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REVISIONS

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5/28/16

# MORPHOLOGICAL MEASUREMENTS TABLE

UT TO MUDDY CREEK  
-R1- Sta. 0+00.00 to Sta. 9+20.00

Variables	Existing Channel	Proposed Reach	USGS Station	Reference Reach
1. Stream type	C/E5	C5		CE 4/1
2. Drainage area	0.49 SQ MI (316 ACRES)	0.45 SQ MI (288 ACRES)		0.55 SQ MI (355 ACRES)
3. Bankfull width	Mean: 11.36 Range: 8.86-14.80	Mean: 12.00 Range:		Mean: 15.48 Range: 11.90-17.70
4. Bankfull mean depth	Mean: 0.72 Range: 0.58-0.85	Mean: 0.83 Range:		Mean: 1.29 Range: 1.23-1.41
5. Width/depth ratio	Mean: 15.56 Range: 13.65-17.48	Mean: 14.4 Range:		Mean: 12.97 Range: 11.42-14.37
6. Bankfull cross-sectional area	Mean: 10.77 Range: 5.93-14.00	Mean: 10.00 Range:		Mean: 21.33 Range: 20.00-22.70
7. Bankfull mean velocity	Mean: 5.38 Range:	Mean: 5.30 Range:		Mean: 2.90 Range:
8. Bankfull discharge, cfs	Mean: 53 Range:	Mean: 53 Range:		Mean: 58 Range:
9. Bankfull max depth	Mean: 1.60 Range: 0.96-2.37	Mean: 1.40 Range: 1.40-1.40		Mean: 1.94 Range: 1.60-2.12
10. Width of floodprone area	Mean: 118.67 Range: 48.69-180.00	Mean: >100.00 Range:		Mean: 171.25 Range: 162.00-186.00
11. Entrenchment ratio	Mean: 11.41 Range: 3.29-17.68	Mean: >2.2 Range:		Mean: 11.30 Range: 10.06-14.45
12. Meander length	Mean: 50.92 Range: 31.09-73.07	Mean: 95.10 Range: 80.10-102.00		Mean: 80.30 Range: 64.32-114.00
13. Ratio of meander length to bankfull width	Mean: 4.48 Range: 2.47-6.43	Mean: 7.93 Range: 6.68-8.50		Mean: 5.19 Range: 4.16-7.37
14. Radius of curvature	Mean: 22.22 Range: 10.01-32.89	Mean: 33.47 Range: 28.00-49.00		Mean: 18.44 Range: 11.73-25.30
15. Ratio of radius of curvature to bankfull width	Mean: 1.96 Range: 0.88-2.90	Mean: 2.79 Range: 2.33-4.08		Mean: 1.19 Range: 0.76-1.63
16. Belt width	Mean: 6.38 Range: 1.28-14.48	Mean: 21.91 Range: 11.52-41.14		Mean: 31.92 Range: 12.54-54.25
17. Meander width ratio	Mean: 0.56 Range: 0.11-1.27	Mean: 1.83 Range: 0.96-3.43		Mean: 2.06 Range: 0.81-3.51
18. Sinuosity (stream length/valley length)	Mean: 1.06 Range:	Mean: 1.12 Range:		Mean: 1.41 Range:
19. Valley slope	Mean: 0.00670 Range:	Mean: 0.00899 Range:		Mean: 0.01230 Range:
20. Average slope	Mean: 0.00632 Range:	Mean: 0.0080 Range: 0.0080-0.0080		Mean: 0.00872 Range:
21. Pool slope	Mean: 0.00606 Range: 0.00081-0.01136	Mean: 0.00194 Range: 0.00120-0.00200		Mean: 0.00221 Range: 0.00175-0.00267
22. Ratio of pool slope to average slope	Mean: 0.96 Range: 0.13-1.80	Mean: 0.24 Range: 0.15-0.25		Mean: 0.25 Range: 0.20-0.31
23. Maximum pool depth	Mean: 1.94 Range: 1.40-2.47	Mean: 1.83 Range: 1.83-1.83		Mean: 2.87 Range: 2.85-2.89
24. Ratio of pool depth to average bankfull depth	Mean: 2.71 Range: 1.95-3.45	Mean: 2.20 Range: 2.20-2.20		Mean: 2.22 Range: 2.21-2.23
25. Pool width	Mean: 11.69 Range: 9.16-14.22	Mean: 12.00 Range:		Mean: 16.30 Range: 12.60-20.00
26. Ratio of pool width to bankfull width	Mean: 1.03 Range: 0.81-1.25	Mean: 1.0 Range:		Mean: 1.05 Range: 0.81-1.29
27. Pool to pool spacing	Mean: 61.22 Range: 29.34-78.63	Mean: 53.50 Range: 39.00-62.00		Mean: 51.98 Range: 35.73-68.22
28. Ratio of pool to pool spacing to bankfull width	Mean: 5.39 Range: 2.58-6.92	Mean: 4.46 Range: 3.25-5.17		Mean: 3.36 Range: 2.31-4.41
29. Ratio of lowest bank height to bankfull height (or max bankfull depth)	Mean: N/A Range: N/A	Mean: 1.0 Range:		Mean: 1.06 Range: 1.0-1.15

PROJECT REFERENCE NO. U-2707	SHEET NO. NS-1
RW SHEET NO.	

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REVISIONS

# MORPHOLOGICAL MEASUREMENTS TABLE

## UT TO MUDDY CREEK -R1- Sta. 9+20.00 to Sta. 18+00.00

Variables	Existing Channel	Proposed Reach	USGS Station	Reference Reach
1. Stream type	C/E5	C5		CE 4/1
2. Drainage area	0.49 SQ MI (316 ACRES)	0.49 SQ MI (316 ACRES)		0.55 SQ MI (355 ACRES)
3. Bankfull width	Mean: 11.36 Range: 8.86-14.80	Mean: 13.96 Range:		Mean: 15.48 Range: 11.90-17.70
4. Bankfull mean depth	Mean: 0.72 Range: 0.58-0.85	Mean: 1.07 Range:		Mean: 1.29 Range: 1.23-1.41
5. Width/depth ratio	Mean: 15.56 Range: 13.65-17.48	Mean: 13.00 Range:		Mean: 12.97 Range: 11.42-14.37
6. Bankfull cross-sectional area	Mean: 10.77 Range: 5.93-14.00	Mean: 15.00 Range:		Mean: 21.33 Range: 20.00-22.70
7. Bankfull mean velocity	Mean: 5.38 Range:	Mean: 3.53 Range:		Mean: 2.90 Range:
8. Bankfull discharge, cfs	Mean: 53 Range:	Mean: 53 Range:		Mean: 58 Range:
9. Bankfull max depth	Mean: 1.60 Range: 0.96-2.37	Mean: 1.75 Range: 1.61-1.76		Mean: 1.94 Range: 1.60-2.12
10. Width of floodprone area	Mean: 118.67 Range: 48.69-180.00	Mean: >100.00 Range:		Mean: 171.25 Range: 162.00-186.00
11. Entrenchment ratio	Mean: 11.41 Range: 3.29-17.68	Mean: >2.2 Range:		Mean: 11.30 Range: 10.06-14.45
12. Meander length	Mean: 50.92 Range: 31.09-73.07	Mean: 97.48 Range: 91.07-120.51		Mean: 80.30 Range: 64.32-114.00
13. Ratio of meander length to bankfull width	Mean: 4.48 Range: 2.47-6.43	Mean: 6.96 Range: 6.51-8.61		Mean: 5.19 Range: 4.16-7.37
14. Radius of curvature	Mean: 22.22 Range: 10.01-32.89	Mean: 33.88 Range: 28.00-49.00		Mean: 18.44 Range: 11.73-25.30
15. Ratio of radius of curvature to bankfull width	Mean: 1.96 Range: 0.88-2.90	Mean: 2.42 Range: 2.0-3.5		Mean: 1.19 Range: 0.76-1.63
16. Belt width	Mean: 6.38 Range: 1.28-14.48	Mean: 23.20 Range: 12.00-44.00		Mean: 31.92 Range: 12.54-54.25
17. Meander width ratio	Mean: 0.56 Range: 0.11-1.27	Mean: 1.66 Range: 0.86-3.14		Mean: 2.06 Range: 0.81-3.51
18. Sinuosity (stream length/valley length)	Mean: 1.06 Range:	Mean: 1.13 Range:		Mean: 1.41 Range:
19. Valley slope	Mean: 0.00670 Range:	Mean: 0.00498 Range:		Mean: 0.01230 Range:
20. Average slope	Mean: 0.00632 Range:	Mean: 0.0044 Range: 0.0044-0.0044		Mean: 0.00872 Range:
21. Pool slope	Mean: 0.00606 Range: 0.00081-0.01136	Mean: 0.00117 Range: 0.00110-0.00130		Mean: 0.00221 Range: 0.00175-0.00267
22. Ratio of pool slope to average slope	Mean: 0.96 Range: 0.13-1.80	Mean: 0.27 Range: 0.25-0.30		Mean: 0.25 Range: 0.20-0.31
23. Maximum pool depth	Mean: 1.94 Range: 1.40-2.47	Mean: 2.40 Range: 2.40-2.40		Mean: 2.87 Range: 2.85-2.89
24. Ratio of pool depth to average bankfull depth	Mean: 2.71 Range: 1.95-3.45	Mean: 2.40 Range: 2.40-2.40		Mean: 2.22 Range: 2.21-2.23
25. Pool width	Mean: 11.69 Range: 9.16-14.22	Mean: 14.00 Range:		Mean: 16.30 Range: 12.60-20.00
26. Ratio of pool width to bankfull width	Mean: 1.03 Range: 0.81-1.25	Mean: 1.0 Range:		Mean: 1.05 Range: 0.81-1.29
27. Pool to pool spacing	Mean: 61.22 Range: 29.34-78.63	Mean: 56.20 Range: 50.00-71.00		Mean: 51.98 Range: 35.73-68.22
28. Ratio of pool to pool spacing to bankfull width	Mean: 5.39 Range: 2.58-6.92	Mean: 4.01 Range: 3.57-5.07		Mean: 3.36 Range: 2.31-4.41
29. Ratio of lowest bank height to bankfull height (or max bankfull depth)	Mean: N/A Range: N/A	Mean: 1.0 Range:		Mean: 1.06 Range: 1.0-1.15

PROJECT REFERENCE NO. U-2707	SHEET NO. NS-2
RW SHEET NO.	

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5/28/19

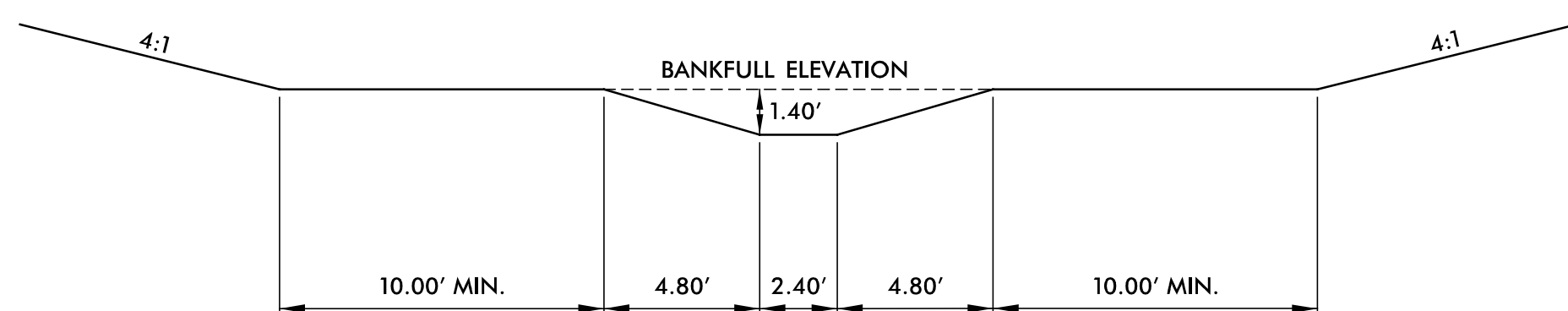
REVISIONS

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RW SHEET NO.	
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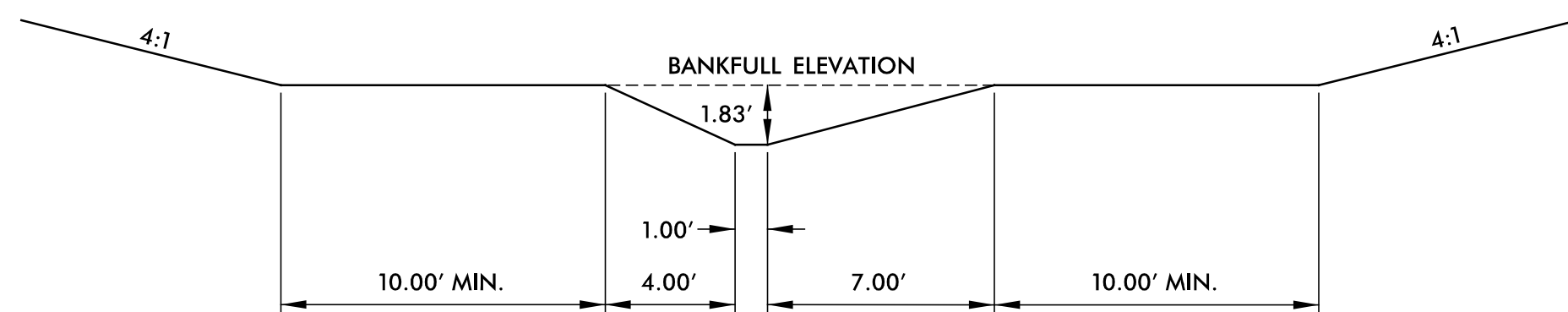
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***RI***  
***Sta. 0 + 00.00 to 9 + 20.00***

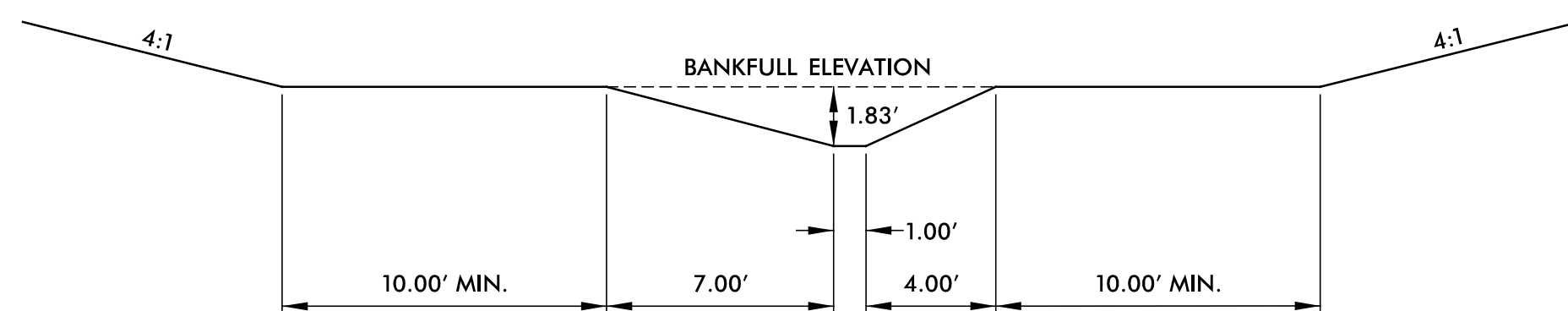
TYPICAL SECTION RIFFLE  
 BANKFULL AREA 10.0 SQ FT



TYPICAL SECTION POOL LEFT  
 BANKFULL AREA 11.9 SQ FT

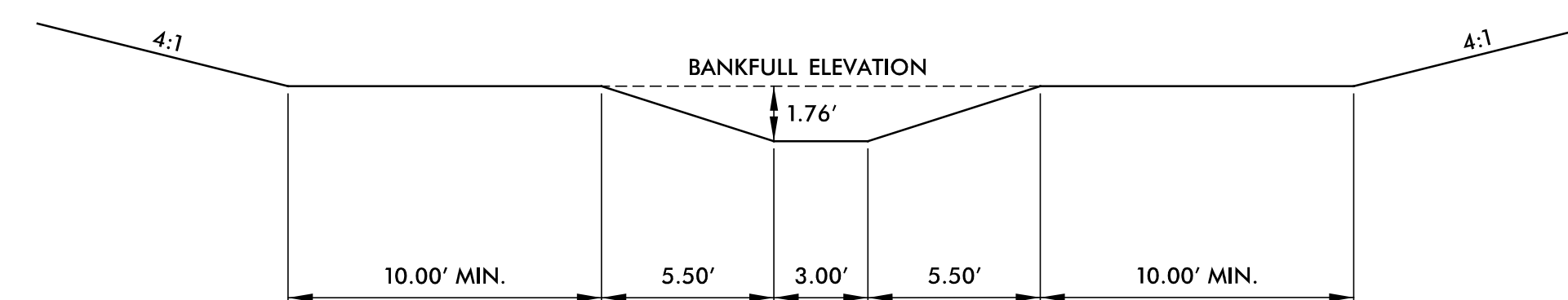


TYPICAL SECTION POOL RIGHT  
 BANKFULL AREA 11.9 SQ FT

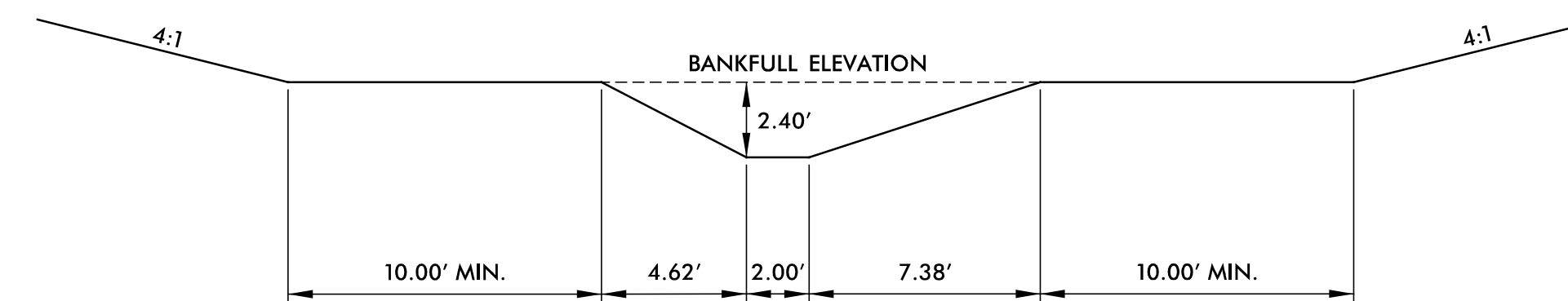


***RI***  
***Sta. 9 + 20.00 to 18 + 00.00***

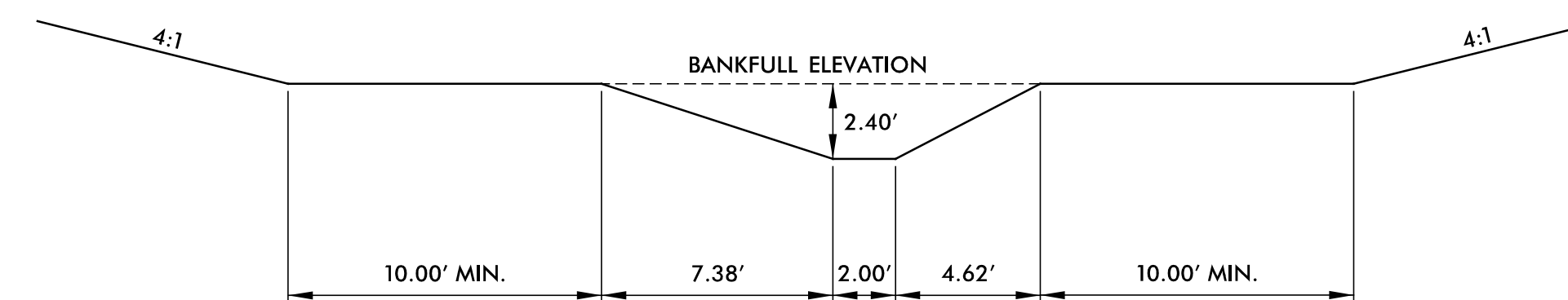
TYPICAL SECTION RIFFLE  
 BANKFULL AREA 15.0 SQ FT



TYPICAL SECTION POOL LEFT  
 BANKFULL AREA 19.2 SQ FT



TYPICAL SECTION POOL RIGHT  
 BANKFULL AREA 19.2 SQ FT

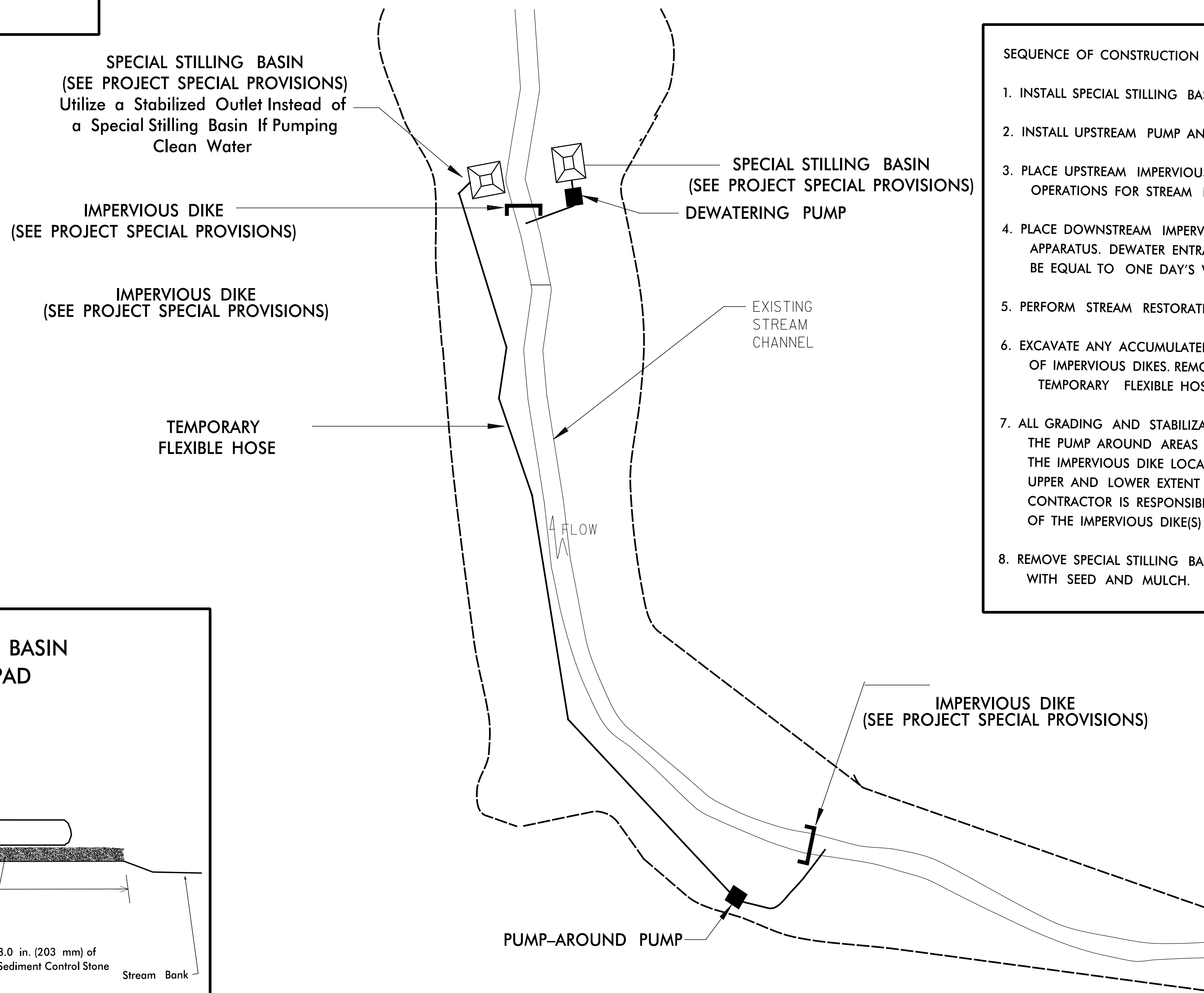


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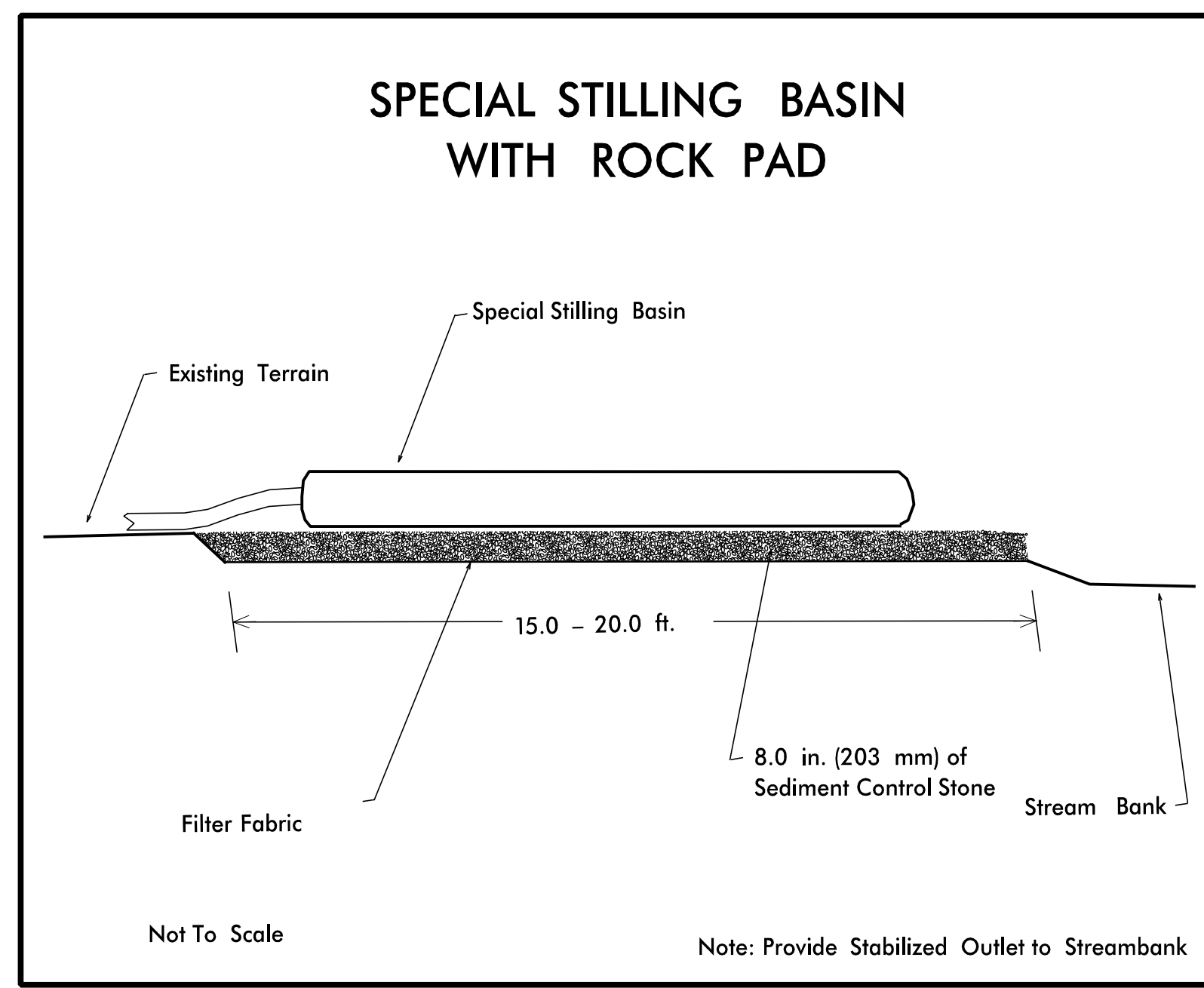
**NOTES:**

- 1) All excavation shall be performed in only dry or isolated sections of channel.
- 2) Impervious dikes are to be used to isolate work from stream flow when necessary.
- 3) All graded areas shall be stabilized within 24 hours.
- 4) Maintenance of stream flow operations shall be incidental to the work. This includes polyethylene sheeting, diversion pipes, pumps and hoses.
- 5) Pumps and hoses shall be of sufficient size to dewater the work area.

## EXAMPLE OF PUMP-AROUND OPERATION



- SEQUENCE OF CONSTRUCTION FOR TYPICAL WORK AREA
1. INSTALL SPECIAL STILLING BASIN(S)..
  2. INSTALL UPSTREAM PUMP AND TEMPORARY FLEXIBLE HOSE.
  3. PLACE UPSTREAM IMPERVIOUS DIKE AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION.
  4. PLACE DOWNSTREAM IMPERVIOUS DIKE AND PUMPING APPARATUS. DEWATER ENTRAPPED AREA. AREA TO BE DEWATERED SHALL BE EQUAL TO ONE DAY'S WORK.
  5. PERFORM STREAM RESTORATION WORK IN ACCORDANCE WITH THE PLANS.
  6. EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF IMPERVIOUS DIKES. REMOVE IMPERVIOUS DIKES, PUMPS, AND TEMPORARY FLEXIBLE HOSE. (DOWNSTREAM IMPERVIOUS DIKES FIRST).
  7. ALL GRADING AND STABILIZATION MUST BE COMPLETED IN ONE DAY WITHIN THE PUMP AROUND AREAS BETWEEN THE IMPERVIOUS DIKES. THE IMPERVIOUS DIKE LOCATIONS AS SHOWN ON THIS SHEET ONLY SHOW THE UPPER AND LOWER EXTENT OF WORK FOR EACH STREAM SEGMENT. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE LOCATION OF THE IMPERVIOUS DIKE(S) FOR EACH DAY'S WORK.
  8. REMOVE SPECIAL STILLING BASIN(S) AND BACKFILL. STABILIZE DISTURBED AREA WITH SEED AND MULCH.

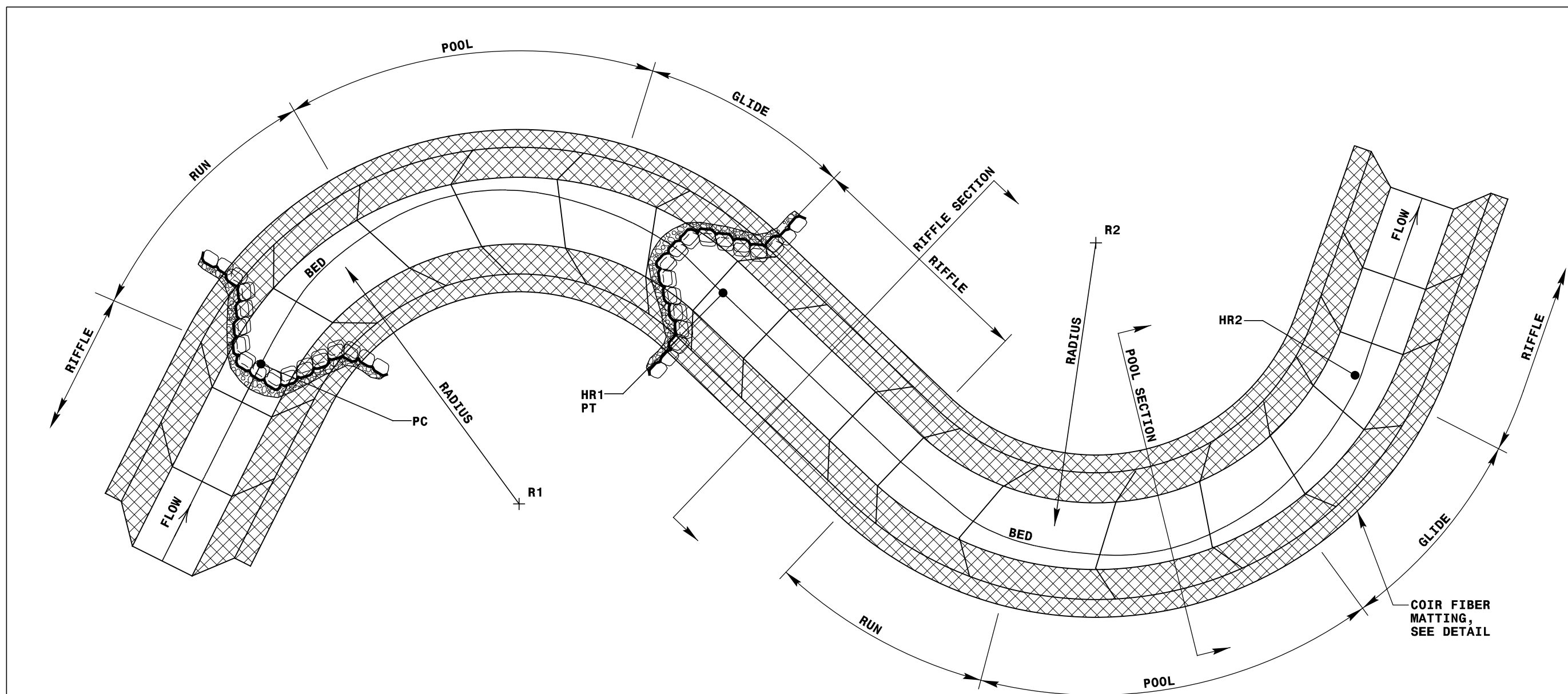


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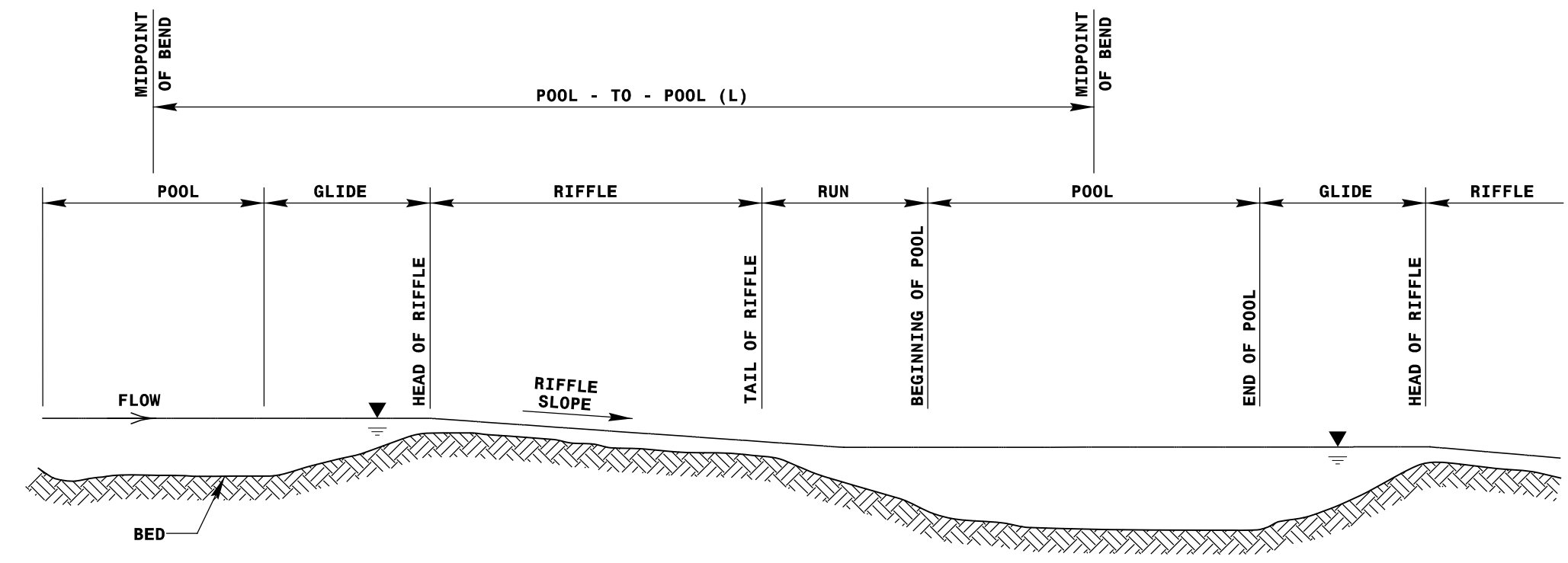
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8/13/19 AM

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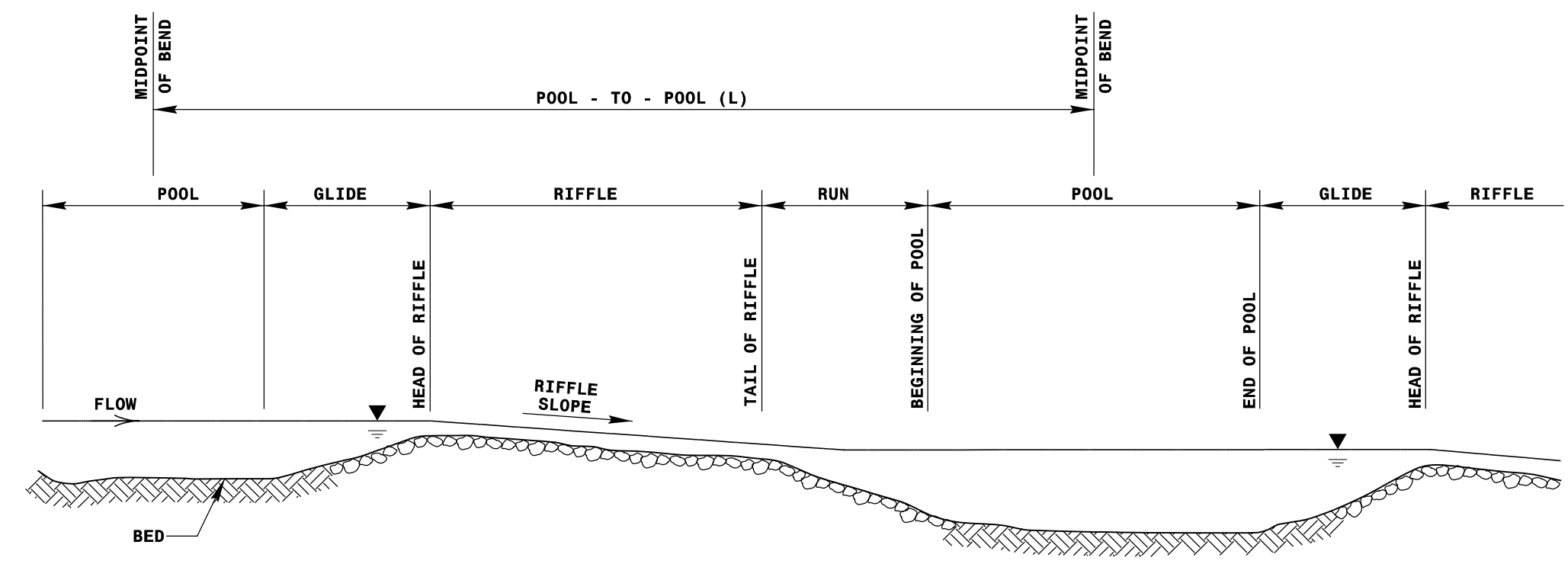
REVISIONS



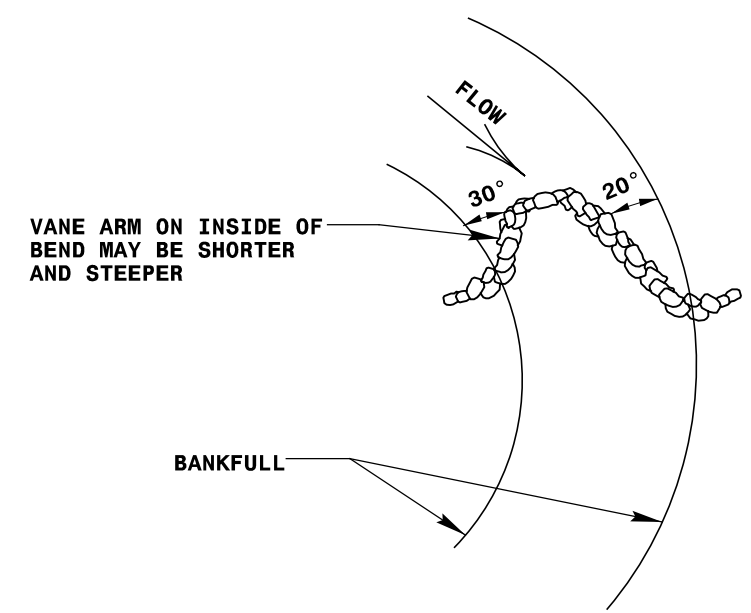
TYPICAL PLAN



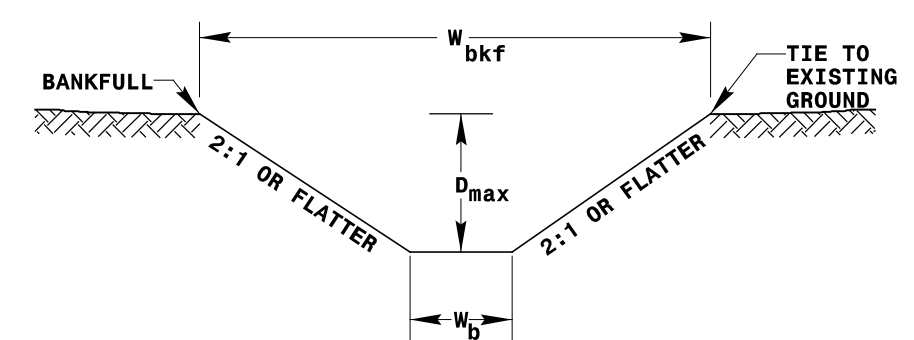
TYPICAL PROFILE



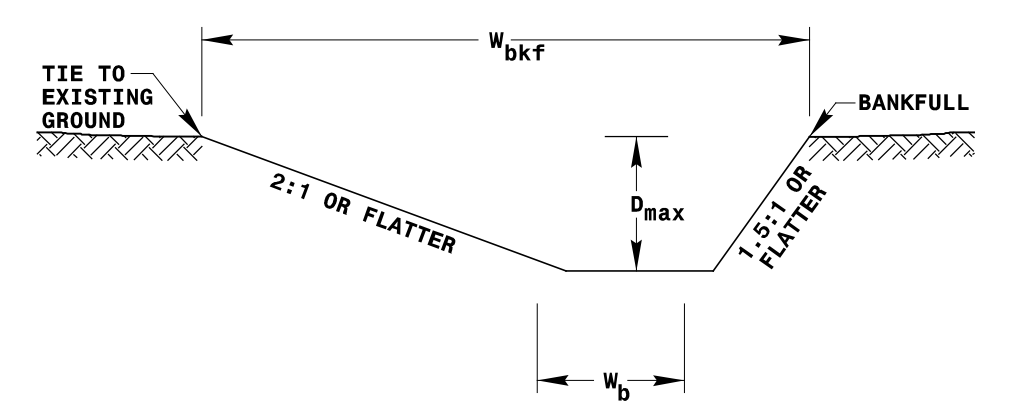
TYPICAL PROFILE FOR ARMORED RIFFLE SECTION



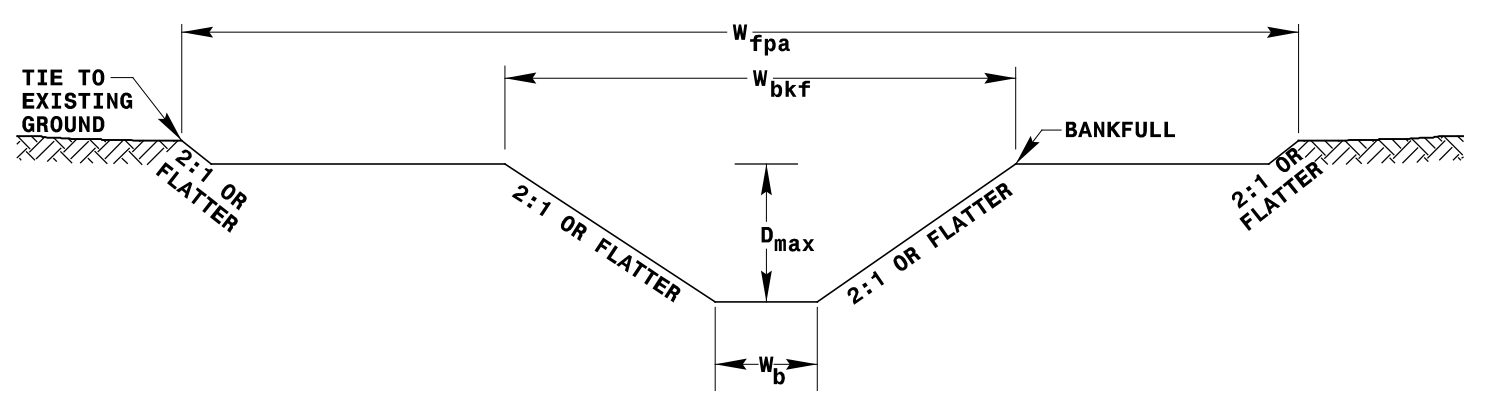
CROSS VANE CONSTRUCTION IN MEANDER-BEND PLAN VIEW



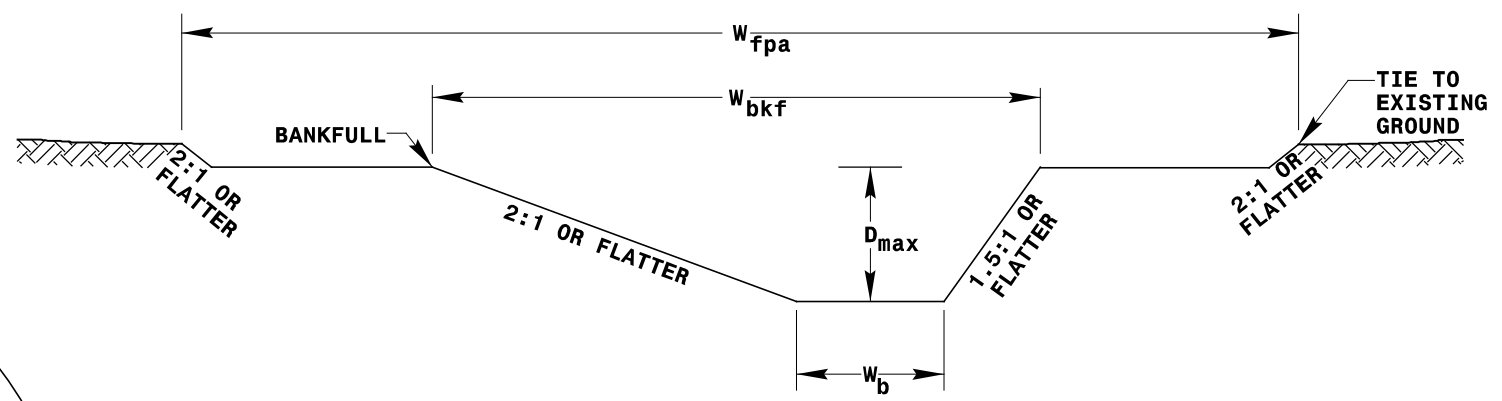
TYPICAL RIFFLE



TYPICAL POOL



TYPICAL RIFFLE WITH BANKFULL BENCH



TYPICAL POOL WITH BANKFULL BENCH

$W_{bkf}$  = BANKFULL WIDTH  
 $D_{max}$  = MAXIMUM DEPTH  
 $W_b$  = BOTTOM WIDTH  
 $W_{fpa}$  = FLOOD PRONE AREA WIDTH

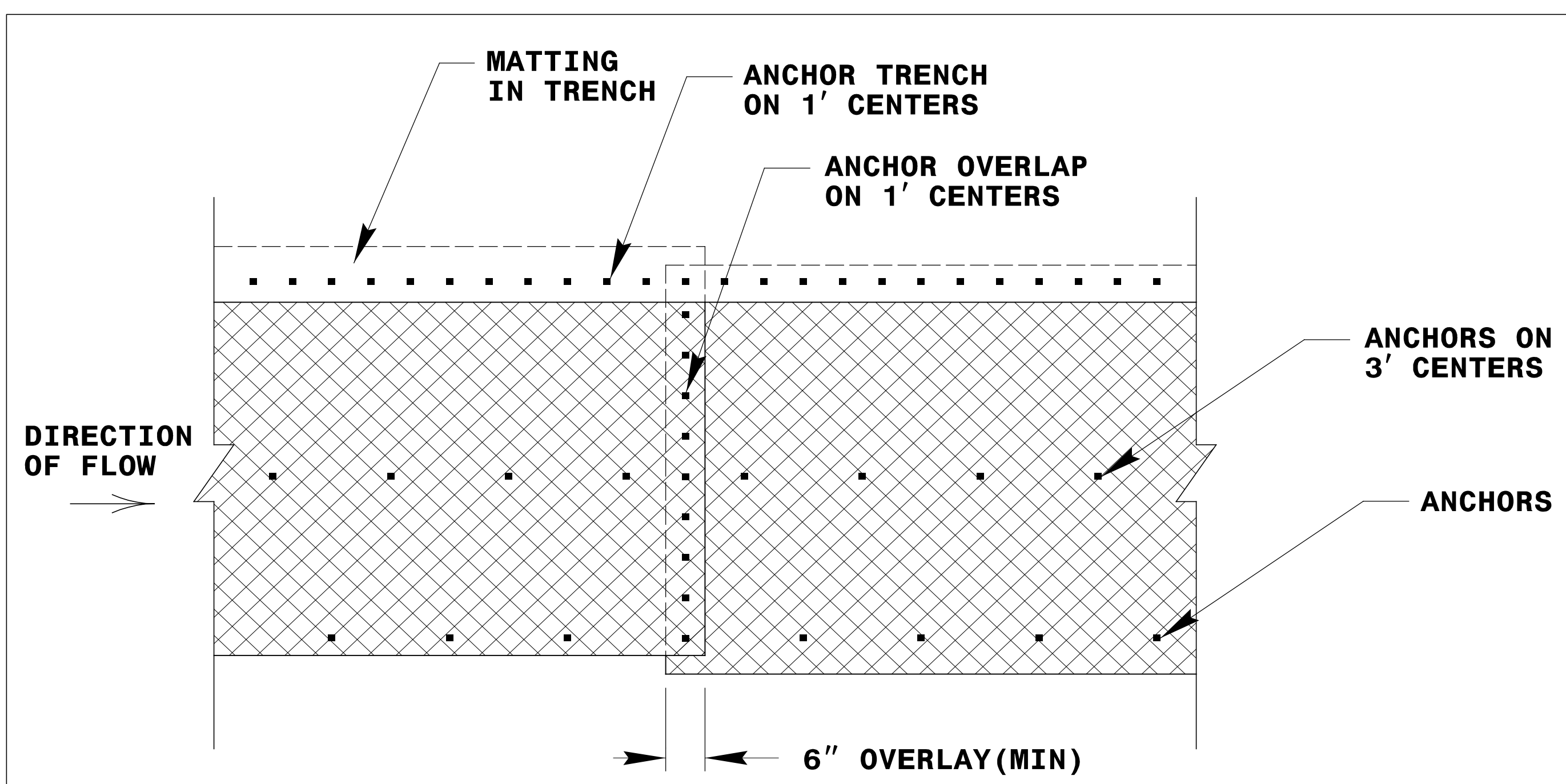
REACH	RIFFLE				POOL				Width/Depth Ratio
	$W_{bkf}$	$D_{max}$	$W_b$	$W_{fpa}$	$W_{bkf}$	$D_{max}$	$W_b$	$W_{fpa}$	
REACH R1									
Sta. 0+00 - Sta. 9+20	12.0	1.40	2.40	>35	12.0	1.83	1.00	>35	14.4
Sta. 9+20 - Sta. 18+00	14.0	1.76	3.00	>35	14.0	2.40	2.00	>35	13.0
REACH R2									
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

NOTES:  
 1. THE COORDINATES FOR EACH CENTER OF RADIUS (EX. "R1", "R2") AND EACH HEAD OF RIFFLE (EX. "HR1", "HR2") ARE INDICATED ON THE PLAN SHEETS.

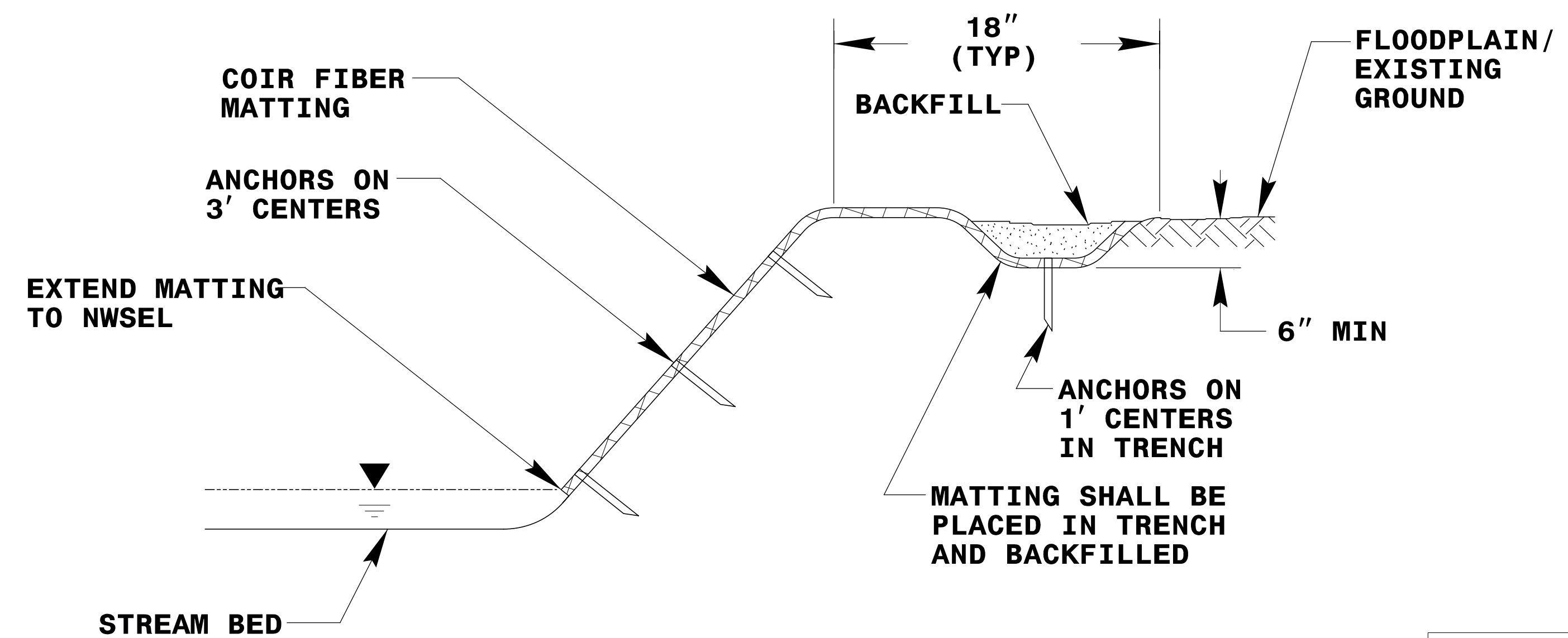
CHANNEL TYPICAL DETAIL  
NOT TO SCALE

PROJECT REFERENCE NO. U-2707	SHEET NO. NS-6
RW SHEET NO.	
HYDRAULICS ENGINEER 2/19/2019 NORTH CAROLINA PROFESSIONAL SEAL 036254 EMMETT PERDUE DocuSign Emmett Perdue 777E39AC4947D	

REVISIONS



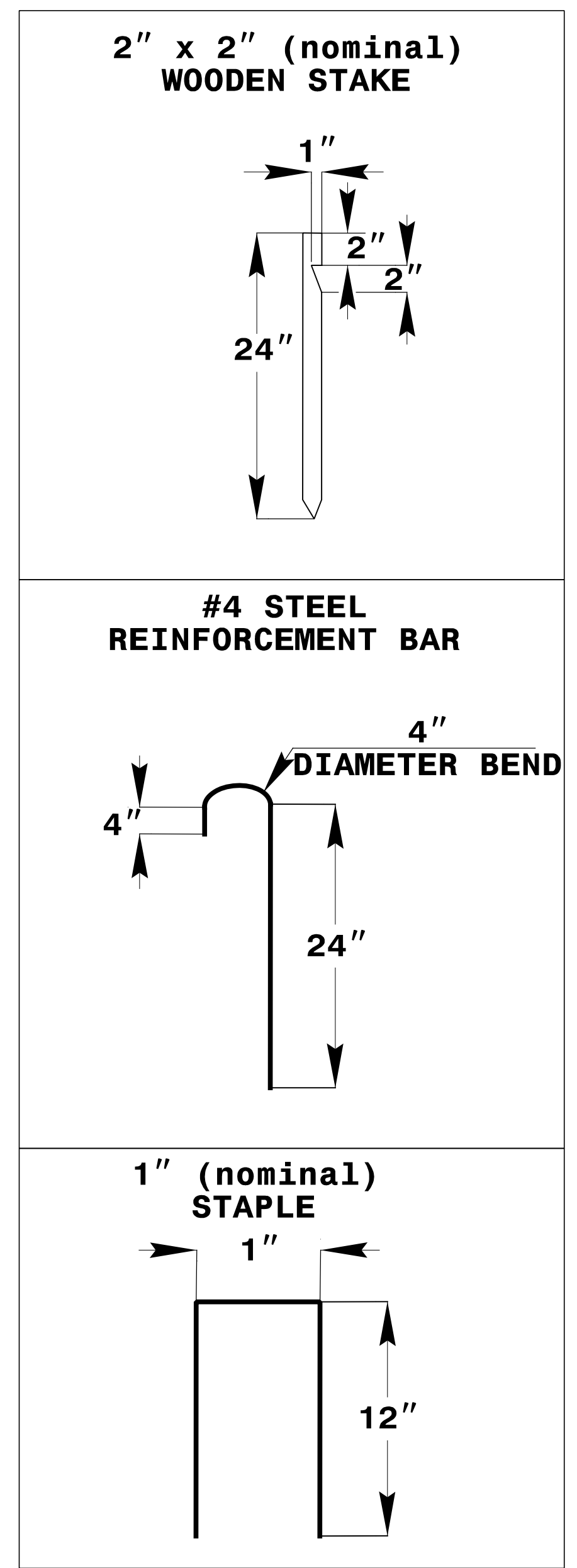
**PLAN VIEW**



**TYPICAL CROSS SECTION**

**COIR FIBER MATTING DETAIL**

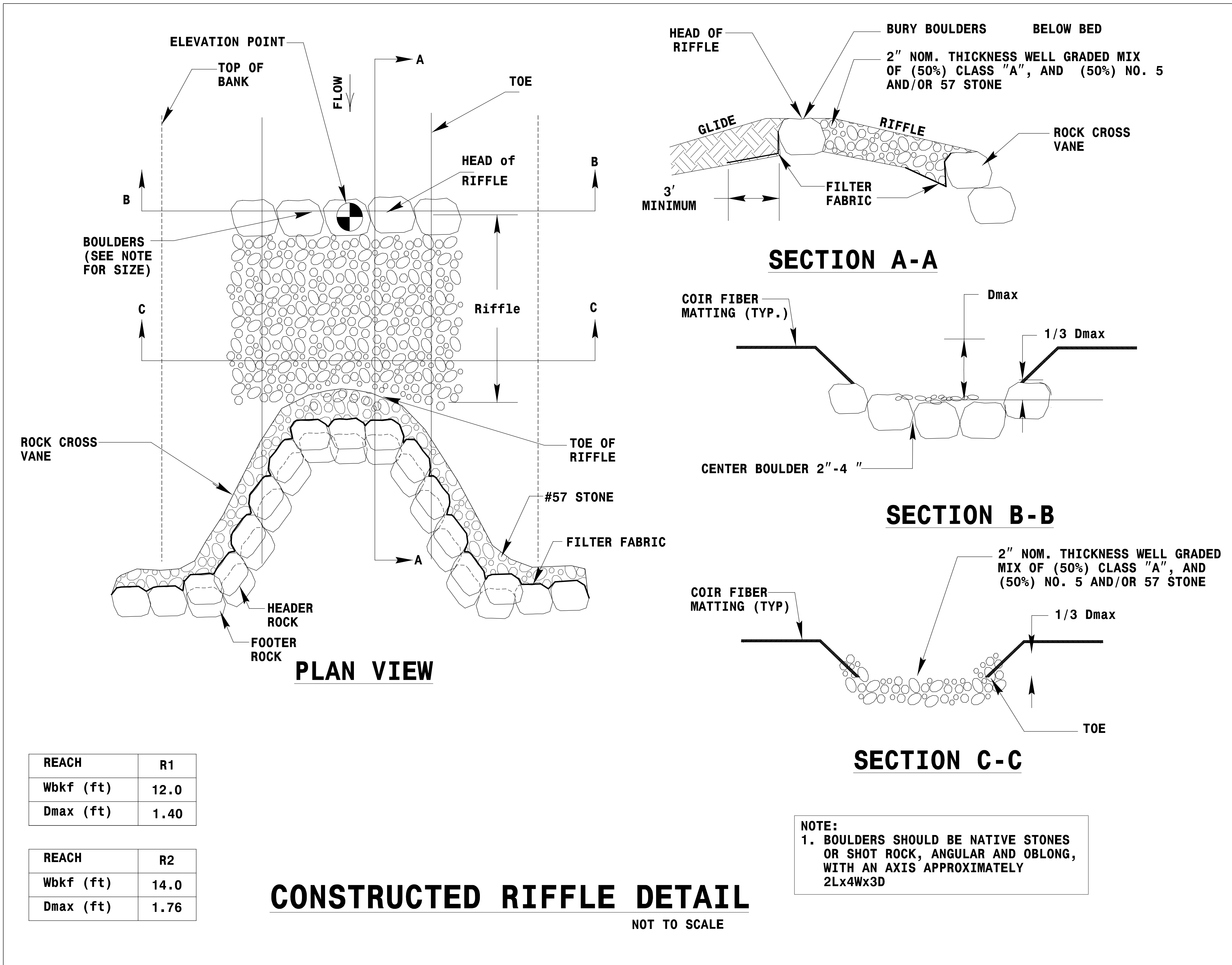
NOT TO SCALE



**ANCHOR OPTIONS**

- NOTES:**
1. IN AREAS TO BE MATTED, ALL SEEDING, SOIL AMENDMENTS, AND SOIL PREPARATION MUST BE COMPLETED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS PRIOR TO PLACEMENT OF COIR FIBER MATTING.
  2. REBAR OR STAPLES MAY BE USED IN PLACE OF WOODEN STAKES AS DIRECTED BY THE ENGINEER.

PROJECT REFERENCE NO. U-2707	SHEET NO. NS-7
RW SHEET NO.	
HYDRAULICS ENGINEER 2/19/2016 NORTH CAROLINA PROFESSIONAL SEAL 036254 EMMETT PERDUE DocuSign Emmett Perdue 772739AC434947D	



REACH	R1
Wbkf (ft)	12.0
Dmax (ft)	1.40

REACH	R2
Wbkf (ft)	14.0
Dmax (ft)	1.76

### CONSTRUCTED RIFFLE DETAIL

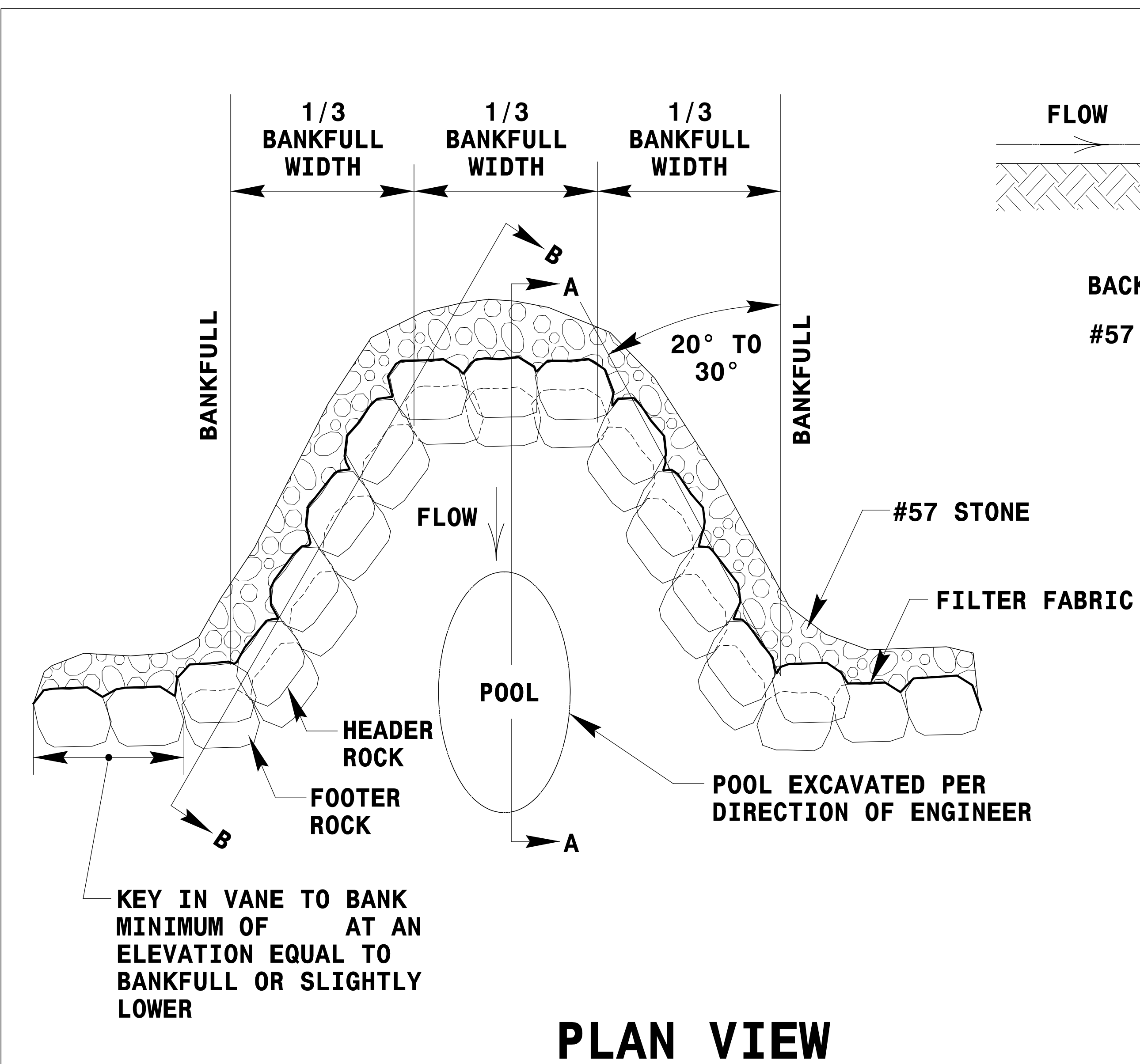
NOT TO SCALE

**NOTE:**  
 1. BOULDERS SHOULD BE NATIVE STONES OR SHOT ROCK, ANGULAR AND OBLONG, WITH AN AXIS APPROXIMATELY 2Lx4Wx3D



5/28/16

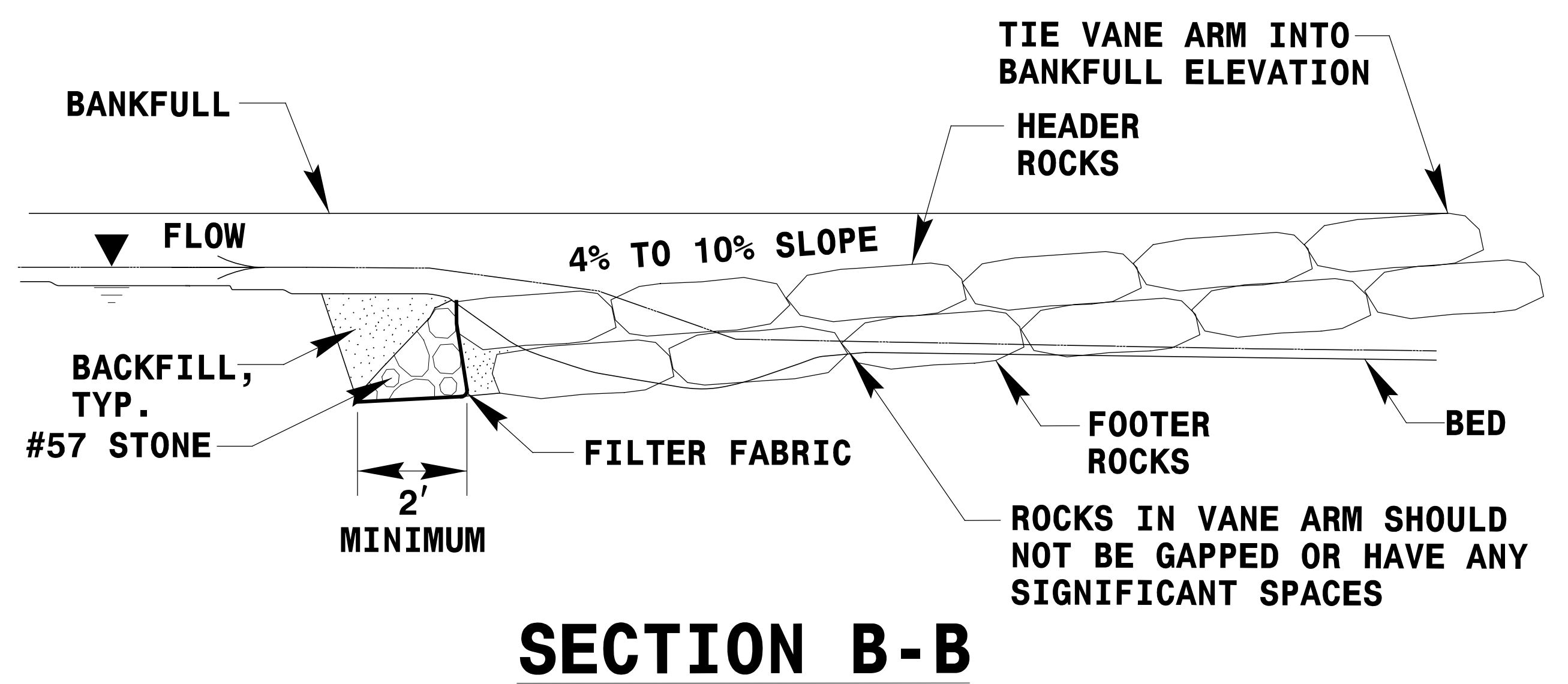
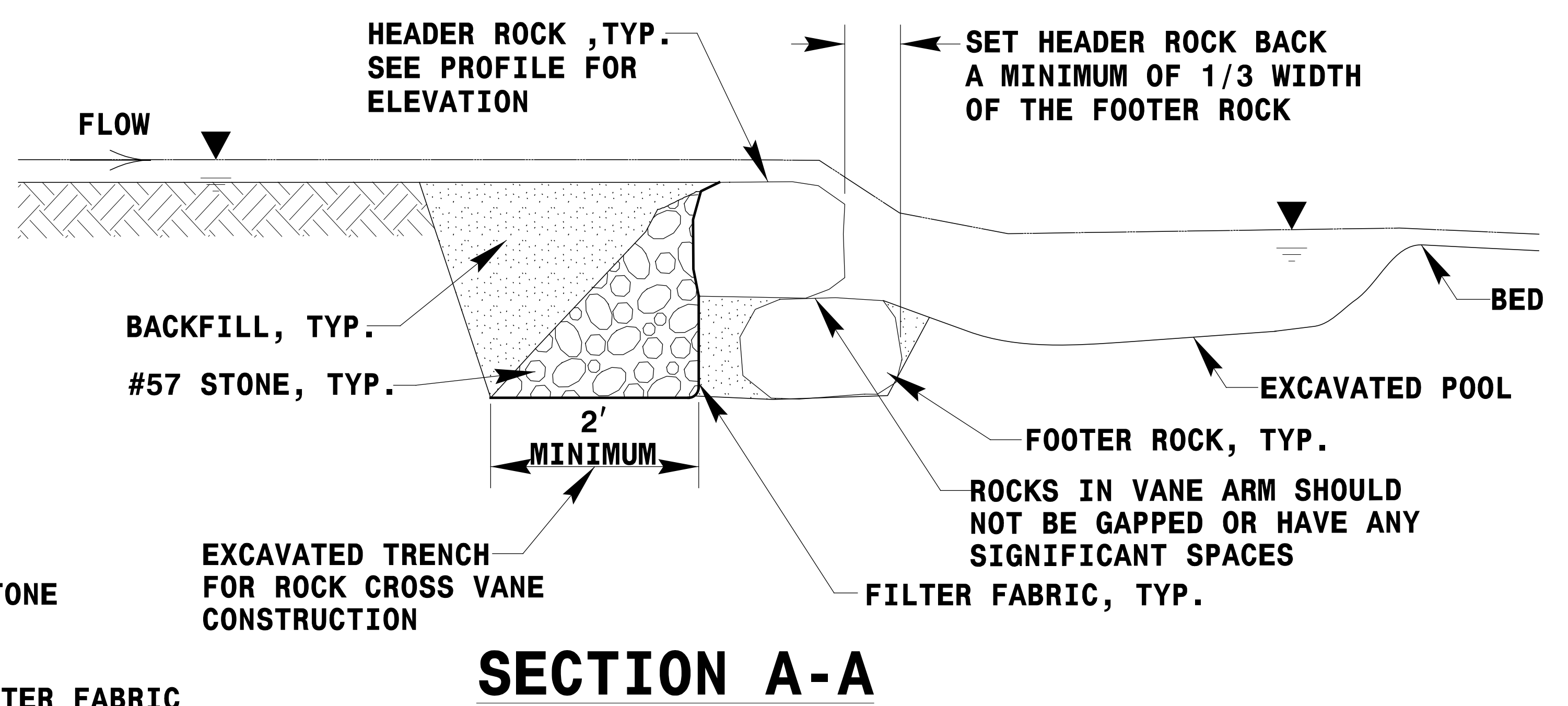
PROJECT REFERENCE NO. U-2707	SHEET NO. NS-8
RW SHEET NO.	
HYDRAULICS ENGINEER 2/19/2016 NORTH CAROLINA PROFESSIONAL SEAL 036254 EMMETT PERDUE Emmett Perdue	



REACH	BOULDER DIMENSIONS (FT)		
	HEIGHT	LENGTH	WIDTH
R1	2	4	3
R2	2	4	3

# ROCK CROSS VANE DETAIL

NOT TO SCALE



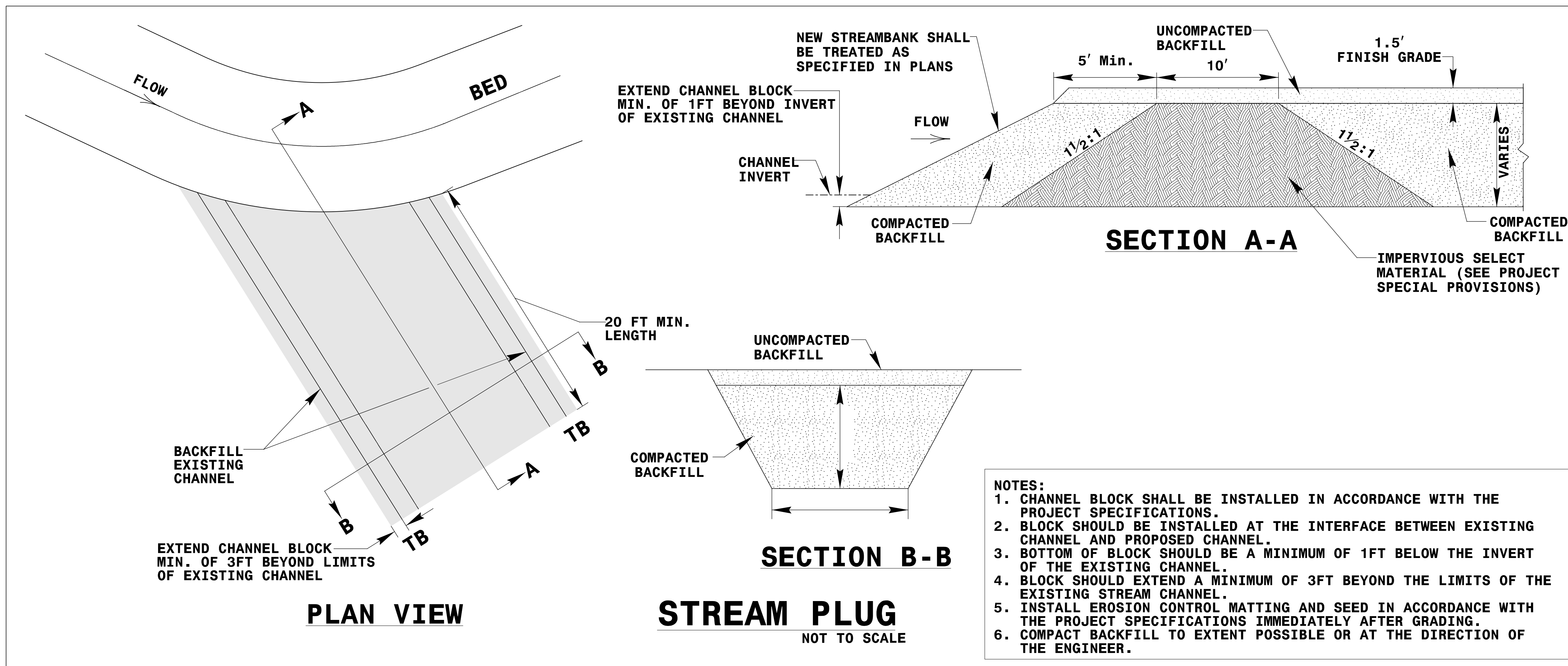
- NOTES:**
1. DEEPEST PART OF POOL TO BE IN LINE WITH WHERE VANE ARM TIES INTO BANKFULL.
  2. DO NOT EXCAVATE POOL TOO CLOSE TO FOOTER BOULDERS.
  3. CLASS "A" STONE CAN BE USED TO REDUCE VOIDS BETWEEN HEADERS AND FOOTERS.
  4. COMPACT BACKFILL TO EXTENT POSSIBLE OR AT THE DIRECTION OF THE ENGINEER.
  5. POOL DEPTH SHOULD BE 2 TO 3 TIMES BANKFULL DEPTH.

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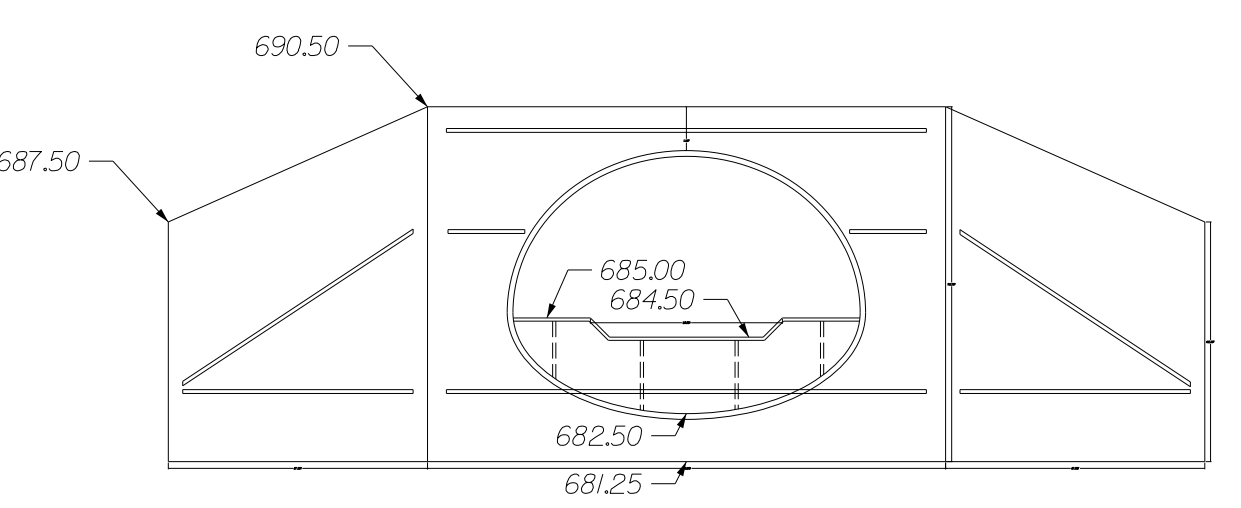
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RW SHEET NO.	
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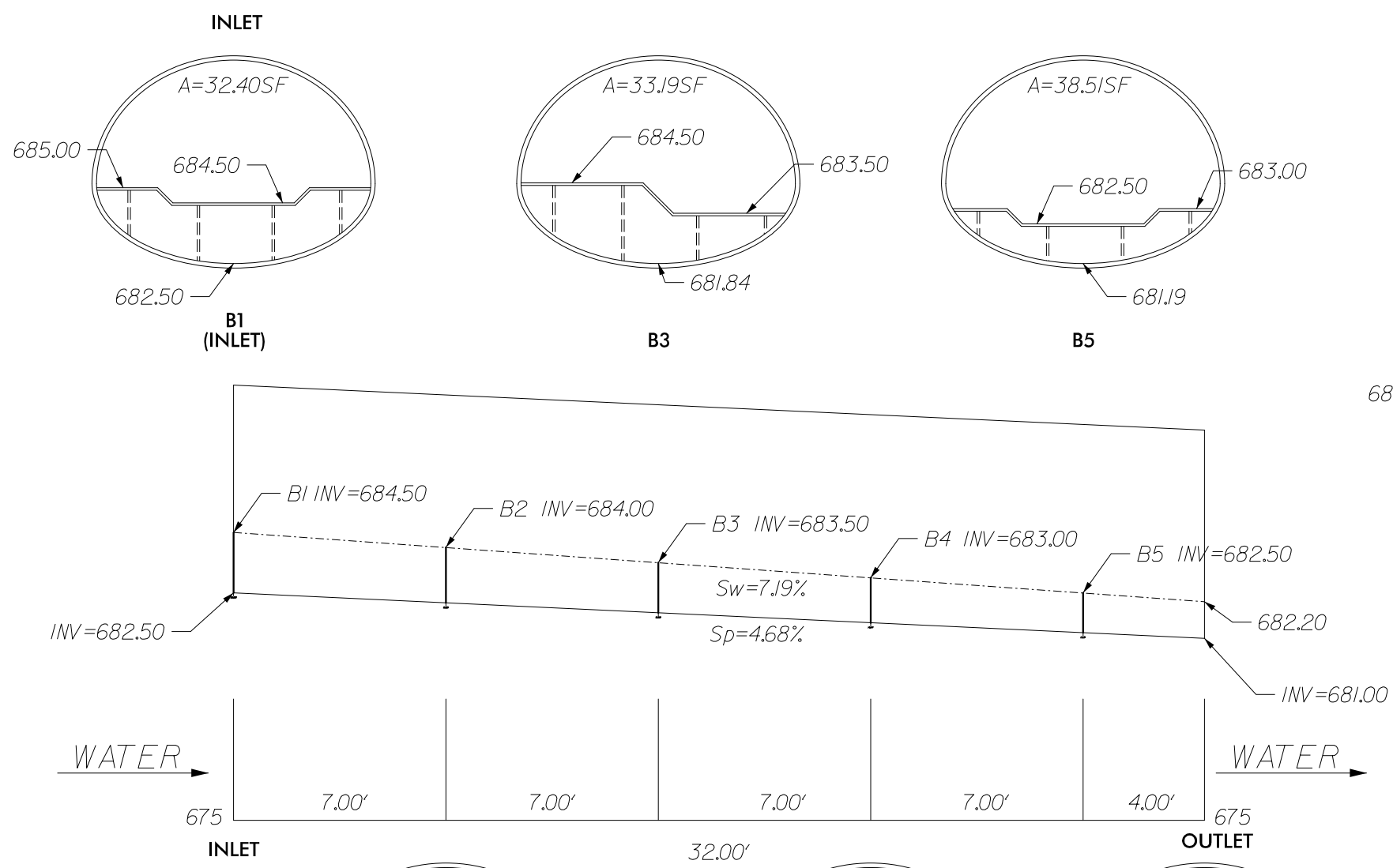


PROJECT REFERENCE NO.	SHEET NO.
U-2707	NS-10
RW SHEET NO.	
HYDRAULICS ENGINEER	
2/23/2016	
NORTH CAROLINA PROFESSIONAL SEAL 029984	
DAVID P. BOCKER	
David P. Bocker	

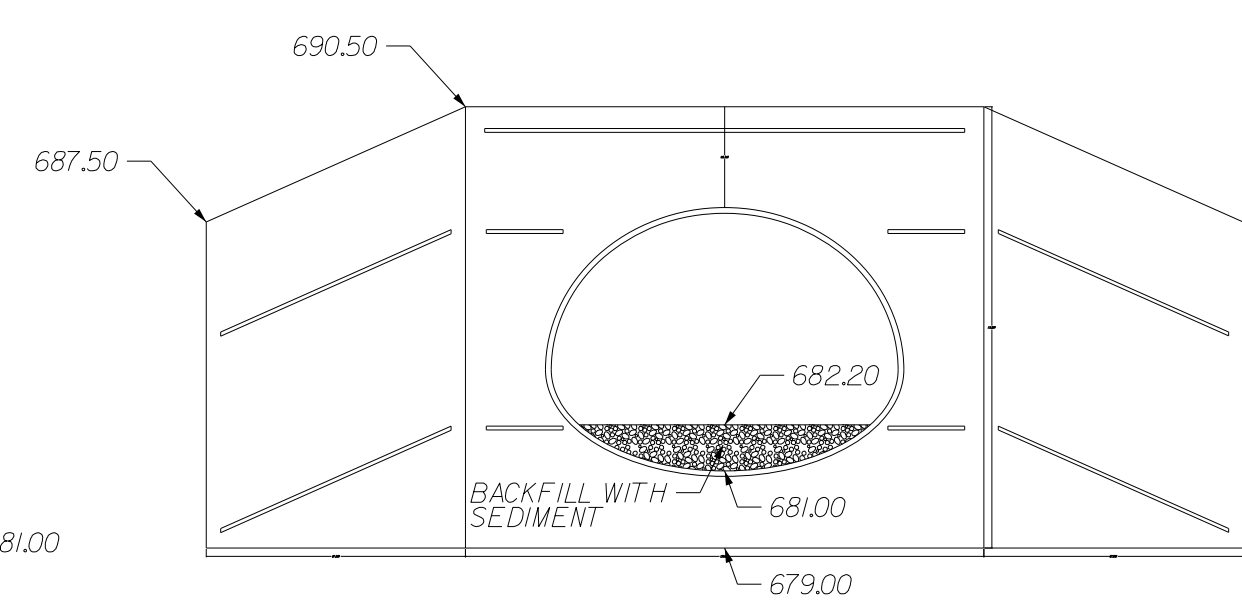
# 95"x67" CAAP PLAN & PROFILE VIEW



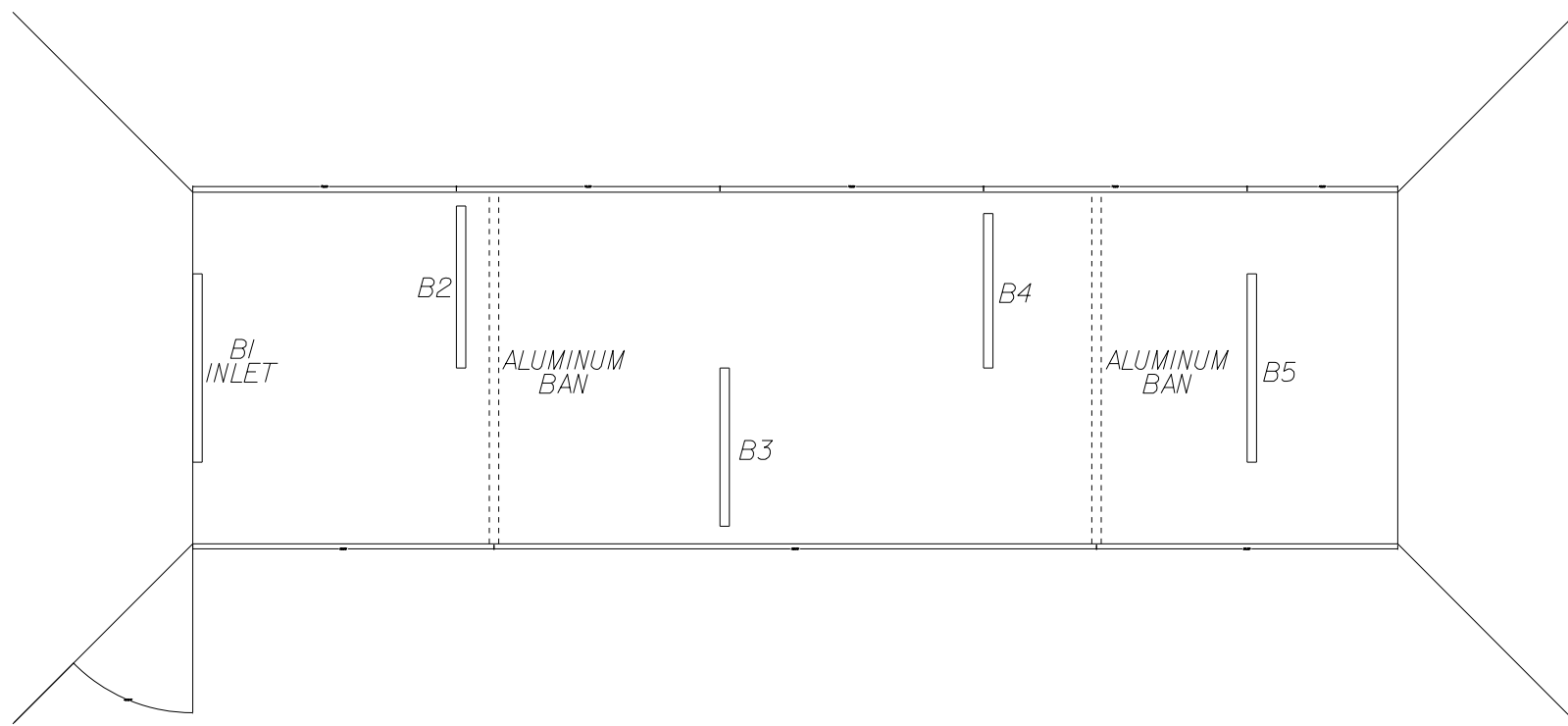
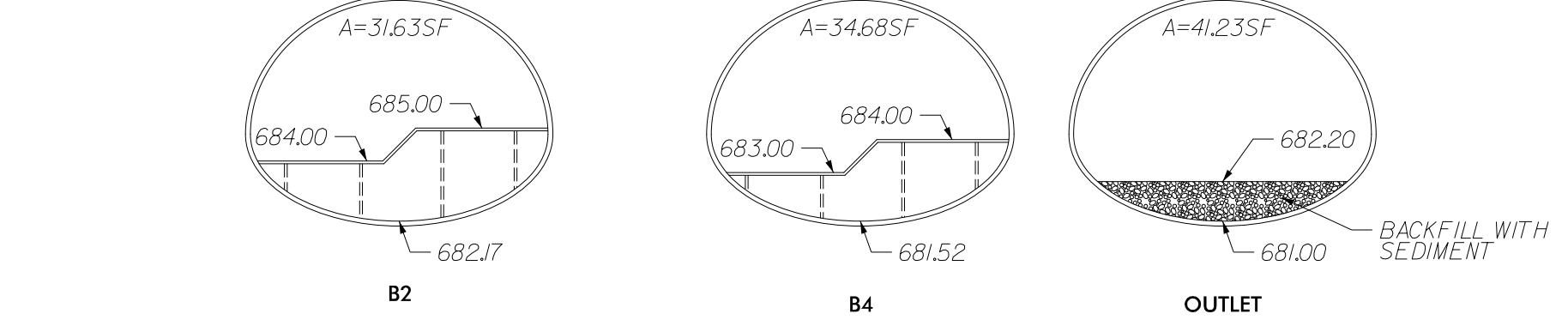
95"x67" CAAP  
INLET WITH HEADWALL



PROFILE WITH CROSS SECTIONS AT BAFFLES



95"x67" CAAP  
OUTLET WITH HEADWALL



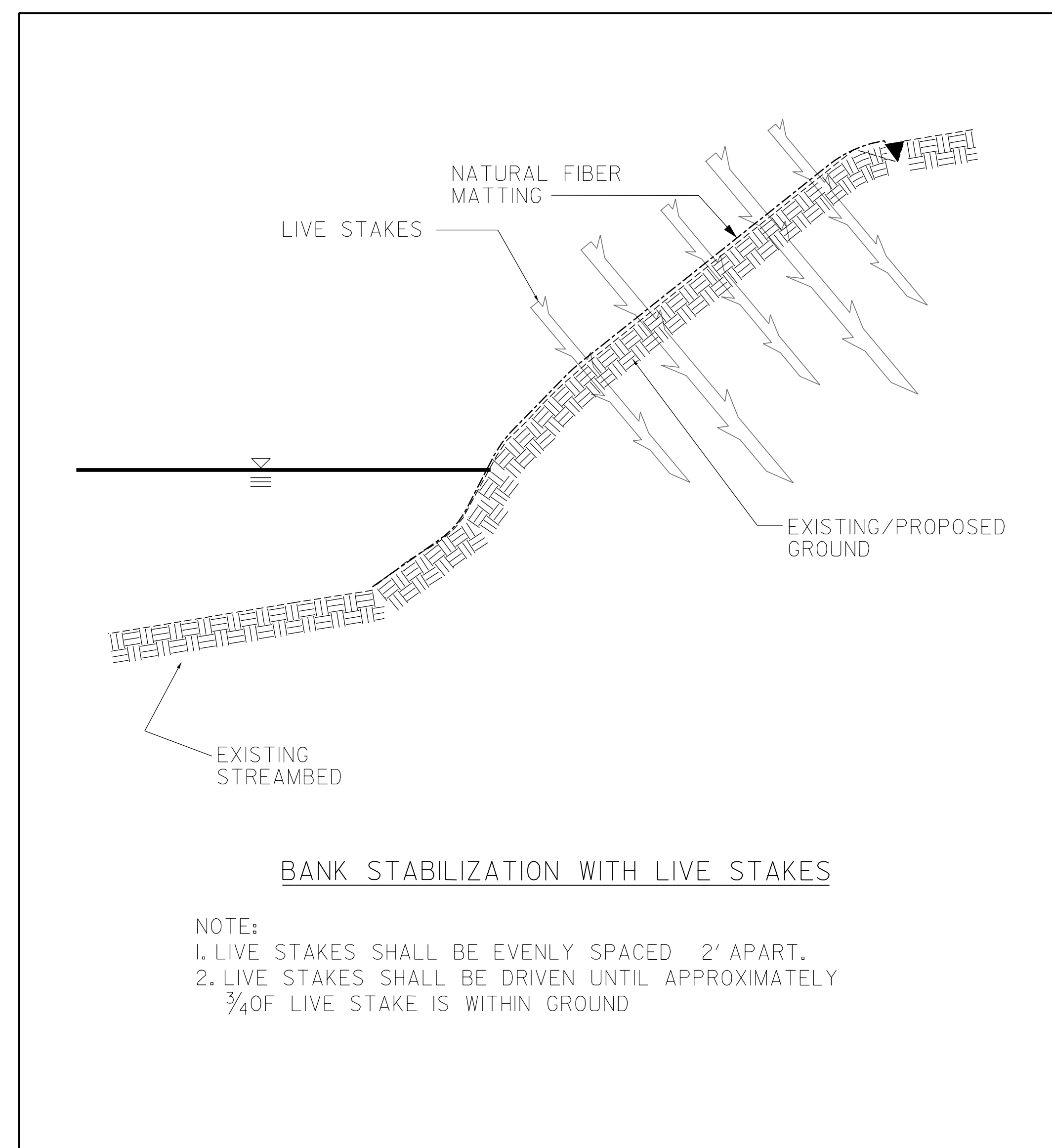
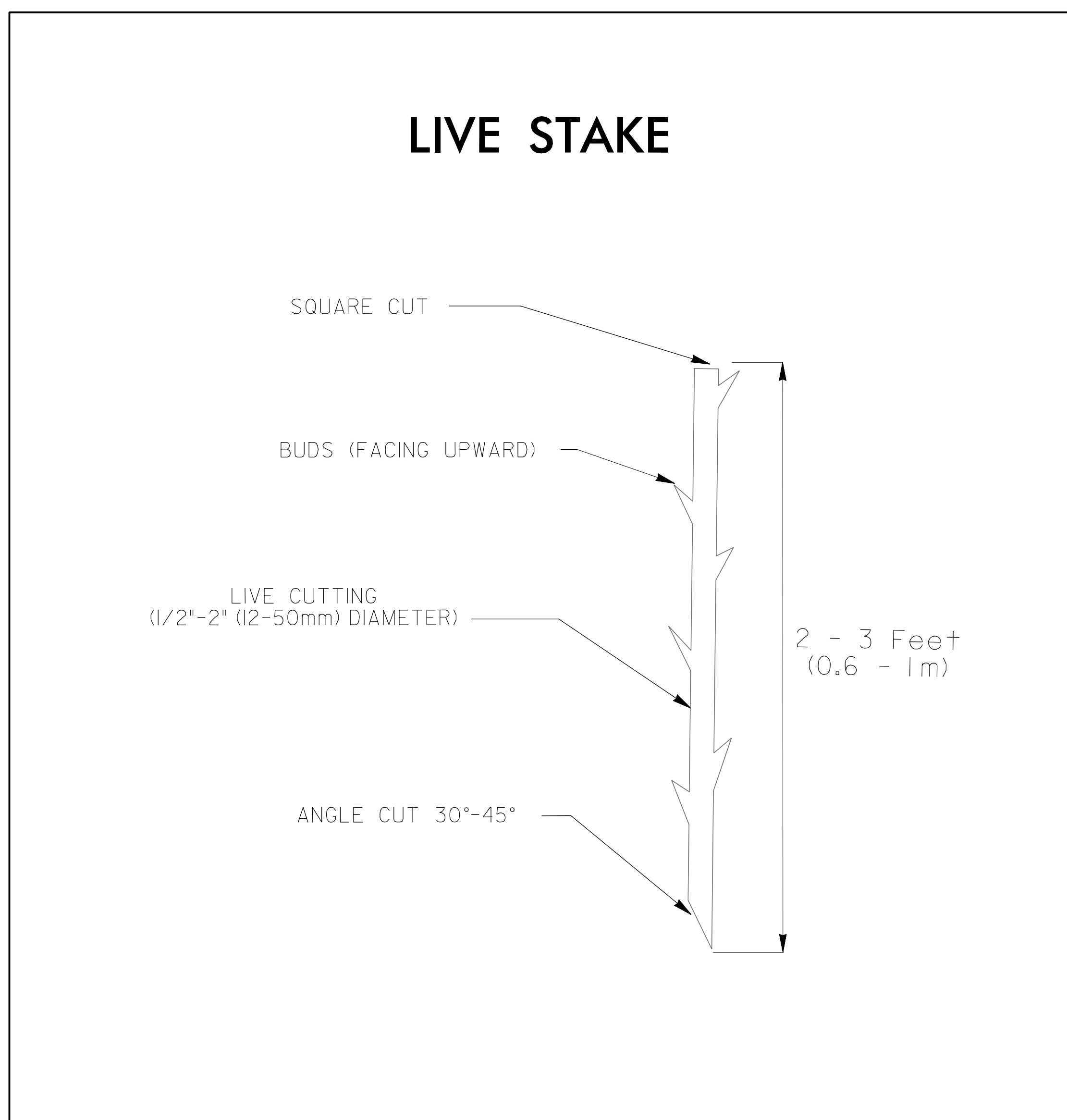
PLAN VIEW

REVISIONS

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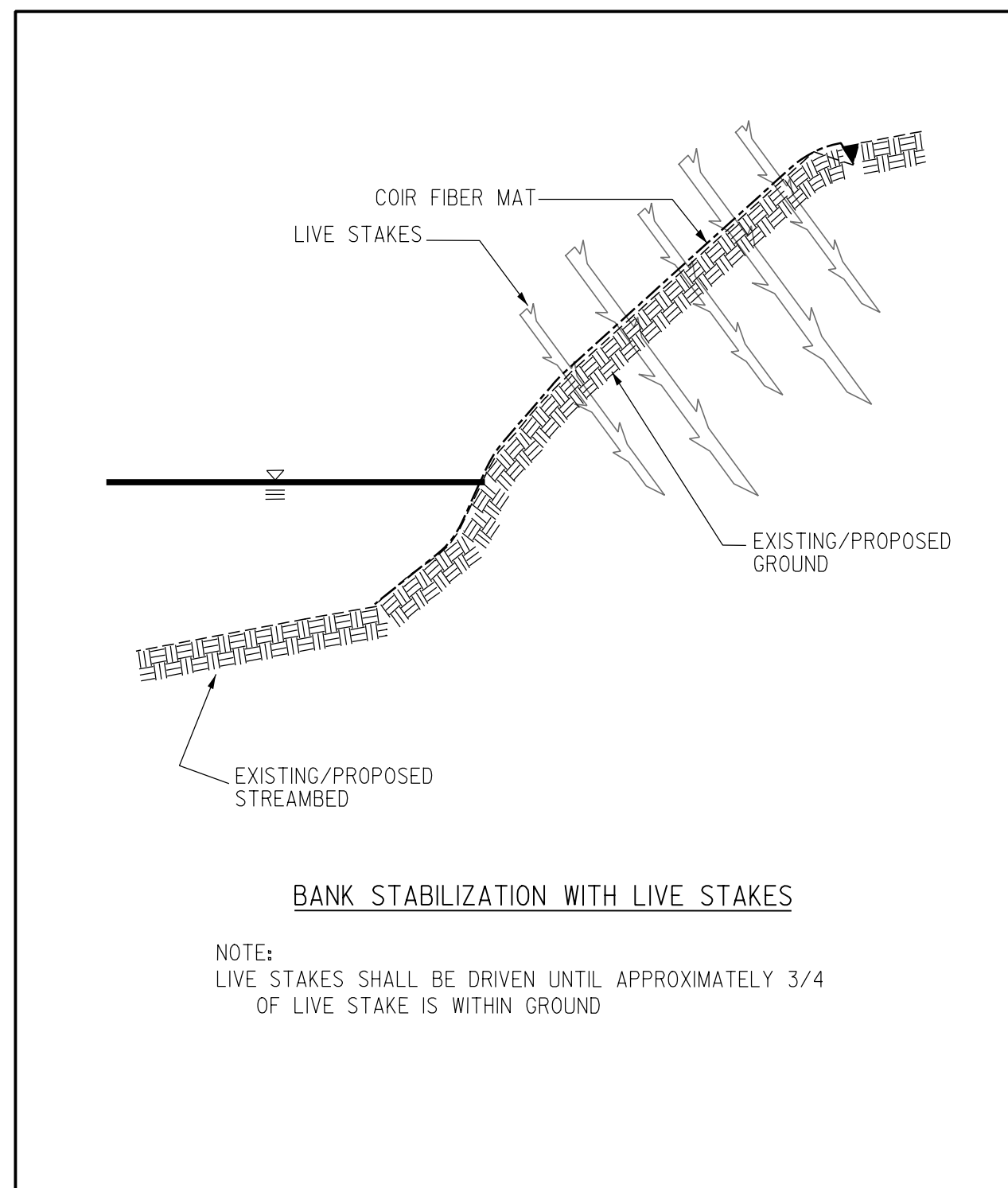
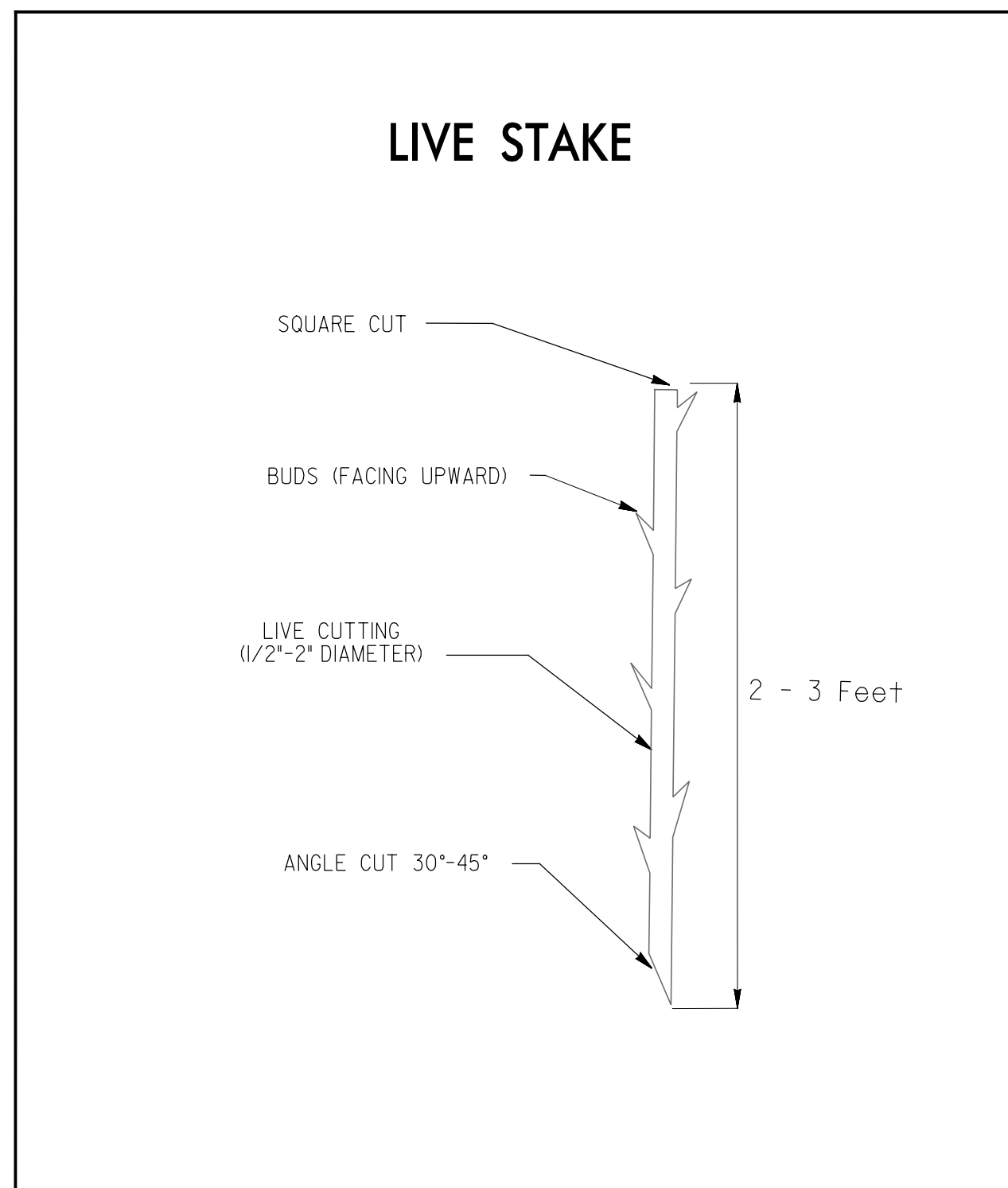
PROJECT REFERENCE NO.	SHEET NO.
U-2707	NS-11
RW SHEET NO.	
HYDRAULICS ENGINEER 2/19/2016 NORTH CAROLINA PROFESSIONAL SEAL 036254 EMMETT PERDUE Emmett Perdue 727E38AC494947D	

# LIVE STAKE DETAIL

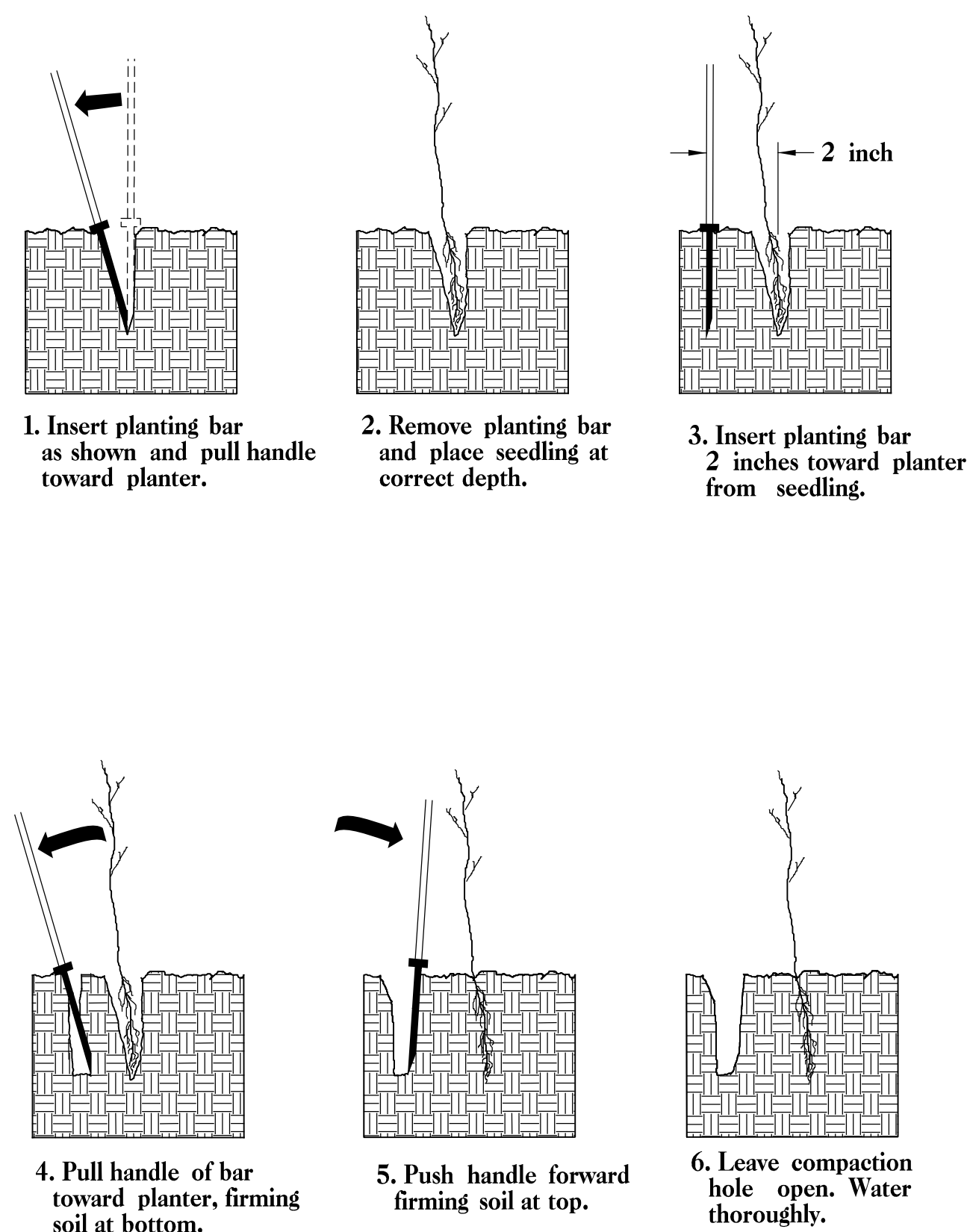


# PLANTING DETAILS

## LIVE STAKES PLANTING DETAIL



## BAREROOT PLANTING DETAIL DIBBLE PLANTING METHOD USING THE KBC PLANTING BAR

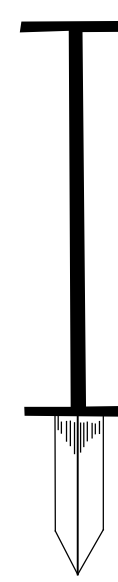


### PLANTING NOTES:

**PLANTING BAG**  
During planting, seedlings shall be kept in a moist canvas bag or similar container to prevent the root systems from drying.



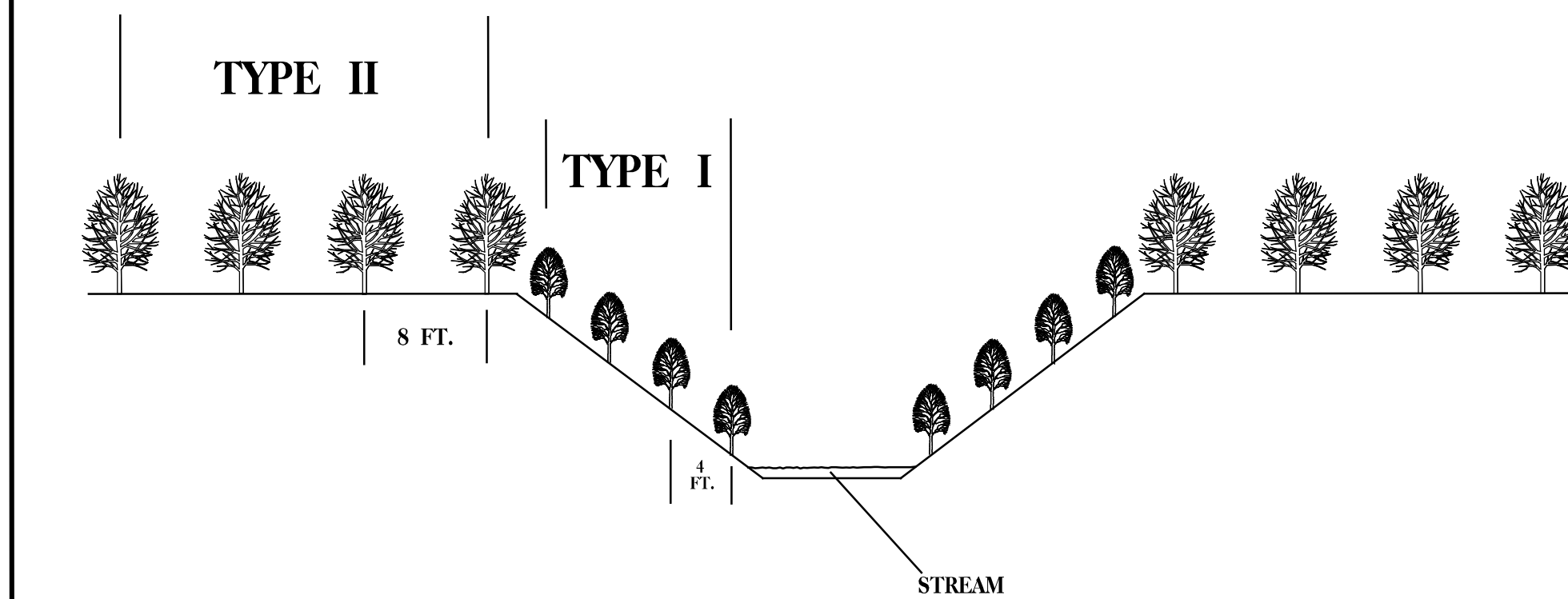
**KBC PLANTING BAR**  
Planting bar shall have a blade with a triangular cross section, and shall be 12 inches long, 4 inches wide and 1 inch thick at center.



**ROOT PRUNING**  
All seedlings shall be root pruned, if necessary, so that no roots extend more than 10 inches below the root collar.

- TYPE 1 STREAMBANK REFORESTATION SHALL BE PLANTED 3 FT. TO 5 FT. ON CENTER, RANDOM SPACING, AVERAGING 4 FT. ON CENTER, APPROXIMATELY 2724 PLANTS PER ACRE.
- TYPE 2 STREAMBANK REFORESTATION SHALL BE PLANTED 6 FT. TO 10 FT. ON CENTER, RANDOM SPACING, AVERAGING 8 FT. ON CENTER, APPROXIMATELY 680 PLANTS PER ACRE.
- NOTE: TYPE 1 AND TYPE 2 STREAMBANK REFORESTATION SHALL BE PAID FOR AS "STREAMBANK REFORESTATION"

## STREAMBANK REFORESTATION TYPICAL



### STREAMBANK REFORESTATION

MIXTURE, TYPE, SIZE, AND FURNISH SHALL CONFORM TO THE FOLLOWING:

**TYPE 1**

- 50% SALIX NIGRA                      BLACK WILLOW      2 ft - 3 ft LIVE STAKES
- 50% CORNUS AMOMUM                SILKY DOGWOOD    2 ft - 3 ft LIVE STAKES

**TYPE 2**

- 25% FRAXINUS PENNSYLVANICA      GREEN ASH              12 in - 18 in BR
- 25% QUERCUS PHELLOS                WILLOW OAK            12 in - 18 in BR
- 25% QUERCUS MICHAUXII              SWAMPCHESTNUT OAK 12 in - 18 in BR
- 25% BETULA NIGRA                      RIVER BIRCH            12 in - 18 in BR

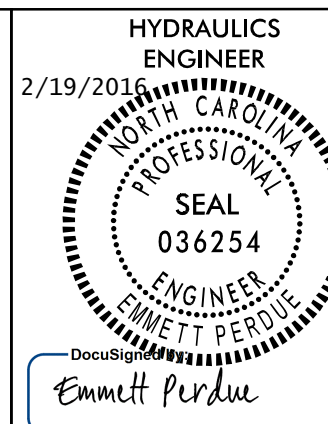
- SEE PLAN SHEETS FOR AREAS TO BE PLANTED

## STREAMBANK REFORESTATION

### DETAIL SHEET

N.C.D.O.T. - ROADSIDE ENVIRONMENTAL UNIT

REVISIONS

PROJECT REFERENCE NO. <i>U-2707</i>	SHEET NO. <i>NS-13</i>
RW SHEET NO.	
HYDRAULICS ENGINEER 2/19/2016  Emmett Perdue 727238AC4848470	

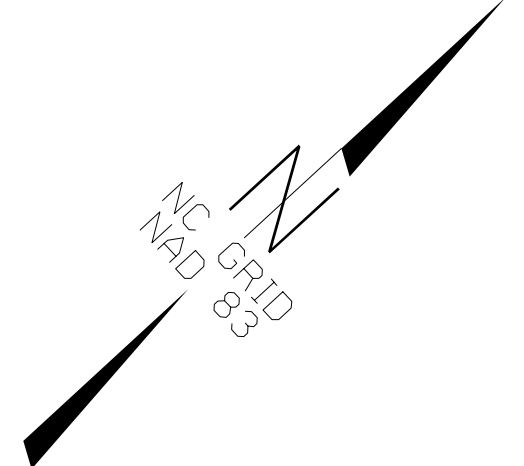
# ALIGNMENT DATA REACH 1

Beginning Point						
Station	<b>00+00.00</b>					
Northing	<b>826494.3736</b>					
Easting	<b>1597877.6360</b>					
Station	Curve/Tangent Number	Curve/Tangent Length (ft)	Chord/Tangent Bearing	Chord Length (ft)	Delta Angle	Radius (ft)
0+00.00	Point 45000					
	Point 45000 to PC R1-1	10.48	N 61° 41' 44.10" E			
0+10.48	Curve R1-1	21.11	N 74° 02' 24.49" E	20.95	24° 41' 20.78" (RT)	49.00
	PT R1-1 to PC R1-2	3.84	N 86° 23' 04.88" E			
0+35.43	Curve R1-2	42.82	N 51° 20' 15.67" E	40.20	70° 05' 38.42" (LT)	35.00
	PT R1-2 to PC R1-3	5.61	N 16° 17' 26.46" E			
0+83.86	Curve R1-3	48.84	N 61° 25' 29.75" E	43.94	90° 16' 06.57" (RT)	31.00
	PT R1-3 to PC R1-4	9.73	S 73° 26' 26.97" E			
1+42.42	Curve R1-4	54.40	N 62° 01' 43.35" E	49.09	89° 03' 39.37" (LT)	35.00
	PT R1-4 to PC R1-5	7.49	N 17° 29' 53.66" E			
2+04.32	Curve R1-5	44.23	N 59° 44' 12.89" E	40.33	84° 28' 38.45" (RT)	30.00
	PT R1-5 to PC R1-6	5.23	S 78° 01' 27.88" E			
2+53.79	Curve R1-6	46.76	N 60° 06' 55.79" E	42.71	83° 43' 12.66" (LT)	32.00
	PT R1-6 to PC R1-7	7.03	N 18° 15' 19.46" E			
3+07.57	Curve R1-7	47.16	N 56° 51' 09.79" E	43.67	77° 11' 40.66" (RT)	35.00
	PT R1-7 to PC R1-8	7.41	S 84° 32' 59.88" E			
3+62.14	Curve R1-8	52.42	N 54° 51' 46.39" E	48.14	81° 10' 27.46" (LT)	37.00
	PT R1-8 to PC R1-9	7.44	N 14° 16' 32.65" E			
4+22.00	Curve R1-9	50.33	N 63° 59' 44.48" E	44.25	99° 26' 23.64" (RT)	29.00
	PT R1-9 to PC R1-10	5.72	S 66° 17' 03.70" E			
4+78.05	Curve R1-10	49.84	N 62° 43' 03.65" E	43.52	101° 59' 45.29" (LT)	28.00
	PT R1-10 to PC R1-11	4.89	N 11° 43' 11.01" E			
5+32.78	Curve R1-11	52.74	N 50° 27' 47.72" E	48.82	77° 29' 13.42" (RT)	39.00
	PT R1-11 to PC R1-12	6.18	N 89° 12' 24.43" E			
5+91.70	Curve R1-12	39.46	N 51° 31' 45.40" E	36.67	75° 21' 18.07" (LT)	30.00
	PT R1-12 to PC R1-13	4.64	N 13° 51' 06.36" E			
6+35.80	Curve R1-13	47.52	N 60° 47' 33.87" E	42.38	93° 52' 55.01" (RT)	29.00
	PT R1-13 to PC R1-14	6.15	S 72° 15' 58.62" E			
6+89.48	Curve R1-14	59.25	N 60° 35' 07.59" E	52.78	94° 17' 47.57" (LT)	36.00
	PT R1-14 to PC R1-15	6.23	N 13° 26' 13.81" E			
7+54.95	Curve R1-15	34.19	N 48° 25' 14.01" E	32.11	69° 58' 00.40" (RT)	28.00
	PT R1-15 to PC R1-16	5.62	N 83° 24' 14.21" E			
7+94.77	Curve R1-16	45.15	N 41° 40' 42.92" E	41.26	83° 27' 02.58" (LT)	31.00
	PT R1-16 to PC R1-17	10.20	N 0° 02' 48.38" W			
8+50.12	Curve R1-17	49.30	N 40° 18' 30.95" E	45.33	80° 42' 38.65" (RT)	35.00
	PT R1-17 to PC R1-18	5.03	N 80° 39' 50.28" E			
9+04.46	Curve R1-18	51.70	N 31° 17' 40.66" E	45.54	98° 44' 19.23" (LT)	30.00
	PT R1-18 to PC R1-19	5.85	N 18° 04' 28.96" W			
9+62.01	Curve R1-19	49.02	N 30° 21' 01.43" E	43.39	96° 51' 00.77" (RT)	29.00
	PT R1-19 to PC R1-20	4.89	N 78° 46' 31.82" E			
10+15.92	Curve R1-20	53.31	N 38° 35' 21.06" E	49.04	80° 22' 21.52" (LT)	38.00
	PT R1-20 to PC R1-21	7.68	N 1° 35' 49.70" W			
10+76.91	Curve R1-21	39.93	N 39° 15' 33.94" E	36.63	81° 42' 47.28" (RT)	28.00
	PT R1-21 to PC R1-22	6.74	N 80° 06' 57.58" E			
11+23.58	Curve R1-22	52.12	N 28° 37' 28.08" E	45.39	102° 58' 59.00" (LT)	29.00
	PT R1-22 to PC R1-23	4.45	N 22° 52' 01.42" W			
11+80.16	Curve R1-23	56.65	N 27° 51' 09.41" E	49.54	101° 26' 21.65" (RT)	32.00
	PT R1-23 to PC R1-24	5.17	N 78° 34' 20.23" E			
12+41.98	Curve R1-24	43.64	N 36° 53' 51.67" E	39.89	83° 20' 57.13" (LT)	30.00
	PT R1-24 to PC R1-25	5.29	N 4° 46' 36.90" W			
12+90.92	Curve R1-25	51.80	N 36° 26' 53.31" E	47.45	82° 27' 00.41" (RT)	36.00
	PT R1-25 to PC R1-26	10.49	N 77° 40' 23.51" E			
13+53.21	Curve R1-26	39.24	N 41° 24' 49.79" E	36.67	72° 31' 07.44" (LT)	31.00

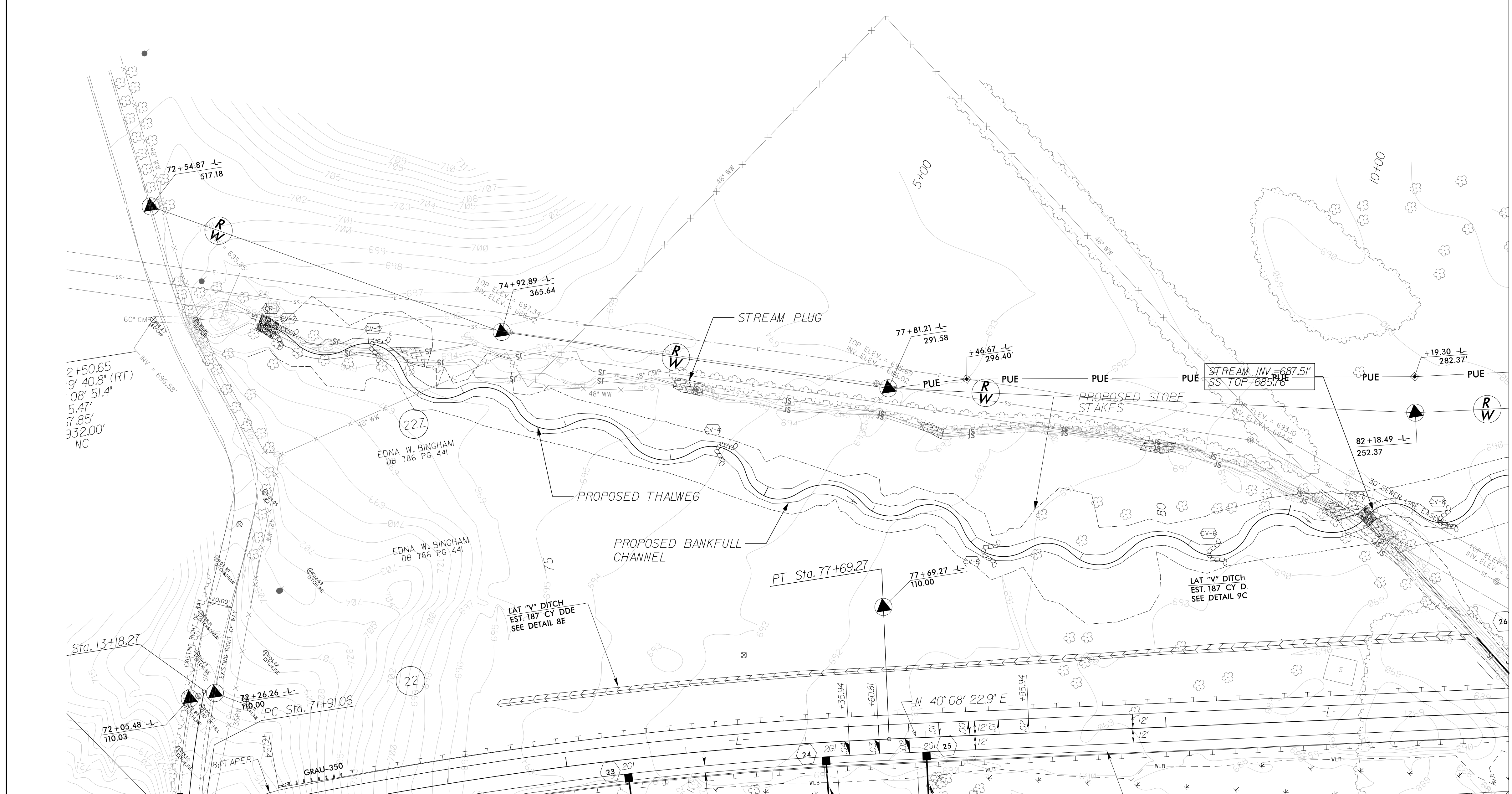
Station	Curve/Tangent Number	Curve/Tangent Length (ft)	Chord/Tangent Bearing	Chord Length (ft)	Delta Angle	Radius (ft)
	PT R1-26 to PC R1-27	8.81	N 5° 09' 16.07" E			
14+01.26	Curve R1-27	47.45	N 43° 59' 48.18" E	43.90	77° 41' 04.22" (RT)	35.00
	PT R1-27 to PC R1-28	9.08	N 82° 50' 20.29" E			
14+57.79	Curve R1-28	37.68	N 45° 37' 08.29" E	35.08	74° 26' 23.99" (LT)	29.00
	PT R1-28 to PC R1-29	8.64	N 8° 23' 56.30" E			
15+04.11	Curve R1-29	50.64	N 47° 36' 30.64" E	46.78	78° 25' 08.69" (RT)	37.00
	PT R1-29 to PC R1-30	6.20	N 86° 49' 04.99" E			
15+60.95	Curve R1-30	46.67	N 47° 29' 36.67" E	43.09	78° 38' 56.63" (LT)	34.00
	PT R1-30 to PC R1-31	7.87	N 8° 10' 08.36" E			
16+15.49	Curve R1-31	50.92	N 45° 34' 27.41" E	47.38	74° 48' 38.09" (RT)	39.00
	PT R1-31 to PC R1-32	8.06	N 82° 58' 46.45" E			
16+74.47	Curve R1-32	51.92	N 41° 39' 33.30" E	47.54	82° 38' 26.30" (LT)	36.00
	PT R1-32 to PC R1-33	11.79	N 0° 20' 20.15" E			
17+38.19	Curve R1-33	80.43	N 47° 21' 38.65" E	71.70	94° 02' 36.99" (RT)	49.00
	PC R1-33 to Point 45001	16.30	S 85° 37' 02.86" E			
18+34.91	Point 45001					

REVISIONS

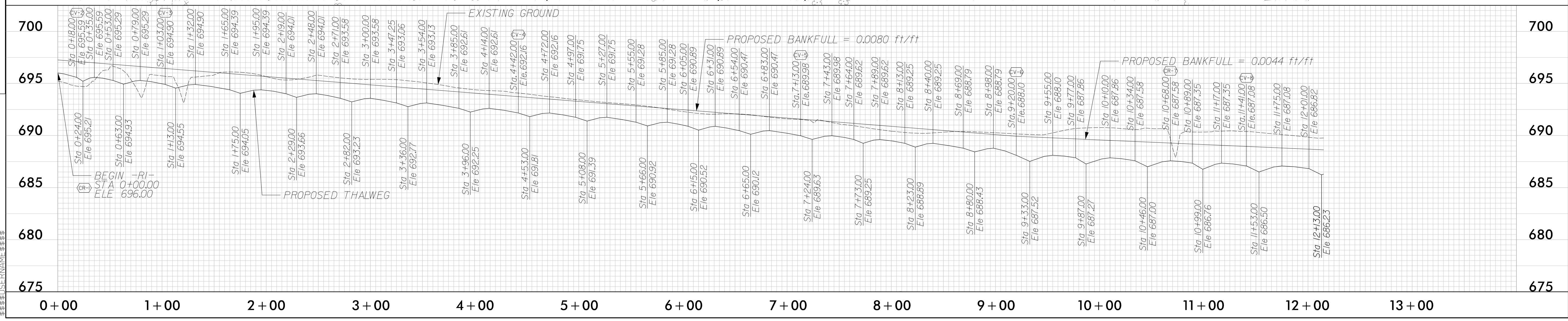
PROJECT REFERENCE NO. U-2707	SHEET NO. NS-14
RW SHEET NO.	
HYDRAULICS ENGINEER	
2/23/2016	
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 036254	
Emmett Perdue	



MATCH TO SHEET NS-15  
-RI- STA 12+15.00



REVISIONS



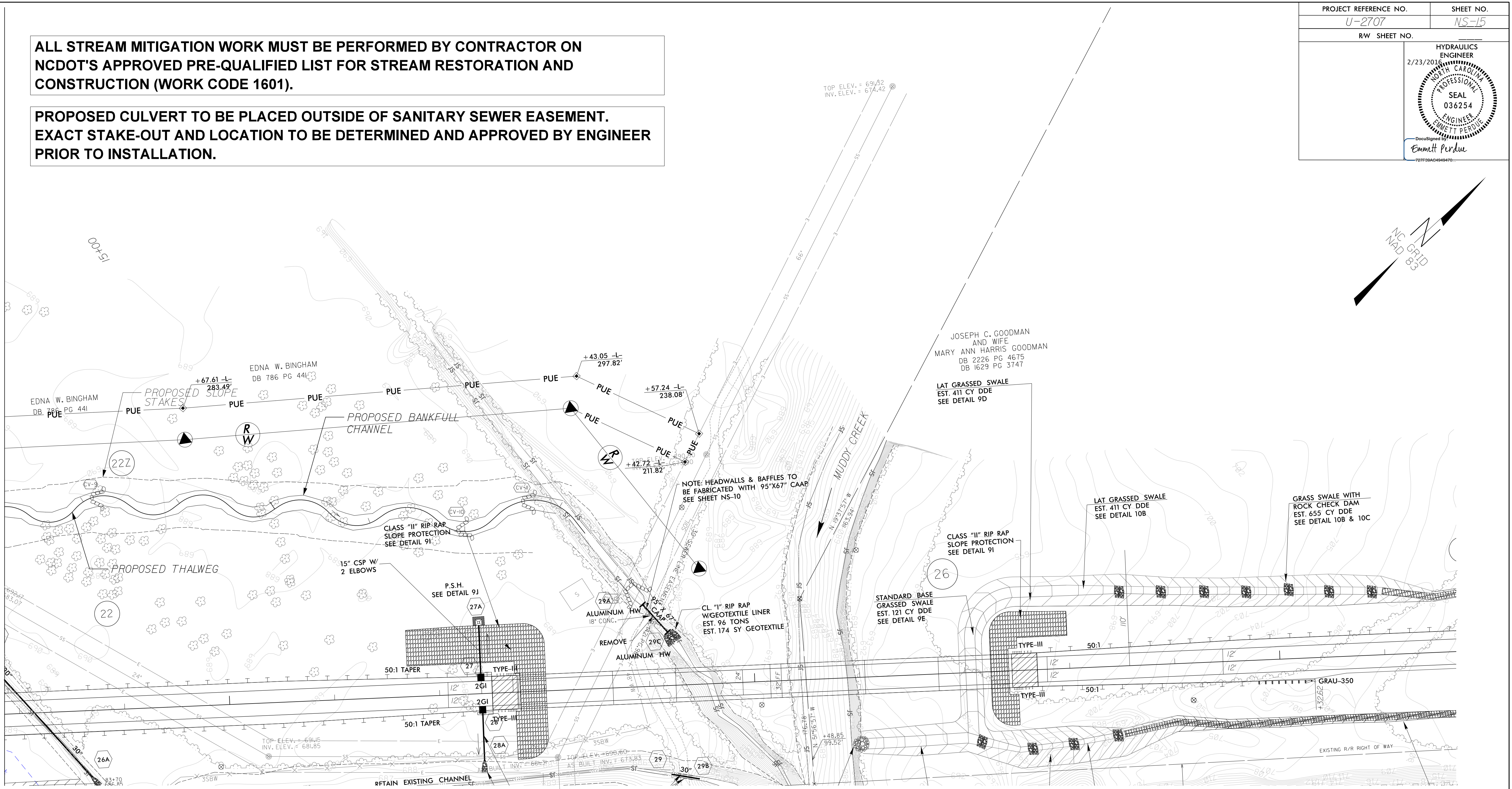
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HYDRAULICS ENGINEER 2/23/2016 NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 036254 EMMETT PERDUE Emmett Perdue 72759404948970	

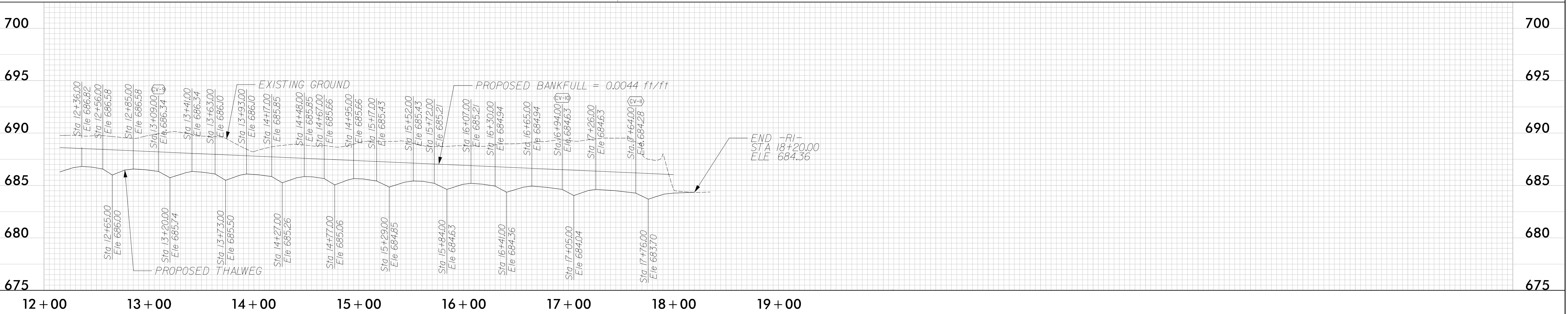
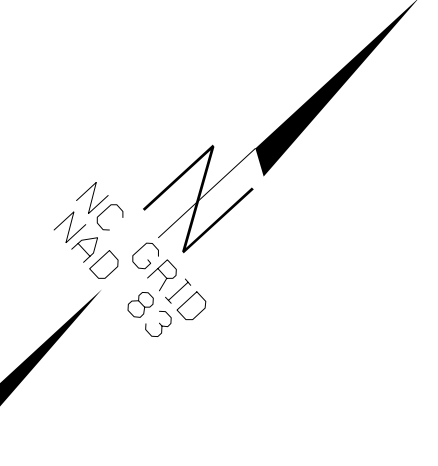
**ALL STREAM MITIGATION WORK MUST BE PERFORMED BY CONTRACTOR ON NCDOT'S APPROVED PRE-QUALIFIED LIST FOR STREAM RESTORATION AND CONSTRUCTION (WORK CODE 1601).**

**PROPOSED CULVERT TO BE PLACED OUTSIDE OF SANITARY SEWER EASEMENT. EXACT STAKE-OUT AND LOCATION TO BE DETERMINED AND APPROVED BY ENGINEER PRIOR TO INSTALLATION.**

MATCH TO SHEET NS-14  
-RI- STA 12+15.00

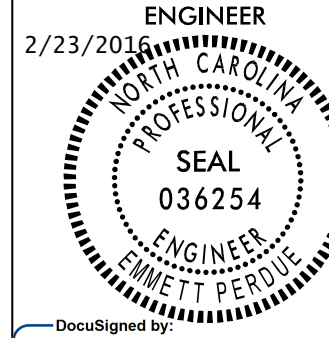


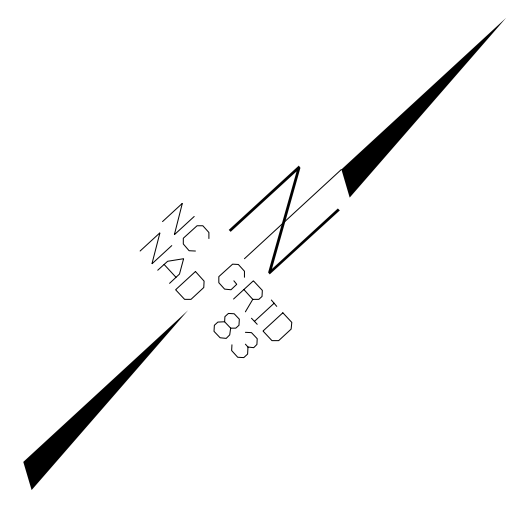
REVISIONS



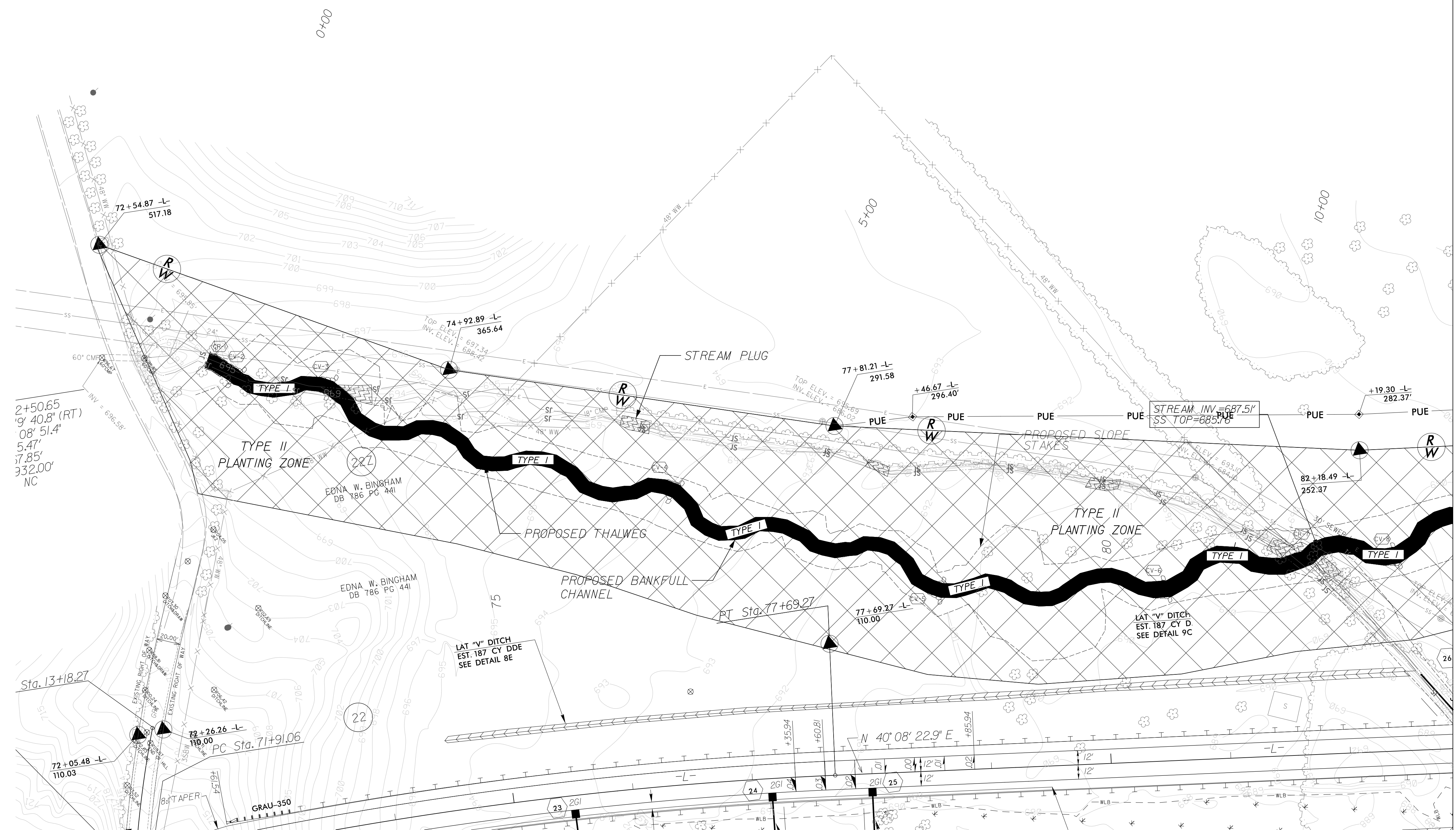
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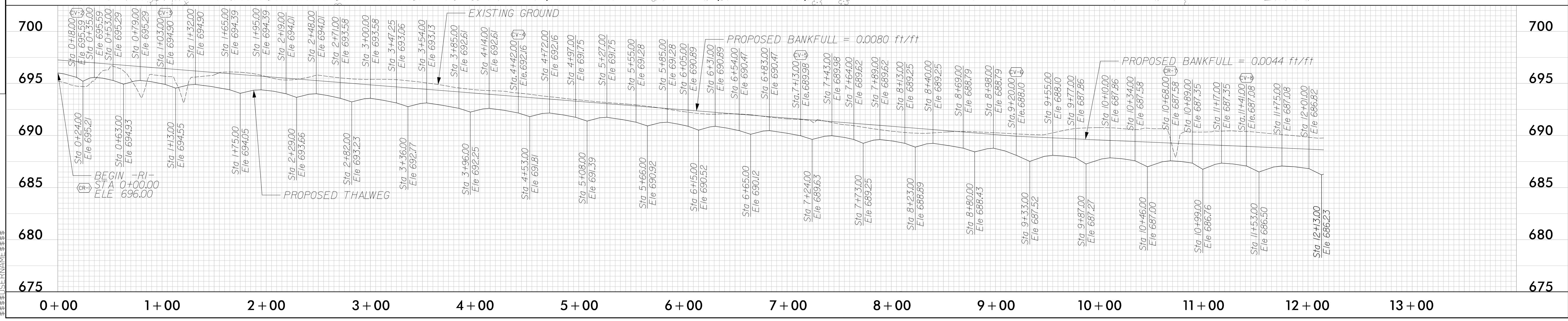
PROJECT REFERENCE NO. U-2707	SHEET NO. NS-16
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HYDRAULICS ENGINEER	
2/23/2016	
	
Emmett Perdue	



REVISIONS

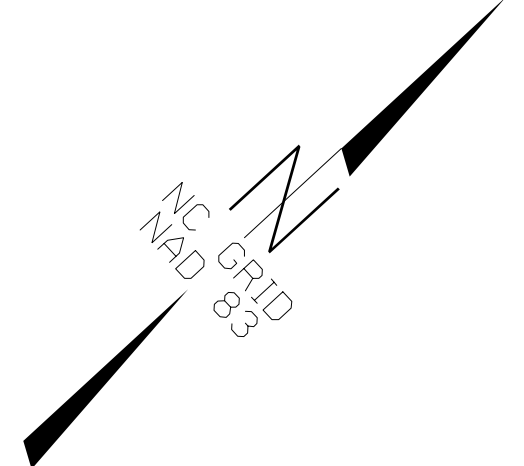


MATCH TO SHEET NS-17  
-RI- STA 12+15.00



5/28/99

PROJECT REFERENCE NO. U-2707	SHEET NO. NS-17
RW SHEET NO.	
HYDRAULICS ENGINEER 2/23/2016 NORTH CAROLINA PROFESSIONAL SEAL 036254 EMMETT PERDUE 727230424848470	



MATCH TO SHEET NS-14  
-RI- STA 12+15.00

REVISIONS

