

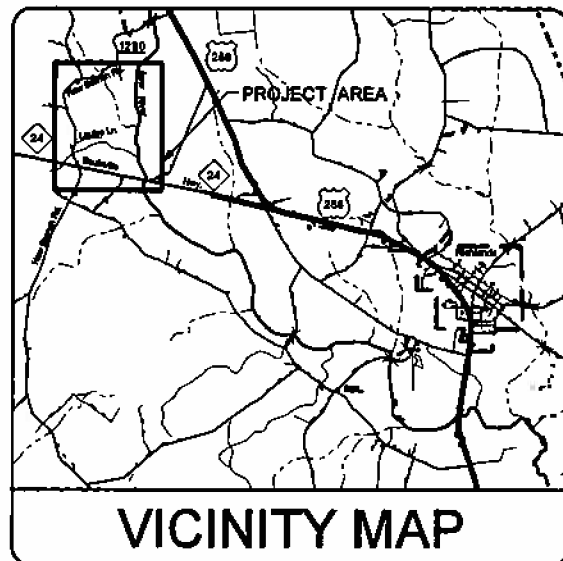
PROJECT: D06003 - 2 CROWNS WEST

CROWNS WEST STREAM RESTORATION PROJECT
PROJECT # - D06003-2

ONSLOW COUNTY

LOCATION: OFF HAW BRANCH ROAD SR 1230
 NORTHWEST OF RICHLANDS

TYPE OF WORK: AS-BUILT FOR STREAM RESTORATION



STATE	PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
NC	0290R	1	13
NO.	DATE	CHECKED BY	APPROVED BY
1	04/07/07	JOSHUA WHITE	KEVIN TWEEDY
2	04/07/07	JOSHUA WHITE	KEVIN TWEEDY

INDEX OF SHEETS

- 1 TITLE SHEET
- 1-A STREAM CONVENTIONAL SYMBOLS
GENERAL NOTES, STANDARD SPECIFICATIONS, AND VEGETATION SELECTION
- 1-B CONVENTIONAL SYMBOLS
- 2 TO 2-C TYPICAL POOL AND RIFFLE CROSS SECTIONS, STRUCTURE DETAILS
- 3 TO 8 AS-BUILT PLAN VIEWS

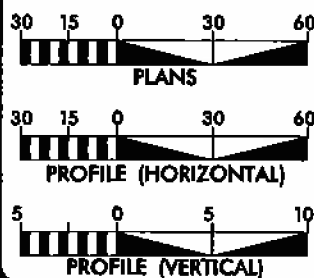
BEGIN CONSTRUCTION M1
 STA 10+00.00
 77.6368 W
 34.9254 N

END CONSTRUCTION M1
 STA 33+20.05

BEGIN CONSTRUCTION M2
 STA 33+83.41

END CONSTRUCTION M2
 STA 48+98.44
 77.6285 W
 34.9290 N

GRAPHIC SCALES



DESIGN DATA

EXISTING STREAM LENGTH = 3334 FT
 AS-BUILT STREAM LENGTH = 3835 FT

PROJECT REACH	EXISTING	AS-BUILT
M1	1819 FT	2320 FT
M2	1515 FT	1515 FT

PREPARED FOR THE OFFICE OF:
 NCDENR - ECOSYSTEM ENHANCEMENT PROGRAM
 2728 CAPITAL BLD, SUITE 1H 103
 RALEIGH, NC 27604



CONTACT: GUY PEARCE
 KEP FULL DELIVERY COORDINATOR

PREPARED IN THE OFFICE OF:

Baker
 Baker Engineering
 6022 Sawyer Parkway
 Suite 202
 Cary, North Carolina 27510
 Phone: 919.941.0400
 Fax: 919.941.0401

MARCH 2007
 COMPLETION DATE:

KEVIN TWEEDY, PE
 PROJECT ENGINEER






























JOSHUA WHITE
 PROJECT DESIGNER

PROJECT ENGINEER



4-30-07
 [Signature] P.E.




STREAM CONVENTIONAL SYMBOLS
SUPERCEDES SHEET 1B

	ROCK J-HOOK		SAFETY FENCE
	ROCK VANE		TAPE FENCE
	OUTLET PROTECTION		100 YEAR FLOOD PLAIN
	ROCK CROSS VANE		CONSERVATION EASEMENT
	DOUBLE DROP ROCK CROSS VANE		EXISTING MAJOR CONTOUR
	SINGLE WING DEFLECTOR		EXISTING MINOR CONTOUR
	DOUBLE WING DEFLECTOR		FOOT BRIDGE
	TEMPORARY SILT CHECK		TEMPORARY STREAM CROSSING
	ROOT WAD		PERMANENT STREAM CROSSING
	LOG J-HOOK		TRANSPLANTED VEGETATION
	LOG VANE		TREE REMOVAL
	LOG WEIR		TREE PROTECTION
	LOG CROSS VANE		TRANSPLANTS OR BRUSH MATRESS
	CONSTRUCTED RIFFLE		
	BOULDER CLUSTER		
	ROCK STEP POOL		

**NOTE: ALL ITEMS ABOVE MAY NOT BE USED ON THIS PROJECT

GENERAL NOTES

1. CONSTRUCTION BEGAN IN NOVEMBER 2006 AND WAS COMPLETED IN MARCH 2007.

PROJECT REFERENCE NO. 0290R	SHEET NO. 1-A
PROJECT ENGINEER	
	
APPROVED BY: 	
DATE: 4-30-07	
	
<small>Baker Engineering 600 Poplar Parkway Suite 202 Cary, NORTH CAROLINA 27513 Phone: 919-483-3444 Fax: 919-483-3440</small>	

STANDARD SPECIFICATIONS

EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL
DECEMBER 1993

- 6.06 CONSTRUCTION ENTRANCE
- 6.62 SILT FENCE
- 6.63 ROCK DAM
- 6.70 TEMPORARY (FORD) STREAM CROSSING
- 6.71 PERMANENT (FORD) STREAM CROSSING

VEGETATION SELECTION

BARE ROOT VEGETATION

The following table lists bare-root vegetation selection for the project site. Species shall be planted at a density of 680 stems per acre. Exact placement of species will be determined prior to site planting and based on apparent wetness of planting locations.

Common Name	Scientific Name	Percent Planted by Species	Total Number of Stems	Wetness Tolerance
River Birch	<i>Betula nigra</i>	15%	1110	moderate
Sugarberry	<i>Celtis laevigata</i>	5%	370	moderate
Green Ash	<i>Fraxinus pennsylvanica</i>	7.5%	555	moderate
Black Walnut	<i>Juglans nigra</i>	5%	370	weak - moderate
Swamp Tupelo	<i>Nyssa sylvatica var. biflora</i>	10%	740	tolerant
Sycamore	<i>Platanus occidentalis</i>	20%	1480	moderate
Overcup Oak	<i>Quercus lyrata</i>	10%	740	moderate
Swamp Chestnut Oak	<i>Quercus michauxii</i>	10%	740	weak
Willow Oak	<i>Quercus phellos</i>	7.5%	555	weak - moderate
Bald Cypress	<i>Taxodium distichum</i>	10%	740	tolerant
	Total		7400	

TEMPORARY SEEDING

The following table temporary seed mix for the project site. All disturbed areas will be stabilized using mulch and temporary seed.

Common Name	Rate	Dates
ANNUAL RYE (COOL SEASON)	70 LBS/ACRE	SEPTEMBER TO MARCH
MILLET (WARM SEASON)	25 LBS/ACRE	APRIL TO AUGUST

LIVE STAKING

Live staking will be applied to all restored streambanks following the details in this plan set and according to the construction specifications.

Common Name	Scientific Name	Number of Stems	Wetness Tolerance
Restored Streambanks			
Silky Dogwood	<i>Cornus amomum</i>	1040	OBL
Elderberry	<i>Sambucus canadensis</i>	520	OBL
Silky Willow	<i>Salix Sericea</i>	1040	OBL
	Total	2600	

PERMANENT SEEDING

Permanent seed mixtures for the restoration site. Permanent seed mixtures shall be applied with temporary seed, as defined in the construction specifications.

Common Name	Scientific Name	Percent of Mixture	Seeding Density (lbs/acre)	Wetness Tolerance
Floodplain and Buffer Areas				
Virginia wildrye	<i>Elymus virginicus</i>	15%	2.4	FAC
Switchgrass	<i>Panicum virgetum</i>	15%	2.4	FAC+
Fox sedge	<i>Carex vulpinoidea</i>	5%	0.8	OBL
Smart Weed	<i>Polygonum pennsylvanicum</i>	5%	0.8	OBL
Soft rush	<i>Juncus effusus</i>	10%	1.6	FACW+
Hop sedge	<i>Carex lupulina</i>	10%	1.6	OBL
Redtop	<i>Agrostis alba</i>	10%	1.6	FACW
Tick seed	<i>Bidens frondosa</i>	10%	1.6	FACW
Lance leaf coreopsis	<i>Coreopsis lanceolata</i>	10%	1.6	FACU
Shallow sedge	<i>Carex lurida</i>	10%	1.6	OBL
	Total			

2/26/03

4/30/2007
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STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

CONVENTIONAL SYMBOLS

*S.U.E = SUBSURFACE UTILITY ENGINEER

ROADS & RELATED ITEMS

Edge of Pavement	---
Curb	---
Prop. Slope Stakes Cut	ε
Prop. Slope Stakes Fill	F
Prop. Woven Wire Fence	○—○
Prop. Chain Link Fence	□—□
Prop. Barbed Wire Fence	◇—◇
Prop. Wheelchair Ramp	WCR
Curb Cut for Future Wheelchair Ramp	CCFR
Exist. Guardrail	---
Prop. Guardrail	---
Equality Symbol	⊕
Pavement Removal	XXXX

RIGHT OF WAY

Baseline Control Point	◆
Existing Right of Way Marker	△
Exist. Right of Way Line w/Marker	—△—
Prop. Right of Way Line with Proposed R/W Marker (Iron Pin & Cap)	—▲—
Prop. Right of Way Line with Proposed (Concrete or Granite) R/W Marker	—⊙—
Exist. Control of Access Line	—⊙—
Prop. Control of Access Line	—⊙—
Exist. Easement Line	---
Prop. Temp. Construction Easement Line	---
Prop. Temp. Drainage Easement Line	---TDC---
Prop. Perm. Drainage Easement Line	---PDC---

HYDROLOGY

Stream or Body of Water	---
River Basin Buffer	---RBB---
Flow Arrow	→
Disappearing Stream	Y
Spring	○
Swamp Marsh	⊕
Shoreline	---
Falls, Rapids	---
Prop Lateral, Tail, Head Ditches	---

STRUCTURES

MAJOR	
Bridge, Tunnel, or Box Culvert	---CONC---
Bridge Wing Wall, Head Wall and End Wall	---CONC WW---

MINOR	
Head & End Wall	---CONC HW---
Pipe Culvert	===
Footbridge	---
Drainage Boxes	□ CB
Paved Ditch Gutter	---

UTILITIES

Exist. Pole	•
Exist. Power Pole	⊕
Prop. Power Pole	⊕
Exist. Telephone Pole	⊕
Prop. Telephone Pole	⊕
Exist. Joint Use Pole	⊕
Prop. Joint Use Pole	⊕
Telephone Pedestal	⊕
UG Telephone Cable Hand Hold	⊕
Cable TV Pedestal	⊕
UG TV Cable Hand Hold	⊕
UG Power Cable Hand Hold	⊕
Hydrant	⊕
Satellite Dish	⊕
Exist. Water Valve	⊕
Sewer Clean Out	⊕
Power Manhole	⊕
Telephone Booth	⊕
Cellular Telephone Tower	⊕
Water Manhole	⊕
Light Pole	⊕
H-Frame Pole	⊕
Power Line Tower	⊕
Pole with Base	⊕
Gas Valve	⊕
Gas Meter	⊕
Telephone Manhole	⊕
Power Transformer	⊕
Sanitary Sewer Manhole	⊕
Storm Sewer Manhole	⊕
Tank; Water, Gas, Oil	⊕
Water Tank With Legs	⊕
Traffic Signal Junction Box	⊕
Fiber Optic Splice Box	⊕
Television or Radio Tower	⊕
Utility Power Line Connects to Traffic Signal Lines Cut Into the Pavement	---

Recorded Water Line	---
Designated Water Line (S.U.E.*)	---
Sanitary Sewer	---SS---
Recorded Sanitary Sewer Force Main	---SSS---
Designated Sanitary Sewer Force Main(S.U.E.*)	---SSS---
Recorded Gas Line	---
Designated Gas Line (S.U.E.*)	---
Storm Sewer	---
Recorded Power Line	---
Designated Power Line (S.U.E.*)	---
Recorded Telephone Cable	---
Designated Telephone Cable (S.U.E.*)	---
Recorded UG Telephone Conduit	---TC---
Designated UG Telephone Conduit (S.U.E.*)	---TC---
Unknown Utility (S.U.E.*)	---UTL---
Recorded Television Cable	---TV---
Designated Television Cable (S.U.E.*)	---TV---
Recorded Fiber Optics Cable	---FO---
Designated Fiber Optics Cable (S.U.E.*)	---FO---
Exist. Water Meter	⊕
UG Test Hole (S.U.E.*)	⊕
Abandoned According to U/G Record	ATUR
End of Information	E.O.I.

BOUNDARIES & PROPERTIES

State Line	---
County Line	---
Township Line	---
City Line	---
Reservation Line	---
Property Line	---
Property Line Symbol	PL
Exist. Iron Pin	⊕
Property Corner	⊕
Property Monument	⊕
Property Number	⊕
Parcel Number	⊕
Fence Line	---
Existing Wetland Boundaries	---
High Quality Wetland Boundary	---HQ WLB---
Medium Quality Wetland Boundaries	---MQ WLB---
Low Quality Wetland Boundaries	---LQ WLB---
Proposed Wetland Boundaries	---
Existing Endangered Animal Boundaries	---
Existing Endangered Plant Boundaries	---

BUILDINGS & OTHER CULTURE

Buildings	---
Foundations	---
Area Outline	---
Gate	---
Gas Pump Vent or U/G Tank Cap	---
Church	---
School	---
Park	---
Cametary	---
Dam	---
Sign	---
Well	---
Small Mine	---
Swimming Pool	---

TOPOGRAPHY

Loose Surface	---
Hard Surface	---
Change in Road Surface	---
Curb	---
Right of Way Symbol	R/W
Guard Post	⊕ GP
Paved Walk	---
Bridge	---
Box Culvert or Tunnel	---
Ferry	---
Culvert	---
Footbridge	---
Trail, Footpath	---
Light House	---

VEGETATION

Single Tree	---
Single Shrub	---
Hedge	---
Woods Line	---
Orchard	---
Vineyard	---

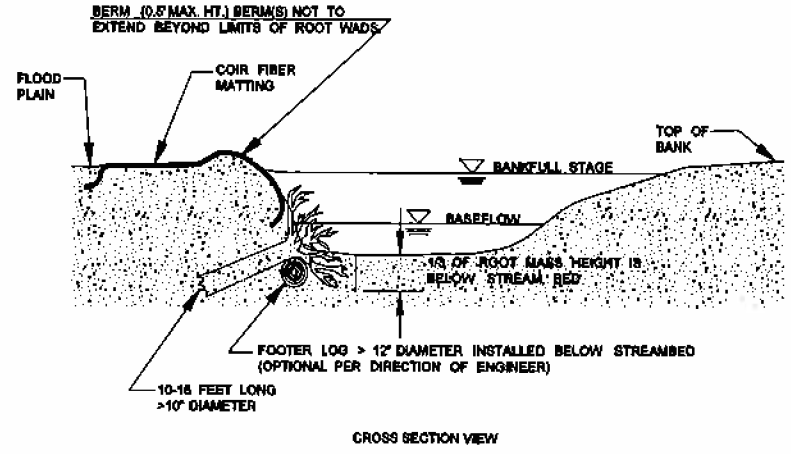
RAILROADS

Standard Gauge	---
RR Signal Milepost	---
Switch	---

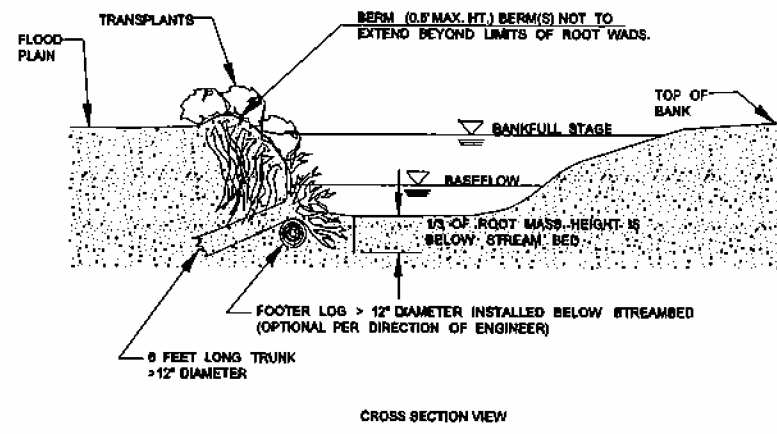
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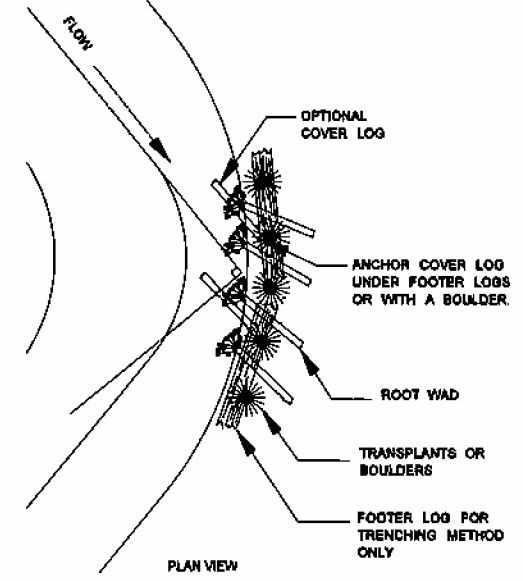
ROOT WADS WITHOUT TRANSPLANTS



ROOT WADS WITH TRANSPLANTS



ROOT WADS



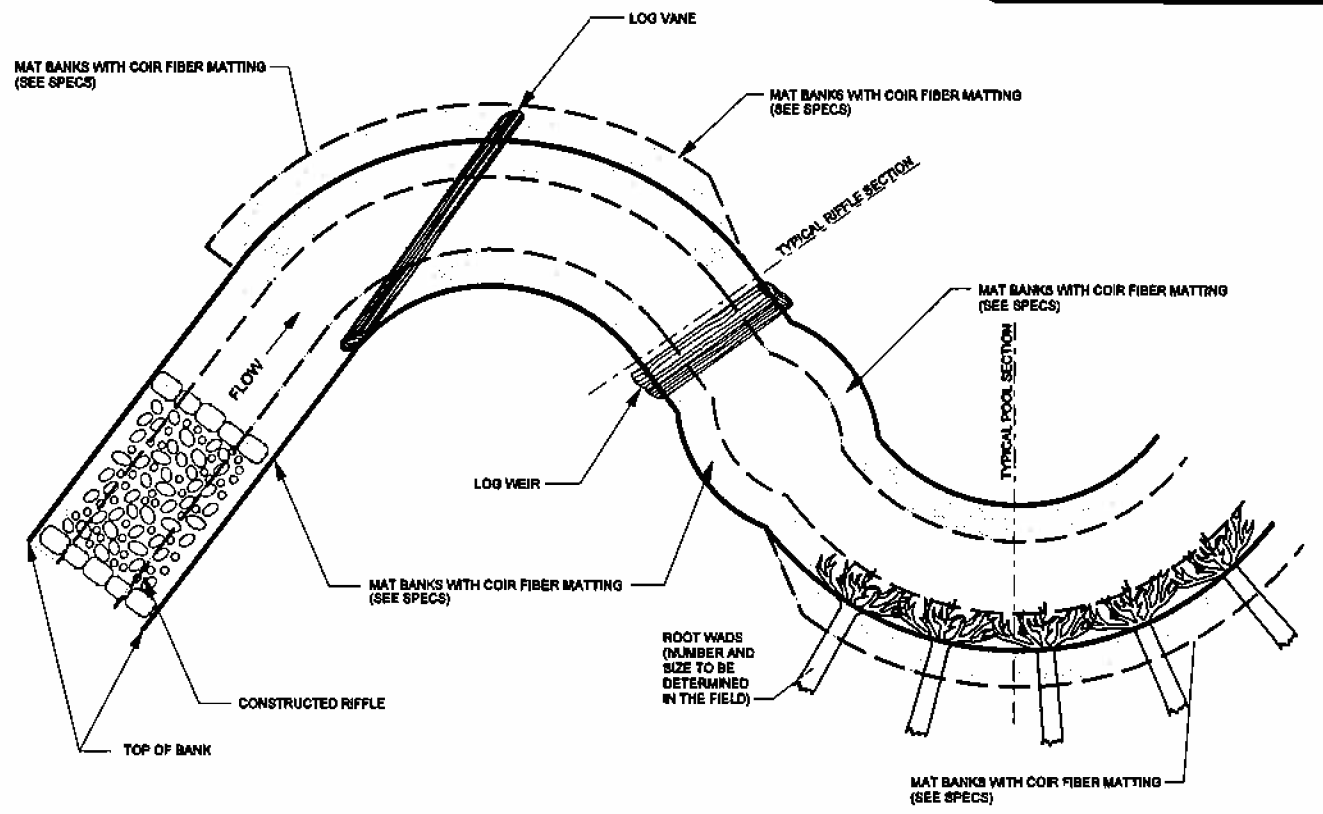
NOTES:
 TRENCHING METHOD:
 IF THE ROOT WAD CANNOT BE DRIVEN INTO THE BANK OR THE BANK NEEDS TO BE RECONSTRUCTED, THE TRENCHING METHOD SHOULD BE USED. THIS METHOD REQUIRES THAT A TRENCH BE EXCAVATED FOR THE LOG PORTION OF THE ROOT WAD. IN THIS CASE A FOOTER LOG SHOULD BE INSTALLED UNDERNEATH THE ROOT WAD IN A TRENCH EXCAVATED PARALLEL TO THE BANK AND WELL BELOW THE STREAMBED ONE-THIRD OF THE ROOT WAD SHOULD REMAIN BELOW NORMAL BASE FLOW CONDITIONS.

NOTES:
 DRIVE POINT METHOD:
 SHARPEN THE END OF THE LOG WITH A CHAINSAW BEFORE "DRIVING" IT INTO THE BANK. ORIENT ROOT WADS UPSTREAM SO THAT THE STREAM FLOW MEETS THE ROOT WAD AT A 90-DEGREE ANGLE DEFLECTING THE WATER AWAY FROM THE BANK. A TRANSPLANT OR BOULDER SHOULD BE PLACED ON THE DOWNSTREAM SIDE OF THE ROOT WAD IF A BACK EDDY IS FORMED BY THE ROOT WAD. THE BOULDER SHALL BE APPROXIMATELY 4'X 3'X 2'.

TYPICAL STRUCTURE PLACEMENT

STRUCTURE NOTES:
 1. GENERALLY LOG WEIRS, ROOT WADS, LOG VANES AND COIR FIBER MATTING WILL BE INSTALLED IN THE LOCATION AND SEQUENCE AS SHOWN.
 2. ADDITIONAL STRUCTURES OR CHANGES TO STRUCTURE LOCATIONS MAY BE MADE BY THE DESIGN ENGINEER DURING CONSTRUCTION.

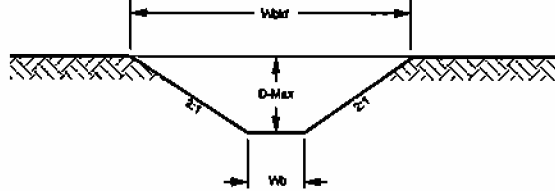
NOTES:
 1. C 12S BN TO BE INSTALLED ON ALL RESTORED STREAMBANKS.
 2. IF ROOT WADS DO NOT COVER ENTIRE SLOPE ON OUTSIDE OF MEANDER BENDS, COIR FIBER MATTING IS NEEDED.



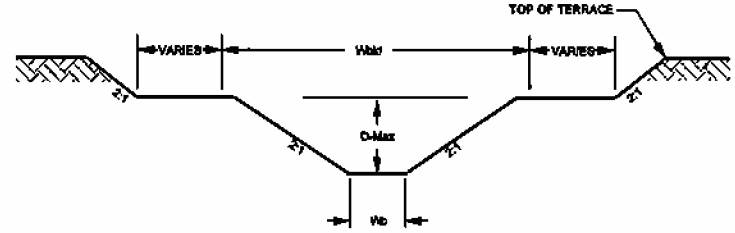
PROJECT REFERENCE NO. 0250R	SHEET NO. 2
PROJECT ENGINEER	
APPROVED BY: <i>[Signature]</i>	
DATE: 4-30-07	

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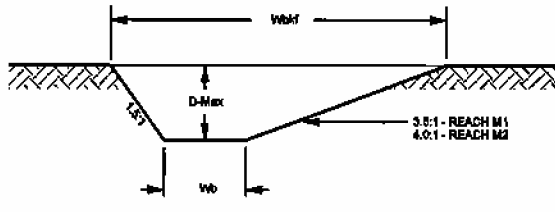
TYPICAL RIFFLE, POOL, AND BANKFULL BENCH CROSS SECTIONS



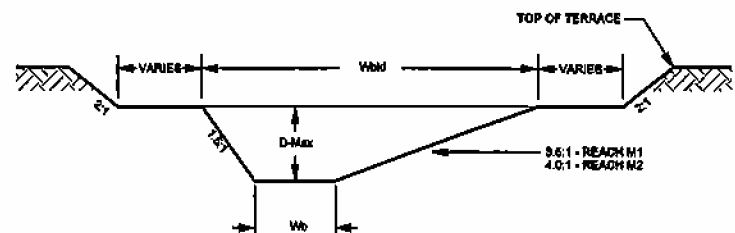
RIFFLE



RIFFLE WITH BANKFULL BENCH



POOL



POOL WITH BANKFULL BENCH

NOTES:
 1. DURING CONSTRUCTION CORNERS OF DESIGN CHANNEL WILL BE ROUNDED AND A THALWEG WILL BE SHAPED PER DIRECTION OF ENGINEER.
 2. POOLS SHOWN ABOVE ARE LEFT POOLS ONLY.

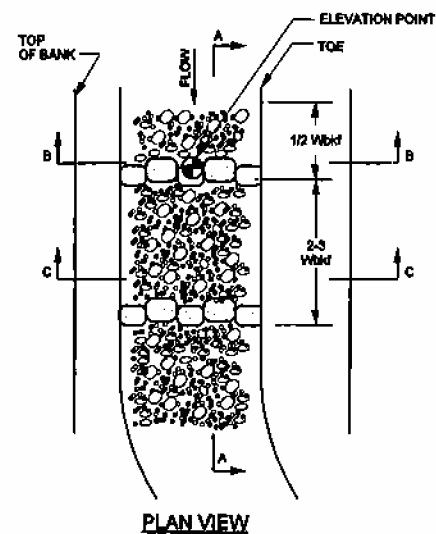
	M1		M2	
	RIFFLE	POOL	RIFFLE	POOL
WIDTH OF BANKFULL (Wbf)	8.0	16.0	10.0	17.0
MAXIMUM DEPTH (D-Max)	1.2	2.5	1.4	2.6
WIDTH TO DEPTH RATIO (Wbf/D)	10.0	6.6	10.0	10.2
BANKFULL AREA (Abf)	8.0	21.9	10.0	26.3
BOTTOM WIDTH (Wb)	4.0	2.6	4.6	3.3

WIDTH OF BANKFULL (Wbf)
 MAXIMUM DEPTH (D-Max)
 WIDTH TO DEPTH RATIO (Wbf/D)
 BANKFULL AREA (Abf)
 BOTTOM WIDTH (Wb)

4/30/07
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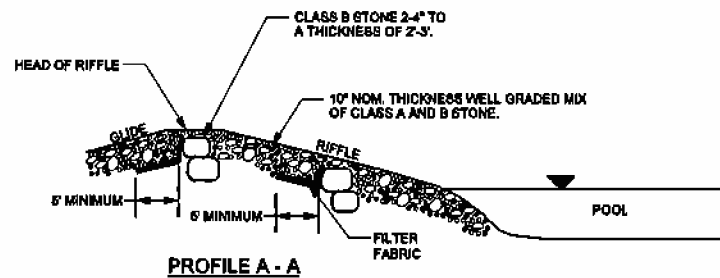
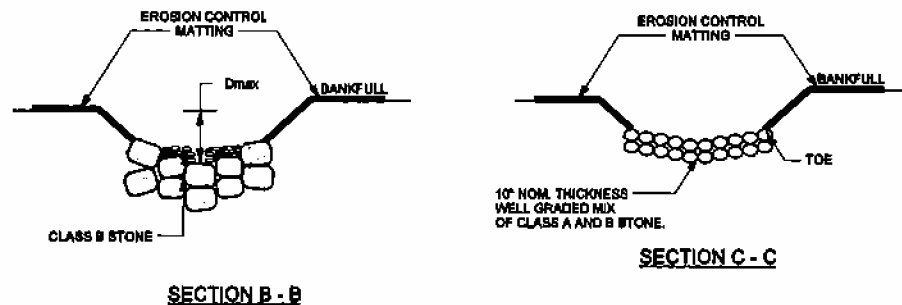
2/25/07

CONSTRUCTED RIFFLE

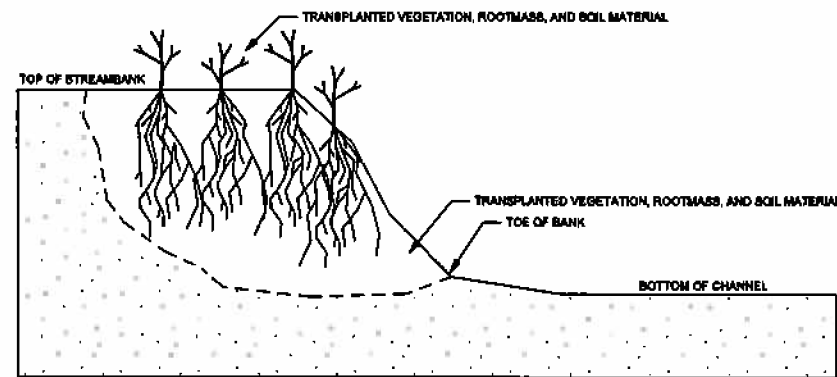


NOTES:

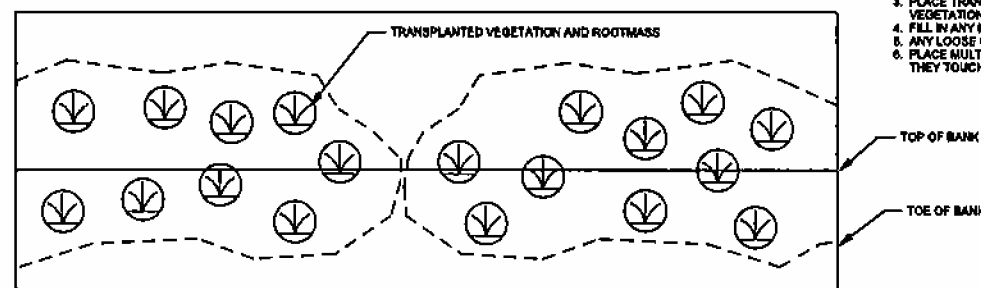
1. DIG A TRENCH BELOW THE BED FOR THE STOCK PILE CUT MATERIAL.
2. DIG A TRENCH FOR THE TAIL OF THE RIFFLE AND INSTALL CLASS B STONE.
3. FOR BOTH INVERTS, INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER AND EXTEND DOWNWARD TO THE DEPTH OF THE FOOTER, AND THEN UPSTREAM TO A MINIMUM OF FIVE FEET.
4. FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH 2 FOOT MIX OF CLASS A STONE, CLASS B STONE, AND #57 STONE TO THE INVERT ELEVATION OF THE CHANNEL.
5. UNDERCUT RIFFLE BETWEEN INVERTS BY 8 INCHES, ALSO UNDERCUT RIFFLE BY 8 INCHES FOR 4 FEET UPSTREAM OF HEAD OF RIFFLE AND 6 FEET DOWN STREAM OF TAIL OF RIFFLE. BACK FILL ALL UNDERCUT AREA WITH AN 8 INCH MIX OF CLASS A AND B STONE.



TRANSPLANTED VEGETATION



CROSS SECTION VIEW



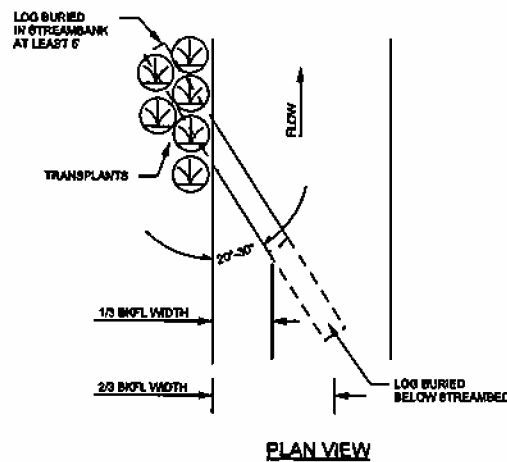
PLAN VIEW

NOTES:

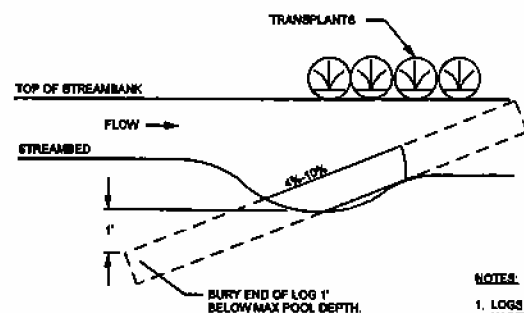
1. EXCAVATE A HOLE IN THE BANK TO BE STABILIZED THAT WILL ACCOMMODATE THE SIZE OF TRANSPLANT TO BE PLACED. BEGIN EXCAVATION AT THE TOE OF THE BANK.
2. EXCAVATE TRANSPLANT USING A FRONT END LOADER. EXCAVATE THE ENTIRE ROOT MASS AND AS MUCH ADDITIONAL SOIL MATERIAL AS POSSIBLE. IF ENTIRE ROOT MASS CAN NOT BE EXCAVATED IN ONE BUCKET LOAD, THE TRANSPLANT IS TOO LARGE AND ANOTHER SHOULD BE SELECTED.
3. PLACE TRANSPLANT IN THE BANK TO BE STABILIZED SO THAT VEGETATION IS ORIENTATED VERTICALLY.
4. FILL IN ANY HOLES AROUND THE TRANSPLANT AND COMPACT.
5. ANY LOOSE SOIL LEFT IN THE STREAM SHOULD BE REMOVED.
6. PLACE MULTIPLE TRANSPLANTS CLOSE TOGETHER SUCH THAT THEY TOUCH.

PROJECT REFERENCE NO. 0290R	SHEET NO. 2-A
PROJECT ENGINEER	
APPROVED BY:	
DATE: 4-30-07	
<small>Baker Engineering 8000 Regency Parkway Raleigh, NC North Carolina 27616 Phone: 919.483.5400 Fax: 919.483.5400</small>	

LOG VANE



PLAN VIEW

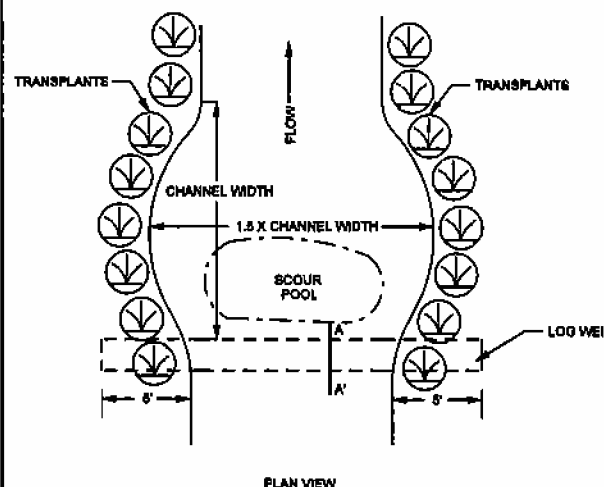


PROFILE VIEW

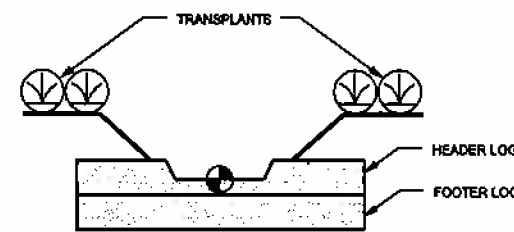
NOTES:

1. LOGS SHOULD BE AT LEAST 12 INCHES IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG.
3. TRANSPLANTS ARE PLACED ALONG THE TOP OF THE BANK OVER THE BURIED LOG VANE TO PROTECT AGAINST EROSION DURING HIGH FLOWS.

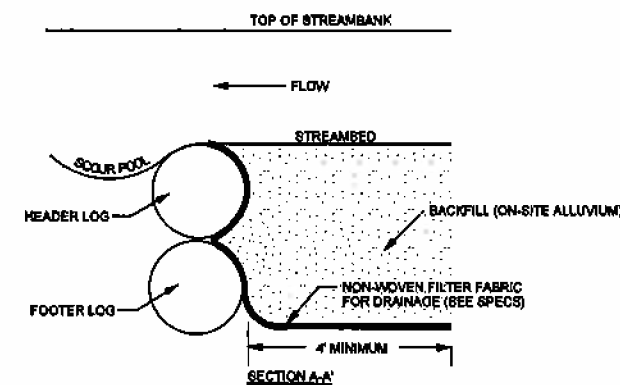
LOG WEIR



PLAN VIEW



CROSS SECTION VIEW



SECTION A-A

NOTES:

1. LOGS SHOULD BE AT LEAST 12 INCHES IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. LOGS >24 INCHES IN DIAMETER MAY BE USED ALONE WITHOUT AN ADDITIONAL LOG. NON-WOVEN FILTER FABRIC SHOULD STILL BE USED TO SEAL AROUND LOG.
3. PLACE FOOTER LOGS FIRST AND THEN HEADER (TOP) LOG. SET HEADER LOG APPROXIMATELY 3 INCHES ABOVE THE INVERT ELEVATION.
4. CUT A NOTCH IN THE HEADER LOG APPROXIMATELY 50 PERCENT OF THE CHANNEL BOTTOM WIDTH AND EXTENDING DOWN TO THE INVERT ELEVATION.
5. USE FILTER FABRIC FOR DRAINAGE TO SEAL GAPS BETWEEN LOGS.
6. PLACE TRANSPLANTS FROM TOE OF STREAMBANK TO TOP OF STREAMBANK.

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