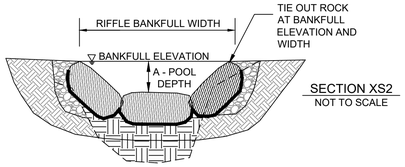


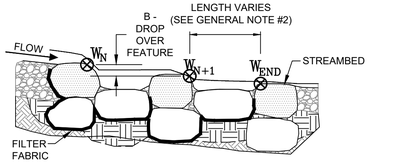
BOULDER POOL NOTES:
1. REFER TO "STRUCTURE ROCK NOTES" (SHEET 15) FOR ADDITIONAL INFORMATION CONCERNING ALL STRUCTURES.
2. SEE LONGITUDINAL PROFILE FOR WEIR POINT LOCATIONS (W) AND ELEVATIONS.
3. ALL WEIR POINTS ARE LOCATED ON THE DOWNSTREAM EDGE OF THE WEIR ROCK.
4. THE WEIR HEADER ROCK LOCATION SHALL BE VARIED LATERALLY WITHIN THE HALF-BANKFULL CHANNEL. CENTER WEIR ROCKS SHALL BE SHIFTED TO FORM AN IRREGULAR FLOW PATTERN FROM POOL TO POOL.
5. FOLLOW THE LOG SILL DETAIL (SHEET 15) FOR INSTALLATION OF DOWNSTREAM LOG SILLS (RATHER THAN BOULDER) WHERE APPLICABLE.

ROCK STEP
NOT TO SCALE







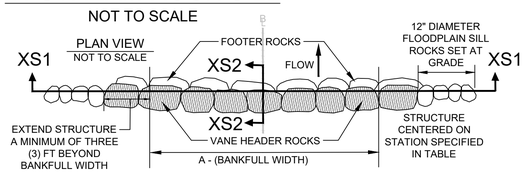


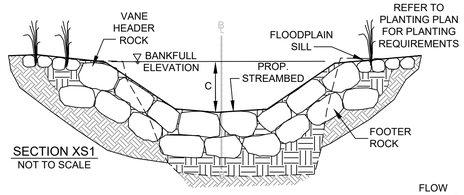
ROCK STEP NOTES:
1. REFER TO "STRUCTURE NOTES" FOR ADDITIONAL INFORMATION CONCERNING ALL STRUCTURES.
2. SEE GRADING PLAN AND/OR PROFILE FOR WEIR POINT LOCATIONS AND ELEVATIONS.
3. WEIR POINTS ARE LOCATED ON THE DOWNSTREAM EDGE OF THE WEIR ROCK, EXCEPT THE LAST WEIR POINT IN THE SERIES IS LOCATED ON THE UPSTREAM EDGE.

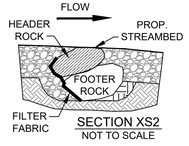
ROCK STEP DIMENSIONS

REACH ID	WEIR STATION	WEIR POINT #	WEIR ELEVATION	PARAMETER (FT) A	B
TRIBUTARY	10+05.0	1	1537.75	----	----
	10+09.0	2	1536.25	1.5	0.5
	10+13.0	3	1534.75	1.5	0.5
	10+17.0	4	1533.25	1.5	0.5
	10+21.0	5	1532.05	1.2	0.5
	10+23.0	END	1530.85	1.2	0.5
	10+40.0	1	1527.55	----	----
	10+44.0	2	1526.55	1.0	0.5
	10+46.0	END	1525.55	1.0	0.5
	10+60.0	1	1523.63	----	----
	10+64.0	2	1521.63	2.0	0.5
	10+68.0	3	1519.63	2.0	0.5
	10+72.0	4	1518.13	1.5	0.5
	10+74.0	END	1516.63	1.5	0.5

IN-STREAM ROCK SILL
NOT TO SCALE

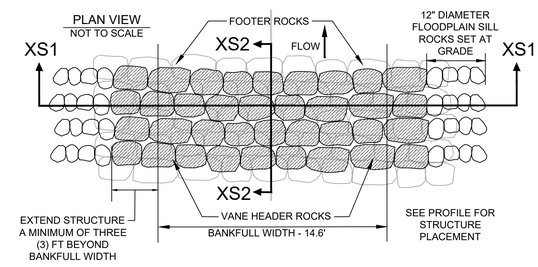


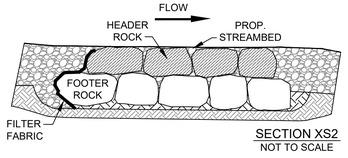




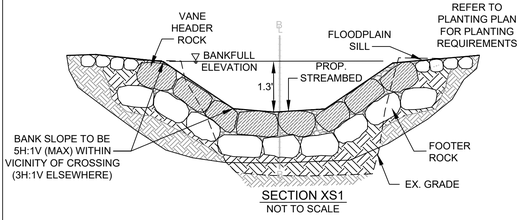
IN-STREAM ROCK SILL NOTES:
1. HEADER AND FOOTER ROCKS SHALL BE THE INTERMEDIATE ROCK SIZE SPECIFIED IN NOTE #1 OF STRUCTURE ROCK NOTES.
2. ROCK SILL IS TO BE INSTALLED WITH TOP OF HEADER ROCKS FLUSH WITH THE PROPOSED RIFFLE GRADE. SEE RIFFLE DETAIL FOR DETAILED SECTION DIMENSIONS.
3. REFER TO PROFILE AND "REINFORCED BED" MIXTURE SPECIFICATIONS FOR THICKNESS OF REINFORCED BED AND MATERIAL SPECIFICATIONS.

IN-STREAM MAINTENANCE CROSSING
NOT TO SCALE





IN-STREAM VEHICLE CROSSING NOTES:
1. HEADER AND FOOTER ROCKS SHALL BE THE ROCK SIZE SPECIFIED IN THE STRUCTURE ROCK TABLE.
2. VEHICLE CROSSING IS TO BE INSTALLED WITH TOP OF HEADER ROCKS FLUSH WITH THE PROPOSED RIFFLE GRADE. SEE RIFFLE DETAIL FOR DETAILED SECTION DIMENSIONS.
3. NUMBER OF ROWS OF ROCKS SHALL BE THE MINIMUM REQUIRED TO ACHIEVE A MINIMUM CROSSING WIDTH OF 15 FEET.
4. DO NOT PLANT VEGETATION WITHIN PATH OF VEHICLE



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COLE AVE STREAM RESTORATION
FINAL DESIGN
City Of Staunton, Virginia

Construction Details (Cont'd)

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COMMONWEALTH OF VIRGINIA
NATHAN A. STALEY
Lic. No. 047145
04/19/2024
PROFESSIONAL ENGINEER

REVISIONS					
No.	Date	Description		Rev. By	App. By

SCALE: As Noted

DATE: APRIL 2024

Horizontal Datum: N/A

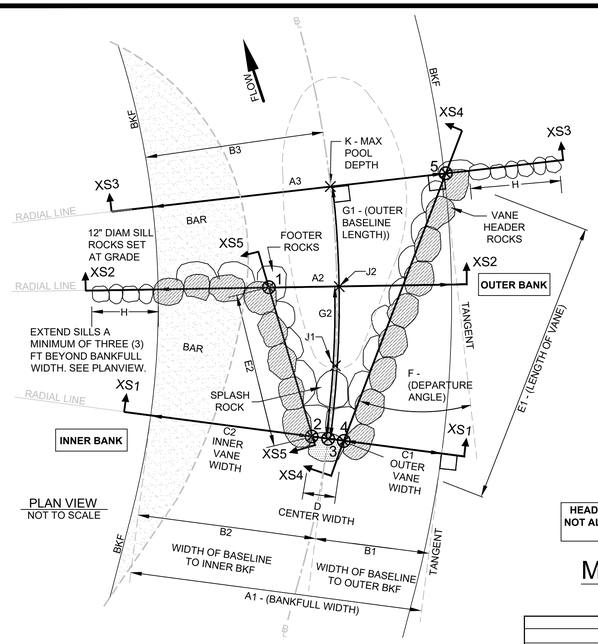
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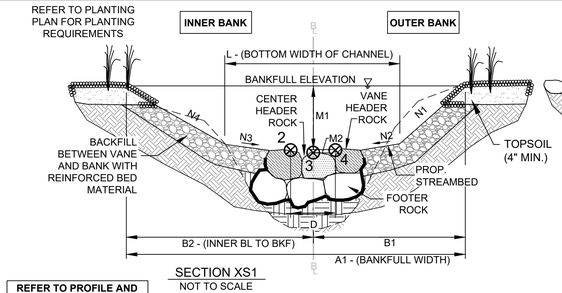
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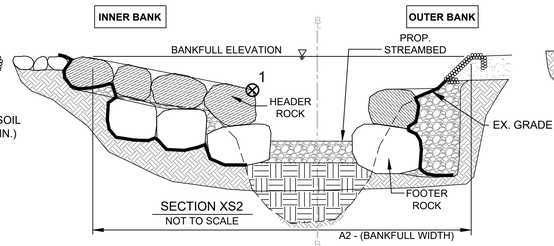


PLAN VIEW
NOT TO SCALE

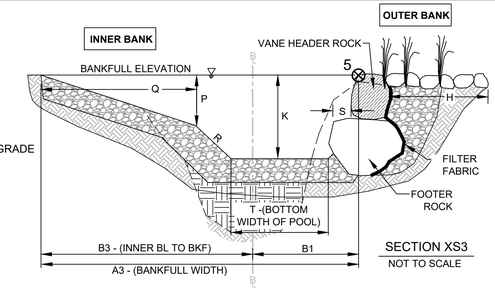
PLAN VIEW DEPICTS A STRUCTURE IN A LEFT MEANDER (WITH THE OUTER BANK SITUATED ON THE RIGHT LOOKING DOWNSTREAM). FOR A RIGHT MEANDER STRUCTURE (WITH THE OUTER BANK ON THE LEFT), THE PLAN VIEW IS A MIRROR IMAGE OF WHAT SHOULD BE CONSTRUCTED. **THE LONG VANE IS ALWAYS SITUATED ON THE OUTER BANK.



SECTION XS1
NOT TO SCALE

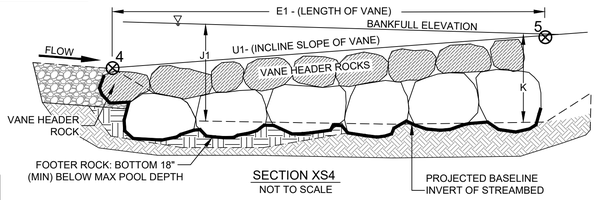


SECTION XS2
NOT TO SCALE

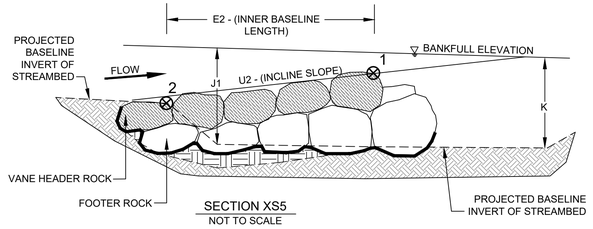


SECTION XS3
NOT TO SCALE

REFER TO PROFILE AND STAKEOUT SHEETS FOR ADDITIONAL INFORMATION



SECTION XS4
NOT TO SCALE



SECTION XS5
NOT TO SCALE

HEADER ROCK SEAMS SHALL NOT ALIGN WITH FOOTER ROCK SEAMS BELOW

MODIFIED CROSS VANE

NOT TO SCALE

STRUCTURE LOCATION			MODIFIED CROSS VANE																														
			MODIFIED CROSS VANE DIMENSIONS PARAMETER (FT)																														
REACH ID	BASELINE STATION AT HEADER ROCK	MEANDER DIRECTION	A1[1]	A2[1]	A3[1]	B1	B2	B3	C1	C2	D	E1	E2	F[2]	G1	G2	H	J1[3]	J2[3]	K[3]	L	M1[3]	M2	N1	N2	N3	N4	P	Q	R	S	T	U1[2]	U2[2]
Main Channel	18+25.00	RIGHT	11.7	11.7	11.5	5.5	6.2	6.0	4.0	4.7	3.0	15.3	7.1	21.7	14.0	7.0	---	2.0	1.9	1.8	6.4	1.2	0.3	40.0:1	50.0:1	50.0:1	30.4:1	0.5	2.0	1.0:1	1.5	8.1	0.013	0.037
Main Channel	22+60.00	LEFT	12.4	12.2	11.9	5.5	6.9	6.4	4.0	5.4	3.0	15.0	7.2	19.3	14.0	7.0	---	2.0	1.9	1.8	6.4	1.2	0.3	40.0:1	50.0:1	50.0:1	24.6:1	0.5	2.6	1.0:1	1.5	7.9	0.018	0.040

MODIFIED CROSS VANE NOTES:

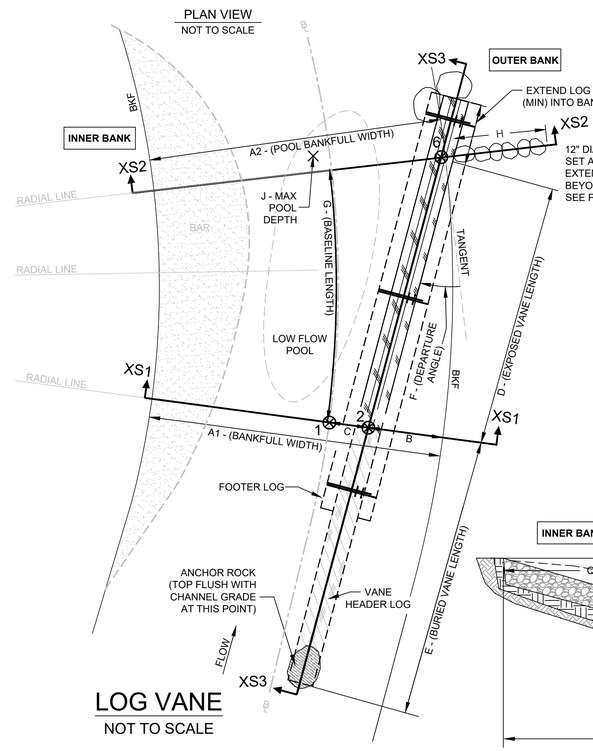
1 VARIABLE "A1" IS THE BANKFULL WIDTH AT SECTION XS1, VARIABLE "A2" IS THE BANKFULL WIDTH AT SECTION XS2, AND "A3" IS BANKFULL WIDTH AT XS3. THE BANKFULL WIDTH CHANGES CONTINUOUSLY THROUGHOUT THE STRUCTURE BASED ON GRADING OF THE BAR.

2 VARIABLE "F" IS IN UNITS OF DEGREES AND VARIABLES "U1" AND "U2" ARE SLOPES EXPRESSED AS VERTICAL:HORIZONTAL (V:H) AND IN UNITS OF FT/FT.

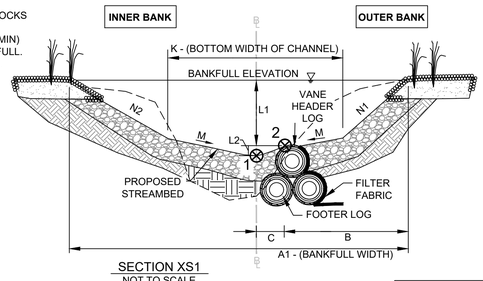
3 VARIABLES "J1", "J2", "K", "M1", & "M2" ARE DEPTHS RELATIVE TO BANKFULL.

4 SEE PLAN VIEW FOR VARIABLE "H" (SILL LENGTH AND PLACEMENT).

5 VARIABLES "N" AND "R" ARE SLOPES EXPRESSED AS HORIZONTAL:VERTICAL (H:V).

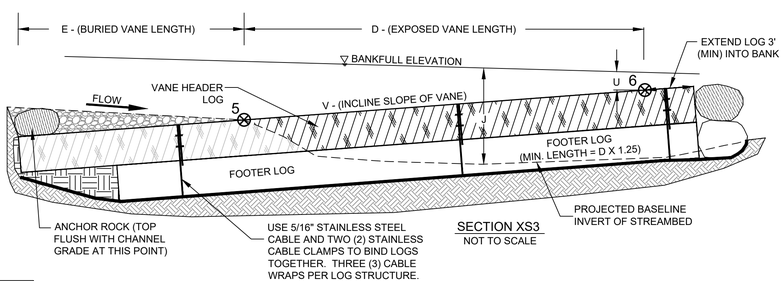


LOG VANE
NOT TO SCALE

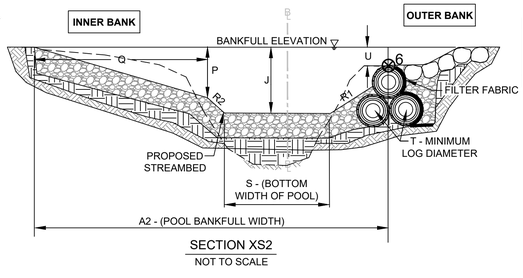


SECTION XS1
NOT TO SCALE

REFER TO PROFILE AND STAKEOUT SHEETS FOR ADDITIONAL INFORMATION



SECTION XS3
NOT TO SCALE



SECTION XS2
NOT TO SCALE

STRUCTURE LOCATION			VANE HEAD																														
			VANE HEAD DIMENSIONS PARAMETER (FT)																														
REACH ID	BASELINE STATION AT HEADER ROCK	MEANDER DIRECTION	A1	A2	B	C	D	E*	F*	G	H*	J*	K	L1	L2	M	N1	N2	P	Q	R1	R2	S	T	U	V							
Main Channel	21+65.00	RIGHT	11.2	11.0	4.0	3.0	15.4	---	22.3	14.0	---	2.0	6.7	1.2	0.3	0.0	2.4	2.6	0.5	1.3	2.0	2.7	2.0	2.0	0.0	0.048							

LOG J-HOOK NOTES:

1 VARIABLE "A1" IS THE BANKFULL WIDTH AT SECTION XS1, AND VARIABLE "A2" IS THE BANKFULL WIDTH AT SECTION XS2. THE BANKFULL WIDTH CHANGES CONTINUOUSLY THROUGHOUT THE STRUCTURE BASED ON GRADING OF THE BAR.

2 VARIABLE "E" SHALL BE A MINIMUM OF 50% OF THE EXPOSED LENGTH (VARIABLE "D").

3 VARIABLE "F" IS IN UNITS OF DEGREES. VARIABLE "V" IS A SLOPE EXPRESSED AS HORIZONTAL:VERTICAL (H:V) AND IN UNITS OF FT/FT.

4 SEE PLANVIEW FOR VARIABLE "H" SILL LENGTH AND PLACEMENT.

5 VARIABLES "L1" AND "J" ARE DEPTHS RELATIVE TO BANKFULL.

6 VARIABLES "M", "N1", "N2", "R1", & "R2" ARE SLOPES EXPRESSED AS HORIZONTAL:VERTICAL (H:V).

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COLE AVE STREAM RESTORATION
FINAL DESIGN
City Of Staunton, Virginia

Construction Details (Cont'd)

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04/19/2024
PROFESSIONAL ENGINEER

REVISIONS					
No.	Date	Description	Rev. By:	App. By:	SCALE: As Noted
					DATE: APRIL 2024

Horizontal Datum: N/A

Vertical Datum: N/A

Boundary and Topo Source: N/A

Design	Draft	Approved
JTS	JTS	NAS

Sheet #
17 of 27

Computer File Name:
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RADIUS POINT LOCATION TABLE		
NO.	NORTHING	EASTING
R5	6743931.8584	11311462.2629
R6	6743982.6410	11311554.2723
R7	6743891.7292	11311520.4874
R8	6743806.2040	11311601.2983
R9	6743769.5869	11311711.4426
R10	6743677.4083	11311675.6614
R11	6743674.4745	11311793.6382
R12	6743562.2261	11311851.9260
R13	6743692.5485	11311949.1321
R14	6743546.0604	11312050.8677
R15	6743558.0987	11312115.4971
R16	6743660.4135	11312219.0168
TRIBUTARY		
R17	6743652.5367	11312261.9704
R18	6743641.3645	11312311.2380
R19	6743632.2434	11312302.4653
R20	6743605.5738	11312271.4574
R21	6743597.9131	11312270.9013

SEE SHEET 4 FOR EXISTING AND GRADING LEGENDS

GEOMETRY TABLE						
NO.	LENGTH	RADIUS	BEARING/DELTA	TANGENT	CHORD BEARING	CHORD
L5	22.89'	--	S 45°14'07" E	--	--	--
C5	13.37'	55.00'	13°55'33"	6.72'	N 38°16'21" W	13.34'
L6	4.43'	--	S 31°18'34" E	--	--	--
C6	23.29'	50.00'	26°41'17"	11.86'	S 44°39'12" E	23.08'
L7	19.53'	--	S 57°59'51" E	--	--	--
C7	5.73'	45.00'	07°17'49"	2.87'	N 54°20'57" W	5.73'
L8	116.70'	--	S 50°42'02" E	--	--	--
C8	45.93'	60.00'	43°51'41"	24.16'	N 28°46'12" W	44.82'
L9	49.47'	--	S 06°50'21" E	--	--	--
C9	36.00'	45.00'	45°50'34"	19.03'	S 29°45'38" E	35.05'
C9	36.00'	45.00'	45°50'34"	19.03'	S 29°45'38" E	35.05'
L10	27.43'	--	S 52°40'55" E	--	--	--
C10	23.51'	50.00'	26°56'45"	11.98'	N 39°12'33" W	23.30'
L11	53.87'	--	S 25°44'10" E	--	--	--
C11	59.64'	55.00'	62°07'47"	33.13'	S 56°48'04" E	56.76'
L12	62.43'	--	S 87°51'57" E	--	--	--
C12	23.38'	55.00'	24°21'34"	11.87'	N 75°41'10" W	23.21'
L13	28.86'	--	S 63°30'23" E	--	--	--
C13	80.03'	105.00'	43°40'17"	42.07'	S 85°20'31" E	78.11'
L14	53.93'	--	N 72°49'20" E	--	--	--
C14	27.61'	65.00'	24°20'16"	14.02'	S 84°59'28" W	27.40'
L15	62.62'	--	S 82°50'24" E	--	--	--
C15	17.52'	45.00'	22°18'10"	8.87'	N 71°41'19" W	17.41'
L16	39.81'	--	S 60°32'14" E	--	--	--
C16	59.54'	95.00'	35°54'25"	30.78'	S 78°29'26" E	58.57'
L17	53.69'	--	N 83°33'21" E	--	--	--

TRIBUTARY						
L18	12.10'	--	S 08°14'57" E	--	--	--
C17	4.47'	20.00'	12°48'37"	2.25'	N 01°50'39" W	4.46'
L19	7.22'	--	S 04°33'40" W	--	--	--
C18	6.74'	30.00'	12°52'45"	3.39'	S 01°52'43" E	6.73'
L20	7.76'	--	S 08°19'05" E	--	--	--
C19	7.10'	20.00'	20°20'34"	3.59'	S 18°29'22" E	7.06'
L21	8.53'	--	S 28°39'39" E	--	--	--
C20	11.45'	20.00'	32°48'44"	5.89'	N 12°15'17" W	11.30'
L22	7.68'	--	S 04°09'05" W	--	--	--
C21	3.50'	20.00'	10°01'30"	1.75'	N 09°09'50" E	3.49'
L23	5.25'	--	S 14°10'35" W	--	--	--

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City Of Staunton, Virginia

Planform Geometry

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PROFESSIONAL ENGINEER

REVISIONS				SCALE: 1" = 20'
No.	Date	Description	App. By	
			Rev. By	
				DATE: APRIL 2024

Horizontal Datum: VCS NAD 83
Vertical Datum: NAVD 88
Boundary and Topo Source: WSSI and City of Staunton Digital Data

Design	Draft	Approved
JTS	JTS	NAS

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I:\2200s\2260\ENGR\STA\ADD\46-ENGR-11-Final GEOMETRY PLAN.dwg

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Stakeout Sheet

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REVISIONS				
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19 of 27

Computer File Name:
L:\22000s\22600\22629.05\CADD\04-ENGR\11-Final STAKEOUT SHEET.dwg

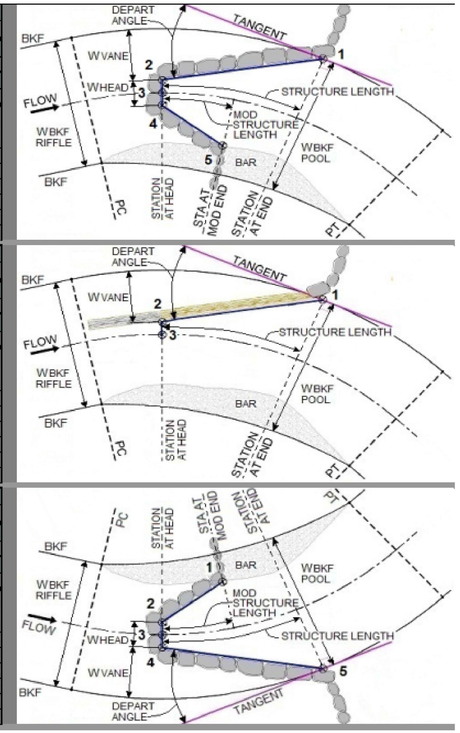
BOULDER POOL STAKEOUT TABLE

STARTING STATION	*POINT	NORTHING (ft)	EASTING (ft)	ELEVATION (ft)	ARM ANGLE (°)	DROP OVER STRUCTURE (ft)
18+70'	W1	6,743,795.23	11,311,663.04	1,537.46	N/A	0.80
	LA1	6,743,791.27	11,311,669.06	1,538.49		
	RA1	6,743,789.96	11,311,658.14	1,538.49		
	S1	6,743,780.46	11,311,664.82	1,536.75	N/A	
19+00'	W2	6,743,765.57	11,311,666.60	1,536.20	N/A	0.80
	LA2	6,743,761.31	11,311,672.82	1,537.07		
	RA2	6,743,760.32	11,311,661.80	1,537.14		
	W3	6,743,752.97	11,311,669.62	1,535.40	N/A	0.60
	LA3	6,743,751.81	11,311,676.17	1,536.42		
	RA3	6,743,746.80	11,311,666.37	1,536.42		
	S2	6,743,741.74	11,311,676.09	1,534.80	N/A	
19+80'	W4	6,743,706.26	11,311,716.50	1,533.43	N/A	0.60
	LA4	6,743,705.61	11,311,723.46	1,534.49		
	RA4	6,743,698.73	11,311,714.72	1,534.43		
	S3	6,743,691.28	11,311,724.48	1,532.83	N/A	
20+70'	W5	6,743,629.57	11,311,761.88	1,531.22	N/A	0.60
	LA5	6,743,632.16	11,311,767.95	1,532.28		
	RA5	6,743,622.58	11,311,762.53	1,532.27		
	S4	6,743,622.04	11,311,777.05	1,530.62	N/A	
21+15'	W6	6,743,619.02	11,311,804.78	1,530.09	N/A	0.60
	LA6	6,743,624.34	11,311,809.75	1,531.10		
	RA6	6,743,613.35	11,311,809.34	1,531.10		
	S5	6,743,618.46	11,311,819.80	1,529.49	N/A	
23+60'	W7	6,743,610.30	11,312,040.98	1,523.84	N/A	0.80
	LA7	6,743,616.29	11,312,044.70	1,524.91		
	RA7	6,743,605.18	11,312,044.13	1,525.00		
	S6	6,743,610.86	11,312,055.93	1,523.04	N/A	
24+60'	W8	6,743,596.39	11,312,139.20	1,519.91	N/A	0.80
	LA8	6,743,598.83	11,312,146.06	1,520.94		
	RA8	6,743,589.95	11,312,139.42	1,521.02		
	S7	6,743,589.50	11,312,151.39	1,519.11	N/A	
25+00'	W9	6,743,566.90	11,312,202.25	1,516.93	N/A	0.80
	LA9	6,743,571.78	11,312,206.59	1,518.05		
	RA9	6,743,560.78	11,312,205.87	1,518.00		
	W10	6,743,565.46	11,312,216.16	1,516.13	N/A	0.80
	LA10	6,743,570.94	11,312,221.26	1,516.94		
	RA10	6,743,559.93	11,312,220.64	1,517.00		
	S8	6,743,566.07	11,312,230.14	1,515.33	N/A	

	MODIFIED CROSS VANE - RIGHT MEANDER				PC	PT	RC
18+25.00	W BKF-Pool =	11	D BKF =	1.2	18+05.94	18+51.87	60
W Head	W Vane	W Bank	S Length	Mod Length	Slope BKF	Step	L Pool
3.0	4.0	2.8	14.0	7.0	0.032	0.7	22.0
Δ Y-HEAD	Depart Angle	W Ramp	L Vane-out	L Vane-Mod	Slope Vane		Mod % Width
0.25	21.7	1.2	15.3	7.1	0.033		100
Point #	Station	BL Dist to Previous Point	Offset from BL to Point	Elevation at Point	Dist to Previous Point	Bankfull Elevation	Slope to Previous Point
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)
1	18+39.00	0.0	5.5	1539.91	0.0	1539.91	---
2	18+25.00	14.0	1.5	1539.41	15.3	1540.36	0.033
3	18+25.00	0.0	---	1539.16	1.5	1540.36	0.167
4	18+25.00	0.0	1.5	1539.41	1.5	1540.36	0.167
5	18+32.00	7.0	4.0	1539.67	7.1	1540.14	0.037

	LOG VANE - RIGHT MEANDER				PC	PT	RC
21+65.00	W BKF-Pool =	11	D BKF =	1.2	21+64.23	21+87.61	55
W Head	W Vane	W Bank	S Length	%BKF-Height	Slope BKF	Step	L Pool
3.0	4.0	2.8	14.0	100%	0.015	0.4	26.0
Δ Y-HEAD	Depart Angle	W Ramp	L Vane-out		Slope Vane		
0.25	22.3	1.2	15.4		0.048		
Point #	Station	BL Dist to Previous Point	Offset from BL to Point	Elevation at Point	Dist to Previous Point	Bankfull Elevation	Slope to Previous Point
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)
1	21+79.00	0.0	5.5	1529.86	0.0	1529.86	---
2	21+65.00	14.0	1.5	1529.12	15.4	1530.07	0.048
3	21+65.00	0.0	---	1528.87	1.5	1530.07	0.167

	MODIFIED CROSS VANE - LEFT MEANDER				PC	PT	RC
22+60.00	W BKF-Pool =	11	D BKF =	1.2	22+16.48	22+96.51	105
W Head	W Vane	W Bank	S Length	Mod Length	Slope BKF	Step	L Pool
3.0	4.0	2.8	14.0	7.0	0.027	0.6	22.0
Δ Y-HEAD	Depart Angle	W Ramp	L Vane-out	L Vane-Mod	Slope Vane		Mod % Width
0.25	19.3	1.2	15.0	7.2	0.038		100
Point #	Station	BL Dist to Previous Point	Offset from BL to Point	Elevation at Point	Dist to Previous Point	Bankfull Elevation	Slope to Previous Point
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)
1	22+67.00	0.0	3.8	1527.29	0.0	1527.76	---
2	22+60.00	7.0	1.5	1527.00	7.2	1527.95	0.040
3	22+60.00	0.0	---	1526.75	1.5	1527.95	0.167
4	22+60.00	0.0	1.5	1527.00	1.5	1527.95	0.167
5	22+74.00	14.0	5.5	1527.56	15.0	1527.56	0.038



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REVISIONS

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JTS	JTS	NAS

Sheet #
20 of 27

Computer File Name:
I:\22000s\22600\22629.03\CADD\04-ENGR\11-Final STAKEOUT SHEET.dwg

EROSION AND SEDIMENT CONTROL NARRATIVE

A. PROJECT DESCRIPTION

THE COLE AVENUE STREAM RESTORATION PROJECT IS LOCATED IN THE CITY OF STAUNTON, VIRGINIA, AND INCLUDES APPROXIMATELY 1,100 LINEAR FEET OF CHANNEL RESTORATION. APPROXIMATELY 1,000 LINEAR FEET OF RESTORATION WILL OCCUR ON THE MAIN CHANNEL, WITH AN ADDITIONAL 100 LINEAR FEET OF AN TRIBUTARY ERODED TRIBUTARY DRAINING SOUTH FROM THE WESTERN TERMINUS OF COLE AVENUE. THE SITE LIES NORTH OF THE CORNER OF HICKORY STREET AND F STREET, EAST OF MONUMENT DRIVE, AND SOUTHWEST OF COLE AVENUE.THE STREAM FLOWS TO THE SOUTHEAST THROUGH LARGE LOT RESIDENTIAL PROPERTIES, WITH THE RIPARIAN CORRIDOR BEING A MIX OF MANAGED LAWN AREAS AND LOW QUALITY WOODLANDS. OVERALL DISTURBED AREA, INCLUDING MODIFICATIONS TO AN EXISTING SANITARY LINE, COMES TO 2.04 ACRES.

B. EXISTING SITE CONDITIONS

THE RESTORATION REACH BEGINS APPROXIMATELY 650 FEET SOUTHEAST OF THE CULVERT OUTLET ALONG GARLAND DRIVE. (AREAS NEARER TO GARLAND DRIVE ARE HEAVILY CONSTRAINED BY RESIDENTIAL PROPERTIES AND DO NOT SHOW SIGNS OF SIGNIFICANT EROSION OR DOWNCUTTING.) THE START OF THE RESTORATION REACH LIES AT AN EXISTING SANITARY SEWER CROSSING WHERE CONCRETE ENCASEMENT HAS RESULTED IN EROSION JUST DOWNSTREAM OF THE CROSSING. CHANNEL CONDITIONS CONTINUE TO DETERIORATE WHEN PROGRESSING IN THE DOWNSTREAM DIRECTION FROM THE CONCRETE CROSSING, WITH SIGNS OF PAST STRAIGHTENING, LIKELY ASSOCIATED WITH THE ESTABLISHMENT OF THE SANITARY SEWER NETWORK. APPROXIMATELY 200 FEET DOWNSTREAM OF THE UPPER SANITARY CROSSING THE CHANNEL HAS BEEN PUSHED TO THE RIVER RIGHT SIDE OF THE VALLEY, DIVING OVER A BEDROCK SHELF AGAINST A STEEP BANK. PAST CHANNEL MANIPULATION HAS RESULTED IN EXTREME EROSION AT THIS LOCATION WITH VERTICAL ERODING BANKS MORE THAN 11 FEET IN HEIGHT. FURTHER DOWNSTREAM, THE CHANNEL ENTERS A WIDER FLOODPLAIN AREA, BUT VERTICAL, ERODED BANKS OF APPROXIMATELY FIVE FEET CONTINUE. MIDWAY DOWN THE REACH THE STREAM CAN BE OBSERVED EATING AROUND A MANHOLE, AND NEAR THE DOWNSTREAM END OF THE REACH ANOTHER SANITARY CROSSING IS EXPOSED IN THE STREAM BED. THE REACH ENDS AT AN EXISTING 60-IN CULVERT WITH A REBAR TRASH RACK. THE TRIBUTARY CHANNEL ENTERS THE MAIN CHANNEL FROM THE NORTH IN THE IMMEDIATE VICINITY OF THE CULVERT INLET. EVIDENCE OF FREQUENT DEBRIS BUILD UP IS SEEN AND LOCAL STAFF REPORT VARIOUS INSTANCES OF FLOW OVERTOPPING THE CULVERT EMBANKMENT AND FLOODING THE PROPERTIES OF DOWNSTREAM LANDOWNERS.

C. ADJACENT AREAS

THE PROJECT AREA LIES ON SEVERAL LARGE PRIVATE PROPERTIES.

D. OFF-SITE AREAS

NO OFF-SITE LAND DISTURBING ACTIVITIES ARE PROPOSED.

E. CRITICAL AREAS

THIS PROJECT IS LOCATED ENTIRELY WITHIN A STREAM CHANNEL; HOWEVER, THE DESIGN PRESENTED HEREIN PROPOSES TO RESTORE THIS DEGRADED STREAM CHANNEL THUS IMPROVING THE WATER QUALITY OF THE DOWNSTREAM RECEIVING WATERS.

F. SOILS

THE SOILS LOCATED WITHIN THE PROJECT SITE IS FREDERICK-CHRISTIAN-URBAN LAND COMPLEX (541C/D3).

G. EROSION AND SEDIMENT CONTROL MEASURES

1. BEFORE ANY WORK IN THE STREAM AREA COMMENCES, AN ON-SITE PRE-CONSTRUCTION MEETING SHALL BE HELD TO ENSURE THAT ALL AFFECTED PARTIES (DESIGN ENGINEER, CONTRACTOR, STATE OFFICIALS, OWNER, AND PROJECT MANAGER) FULLY UNDERSTAND THE CONSTRUCTION SEQUENCING.
2. MATERIALS AND METHODS USED IN CONSTRUCTION AND MAINTENANCE OF THE EROSION AND SEDIMENT CONTROL MEASURES REQUIRED SHALL CONFORM TO THE CONSTRUCTION STANDARDS AND SPECIFICATIONS IN CHAPTER 3 OF THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK (VESCH), THIRD EDITION, 1992, AS WELL AS ANY OTHER APPLICABLE LOCAL, STATE, AND FEDERAL REGULATIONS.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ANY ADDITIONAL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES THAT MAY BE REQUIRED BY THE CITY INSPECTOR, OR COMMENSURATE WITH THEIR SEQUENCE OF CONSTRUCTION, TO PREVENT EROSION AND SEDIMENT CONTROL RELATED DAMAGE TO PROPERTY OF OTHERS, ADJACENT AND/OR DOWNSTREAM WATERWAYS, OR TO THE PROJECT, DURING CONSTRUCTION AND PRIOR TO PERMANENT STABILIZATION OF ALL DISTURBED AREAS.
4. PRIOR TO ANY OTHER CONSTRUCTION ACTIVITIES, PERIMETER EROSION CONTROL MEASURES ARE TO BE INSTALLED (I.E. TREE PROTECTION FENCE, STONE CONSTRUCTION ENTRANCE AND THE ASSOCIATED WASH RACK AN TEMPORARY SEDIMENT TRAP, AND DIVERSION DIKE WITH ROCK OUTLET) AROUND THE LIMITS OF CLEARING.
5. WORK WITHIN THE STREAM AREA SHALL NOT COMMENCE UNTIL AFTER PERIMETER EROSION CONTROL MEASURES ARE APPROVED BY THE CITY INSPECTOR.
6. FOR ANY CLEARING OR GRADING ON THE SITE, THE LIMITS OF CLEARING AND GRADING (LOD) SHALL BE MARKED WITH FLAGGING.
7. THE LOD SHALL BE REVIEWED ON-SITE WITH THE CONTRACTOR, THE OWNER OR OWNER'S REPRESENTATIVE(S), AND A CITY URBAN FORESTER, AND A DETERMINATION MADE AT THAT TIME REGARDING WHICH TREES WILL BE REMOVED BASED ON THE APPROVED GRADING AND STREAM RESTORATION ACTIVITIES.
8. ADJUSTMENTS WILL BE MADE TO FLAGGING MARKING THE LOD TO ADEQUATELY PROTECT TREES TO BE PRESERVED AND ALLOW REMOVAL OF TREES TO BE REMOVED, TREE PROTECTION FENCING SHALL BE ERECTED ALONG THESE ADJUSTED LIMITS OF CLEARING AND GRADING PRIOR TO THE COMMENCEMENT OF ANY OTHER CONSTRUCTION ACTIVITIES.
9. TREES TO BE REMOVED THAT ARE LOCATED ON THE LOD OR IMMEDIATELY ADJACENT TO THE LOD WITHIN THE PROTECTED AREA SHALL BE REMOVED USING CHAIN SAWS TO MINIMIZE ROOT ZONE DISTURBANCE OR TREES TO BE PRESERVED.
10. THE CONTRACTOR SHALL AVOID WETLAND AREAS WHEN POSSIBLE DURING CONSTRUCTION. ALL ACCESS AND STOCKPILE AREAS TO BE RETURNED TO PRE-CONSTRUCTION CONDITIONS AT THE COMPLETION OF CONSTRUCTION.
11. STOCKPILE AREAS HAVE BEEN DESIGNATED PRIMARILY FOR STOCKPILING SOIL AND ROCK. SILT FENCE SHALL BE PLACED ALONG THE DOWNSTREAM SIDE OF ANY STOCKPILE OF SOIL THAT WILL REMAIN STOCKPILED AT THE END OF ANY WORK DAY. ADDITIONAL AREAS MAY BE UTILIZED AS STOCKPILE AREAS IF APPROVED BY ENGINEER AND THE CITY OF VINTON SITE INSPECTOR.
12. STABILIZATION MEASURES SHALL BE APPLIED TO EARTHEN STRUCTURES SUCH AS DAMS, DIKES, AND DIVERSIONS IMMEDIATELY AFTER INSTALLATION.
13. ONLY DISTURB AS MUCH AREA AS CAN BE STABILIZED IN ONE DAY.
14. STABILIZE ALL DISTURBED AREAS, INCLUDING ACCESS AREAS AT THE END OF EACH DAY.
15. ALL STREAM WORK SHALL BE CONDUCTED IN THE DRY, AND NO WORK SHALL BE PERFORMED IN THE RAIN. IF THERE IS A THREAT OF RAIN, WORK IS TO STOP AND WORK AREA SHALL BE STABILIZED.
16. A "PUMP AROUND" SYSTEM SHALL BE USED TO DIVERT THE STREAM DURING CONSTRUCTION. SANDBAG DIKES SHALL BE INSTALLED WITHIN THE STREAM AROUND THE AREA TO BE DISTURBED THAT DAY (LARGER REACHES ARE ALLOWED IF APPROVED BY THE SITE ENGINEER); ONE AT THE UPSTREAM LIMIT OF DISTURBANCE AND ONE AT THE DOWNSTREAM LIMIT OF DISTURBANCE. IF BASEFLOW IS PRESENT, AN ADEQUATELY SIZED PUMP SYSTEM SHALL BE USED TO PUMP BASEFLOW AROUND THE AREA OF CONSTRUCTION AND BACK INTO THE STREAM AT A POINT DOWNSTREAM OF THE SECOND SANDBAG DIKE. WORK SHALL NOT PROCEED DURING RAIN EVENTS. IF SEDIMENT LADEN WATER ACCUMULATES AT THE DOWNSTREAM SANDBAG DIKE, SUCH WATER SHALL BE PUMPED INTO A FILTER BAG PRIOR TO BEING RELEASED BACK INTO THE STREAM.
17. ACCESS ACROSS AND IN THE STREAM SHALL BE ALLOWED WITHIN THE STREAM REACH PROTECTED BY THE "PUMP AROUND" SYSTEM AS DESCRIBED ABOVE.
18. SITE WORK ACTIVITIES SHALL BE COMPLETED, IF POSSIBLE, AT LEAST EIGHT WEEKS EARLIER THAN THE RECOMMENDED PLANTING WINDOW (I.E. AUGUST 30). DURING THIS TIME, THE EROSION CONTROL COVER CROP SHALL BE PERMITTED TO MATURE.
19. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED WITHIN 30 DAYS AFTER FINAL SITE STABILIZATION OR AFTER THE TEMPORARY MEASURES ARE NO LONGER NEEDED, UNLESS OTHERWISE AUTHORIZED BY THE CITY INSPECTOR. TRAPPED SEDIMENT AND THE DISTURBED SOIL AREA RESULTING FROM THE DEPOSITION OF TEMPORARY MEASURES SHALL BE PERMANENTLY STABILIZED TO PREVENT FURTHER EROSION AND SEDIMENTATION.

H. PERMANENT STABILIZATION

1. PLANTING OF ALL SPECIFIED CONTAINERIZED STREAMSIDE AND RIPARIAN VEGETATION SHALL BE LIMITED TO THE PERIOD BETWEEN NOVEMBER 30 AND MARCH 30, UNLESS APPROVED BY WSSI WITH SPECIAL WARRANTY CONDITIONS. NO PLANTING SHALL OCCUR WHEN THE SOIL IS FROZEN.
2. PLANT ALL SPECIFIED PLANT MATERIAL ON THE NEW STREAM BANKS AND RIPARIAN AREAS - SUBJECT TO TIME OF YEAR RESTRICTIONS IN PLANTING SPECIFICATIONS, CUTTING HOLES AS REQUIRED IN THE EROSION CONTROL FABRIC. SEE VEGETATION NOTES AND THE SCHEDULE FOR SPECIFICATIONS REGARDING PLANTS AND PLANTING MATERIAL. PLANTING CONTRACTOR SHALL USE SAME ACCESS POINTS TO MINIMIZE DISTURBANCE.
3. FOR ALL PLANTING TYPES, QUANTITIES, SPECIFICATIONS AND DETAILS PLEASE REFER TO THE PLANTING PLAN.

I. GENERAL LAND CONSERVATION NOTES

1. PERMANENT OR TEMPORARY STABILIZATION MUST BE APPLIED TO DENUDED AREAS WITHIN 7 DAYS AFTER FINAL GRADE IS REACHED OR WITHIN 7 DAYS TO DENUDED AREAS TO REMAIN DORMANT FOR LONGER THAN 14 DAYS.
2. ANY DISTURBED AREA NOT COVERED BY GENERAL CONSERVATION NOTE 1 AND NOT PAVED, SODDED OR BUILT UPON BY NOVEMBER 1, OR DISTURBED AFTER THAT DATE, SHALL BE MULCHED IMMEDIATELY WITH HAY OR STRAW MULCH AT THE RATE OF 2 TONS/ACRE (4483 KG/HA) AND OVERSEEDED BY APRIL 15.
3. AT THE COMPLETION OF THE PROJECT CONSTRUCTION AND PRIOR TO BOND RELEASE ALL TEMPORARY SEDIMENT CONTROLS SHALL BE REMOVED AND ALL DENUDED AREAS SHALL BE STABILIZED.

J. MAINTENANCE PROGRAM.

THE CONTRACTOR SHALL INSPECT ALL EROSION AND SEDIMENT CONTROL MEASURES IMMEDIATELY (WITHIN 24 HOURS) AFTER EACH RUNOFF PRODUCING RAINFALL EVENT, AT LEAST DAILY DURING PROLONGED RAINFALL, AND AT LEAST ONCE EVERY FOURTEEN DAYS. DAMAGED OR DEFICIENT MEASURES SHALL BE REPAIRED BY THE CLOSE OF EACH DAY AND ANY ADDITIONAL MEASURES REQUIRED SHALL BE IMMEDIATELY INSTALLED. FURTHER, THE CONTRACTOR SHALL MAKE A DAILY REVIEW OF AREAS OF CONSTRUCTION ACTIVITY TO INSURE THAT EROSION AND SEDIMENT CONTROL DEVICES ARE PROPERLY LOCATED FOR EFFECTIVENESS. WHERE DEFICIENCIES EXIST, ADDITIONAL MEASURES SHALL BE PROMPTLY INSTALLED. THE CONTRACTOR SHALL ALSO BE RESPONSIBLE FOR PROVIDING ANY ADDITIONAL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES THAT MAY BE REQUIRED, COMMENSURATE WITH HIS SCHEDULING SEQUENCE OF CONSTRUCTION, TO PREVENT EROSION AND SEDIMENT RELATED DAMAGE TO THE PROPERTY OF OTHERS, TO ADJACENT AND/OR DOWNSTREAM WATERWAYS, OR TO THE PROJECT, DURING CONSTRUCTION AND PRIOR TO PERMANENT STABILIZATION OF ALL DISTURBED AREAS.

THE CONTRACTOR SHALL INSTALL ANY AND ALL EROSION AND SEDIMENT CONTROLS DEEMED NECESSARY TO ACCOUNT FOR SITE AND ACTIVITY SPECIFIC ISSUES DETERMINED BY EITHER THE CITY INSPECTOR OR THE ENGINEER'S REPRESENTATIVE.

K. TWO-PHASE E&S CONTROLS

DUE TO THE NATURE OF THIS PROJECT ONLY A PHASE I EROSION AND SEDIMENT CONTROL PLAN IS REQUIRED. NO STORMWATER INFRASTRUCTURE WILL BE CONSTRUCTED (I.E. CURB, GUTTER, INLETS, ETC.), MAKING INCLUSION OF A PHASE II EROSION AND SEDIMENT CONTROL PLAN UNNECESSARY. SITE DISTURBANCE SHALL BE LIMITED TO THE SECTION OF STREAM CHANNEL THAT IS BEING RESTORED THAT DAY, AS WELL AS THE AREA IMMEDIATELY ADJACENT. NO SECTION OF STREAM WILL BE LEFT UNSTABILIZED OVERNIGHT. THIS WORK AREA WILL BE ISOLATED FROM THE ACTIVE STREAM CHANNEL THROUGH THE USE OF A PUMP AROUND DIVERSION. IN ADDITION, THIS DIVERSION WILL NOT BE REMOVED UNTIL THE STREAM CHANNEL IS STABILIZED AND THE ADJACENT AREA IS COVERED WITH STRAW.

MINIMUM STANDARDS NARRATIVE

MS-1 (SOIL STABILIZATION): SOIL SHALL BE STABILIZED PURSUANT TO THE EROSION AND SEDIMENT CONTROL NARRATIVE, SECTIONS H AND I.

MS-2 (SOIL STOCKPILE STABILIZATION): PURSUANT TO THE EROSION AND SEDIMENT CONTROL NARRATIVE, SECTION G, NOTE 11 (THIS SHEET); SILT FENCE WILL BE PLACED AROUND ANY SOIL THAT WILL BE STOCKPILED FOR LONGER THAN ONE DAY.

MS-3 (PERMANENT STABILIZATION): PERMANENT STABILIZATION SHALL BE APPLIED PURSUANT TO THE EROSION AND SEDIMENT CONTROL NARRATIVE, SECTION I (THIS SHEET). SPECIFICS REGARDING THE PLANTINGS ARE PROVIDED ON THE PLANTING PLAN, VEGETATION SCHEDULE, AND PLANTING NOTES & DETAILS SHEETS.

MS-4 (SEDIMENT BASINS & TRAPS): NOT APPLICABLE, NO SEDIMENT BASINS OR TRAPS ARE PROPOSED TO BE CONSTRUCTED AS PART OF THIS PROJECT.

MS-5 (STABILIZATION OF EARTHEN STRUCTURES): PURSUANT TO THE EROSION AND SEDIMENT CONTROL NARRATIVE, SECTION G, NOTE 12 (THIS SHEET); ALL EARTHEN STRUCTURES SHALL BE STABILIZED IMMEDIATELY AFTER INSTALLATION.

MS-6 (SEDIMENT TRAPS & SEDIMENT BASINS): NOT APPLICABLE, NO SEDIMENT BASINS OR TRAPS ARE PROPOSED TO BE CONSTRUCTED AS PART OF THIS PROJECT.

MS-7 (CUT/FILL SLOPES DESIGN & CONSTRUCTION): CUT/ FILL SLOPES DESIGN TO MINIMIZE EROSION AND CONFIRMED WITH MODELING. FURTHERMORE A DETAILED PLANTING PLAN WILL YIELD LONG TERM STABILITY.

MS-8 (CONCENTRATED RUNOFF DOWN SLOPES): NO CONCENTRATED RUNOFF SHALL BE ROUTED DOWN PROPOSED FILL/ CUT SLOPES.

MS-9 (SLOPE MAINTENANCE): NOT APPLICABLE, NO SLOPES ARE PROPOSED TO BE DISTURBED AS PART OF THIS PROJECT.

MS-10 (STORM SEWER INLET PROTECTION): NOT APPLICABLE, NO STORMWATER INLETS ARE PROPOSED TO BE CONSTRUCTED AS PART OF THIS PROJECT.

MS-11 (STORMWATER CONVEYANCE PROTECTION): NOT APPLICABLE, NO STORMWATER CONVEYANCES ARE PROPOSED TO BE CONSTRUCTED AS PART OF THIS PROJECT.

MS-12 (WORK IN LIVE WATERCOURSE): PURSUANT TO THE EROSION AND SEDIMENT CONTROL NARRATIVE, SECTION G, NOTE 17 (THIS SHEET); A "PUMP AROUND" SYSTEM WILL BE USED TO ISOLATE THE WORK AREA AND PROTECT DOWNSTREAM RECEIVING WATERS.

MS-13 (CROSSING LIVE WATERCOURSE): PURSUANT TO THE EROSION AND SEDIMENT CONTROL NARRATIVE, SECTION G, NOTE 17 (THIS SHEET); *"ACCESS ACROSS AND IN THE STREAM SHALL BE ALLOWED WITHIN THE STREAM REACH PROTECTED BY THE "PUMP AROUND" SYSTEM DESCRIBED ABOVE"*

MS-14 (REGULATION OF WATERCOURSE CROSSING): THE PROPOSED PROJECT IS BEING REGULATED BY NATIONWIDE PERMIT 27.

MS-15 (STABILIZATION OF WATERCOURSE): THIS MINIMUM STANDARD IS ADDRESSED IN THE EROSION AND SEDIMENT CONTROL NARRATIVE, SECTION G, NOTES 13, 14, & 15 (THIS SHEET).

MS-16 (UNDERGROUND UTILITY LINE CONSTRUCTION): NOT APPLICABLE, UNDERGROUND UTILITIES ARE COVERED UNDER E&S PLAN FOUND IN SHEETS 8-14.

MS-17 (VEHICULAR SEDIMENT TRAPPING): A STONE CONSTRUCTION ENTRANCE SHALL BE PLACED AT THE ENTRANCE TO THE PROJECT SITE IF REGULAR SWEEPING IS NOT DEEMED SUFFICIENT TO PREVENT ROADWAY TRACKING. DETAILS ARE PROVIDED ON THIS SHEET AND THE LOCATION OF THE CONSTRUCTION ENTRANCE WITH APPURTENCES ARE SHOWN ON THE ACCESS PLAN.

MS-18 (REMOVAL OF TEMPORARY MEASURES): THIS MINIMUM STANDARD IS ADDRESSED IN THE EROSION AND SEDIMENT CONTROL NARRATIVE, SECTION G, NOTE 19 (THIS SHEET).

MS-19 (STORMWATER MANAGEMENT): THE PROPOSED STREAM RESTORATION DESIGN EMPLOYS NATURAL CHANNEL DESIGN TECHNIQUES. THEREFORE PURSUANT TO §10.1-561.A OF THE VIRGINIA LEGISLATIVE CODE; *"STREAM RESTORATION AND RELOCATION PROJECTS THAT INCORPORATE NATURAL CHANNEL DESIGN CONCEPTS ARE NOT MAN-MADE CHANNELS AND SHALL BE EXEMPT FROM ANY FLOW RATE CAPACITY AND VELOCITY REQUIREMENTS FOR NATURAL OR MAN-MADE CHANNELS AS DEFINED IN ANY REGULATIONS PROMULGATED PURSUANT TO THIS SECTION, § 10.1-562, OR 10.1-570."*

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COLE AVE STREAM RESTORATION
FINAL DESIGN
City Of Staunton, Virginia

Erosion and Sediment Control Narrative
and Minimum Standards Narrative

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COMMONWEALTH OF VIRGINIA
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04/19/2024
PROFESSIONAL ENGINEER

REVISIONS							SCALE: N/A
No.	Date	Description				Rev. By	App. By	DATE: APRIL 2024

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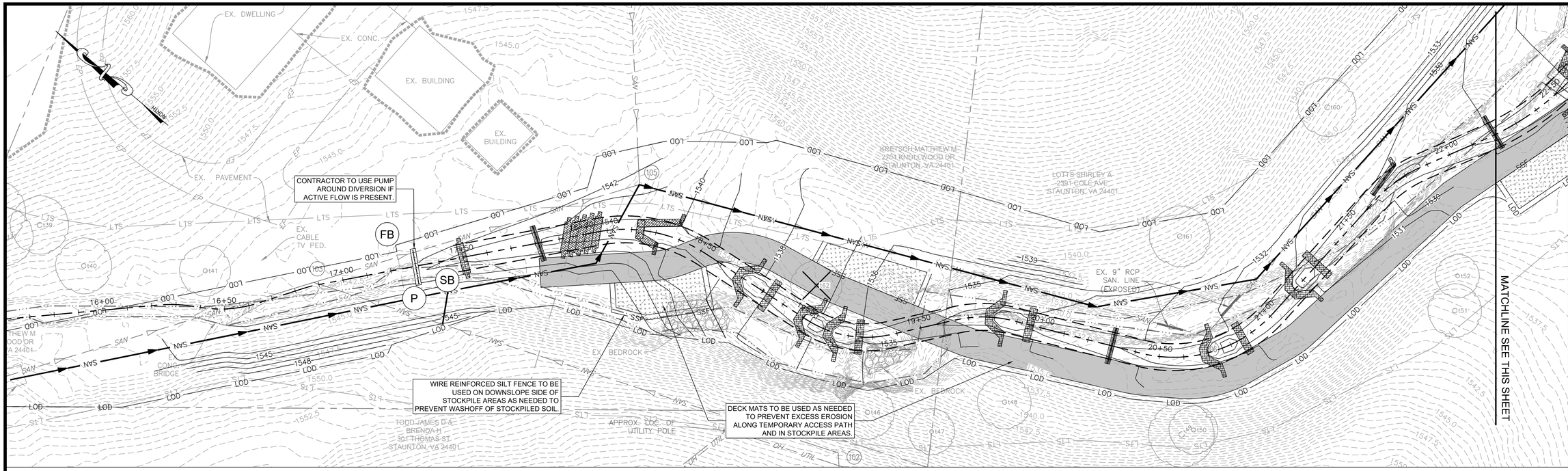
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Boundary and Topo Source:
WSSI and City of Staunton Digital Data

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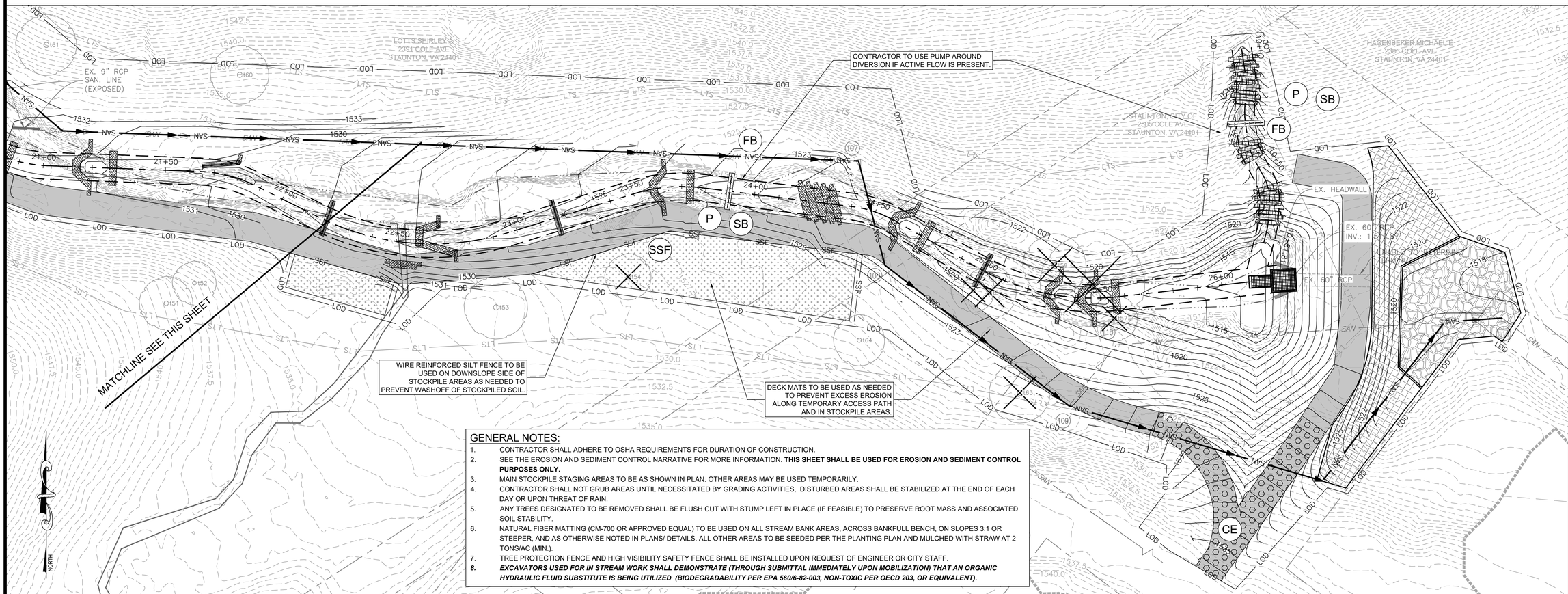
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SEE SHEETS 8-14 FOR E&S MEASURES ASSOCIATED WITH SANITARY AND RISER WORK.

SCALE: 1"=20'

SEE SHEET 4 FOR EXISTING AND GRADING LEGENDS. SEE NEXT SHEET FOR E&S LEGEND.



GENERAL NOTES:

1. CONTRACTOR SHALL ADHERE TO OSHA REQUIREMENTS FOR DURATION OF CONSTRUCTION.
2. SEE THE EROSION AND SEDIMENT CONTROL NARRATIVE FOR MORE INFORMATION. **THIS SHEET SHALL BE USED FOR EROSION AND SEDIMENT CONTROL PURPOSES ONLY.**
3. MAIN STOCKPILE STAGING AREAS TO BE AS SHOWN IN PLAN. OTHER AREAS MAY BE USED TEMPORARILY.
4. CONTRACTOR SHALL NOT GRUB AREAS UNTIL NECESSITATED BY GRADING ACTIVITIES, DISTURBED AREAS SHALL BE STABILIZED AT THE END OF EACH DAY OR UPON THREAT OF RAIN.
5. ANY TREES DESIGNATED TO BE REMOVED SHALL BE FLUSH CUT WITH STUMP LEFT IN PLACE (IF FEASIBLE) TO PRESERVE ROOT MASS AND ASSOCIATED SOIL STABILITY.
6. NATURAL FIBER MATTING (CM-700 OR APPROVED EQUAL) TO BE USED ON ALL STREAM BANK AREAS, ACROSS BANKFULL BENCH, ON SLOPES 3:1 OR STEEPER, AND AS OTHERWISE NOTED IN PLANS/ DETAILS. ALL OTHER AREAS TO BE SEEDED PER THE PLANTING PLAN AND MULCHED WITH STRAW AT 2 TONS/AC (MIN.).
7. TREE PROTECTION FENCE AND HIGH VISIBILITY SAFETY FENCE SHALL BE INSTALLED UPON REQUEST OF ENGINEER OR CITY STAFF.
8. ***EXCAVATORS USED FOR IN STREAM WORK SHALL DEMONSTRATE (THROUGH SUBMITTAL IMMEDIATELY UPON MOBILIZATION) THAT AN ORGANIC HYDRAULIC FLUID SUBSTITUTE IS BEING UTILIZED (BIODEGRADABILITY PER EPA 560/6-82-003, NON-TOXIC PER OECD 203, OR EQUIVALENT).***

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COLE AVE STREAM RESTORATION
FINAL DESIGN
City Of Staunton, Virginia

Erosion and Sediment Control Plan

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COMMONWEALTH OF VIRGINIA
NATHAN A. STALEY
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04/19/2024
PROFESSIONAL ENGINEER

REVISIONS				
No.	Date	Description	Rev. By	App. By

SCALE: 1" = 20'

DATE: APRIL 2024

Horizontal Datum: VCS NAD 83

Vertical Datum: NAVD 88

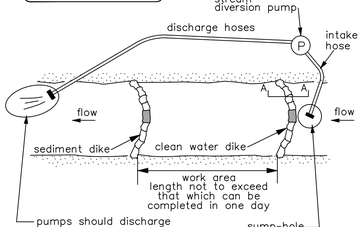
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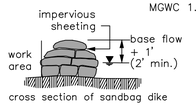
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PUMP AROUND DIVERSION (P) (SB)

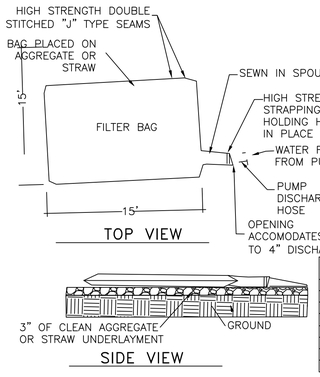


PLAN VIEW

MGWC 1.2



SECTION A–A



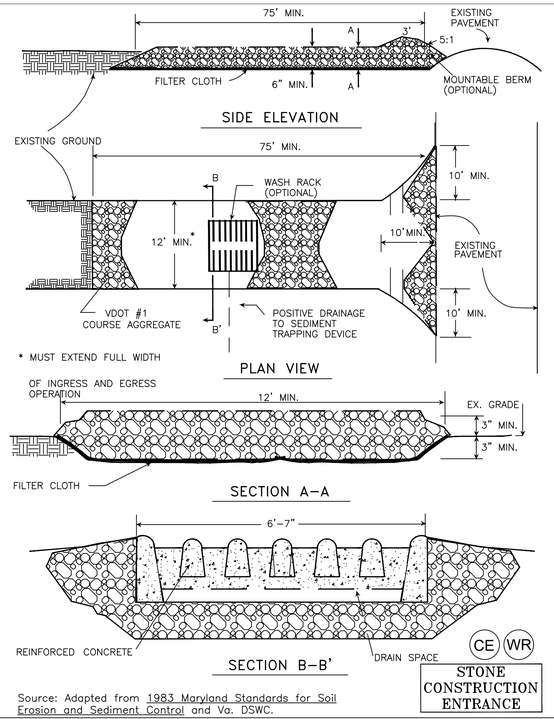
SPECIFICATIONS

1. FILTER BAG SHALL BE MADE OF NON–WOVEN GEOTEXTILE WITH A MINIMUM SURFACE AREA OF 225 SQUARE FEET PER SIDE.
2. ALL STRUCTURAL SEAMS SHALL BE SEWN WITH A DOUBLE STITCH USING A DOUBLE NEEDLE MACHINE WITH HIGH STRENGTH THREAD. SEAM STRENGTH SHALL WITHSTAND 100 LB/IN USING ASTM D–4884 TEST METHOD.
3. FILTER BAG SHALL HAVE A NOZZLE LARGE ENOUGH TO ACCOMMODATE A FOUR (4) INCH DIAMETER PUMP DISCHARGE HOSE.
4. NOZZLE SHALL BE SEALED TIGHTLY AROUND THE PUMP DISCHARGE HOSE WITH A STRAP OR SIMILAR DEVICE TO PREVENT UNFILTERED WATER FROM ESCAPING.
5. FILTER BAG SHALL BE PLACED ON A LEVEL OR GENTLY SLOPING (5% MAXIMUM) VEGETATED AREA.
6. FILTER BAG SHALL BE PLACED UPON A BASE OF STRAW BALES OR THREE (3) INCHES OF CLEAN STONE TO PROMOTE DEWATERING THROUGH BOTTOM SURFACE OF THE FILTER BAG.
7. PUMPING RATE SHALL BE CONTROLLED TO PREVENT EXCESSIVE PRESSURE WITHIN THE FILTER BAG. AS THE BAG BECOMES FILLED WITH SEDIMENT THE PUMPING RATE SHALL BE REDUCED.
8. THE FILTER BAG SHALL BE REMOVED AND DISPOSED OF AFTER IT IS FILLED WITH SEDIMENT AND HAS DEWATERED. THE DEWATERED SEDIMENT FROM THE BAG SHALL BE SPREAD IN AN UPLAND AREA AND STABILIZED WITHIN 24 HOURS.

THE GEOTEXTILE FABRIC SHALL MEET THE FOLLOWING MINIMUM REQUIREMENTS WITH PROPERTIES DETERMINED IN ACCORDANCE WITH THE PROCEDURES AT LEFT.

PROPERTIES	TEST METHOD	UNITS	MDE REQUIREMENTS
WEIGHT	ASTM D –3776	Oz/yd	10
GRAB TENSILE	ASTM D –4632	Lbs	210
PUNCTURE	ASTM D –4833	Lbs	150
FLOW RATE	ASTM D –4491	Gpm/ft^2	70
PERMITTIVITY	ASTM D –4491	Sec^{-1}	1.3
MULLEN BURST	ASTM D –3786	Psi	– – – –
UV RESISTANT	ASTM D –4355	%	70
AOS% RETAINED	ASTM D –4751	%	4080

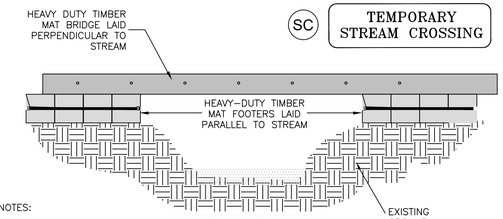
(FB) FILTER BAG



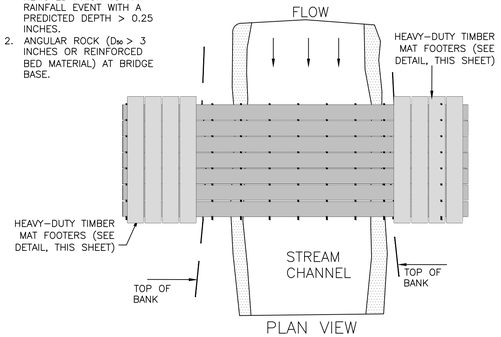
(CE) (WR) STONE CONSTRUCTION ENTRANCE

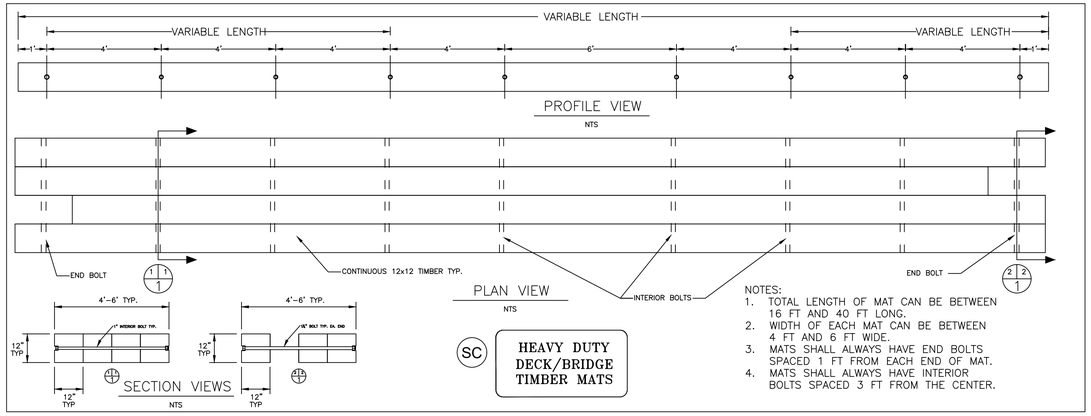
Source: Adapted from 1983 Maryland Standards for Soil Erosion and Sediment Control and Va. DSWC.

TEMPORARY STREAM CROSSING (SC)



NOTES:
1. BRIDGE SHALL BE REMOVED PRIOR TO ANY RAINFALL EVENT WITH A PREDICTED DEPTH > 0.25 INCHES.
2. ANGULAR ROCK (D_{50} > 3 INCHES OR REINFORCED BED MATERIAL) AT BRIDGE BASE.



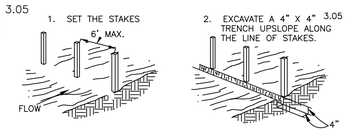


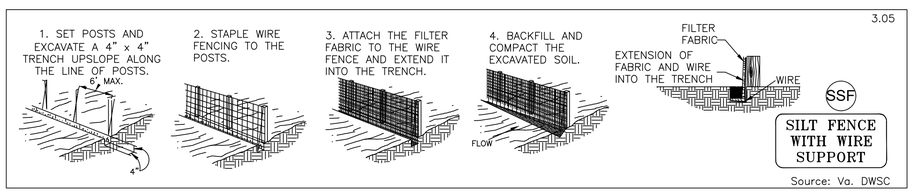
NOTES:
1. TOTAL LENGTH OF MAT CAN BE BETWEEN 16 FT AND 40 FT LONG.
2. WIDTH OF EACH MAT CAN BE BETWEEN 4 FT AND 6 FT WIDE.
3. MATS SHALL ALWAYS HAVE END BOLTS SPACED 1 FT FROM EACH END OF MAT.
4. MATS SHALL ALWAYS HAVE INTERIOR BOLTS SPACED 3 FT FROM THE CENTER.

(SC) HEAVY DUTY DECK/BRIDGE TIMBER MATS

SILT FENCE WITHOUT WIRE SUPPORT (SF) 3.05

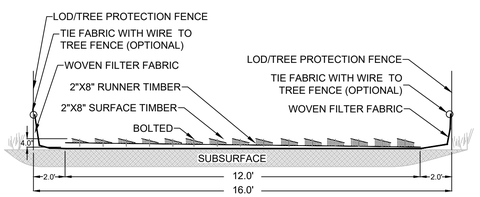
Source: Va. DWSC





3.05 (SSF) SILT FENCE WITH WIRE SUPPORT

Source: Va. DWSC

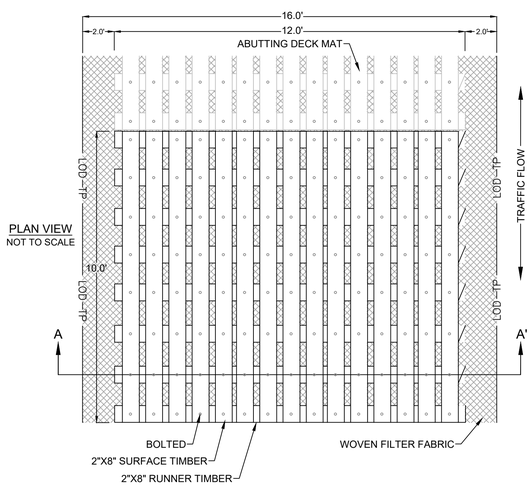


SECTION A-A'
NOT TO SCALE

NOTES:.

1. MATS SHALL BE INSTALLED SUCH THAT THE SURFACE TIMBER RUNS PARALLEL WITH THE VEHICLE TREAD. SUBSEQUENT MATS SHALL BE INSTALLED SUCH THAT THEY BUTT UP AGAINST EACH OTHER.
2. PLACE 6" OF WOOD CHIP MULCH BENEATH DECK MATS THROUGH ALL CRITICAL ROOT ZONE (CRZ) AREAS.

(DM) ACCESS ROAD DECK MAT



PLAN VIEW
NOT TO SCALE

EROSION/SEDIMENT CONTROL LEGEND

NO.	TITLE	KEY	SYMBOL	UNITS	QUANTITY
MGWC 1.2	PUMP AROUND DIVERSION*	P	(P)	EA	1
MGWC 1.2	SANDBAG DIKE	SB	(SB)	EA	2
3.01; IRM PLATE E-12	WELDED WIRE TREE PROTECTION FENCE	TP	LOD–TP	LF	AS NEEDED
3.02	WASH RACK	WR		EA	AS NEEDED
3.02	TEMP. STONE CONSTRUCTION ENTRANCE	CE		EA	1
3.05	SILT FENCE	SF	SF	LF	AS NEEDED
3.05 B	SILT FENCE WITH WIRE SUPPORT (SUPER SILT FENCE)	SSF	SSF	LF	400
N/A	FILTER BAG	FB	(FB)	EA	1
N/A	TEMPORARY DECK MATS	DM	(DM)	LF	AS NEEDED

*PUMP AROUND SHALL MOVE AS CONTRACTOR STARTS NEW AREAS.

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COLE AVE STREAM RESTORATION
FINAL DESIGN
City Of Staunton, Virginia

Erosion and Sediment Control Details

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NATHAN A. STALEY
Lic. No. 047145
04/19/2024
PROFESSIONAL ENGINEER

REVISIONS

No.	Date	Description	Rev. By	App. By

SCALE: NOT TO SCALE

DATE: APRIL 2024

Horizontal Datum: VCS NAD 83
Vertical Datum: NAVD 88
Boundary and Topo Source: WSSI and City of Staunton Digital Data

Design	Draft	Approved
JTS	JTS	NAS

Sheet # 23 of 27

Computer File Name:
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PLANTING SPECIFICATIONS

1. PLAN DETAILS ARE INCORPORATED INTO THIS SPECIFICATION BY REFERENCE.
2. THE SUPPLIER OF ALL SEEDS AND/OR VEGETATION SHALL CERTIFY THAT THE ORIGIN OF THE SEEDS FROM WHICH THE PLANTS OR SEEDS WERE PRODUCED IS FROM HARDINESS ZONES 6 AND 7, FROM THE EASTERN OR CENTRAL PORTIONS OF THE U.S., PRIOR TO PLANTING.
3. ANY NURSERY SUPPLYING THE STOCK SHALL PROVIDE A CURRENT NURSERY INSPECTION CERTIFICATE FROM THE STATE DEPARTMENT OF AGRICULTURE, OR PROVIDE AT LEAST THIRTY DAYS ADVANCE NOTICE FOR OWNER TO INSPECT THE PLANT SOURCE AREAS AT OWNER'S DISCRETION. ANY SUCH INSPECTION IS NOT DEEMED APPROVAL OF THE PLANT MATERIALS.
4. ALL PLANTS SHALL BE SET STRAIGHT, OR PLUMB.
5. PLANTING SHALL ONLY BE PERMITTED BETWEEN SEPTEMBER 30 THROUGH MARCH 31. LIVESTAKES SHALL ONLY BE PLANTED BETWEEN FEBRUARY 1 THROUGH MARCH 31. NO PLANTING SHALL OCCUR WHEN THE SOIL IS FROZEN. THESE TIME LIMITS MAY NOT BE MODIFIED UNLESS APPROVED BY OWNER, IN ADVANCE WITH THE RISK OF SURVIVAL BORNE SOLELY BY THE CONTRACTOR.
6. PLANTING HOLES FOR BARE ROOT TREES SHALL BE 1-2" DEEPER THAN THE ROOT COLLAR (I.E. 1-2" DEEPER THAN THEY WERE GROWING IN THE NURSERY). BARE ROOT SEEDLINGS SHALL BE INSTALLED WITH A NARROW SPADED SHOVEL (E.G. "SHARPSHOOTER"), AS DEPICTED WITHIN THESE PLANS. THE PLANTING HOLE SHALL BE LARGE ENOUGH TO AVOID THE NEED FOR ROOT TRIMMING WHERE EVER POSSIBLE. NO J-ROOTS (SEE PLANTING DETAILS) SHALL BE ALLOWED; IT IS EXTREMELY CRITICAL THIS BE ADHERED TO FOR EVERGREENS. BARE ROOT STOCK SHALL BE PLANTED WITH THEIR ROOT-COLLAR 1 TO 2 INCHES DEEPER THAN THE ADJACENT SOIL ELEVATION, USING ADJACENT SOIL TO CREATE A HUMMOCK OR MOUND THAT THE SEEDLING IS SET WITHIN.
7. PLANTING HOLES FOR CONTAINER GROWN PLANTS SHALL BE ONE FOOT (1') DEEP PLUS THE CONTAINER DEPTH IN WHICH THE PLANT HAS BEEN GROWN AND TWO FEET (2') WIDER THAN CONTAINER.
8. BACKFILL THE PLANTING HOLES WITH THE IN-SITU SOIL MATERIALS REMOVED FOR PLANTING AFTER REMOVING ALL STONES, ROOTS, AND OTHER DEBRIS GREATER THAN 1-1/2" IN DIAMETER.
9. FOLLOWING THE BACKFILLING, WATER TO THE POINT OF SOIL SATURATION (IF NOT PLANTED IN THE "WET") AND TAMP TO COMPACT THE BACKFILL MIXTURE. ADD EXISTING SOIL TO BRING THE FINAL GRADE IN THE PLANTING HOLE TO THE SURROUNDING SOIL SURFACE. RAKE THE UNUSED EXISTING SOIL OUTSIDE THE PLANTING HOLES, TAKING CARE NOT TO MOUND THE SOIL OR TO SIGNIFICANTLY ALTER THE EXISTING GRADES AND THEN PLACE MULCH (MIN. 2" THICK) ATOP ENTIRE PLANTING HOLE (EXCEPT THAT NO MULCH IS REQUIRED FOR EMERGENT PLANTINGS). THE PLANTING HOLE AREAS MUST NOT BE DEPRESSED BELOW THE SURROUNDING SOIL SURFACE ELEVATIONS. SAID AREAS SHALL BE SLIGHTLY RAISED (2-3"), RELATIVE TO THE SOIL SURFACE. WHEN PLANTED THROUGH MATTING (COIR OR OTHERWISE) PLANTING CONTRACTOR TO RESTAKE MATTING AROUND PLANTING HOLES.
10. THE SHRUBS THAT ARE SPECIFIED AS CONTAINER GROWN SPECIMENS SHALL BE BETWEEN 15" AND 18" IN HEIGHT. THEY SHALL BE HEALTHY, VIGOROUS, WELL ROOTED AND ESTABLISHED IN THE PLANTING CONTAINER IN WHICH THEY ARE GROWING. A CONTAINER SHRUB SHALL BE IN THAT CONTAINER A SUFFICIENT TIME SUCH THAT FIBROUS ROOTS ARE FORMED SO THE SHAPE WILL REMAIN AND THE MEDIUM WILL HOLD TOGETHER WHEN REMOVED FROM THE CONTAINER (REFER TO AMERICAN STANDARD FOR NURSERY STOCK).
11. DO NOT REMOVE PLANTS FROM CONTAINERS UNTIL IMMEDIATELY BEFORE PLANTING. EXAMINE THE ROOTS TO SEE IF THEY ARE POT BOUND. CAREFULLY SEPARATE ANY POT BOUND OR CRAMPED ROOTS AND SPREAD THEM OUT WHEN PLACING THE PLANT SO THAT THE ROOTS CAN GROW WITHOUT FURTHER CONSTRICTION OF THE ROOT BALL.
12. FERTILIZE EACH BARE ROOT, PLUG, TUBER, AND PINT CONTAINER PLANT WITH A 5 GRAM TABLET OF CONTROLLED RELEASE FERTILIZER. FERTILIZE EACH QUART CONTAINER WITH A 10 GRAM TABLET. USE A 20 GRAM TABLET OF FERTILIZER WITH EACH 1 GALLON AND 2 GALLON CONTAINER. GENERALLY, FOR EACH 12 TO 18 INCHES OF PLANT HEIGHT OR FOR EACH 1/2" OF TREE DIAMETER AT THE BASE, USE 20 GRAMS FOR SLOW GROWING PLANTS OR 40 GRAMS FOR FAST GROWING PLANTS OR POOR SOIL SITUATIONS. SAID FERTILIZER TABLETS SHALL BE AGRIFORM 20-10-5 OR APPROVED EQUIVALENT, APPLIED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
13. LOCAL CONDITIONS MAY NECESSITATE POST-INSTALLATION WATERING. SEE THE PROJECT SPECIFICATIONS DOCUMENT FOR ADDITIONAL INFORMATION REGARDING WATERING ACTIVITIES.
14. THE CONTRACTOR IS RESPONSIBLE FOR REPLACING NON- SURVIVING TREES AND SHRUBS DURING THE CARE AND REPLACEMENT PERIOD (12 MONTHS TO INCLUDE ONE FULL GROWING SEASON, UNLESS OTHERWISE SPECIFIED IN CONTRACT DOCUMENTS) OR UNTIL FINAL ACCEPTANCE, WHICHEVER IS THE SHORTEST, AS REQUIRED BY THE TERMS OF THE SURVIVAL WARRANTY SPECIFIED HEREIN AND/OR IN CONTRACT DOCUMENTS. THE SPECIFICATIONS FOR THE REPLACED PLANTS SHALL BE THOSE PROVIDED IN THE PLANT LIST.
15. REFER TO APPLICABLE SKETCHES WITHIN THIS PLAN SET FOR ADDITIONAL GUIDANCE ON PLANTING REQUIREMENTS.
16. INVASIVE AND NOXIOUS WEEDS SHALL BE REMOVED BY HAND WITH LOCALIZED APPLICATIONS OF RODEO, BY A LICENSED PROFESSIONAL, WHERE NECESSARY.
17. ALL BARE ROOT SEEDLINGS SHALL BE TREATED WITH ROOT DIP ABSORBENT POLYMERS AND MYCORRHIZAL ROOT DIP INOCULATES IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS. SAID ROOT DIP SHALL BE MYCORTREE™ ROOT DIP OR APPROVED EQUAL

SEEDING SPECIFICATIONS

1. SEED SHALL HAVE BEEN COLLECTED THE SAME YEAR OF SEEDING. A SEED GERMINATION AND PURITY RATE OF 75% IS REQUIRED. EVIDENCE OF SUCH SHALL BE PROVIDED TO OWNER PRIOR TO PLANTING.
2. THE LANDSCAPE CONTRACTOR SHALL INSPECT THE AREAS AND CONDITIONS UNDER WHICH THE SEEDING WORK IS TO BE PERFORMED PRIOR TO COMMENCING WORK. IF CONDITIONS ARE DETRIMENTAL TO THE PROPER AND TIMELY COMPLETION OF THE WORK, HE/SHE SHALL NOTIFY THE OWNER VERBALLY AND IN WRITING AND POSTPONE COMMENCING WORK UNTIL THE UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.
3. PRIOR TO SEEDING, THE TOP SOIL SHALL BE RAKED SMOOTH AND CLEARED OF ALL STONES LARGER THAN 5" AND TRASH, DEBRIS, BRANCHES AND OTHER MATTER DETRIMENTAL TO THE SUCCESS OF SEEDING.
4. SEEDING SHALL BE COMPLETED IMMEDIATELY AFTER FINE GRADING OF AN AREA.
5. MULCH SHALL BE STRAW IF APPLIED AT A RATE SPECIFIED BY THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK, 3RD EDITION, 1992.
6. CARE SHOULD BE EXERCISED TO INSURE UNIFORM SEED COVERAGE IS OBTAINED. SEED SHALL BE APPLIED AT THE RATE SPECIFIED ON THE PLANTING SCHEDULE.
7. THE SPECIFIED SEED SHALL BE BROADCAST IN AREAS SPECIFIED ON THE PLANTING PLAN.FOLLOWING SEEDING, MECHANICALLY SOW SEED TO A DEPTH OF 1/8 OF AN INCH BY THE USE OF A CULTIPACTOR, YORK RAKE, OR HAND RAKE.

PLANTING AND SEEDING SURVIVAL WARRANTY

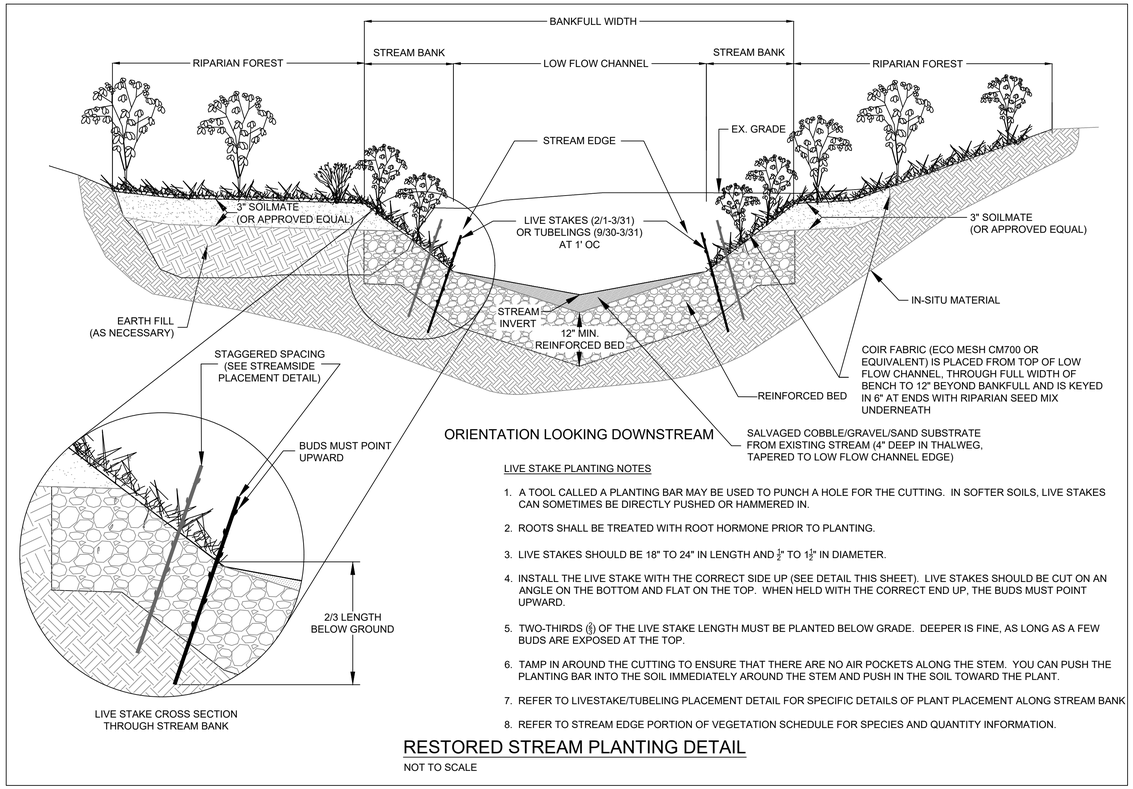
1. LANDSCAPE CONTRACTOR SHALL GUARANTEE A MINIMUM SURVIVAL RATE OF EACH VEGETATION SPECIES AFTER 12 MONTHS OF 85% FOR B&B, CONTAINER GROWN, AND TUBLINGS, AND 60% FOR BARE ROOT, TUBER STOCK, AND LIVE STAKES.
2. IF SURVIVAL RATES ARE LESS THAN THE ABOVE WARRANTY RATES, THEN LANDSCAPE CONTRACTOR SHALL REPLACE THE QUANTITY OF DEAD PLANTS WITHIN THE NEXT PLANTING WINDOW FOLLOWING THE END OF THE APPLICABLE WARRANTY PERIOD.

PRODUCT HANDLING, STORAGE, AND DELIVERY

1. HANDLE PLANTS AT ALL TIMES SO THAT ROOTS OR BALLS ARE ADEQUATELY PROTECTED FROM BREAKAGE OF BALLS, FROM SUN AND DRYING WINDS. PLANTS WITH DRIED OUT TOPS OR ROOTS SHALL BE REJECTED.
2. ALL PLANT MATERIALS SHALL BE STORED AND DELIVERED IN SUCH A FASHION AND FOR TIME INTERVALS CONSISTENT WITH SOUND SILVICULTURAL PRACTICES.
3. PLANT MATERIAL WILL BE TRANSPORTED FROM THE NURSERY TO THE PLANTING AREAS BY SUCH MEANS AS TO AVOID WIND DAMAGE, OVER-CROWDING, OR OTHER MECHANISMS BY WHICH PHYSICAL DAMAGE MAY RESULT TO THE PLANTS.
4. PLANT MATERIAL MAY BE RANDOMLY INSPECTED BY THE OWNER UPON ARRIVAL AT EACH PLANTING AREA AND DURING PLANTING ACTIVITIES. MATERIAL FOUND TO BE
   UNACCEPTABLE WILL BE REJECTED AND THE CONTRACTOR WILL BE REQUIRED TO SUPPLY REPLACEMENT MATERIAL WITHIN A REASONABLE TIME FRAME (I.E. 1-WEEK).
   UNACCEPTABLE MATERIAL IS TO BE DEFINED AS THE FOLLOWING:
   (A) PLANTS WITH BENT TRUNKS OR MULTIPLE LEADERS, UNLESS CHARACTERISTIC FOR THE SPECIES;
   (B) PLANTS WITH DISEASED TRUNKS, STEMS, OR LEAVES;
   (C) PLANTS WITH PEST-INFESTED TRUNKS, STEMS, OR LEAVES;
   (D) PLANTS OF INSUFFICIENT SIZE (LESS THAN A SPECIFIED HEIGHT OR CALIPER);
   (E) PLANTS OF THE WRONG SPECIES/SUB-SPECIES;
   (F) PLANTS HAVING ROOT GIRDLING IN THE CONTAINER;
   UNLESS OTHERWISE APPROVED BY THE OWNER. JUSTIFICATION FOR USE OF TENTATIVELY REJECTED MATERIAL MAY BE PRESENTED TO THE OWNER.

THIS PLAN IS FOR PLANTING PURPOSES ONLY

PLEASE REFER TO PLANTING PLAN SHEETS FOR LEGEND

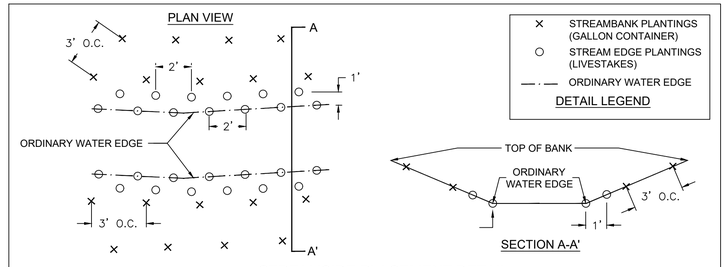


LIVE STAKE PLANTING NOTES

1. A TOOL CALLED A PLANTING BAR MAY BE USED TO PUNCH A HOLE FOR THE CUTTING. IN SOFTER SOILS, LIVE STAKES CAN SOMETIMES BE DIRECTLY PUSHED OR HAMMERED IN.
2. ROOTS SHALL BE TREATED WITH ROOT HORMONE PRIOR TO PLANTING.
3. LIVE STAKES SHOULD BE 18" TO 24" IN LENGTH AND ½" TO 1½" IN DIAMETER.
4. INSTALL THE LIVE STAKE WITH THE CORRECT SIDE UP (SEE DETAIL THIS SHEET). LIVE STAKES SHOULD BE CUT ON AN ANGLE ON THE BOTTOM AND FLAT ON THE TOP. WHEN HELD WITH THE CORRECT END UP, THE BUDS MUST POINT UPWARD.
5. TWO-THIRDS (⅔) OF THE LIVE STAKE LENGTH MUST BE PLANTED BELOW GRADE. DEEPER IS FINE, AS LONG AS A FEW BUDS ARE EXPOSED AT THE TOP.
6. TAMP IN AROUND THE CUTTING TO ENSURE THAT THERE ARE NO AIR POCKETS ALONG THE STEM. YOU CAN PUSH THE PLANTING BAR INTO THE SOIL IMMEDIATELY AROUND THE STEM AND PUSH IN THE SOIL TOWARD THE PLANT.
7. REFER TO LIVESTAKE/TUBELING PLACEMENT DETAIL FOR SPECIFIC DETAILS OF PLANT PLACEMENT ALONG STREAM BANK
8. REFER TO STREAM EDGE PORTION OF VEGETATION SCHEDULE FOR SPECIES AND QUANTITY INFORMATION.

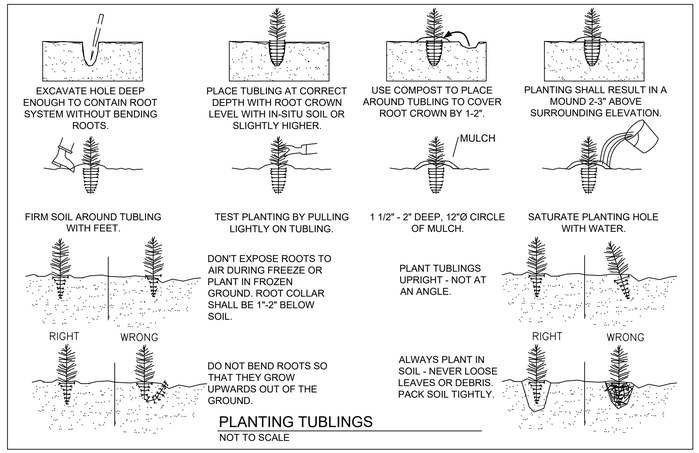
RESTORED STREAM PLANTING DETAIL

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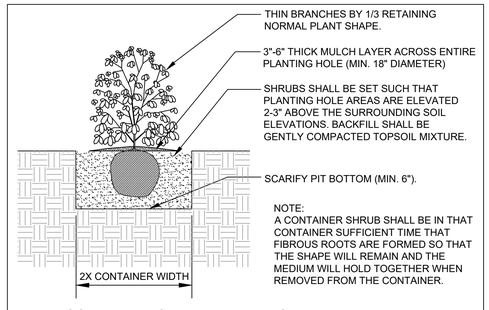
STREAMSIDE PLACEMENT DETAIL

NOT TO SCALE



PLANTING TUBLINGS

NOT TO SCALE



CONTAINER SHRUB PLANTING DETAIL

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COLE AVE STREAM RESTORATION
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Planting Notes & Details

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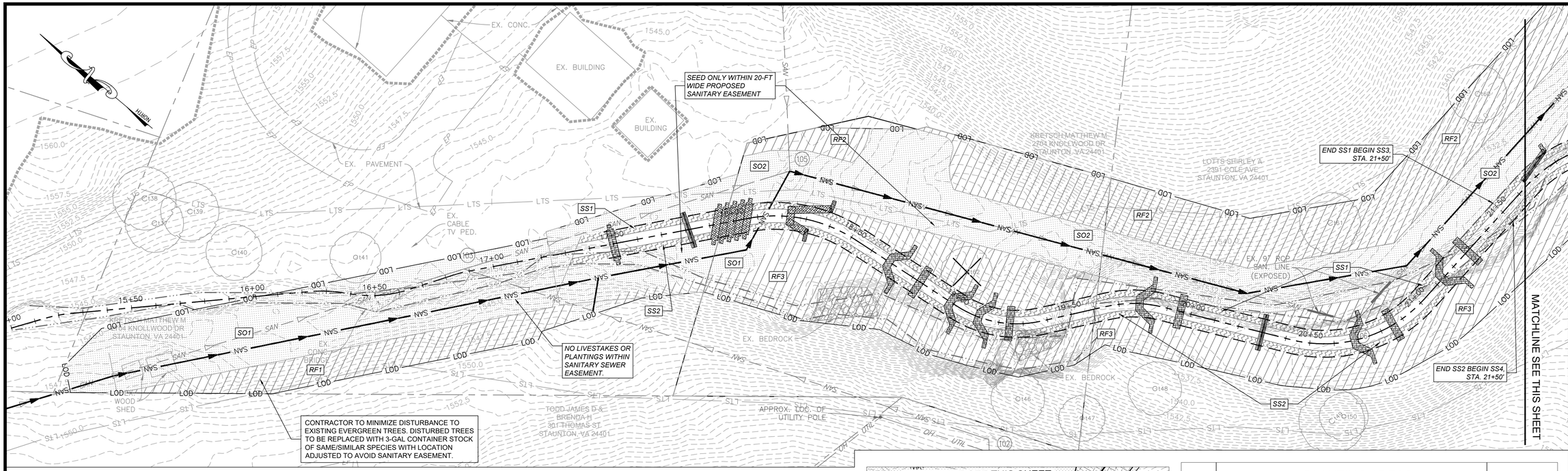
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					DATE: APRIL 2024

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Vertical Datum: NAVD 88
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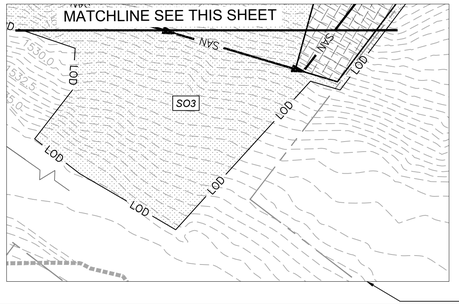
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20 10 0 20 40 60

SCALE: 1"=20'

SEE SHEET 4 FOR EXISTING CONDITIONS LEGEND AND GRADING LEGEND.



	PLANTING AREAS	SYMBOL
UPLAND ZONE	STREAMSIDE*	SS1, SS2, SS3, SS4
	RIPARIAN FOREST SEED AND PLANTING*	RF1, RF2, RF3
	RIPARIAN FOREST *SEED ONLY**	SO1, SO2, SO3

*SEED MIX SHALL BE DISTRIBUTED EVENLY THROUGHOUT ALL DISTURBED AREAS IN THE AMOUNT SPECIFIED ON THE VEGETATION SCHEDULE SHEET.

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Planform Geometry (Cont'd)

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Sheet # 25 of 27

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RIPARIAN FOREST VEGETATION SCHEDULE FOR SHADY & VARIABLE HYDROLOGY CONDITIONS

PLANTING SCHEDULE

CONTAINER PLANTING ZONE		SPECIES GROUP[1,2]	SPECIES[2]	INDICATOR STATUS (AGCP)	INDICATOR STATUS (EMP)	WILDLIFE VALUE: FUNCTIONS	WILDLIFE VALUE: PRIMARY SPECIES	WILDLIFE VALUE: PLANT PART	WILDLIFE VALUE: SEASON	PLANT SPACING[3]	CONTAINER SIZE, RATE, AND QUANTITY[4]: PLANTS PER ACRE	CONTAINER SIZE, RATE, AND QUANTITY[4]: # OF PLANTS
RIPARIAN FOREST (VARIABLE, SHADY)	OVERSTORY LAYER	1	QUERCUS FALCATA (SOUTHERN RED OAK)	FACU	FACU	Food	Woodpeckers, turkey, deer, squirrels, raccoons, other small mammals	Nuts, trees	All	12' O.C.[3]	300 ONE GAL -- or -- 600 TUBELINGS -- or -- MIX AT 1:2 RATIO[4]	264 (BASED ON ONE-GALLON)
			QUERCUS ALBA (WHITE OAK)	FACU	FACW	Food	Woodpeckers, turkey, deer, squirrels, raccoons, other small mammals	Nuts, trees	All			
			QUERCUS PALUSTRIS (PIN OAK)	FACW	FACW	Food	Woodpeckers, turkey, deer, squirrels, raccoons, other small mammals	Nuts, trees	All			
			QUERCUS PHELLOS (WILLOW OAK)	FACW	FAC	Food	Woodpeckers, turkey, deer, squirrels, raccoons, other small mammals	Nuts, trees	All			
			QUERCUS RUBRA (NORTHERN RED OAK)	FACU	FACU	Food	Woodpeckers, turkey, deer, squirrels, raccoons, other small mammals	Nuts, trees	All			
		2	ACER NEGUNDO (BOX ELDER)[8]	FAC	FAC	Food	Finches, chickadees, squirrels, robins, goldfinches, other birds	Seeds, buds, flowers, tree	Spring, summer	21' O.C.[3]	100 ONE-GALLON -- or -- 400 TUBELINGS -- or -- MIX AT 1:2 RATIO[4]	88 (BASED ON ONE-GALLON)
			CARYA CORDIFORMIS (BITTERNUT HICKORY)	FAC	FACU	Food	Squirrels, small mammals	Seed, tree	Spring, summer, fall			
			DIOSPYROS VIRGINIANA (COMMON PERSIMMON)	FAC	FAC	Food	Bees, large and small mammals, song birds including cedar waxwing, game birds	Fruits, flowers, leaves, twigs	All			
			LIQUIDAMBAR STYRACIFLUA (SWEET GUM)	FAC	FAC	Food	Finches, cardinals, chickadees, sparrows, squirrels	Seed	Summer, fall, winter			
			NYSSA SYLVATICA (BLACK GUM)	FAC	FACW	Food, cover	Song birds, waterfowl, small mammals	Fruit, tree	All			
			PLATANUS OCCIDENTALIS (AMERICAN SYCAMORE)	FACW	FACW	Food	Raccoons, opossum, wood duck, pileated and other woodpeckers	Hollow trunks	All			
	UNDERSTORY LAYER	3	ACER RUBRUM (RED MAPLE)[9]	FAC	FAC	Food	Finches, chickadees, squirrels, robins, goldfinches, other birds	Seeds, buds, flowers, tree	Spring, summer	15' O.C.3	200 ONE-GALLON -- or -- 400 TUBELINGS -- or -- MIX AT 1:2 RATIO[4]	176 (BASED ON ONE-GALLON)
			AMELANCHIER CANADENSIS (CANADIAN SERVICEBERRY)	FAC	FAC	Food, cover	Song birds, small mammals	Fruit, tree	All			
			ASIMINA TRILOBA (PAWPAW)	FAC	FAC	Food	Catbird, thrasher, thrushes, woodpeckers, zebra swallowtail butterfly larval food	Fruit, leaves	Spring, summer, fall			
			CERCIS CANADENSIS (EASTERN REDBUD)	UPL	FACU	Food	Honeybees, butterfly caterpillars	Flowers, leaves	Spring, summer			
			JUNIPERUS VIRGINIANA (EASTERN RED CEDAR)	FACU	FACU	Food, cover, reproduction	Birds, small mammals	Fruit, needles, twigs	All			
			MAGNOLIA VIRGINIANA (SWEETBAY MAGNOLIA)	FACW	FACW	Food	Birds, small mammals, pollinators	Flower, fruit, leaves	Spring, summer, fall			
	SHRUB LAYER	4	CORYLUS AMERICANA (AMERICAN HAZELNUT)	FACU	FACU	Food, cover	Songbirds, small mammals	Fruit	Summer, fall	15' O.C.[3]	200 ONE-GALLON -- or -- 400 TUBELINGS[4]	176 (BASED ON ONE-GALLON)
			LINDERA BENZOIN (NORTHERN SPICEBUSH)	FACW	FAC	Food	Thrushes vireos, catbird, bluebird, butterfly caterpillars	Fruit, leaves	Spring, summer, fall			
			VIBURNUM DENTATUM (SOUTHERN ARROWWOOD)	FAC	FAC	Food	Robins, bluebirds, other thrushes, thrashers, catbirds, vireos	Fruit	Fall			
			VIBURNUM PRUNIFOLIUM (BLACK-HAW)	FACU	FACU	Food, cover	Catbirds, thrashers, thrushes, cover and next sites for songbirds	Fruit, tree	Spring, fall			
RIPARIAN FOREST QUANTITY SUBTOTALS											**800**	**704**
STREAMSIDE PLANTING ZONES	STREAM BANK	SHRUB LAYER	5	ALNUS SERRULATA (BROOKSIDE ALDER)	FACW	OBL	Food, reproductive areas	Finches, sparrows, doves, yellow warbler, song sparrow, other songbirds	Seeds, buds, stems	Summer, fall, winter	3' O.C.[6]	4800 ONE-GALLON -- or -- 9600 TUBELINGS -- or -- MIX AT 1:2 RATIO[4]	672 (BASED ON ONE-GALLON)
				ARONIA ARBUTIFOLIA (RED CHOKEBERRY)	FACW	FACW	Food, cover, reproductive areas	Finches, sparrows, doves, yellow warbler, song sparrow, other songbirds	Flower, fruit	Summer, fall, winter			
				CEPHALANTHUS OCCIDENTALIS (BUTTONBUSH)	OBL	OBL	Food, cover, reproductive areas	Catbird, thrasher, thrushes, cedar waxwings, rabbits	Flower, fruit	Summer, fall, winter			
				ILEX VERTICILLATA (COMMON WINTERBERRY)	FACW	FACW	Food, cover, reproductive areas	Bluebird, catbird, brown thrasher, robin, yellow bellied sapsucker, mockingbird	Flower, seed, leaves	All			
				VIBURNUM DENTATUM (SOUTHERN ARROWWOOD)	FACU	FAC	Food, cover, reproductive areas	Purple finch, goldfinch, robin, junco, bluebird, hermit thrush	Flower, fruit	Spring, summer, fall			
STREAM BANK QUANTITY SUBTOTALS												**4800**	**672**
	STREAM EDGE	SHRUB LAYER	6	ALNUS SERRULATA (SMOOTH ALDER)	FACW	OBL	Food, reproductive areas	Finches, sparrows, doves, yellow warbler, song sparrow, other songbirds	Seeds, buds, stems	Summer, fall, winter	1 PER L.F. STAGGERED[6]	N/A	1,887 (TUBELINGS OR LIVESTAKES ONLY)[7]
				CEPHALANTHUS OCCIDENTALIS (BUTTONBUSH)	OBL	OBL	Food, cover, reproductive areas	Catbird, thrasher, thrushes, cedar waxwings, rabbits	Flower, fruit	Summer, fall, winter			
				CORNUS AMOMUM (SILKY DOGWOOD)	FACW	FACW	Food, cover, reproductive areas	Catbird, thrasher, thrushes, cedar waxwings, rabbits	Flower, fruit	Summer, fall, winter			
				SAMBUCUS NIGRA spp. CANADENSIS (ELDERBERRY/BLACK ELDER)	FACW	FAC	Food, cover	Brown thrasher, catbird, woodpeckers, thrushers	Seed	Spring, fall, winter			
STREAM EDGE QUANTITY SUBTOTALS												**---**	**1,887**
	LIVE STAKE		7	SALIX NIGRA (BLACK WILLOW)	OBL	OBL	Food, cover, reproductive areas	Beaver, porcupine, deer, muskrat, ducks, fish	Buds, foliage, bark	All	1 PER L.F. STAGGERED[6]	N/A	1,887 LIVE STAKES
LIVE STAKE QUANTITY SUBTOTALS												**---**	**1,887**

PLANTING QUANTITIES (BASED ON ONE-GALLON SIZE)[4]

	SS1	SS2	SS3	SS4	SS5	SS6	RF1	RF2	RF3	SO1	SO2	SO3
AREA (SF):	1,109	1,138	1,154	1,155	249	249	2,720	19,878	15,574	6,882	12,840	15,834
AREA (AC):	0.03	0.03	0.03	0.03	0.01	0.01	0.06	0.46	0.36	0.16	0.29	0.36
LENGTH (LF):	416	423	431	437	90	90	-	-	-	-	-	-
	0	0	0	0	0	0	18	138	108	0	0	0
	0	0	0	0	0	0	6	46	36	0	0	0
	0	0	0	0	0	0	12	92	72	0	0	0
	0	0	0	0	0	0	12	92	72	0	0	0
	-	**-**	**-**	**-**	**-**	**-**	**48**	**368**	**288**	**-**	**-**	**-**
	144	144	144	144	48	48	0	0	0	0	0	0
	144	**144**	**144**	**144**	**48**	**48**	**-**	**-**	**-**	**-**	**-**	**-**
	416	423	431	437	90	90	0	0	0	0	0	0
	416	**423**	**431**	**437**	**90**	**90**	**-**	**-**	**-**	**-**	**-**	**-**
	416	423	431	437	90	90	0	0	0	0	0	0
	416	**423**	**431**	**437**	**90**	**90**	**-**	**-**	**-**	**-**	**-**	**-**

PLANTING AND SEEDING NOTES:

1. It is expected and preferred that all species in each of the Species Groups are planted. The tolerances listed in this note are intended to incorporate flexibility according to species availability. At a minimum, Contractor to provide at least:
   a) 4 of the 5 species in Group 1,
   b) 5 of the 6 species in Group 2,
   c) 5 of the 6 species in Group 3,
   d) 3 of the 4 species in Group 4,
   e) 4 of the 5 species in Group 5,
   f) 3 of the 4 species in Group 6,
   g) all of the species in Group 7,
   h) all of the species in Group 8,
   i) 3 of the 4 species in Group 9,
   j) 3 of the 4 species in Group 10,
   k) 5 of the 6 species in Group 11,
   l) 5 of the 7 species in Group 12,
   m) 4 of the 5 species in Group 13, and
   n) 5 of the 6 species in Group 14.
2. Substitutions for selected species based upon availability shall be requested in writing to engineer, documenting the lack of availability, If the flexibility inherent in the above schedule is still not sufficient, Engineer is under no obligation to approve substitutions.
3. The planted trees and shrubs shall be randomly spaced and species mixed throughout the planting areas.
4. Container rates and quantities shown for one gallon size. For purposes of substitution, two tubelings are the equivalent of one 1-gallon container plant in this schedule. Contractor may provide a mix of container and tubeling sizes for each species requirement, provided the ratio of tubelings to containers is not less than 2:1. Exception -- Group 6 (Stream Edge) shall be planted in accordance with Note #5.
5. Group 6 (Stream Edge) zone shall be planted with tubelings, or as livestakes. No one gallons are required to be used for any of this Group's species.
6. Stream Bank (Group 5) and Stream Edge (Group 6) zones shall be planted such that the combined mix of species is spaced approx. 3' O.C. and 1 plant per L.F. respectively. Live stake zones upstream of outer vane arm (Group 7) spaced at 1 plant per L.F. Live stake zones downstream of outer vane arm (Group 8) spaced at 4 plants per L.F.
7. All seeding rates are expressed in pounds of pure live seed (PLS).
8. If there is an abundance of existing or established maples on site, a substitution for maples may be made with an alternate species to avoid tapping into and adding to existing saturated seed bank. Final decision as to whether or not to plant maples will be made by engineer of record.

NOTE: THE ABOVE SCHEDULE DOES NOT INCLUDE ADDITIONAL EVERGREEN PLANTINGS WHICH MAY BE REQUIRED TO MAINTAIN VISUAL SCREENING IF EXISTING TREES AT THE NORTHWEST CORNER OF THE PROJECT AREA ARE DISTURBED.

Wetland Studies and Solutions, Inc. a DAVEY company
5450 Peters Creek Road • Suite 110
Roanoke, Virginia 24019
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COLE AVE STREAM RESTORATION
FINAL DESIGN
City Of Staunton, Virginia

Vegetation Schedule

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COMMONWEALTH OF VIRGINIA
NATHAN A. STALEY
Lic. No. 047145
04/19/2024
PROFESSIONAL ENGINEER

REVISIONS

No.	Date	Description	Rev. By	App. By

SCALE: N/A
DATE: APRIL 2024

Horizontal Datum: N/A
Vertical Datum: N/A
Boundary and Topo Source: N/A

Design	Draft	Approved
JTS	JTS	NAS

Sheet # 26 of 27

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SEEDING SCHEDULE

SEED PLANTING ZONE	SPECIES GROUP[1,2]	SPECIES[2]	INDICATOR STATUS (AGCP)	INDICATOR STATUS (EMP)	WILDLIFE VALUE		PLANT PART	SEASON	SEEDING RATE[7] (LBS/AC)	AREA PER PLANT (AC)	QUANTITY (LBS)
					FUNCTIONS	PRIMARY SPECIES					
RIPARIAN FOREST (VARIABLE, SHADY) SEED MIX	8	LOLIUM PERENNE spp. MULTIFLORUM (ANNUAL RYEGRASS)	FACU	FACU	Erosion control, food	Sparrows, finches, small mammals.	Seeds	Summer, fall	45.00	1.83	82.35
		SETARIA ITALICA (FOXTAIL MILLET/ITALIAN BRISTLE GRASS)	FACU	UPL	Erosion control, food	Sparrows, finches, small mammals.	Seeds	Fall, winter	45.00	1.83	82.35
	9	ELYMUS RIPARIUS (RIVERBANK WILD RYE)	FACW	FACW	Food	Song birds, small mammals	Seeds, leaves	All	10.00	1.83	18.30
		ELYMUS VIRGINICUS (VIRGINIA WILD RYE)	FAC	FACW	Food	Deer, sparrows, small mammals	Seeds, leaves	All	10.00	1.83	18.30
		DICHANTHELIUM CLANDESTINUM (DEER TONGUE GRASS)	FACW	FAC	Food	Song birds, waterfowl, small mammals	Seeds	Summer, fall	10.00	1.83	18.30
		SENNA HEBECARPA (WILD SENNA)	FAC	FAC	Food	Pollinators, birds	Flower, seeds	Summer, Fall	10.00	1.83	18.30
	10	AGRIMONIA PARVIFLORA (HARVESTLICE)	FAC	FACW	Food	Pollinators, butterflies, beneficial insects	Flowers	Summer	0.20	1.83	0.37
		CAREX SQUARROSA (SQUARROSE SEDGE)	FACW	FACW	Food	Song birds, waterfowl	Seeds	Summer, fall	0.20	1.83	0.37
		PARTHENOCISSUS QUINQUEFOLIA (VIRGINIA CREEPER)	FACU	FACU	Food	Song birds	Fruit	Summer	0.20	1.83	0.37
		JUNCUS TENUIS (PATH RUSH)	FAC	FAC	Food	Songbirds, small mammals	Seeds	Summer, fall	0.20	1.83	0.37
	11	ANEMONE VIRGINIANA (THIMBLEWEED)	FACU	FACU	Food	Pollinators, butterflies, beneficial insects	Flowers	Spring, summer	0.10	1.83	0.19
		EUPATORIUM PERFOLIATUM (COMMON BONESET)	FACW	FACW	Food	Caterpillars, pollinators	Flowers, leaves	Spring, summer	0.10	1.83	0.19
		SYMPHYOTRICHUM PILOSUM (WHITE OLDFIELD AMERICAN-ASTER)	FACW	FAC	Food	Butterflies	Flowers	Summer, fall	0.10	1.83	0.19
		RHUS GLABRA (SMOOTH SUMAC)	UPL	UPL	Food	Beneficial insects, song birds, game birds, mammals	Flowers, fruit, leaves	Spring, summer, fall	0.10	1.83	0.19
		SOLIDAGO SPECIOSA (SHOWY GOLDENROD)	NI	NI	Food	Butterflies, song birds, small mammals	Flowers	Summer, fall	0.10	1.83	0.19
		VERNONIA NOVEBORACENSIS (NEW YORK IRONWEED)	FACW	FACW	Food	Butterflies	Flowers	Fall	0.10	1.83	0.19
	12	ASCLEPIAS SYRIACA (COMMON MILKWEED) - *MUST INCLUDE*	UPL	FACU	Food	Butterflies, beneficial insects	Flowers	Spring, summer	0.20	1.83	0.37
		GEUM CANADENSE (WHITE AVENS)	FAC	FACU	Food	Pollinators, butterflies, beneficial insects	Flowers	Summer	0.20	1.83	0.37
		CHAMAECRISTA NICITANS (SENSITIVE PARTRIDGE PEA)	FACU	FACU	Food	Pollinators, caterpillars, mammals	Flowers, seeds, leaves	Spring, summer, fall	0.20	1.83	0.37
		DESMODIUM GLABELLUM (DILLENIUS' TICK-TREFOIL)	UPL	UPL	Food	Pollinators, small mammals	Seeds, plant	Summer, fall	0.20	1.83	0.37
		PENSTEMON DIGITALIS (PENSTEMON)	FAC	FAC	Food	Pollinators, butterflies, beneficial insects	Leaves, seeds	All	0.20	1.83	0.37
		CLEMATIS VIRGINIANA (VIRGIN'S BOWER)	FAC	FAC	Food, cover	Pollinators, birds	Flowers, plant	Spring, summer, fall	0.20	1.83	0.37
		VERBESINA ALTERNIFOLIA (WINGSTEM)	FAC	FAC	Food	Butterflies, other insects	Flowers	Summer, fall	0.20	1.83	0.37
	13	HAMAMELIS VIRGINIANA (WITCH HAZEL)	FACU	FACU	Food, cover, reproductive areas	Rufted grouse, wild turkey, rabbit, deer, beaver	Flowers, fruit	Spring, fall, winter	0.20	1.83	0.37
		ILEX VERTICILLATA (WINTERBERRY)	FACW	FACW	Food, cover, reproductive areas	Song birds, upland game birds	Flower, seed, leaves	All	0.20	1.83	0.37
		LINDERA BENZOIN (NORTHERN SPICEBUSH)	FACW	FAC	Food	Thrushes vireos, catbird, bluebird, butterfly caterpillars	Fruit, leaves	Spring, summer, fall	0.20	1.83	0.37
		VIBURNUM DENTATUM (SOUTHERN ARROW WOOD)	FAC	FAC	Food	Robins, bluebirds, other thrushes, thrashers, catbirds, vireos	Fruit	Fall	0.20	1.83	0.37
		VIBURNUM PRUNIFOLIUM (BLACK-HAW)	FACU	FACU	Food, cover	Catbirds, thrashers, thrushes, cover and next sites for songbirds	Fruit, plant	Spring, fall	0.20	1.83	0.37
	14	ACER RUBRUM (RED MAPLE)[8]	FAC	FAC	Food	Finches, chickadees, squirrels, robins, goldfinches, other birds	Seeds, buds, flowers, plant	Spring, summer	0.50	1.83	0.95
		CARPINUS CAROLINIANA (AMERICAN HORNBEAM)	FAC	FAC	Food	Rufted grouse, bobwhite, pheasant, wild turkey, squirrel, rabbit, deer	Fruit	Summer, fall	0.50	1.83	0.95
		CERCIS CANADENSIS (EASTERN REDBUD)	UPL	FACU	Food	Honeybees, butterfly caterpillars	Flowers, leaves	Spring, summer	0.50	1.83	0.95
		CORNUS FLORIDA (FLOWERING DOGWOOD)	FACU	FACU	Food	Wild turkey, cardinal, cedar waxwing, robin, brown thrasher, wood thrush, rabbits	Flower, fruit	Spring, fall	0.50	1.83	0.95
		NYSSA SYLVATICA (BLACK GUM)	FAC	FAC	Food, cover	Song birds, waterfowl, small mammals	Fruit, plant	All	0.50	1.83	0.95
		PLATANUS OCCIDENTALIS (AMERICAN SYCAMORE)	FACW	FACW	Food, cover	Raccoons, opossum, wood duck, pileated and other woodpeckers	Fruit, Hollow trunks	All	0.50	1.83	0.95
SEEDING TOTALS									136.80		250.66

SEEDING QUANTITIES

AREA (SF): / AREA (AC):	SS1 1,109 0.03	SS2 1,138 0.03	SS3 1,154 0.03	SS4 1,155 0.03	SS5 249 0.01	SS6 249 0.01	RF1 2,720 0.06	RF2 19,878 0.46	RF3 15,574 0.36	SO1 6,882 0.16	SO2 12,840 0.29	SO3 15,834 0.36
	1.35	1.35	1.35	1.35	0.45	0.45	2.70	20.70	16.20	7.20	13.05	16.20
	1.35	1.35	1.35	1.35	0.45	0.45	2.70	20.70	16.20	7.20	13.05	16.20
	0.30	0.30	0.30	0.30	0.10	0.10	0.60	4.60	3.60	1.60	2.90	3.60
	0.30	0.30	0.30	0.30	0.10	0.10	0.60	4.60	3.60	1.60	2.90	3.60
	0.30	0.30	0.30	0.30	0.10	0.10	0.60	4.60	3.60	1.60	2.90	3.60
	0.30	0.30	0.30	0.30	0.10	0.10	0.60	4.60	3.60	1.60	2.90	3.60
	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.09	0.07	0.03	0.06	0.07
	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.09	0.07	0.03	0.06	0.07
	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.09	0.07	0.03	0.06	0.07
	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.09	0.07	0.03	0.06	0.07
	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.04	0.02	0.03	0.04
	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.04	0.02	0.03	0.04
	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.04	0.02	0.03	0.04
	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.04	0.02	0.03	0.04
	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.04	0.02	0.03	0.04
	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.04	0.02	0.03	0.04
	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.09	0.07	0.03	0.06	0.07
	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.09	0.07	0.03	0.06	0.07
	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.09	0.07	0.03	0.06	0.07
	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.09	0.07	0.03	0.06	0.07
	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.09	0.07	0.03	0.06	0.07
	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.09	0.07	0.03	0.06	0.07
	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.09	0.07	0.03	0.06	0.07
	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.09	0.07	0.03	0.06	0.07
	0.02	0.02	0.02	0.02	0.01	0.01	0.03	0.23	0.18	0.08	0.15	0.18
	0.02	0.02	0.02	0.02	0.01	0.01	0.03	0.23	0.18	0.08	0.15	0.18
	0.02	0.02	0.02	0.02	0.01	0.01	0.03	0.23	0.18	0.08	0.15	0.18
	0.02	0.02	0.02	0.02	0.01	0.01	0.03	0.23	0.18	0.08	0.15	0.18
	0.02	0.02	0.02	0.02	0.01	0.01	0.03	0.23	0.18	0.08	0.15	0.18
	0.02	0.02	0.02	0.02	0.01	0.01	0.03	0.23	0.18	0.08	0.15	0.18
	4.18	4.18	4.18	4.18	1.36	1.36	8.20	62.92	49.24	21.88	39.74	49.24

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PLANTING AND SEEDING NOTES:

1. It is expected and preferred that all species in each of the Species Groups are planted. The tolerances listed in this note are intended to incorporate flexibility according to species availability. At a minimum, Contractor to provide at least:
   a) 4 of the 5 species in Group 1,
   b) 5 of the 6 species in Group 2,
   c) 5 of the 6 species in Group 3,
   d) 3 of the 4 species in Group 4,
   e) 4 of the 5 species in Group 5,
   f) 3 of the 4 species in Group 6,
   g) all of the species in Group 7,
   h) all of the species in Group 8,
   i) all of the species in Group 9,
   j) 3 of the 4 species in Group 10,
   k) 3 of the 4 species in Group 11,
   l) 5 of the 6 species in Group 12,
   m) 5 of the 7 species in Group 13, (must include common milkweed)
   n) 4 of the 5 species in Group 14, and
   o) 5 of the 6 species in Group 15.
2. Substitutions for selected species based upon availability shall be requested in writing to engineer, documenting the lack of availability, If the flexibility inherent in the above schedule is still not sufficient, Engineer is under no obligation to approve substitutions.
3. The planted trees and shrubs shall be randomly spaced and species mixed throughout the planting areas.
4. Container rates and quantities shown for one gallon size. For purposes of substitution, two tubelings are the equivalent of one 1-gallon container plant in this schedule. Contractor may provide a mix of container and tubeling sizes for each species requirement, provided the ratio of tubelings to containers is not less than 2:1. Exception -- Group 6 (Stream Edge) shall be planted in accordance with Note #5.
5. Group 6 (Stream Edge) zone shall be planted with tubelings, or as livestakes. No one gallons are required to be used for any of this Group's species.
6. Stream Bank (Group 5) and Stream Edge (Group 6) zones shall be planted such that the combined mix of species is spaced approx. 3' O.C. and 1 plant per L.F. respectively. Live stake zones upstream of outer vane arm (Group 7) spaced at 1 plant per L.F. Live stake zones downstream of outer vane arm (Group 8) spaced at 4 plants per L.F.
7. All seeding rates are expressed in pounds of pure live seed (PLS).
8. If there is an abundance of existing or established maples on site, a substitution for maples may be made with an alternate species to avoid tapping into and adding to existing saturated seed bank. Final decision as to whether or not to plant maples will be made by engineer of record.

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COLE AVE STREAM RESTORATION
FINAL DESIGN
City Of Staunton, Virginia

Seeding Schedule

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COMMONWEALTH OF VIRGINIA
NATHAN A. STALEY
Lic. No. 047145
04/19/2024
PROFESSIONAL ENGINEER

REVISIONS

No.	Date	Description	Rev. By	App. By

SCALE: N/A
DATE: APRIL 2024

Horizontal Datum: N/A
Vertical Datum: N/A
Boundary and Topo Source: N/A

Design	Draft	Approved
JTS	JTS	NAS

Sheet # 27 of 27

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