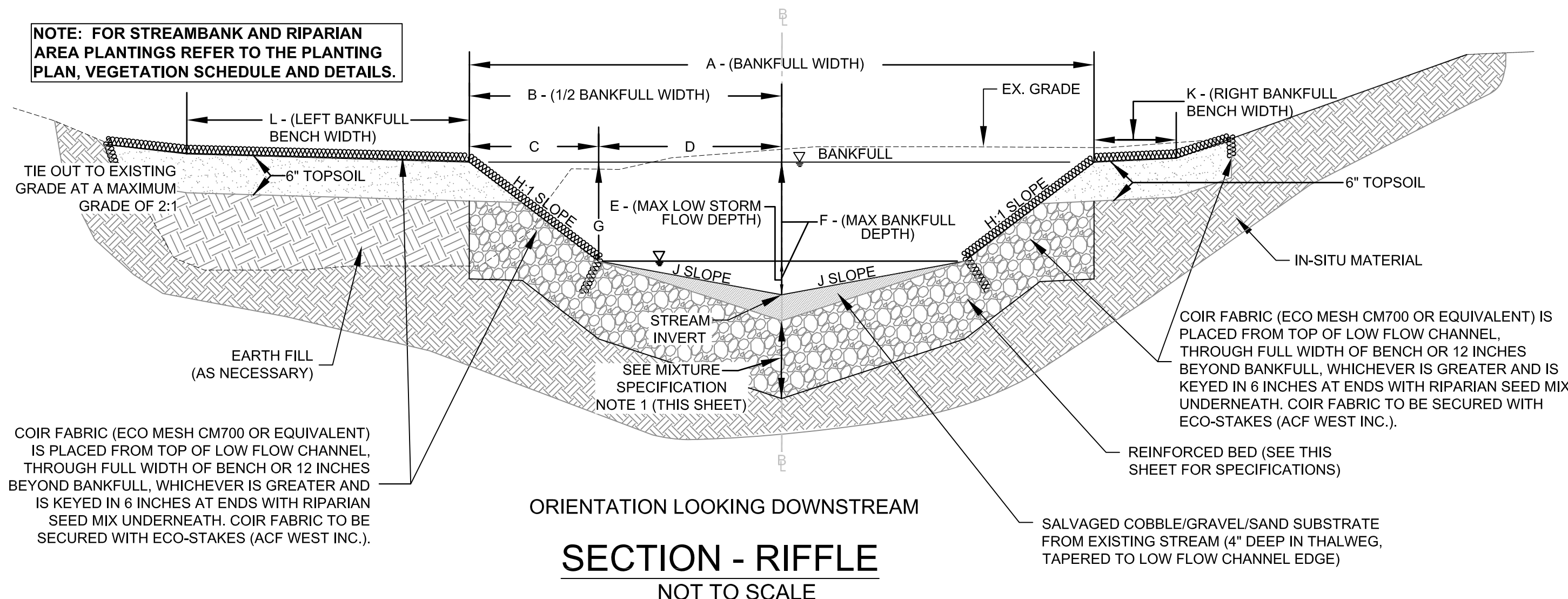


NOTE: FOR STREAMBANK AND RIPARIAN AREA PLANTINGS REFER TO THE PLANTING PLAN, VEGETATION SCHEDULE AND DETAILS.



COIR FABRIC (ECO MESH CM700 OR EQUIVALENT) IS PLACED FROM TOP OF LOW FLOW CHANNEL THROUGH FULL WIDTH OF BENCH OR 12 INCHES BEYOND BANKFULL, WHICHEVER IS GREATER AND IS KEYPED IN 6 INCHES AT ENDS WITH RIPARIAN SEED MIX UNDERNEATH. COIR FABRIC TO BE SECURED WITH ECO-STAKES (ACF WEST INC.).

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REINFORCED BED (SEE THIS SHEET FOR SPECIFICATIONS)

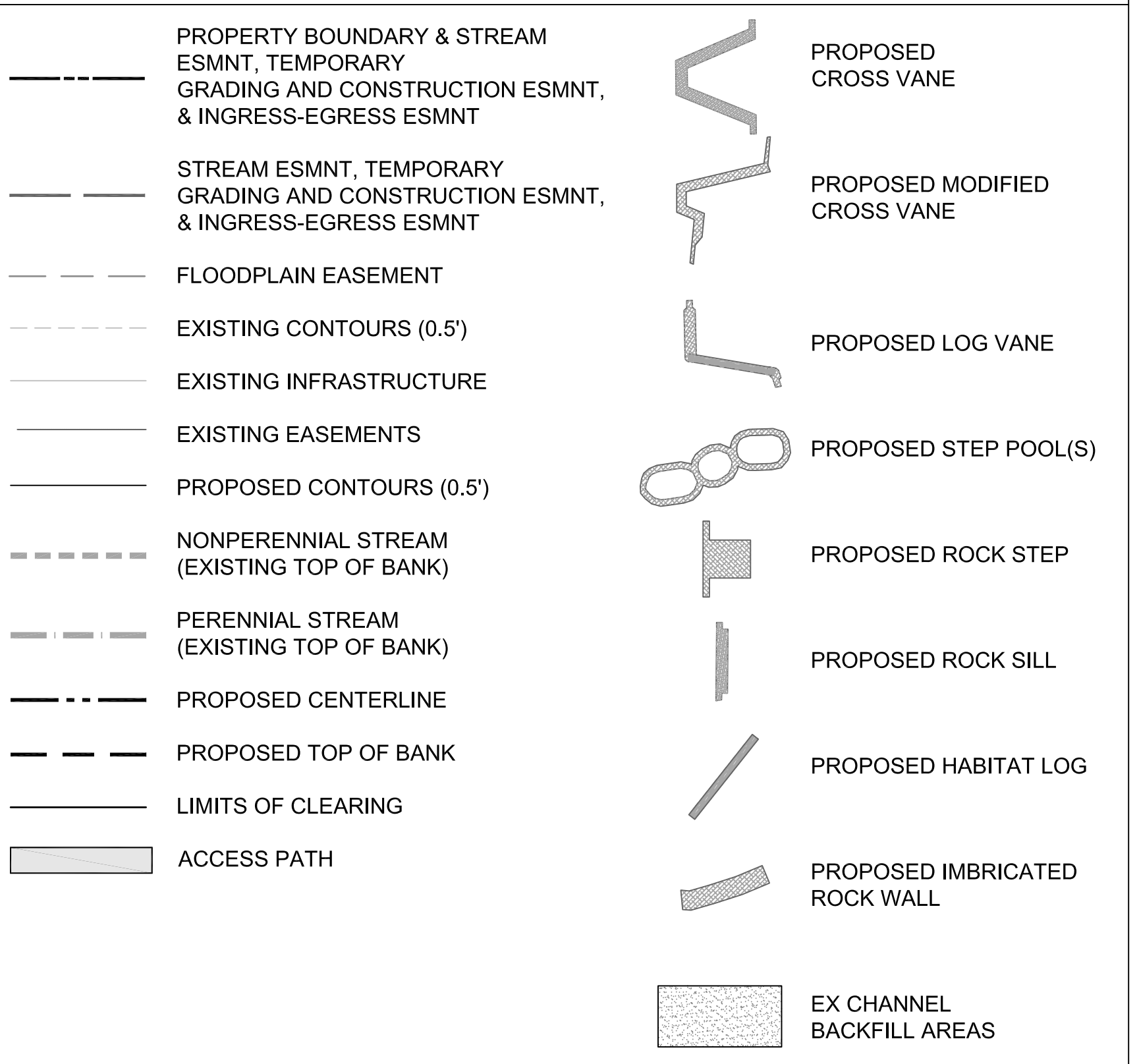
SALVAGED COBBLE/GRAVEL/SAND SUBSTRATE FROM EXISTING STREAM (4\"/>

SECTION - RIFFLE
NOT TO SCALE

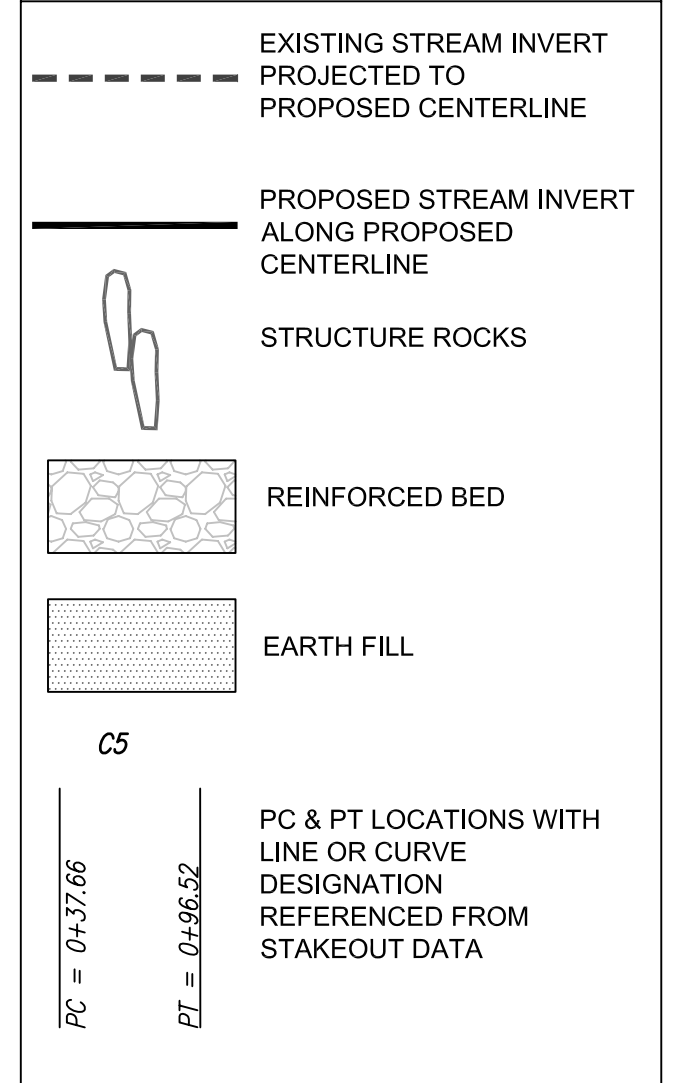
SECTION LOCATION ²	RIFFLE CROSS-SECTION DIMENSIONS													NOTES
	PER BASELINE STATION		CROSS SECTION PARAMETER (FT)											
REACH ID	FROM	TO	A	B	C	D	E	F	G	H	J ³	K	L	
REACH 4B ¹	10+00.00	16+60.00	19.0	9.5	3.6	5.9	0.7	1.9	1.2	3.0	11.9%	*	*	*VARIES - SEE GRADING PLAN
	16+60.00	33+84.91	20.0	10.0	4.2	5.8	0.7	2.1	1.4	3.0	12.1%	*	*	*VARIES - SEE GRADING PLAN
TRIBUTARY 1	10+00.00	10+38.08	3.0	1.5	0.6	0.9	0.1	0.3	0.2	3.0	11.1%	*	*	*VARIES - SEE GRADING PLAN
TRIBUTARY 2	10+00.00	10+74.15	6.0	3.0	1.9	1.1	0.2	1.0	0.8	2.5	17.8%	*	*	*VARIES - SEE GRADING PLAN
TRIBUTARY 3	10+00.00	10+33.55	3.0	1.5	0.6	0.9	0.1	0.3	0.2	3.0	11.1%	*	*	*VARIES - SEE GRADING PLAN
TRIBUTARY 4	10+00.00	10+77.58	4.0	2.0	1.0	1.0	0.1	0.5	0.4	2.5	10.0%	*	*	*VARIES - SEE GRADING PLAN

NOTES:
¹ LOW FLOW POOLS SHALL BE GRADED WITHIN THE RIFFLE SEGMENTS IDENTIFIED ABOVE. REFER TO THE GRADING PLAN AND LONGITUDINAL PROFILE SHEETS FOR PLACEMENT AND DEPTH OF ALL LOW FLOW POOLS.
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 AND IS GIVEN AS A PERCENTAGE.

GRADING LEGEND



PROFILE LEGEND



SEQUENCE OF CONSTRUCTION

- PRIOR TO THE START OF ANY EARTH DISTURBANCE THE CONTRACTOR SHALL NOTIFY COE IN ACCORDANCE WITH THE APPROVED PERMIT. IN ADDITION, AN ON-SITE PRE-CONSTRUCTION MEETING SHALL BE HELD TO ENSURE THAT ALL AFFECTED PARTIES (DESIGN ENGINEER, CONTRACTOR, COUNTY STAFF, OWNER, AND PROJECT MANAGER) FULLY UNDERSTAND THE CONSTRUCTION SEQUENCING.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING MISS UTILITY AT 1-800-552-7001 FOR THE LOCATION OF ALL PUBLIC AND PRIVATE UTILITY LINES, PIPES, CABLES, AND ASSOCIATED FEATURES PRIOR TO ANY CONSTRUCTION WORK; ALL UTILITIES SHALL BE CLEARLY IDENTIFIED PRIOR TO CONSTRUCTION.
- PRIOR TO ANY EARTH DISTURBING ACTIVITIES ALL NECESSARY EROSION AND SEDIMENT CONTROL MEASURES AND DEVICES SHALL BE INSTALLED AS SPECIFIED ON THE EROSION & SEDIMENT CONTROL PLAN SHEETS.
- STAKE OUT THE NEW STREAM ALIGNMENT AS SHOWN ON THE GEOMETRY PLAN SHEETS. PC AND PT POINTS SHALL BE STAKED ALONG THE CENTERLINE AND AT 25-FOOT OFFSETS, IDENTIFIED BY CORRESPONDING CENTERLINE STATION, ON EACH SIDE OF THE PROPOSED CHANNEL. THE CENTER OF EACH CURVE SHALL BE STAKED AND MARKED WITH THE CORRESPONDING RADIUS OF CURVATURE. VERTICAL CONTROL SHALL BE CLEARLY MARKED AT SEVERAL LOCATIONS ALONG THE PROPOSED CHANNEL.
- CONSTRUCTION SHALL PROCEED FROM UPSTREAM TO DOWNSTREAM, UNLESS AN ALTERNATIVE SEQUENCE IS APPROVED BY THE FIELD ENGINEER.
- NO WORK SHALL BE STARTED THAT CANNOT BE COMPLETED AND STABILIZED IN ONE DAY.
- EXCAVATE STREAM CHANNEL TO THE SUBGRADE.
- PLACE REINFORCED SUBSTRATE MIXTURE IN THE CHANNEL BOTTOM (SEE THIS SHEET FOR MIXTURE SPECIFICATIONS). PRIOR TO PLACING THE REINFORCED BED MATERIAL IN THE CHANNEL THE CONTRACTOR SHALL ENSURE A WELL GRADED BED MATERIAL IS PLACED THROUGHOUT THE CHANNEL. ADDITIONAL ON-SITE MIXING MAY BE NECESSARY.
- GRADE THE REMAINING PORTION OF THE CHANNEL AS SHOWN ON THE PLAN. TIE OUT SLOPES SHALL NOT EXCEED 2:1.
- UPON COMPLETION OF WORK, ALL E&S MEASURES ARE TO REMAIN IN PLACE UNTIL FINAL SITE STABILIZATION IS ACHIEVED, WITH THE EXCEPTION OF THE SANDBAG DIKES AND THE PUMP AROUND DIVERSION.

SUBSTRATE SIZING CALCULATION FOR THE REINFORCED BED

SHEAR STRESS:
 $\tau = \gamma \cdot D_{max} \cdot S$

WHERE

	REACH 4B	TRIB. 1	TRIB. 2	TRIB. 3	TRIB. 4
1. γ = SPECIFIC WEIGHT OF WATER, LB/CF	= 62.4 LB/CF	62.4 LB/CF	62.4 LB/CF	62.4 LB/CF	62.4 LB/CF
2. D_{max} = MAXIMUM RIFFLE DEPTH, FT	= 2.1 FT	0.30 FT	0.95 FT	0.30 FT	0.50 FT
3. S = MAXIMUM CHANNEL SLOPE, FT/FT	= 0.014 FT/FT	0.008 FT/FT	0.009 FT/FT	0.01 FT/FT	0.01 FT/FT

THEREFORE:
 SHEAR STRESS (τ) = 1.83 LBS/SF 0.15 LBS/SF 0.53 LBS/SF 0.19 LBS/SF 0.31 LBS/SF

SUBSTRATE PARTICLE SIZE:
 $D_{50} = 3.070 \cdot \tau^{1.042}$

WHERE: D_{50} = MIN. DIAMETER OF THE MEAN SUBSTRATE PARTICLE SIZE, IN.

THEREFORE:

D_{50} =	REACH 4B	TRIBUTARY 1	TRIBUTARY 2	TRIBUTARY 3	TRIBUTARY 4
	5.8 IN	0.4 IN	1.6 IN	0.5 IN	0.9 IN

SHEAR STRESS CALCULATIONS ARE TYPICALLY PERFORMED USING THE MEAN RIFFLE DEPTH. THE SHEAR STRESS CALCULATIONS ON THIS SHEET USE THE MAXIMUM RIFFLE DEPTH TO FURTHER INCREASE THE FACTOR OF SAFETY AND ENSURE STABILITY OF THE REINFORCED BED MATERIAL. THE ROCK FRACTION OF THE REINFORCED BED MATERIAL WAS SIZED USING THE CALCULATED MAXIMUM SHEAR STRESS. CALCULATIONS SHOW THAT THE D_{50} PARTICLE SIZE NEEDED TO ACHIEVE A STABLE STREAM BED IS 5.8 INCHES FOR REACH 4B, 0.4 INCHES FOR TRIBUTARY 1, 1.6 INCHES FOR TRIBUTARY 2, 0.5 INCHES FOR TRIBUTARY 3, AND 0.9 INCHES FOR TRIBUTARY 4. HOWEVER, TO ENSURE A SIGNIFICANT FACTOR OF SAFETY THE ROCK FRACTION OF THE REINFORCED BED SUBSTRATE SHALL HAVE A MINIMUM D_{50} OF 10.9" AND SHALL BE CONSTRUCTED USING CRUSHED ROCK (USING CAP-ROCK AND/OR CLASS A1 RIPRAP).

SHEAR STRESS COMPUTATIONS GENERALLY REPRESENT THE REQUIRED FORCE TO INITIATE MOVEMENT OF LOOSE, NON-IMBRICATED PARTICLES. GRAVEL, SAND, AND TOPSOIL SHALL BE MIXED WITH THE ROCK MATERIAL TO FILL THE VOID SPACES IN THE ROCKS AND ALLOW IMBRICATION AND ARMORING OF THE REINFORCED BED MATERIAL MIXTURE, FURTHER ENHANCING THE BED MATERIAL STABILITY. THE SMALLER BED MATERIAL FRACTIONS IMPROVE THE HABITAT AND 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 FORMED DURING CONSTRUCTION. THESE FINES ARE A NECESSARY COMPONENT OF THE BED MATERIAL SINCE A SIGNIFICANT UPSTREAM SEDIMENT SOURCE IS NOT OTHERWISE PROVIDED IN THIS FULLY RESTORED URBAN WATERSHED SYSTEM.

"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	10.9 in (277 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	LOAM OR SILT LOAM WITH 3-5% ORGANIC CONTENT	0.5 BUCKET	7 - 12%

- THE REINFORCED BED SHALL BE A MINIMUM OF 12" 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.
- THE ROCK PORTION OF THE MIXTURE SHALL CONSIST OF CRUSHED STONE (CLASS A1 RIPRAP). THE VOIDS FILLED WITH A MIXTURE OF SAND, GRAVEL, AND TOPSOIL. THE ANGULARITY OF THE CRUSHED ROCK, ALONG WITH THE FILLING OF THE VOIDS, 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. RIVER WASHED COBBLE (WHITE, TAN, YELLOW, OR BROWN) WITH THE SPECIFIED D_{50} SHALL BE AN ACCEPTABLE ALTERNATE AS LONG AS IT IS WELL GRADED IN SIZE DISTRIBUTION ($\pm 6\%$ FROM D_{50}) TO PROVIDE THE ARMOR NEEDED - SUBJECT TO ENGINEERS APPROVAL.
- 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).
- 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.

STREAM PROJECT CONSTRUCTION TOLERANCES

RIFFLE:
 DEPTH: ± 0.2 FT (TOTAL DEPTH AS WELL AS ACTUAL ELEVATION)
 WIDTH: $\pm 5\%$ OF DESIGN WIDTH (INCLUDES BOTH TOP WIDTH AND WIDTH AT BASE OF THE TIE-OUT SLOPE).

STEP POOLS/ROCK STEPS:

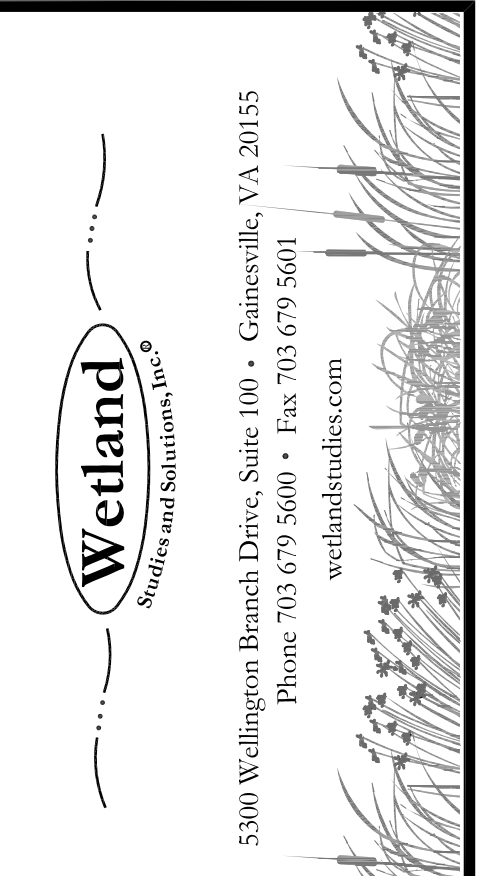
DESIGN DROP-HEIGHT (FT)	TOLERANCE (FT)	COMMENT
0.0 - 0.3	0.1	NO GREATER THAN 0.3' (NO POOL REINFORCEMENT REQUIRED)
0.3 - 0.7	0.1	NO GREATER THAN 0.7' (POOL LINED WITH REINFORCED BED MIX)
>0.7	0.1	POOL LINED WITH BOULDER REINFORCEMENT

HORIZONTAL LOCATION (ALONG THALWEG): ± 1.5 FT FROM DESIGN
 LATERAL LOCATION: ± 0.5 FT FROM DESIGN

CROSS VANES:

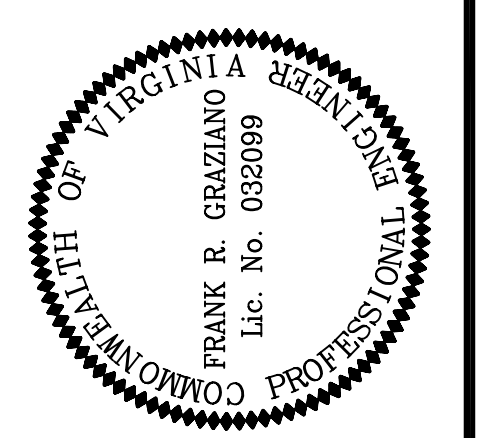
ARM SLOPE: $\pm 2\%$ FROM DESIGN SLOPE (AS LONG AS SLOPE IS BETWEEN 2-7%)
 DEFLECTION ANGLE: $\pm 3\%$ FROM DESIGN ANGLE (AS LONG AS BETWEEN 20-30")
 INVERT: ± 0.1 FT (ACTUAL ELEVATION)
 POOL DEPTH: ± 6 IN. (POOL LENGTHS MAY BE "OVER-DUG" UP TO 5 FT)
 HORIZONTAL HEAD OF STRUCTURE LOCATION ALONG THALWEG: ± 1.5 FT FROM DESIGN LOCATION
 LATERAL LOCATION: ± 0.5 FT FROM DESIGN LOCATION

NOTE: THE ABOVE TOLERANCES CAN BE ADJUSTED AS NECESSARY TO REFLECT FIELD CONDITIONS, WITH THE PRIOR WRITTEN APPROVAL OF THE DESIGN ENGINEER AND/OR HIS DESIGNATED REPRESENTATIVE IF THE ENGINEER DOES NOT BELIEVE THAT THE DESIGN INTEGRITY AND STABILITY OF THE WORK WILL BE AFFECTED. HOWEVER, ALL POINTS WITHIN A GIVEN STRUCTURE (STEP POOL, ROCK STEP, OR CROSS VANE) MUST BE SHIFTED EQUALLY TO MAINTAIN DIMENSIONAL INTEGRITY. ANY SUCH CHANGE MUST BE NOTED ON THE AS-BUILT DRAWING, INCLUDING THE JUSTIFICATION FOR THE CHANGE.



Northern Virginia Stream Restoration Bank
 The Glade - Reach 4B
 Fairfax County, Virginia

Construction Sequence, Sediment Sizing,
 Typical Cross Sections, & Construction Details
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No.	Date	Description	App. By	Rev. By

SCALE: N/A
 DATE: MAY 2009

Horizontal Datum: N/A		
Vertical Datum: N/A		
Boundary and Topo Source: N/A		
Design	Draft	Approved
SRP	NAS	FRG
Sheet #		
7 of 80		
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