STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

December 29, 2005

MEMORANDUM TO: Mr. S. P. Ivey, P.E.
Division 9 Engineer

FROM: for Philip S. Harris, III, P.E. ELL
Natural Environment Unit Head
Project Development and
Environmental Analysis Branch

SUBJECT: Davidson County, Replace Bridge No. 74 & 76 over SR 1242 and Michael's Branch; Federal Project No. BRSTP-29(10); State Project No. 8.1601401; TIP Number B-3157

Attached is the modification to the U. S. Army Corps of Engineers 404 Individual Permit for the above referenced project. All environmental permits have been received for the construction of this project.

PSH/gyb

Attachment

cc: Mr. Art McMillan, P.E.
Mr. Jay Bennett, P.E.
Mr. David Chang, P.E.
Mr. Randy Garris, P.E.
Mr. Greg Perfetti, P.E.
Mr. Mark Staley
Mr. John F. Sullivan, III, FHWA
Mr. Omar Sultan
Ms. Diane Hampton, P.E., Division 9 DEO
Mr. Randy Griffin

MAILING ADDRESS:
NC DEPARTMENT OF TRANSPORTATION
PROJECT DEVELOPMENT AND ENVIRONMENTAL ANALYSIS
1598 MAIL SERVICE CENTER
RALEIGH NC 27699-1598

TELEPHONE: 919-733-3141
FAX: 919-733-9794

WEBSITE: WWW.DOT.ORG

LOCATION:
TRANSPORTATION BUILDING
1 SOUTH WILMINGTON STREET
RALEIGH NC

PROJECT COMMITMENTS

Davidson County
Replace Bridges No. 74 & 76 over SR 1242 and Michael's Branch
Federal Aid Project BRSTP-29(10)
State Project 8.1601401
TIP No. B-3157

In addition to the standard Individual Section 404 and 401 Permit Conditions, State Consistency Conditions, NCDOT's Guidelines for Best Management Practices for Protection of Surface Waters, the following special commitments have been agreed to by NCDOT:

Commitments Developed through Permitting

No new special permit conditions are stated in the attached permit. All other conditions written into previous Section 404 Permits and Section 401 Water Quality Certifications still apply.

Beauregard

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1890
WILMINGTON, NORTH CAROLINA 28402-1890

RECEIVED
DEC 16 2005
DIVISION OF HIGHWAYS
PDEA-OFFICE OF NATURAL ENVIRONMENT

IN REPLY REFER TO

December 13, 2005

Regulatory Division

Action ID. 200020843

Gregory J. Thorpe, Ph.D.
Environmental Management Director, PDEA
N.C. Department of Transportation
1548 Mail Service Center
Raleigh, NC 27699-1548

Dear Mr. Thorpe:

Reference the Department of the Army permit issued on September 7, 2004, for the replacement of bridges No. 74 and 76 and interchange improvements over SR 1242 and Michael Branch, TIP B-3157, in Lexington, Davidson County, North Carolina. Reference is also made to your written request of November 18, 2005, for a permit modification to temporarily impact an additional 88 linear feet of jurisdictional stream channels of Michael Branch. The additional temporary impacts are necessary for the construction of a diversion channel for the authorized relocation of Michael Branch. This diversion channel as depicted in the attached plans would allow the relocated channel to stabilize before the scheduled release of flows in the spring of 2006. Also reference your written request of November 30, 2005, for a permit modification to permanently impact an additional 20 linear feet of jurisdictional waters of Michael Branch.

We have determined that the proposed additional temporary stream channel and permanent stream channel impacts are minor, and that a supplemental public notice is not necessary. Your permit is hereby modified to include the additional 88 linear feet of temporary stream channel impacts as described in the November 18, 2005, modification request and 20 linear feet of permanent jurisdiction stream channel impacts in your November 30, 2005, modification request. It is understood that all other conditions of the original permit and previous modifications remain applicable, including the permit expiration date of December 31, 2007.

If you have questions, please contact John Thomas of the Raleigh Regulatory Field Office, at telephone (919) 876-8441, extension 25.

Sincerely,

John E. Pulliam, Jr.
Colonel, U.S. Army
District Engineer

Enclosure

Copy Furnished (without enclosure):

Mr. John Hennessy
Division of Water Quality
North Carolina Department of
Environment and Natural Resources
1650 Mail Service Center
Raleigh, NC 27699-1650

Michael F. Easley, Governor

William G. Ross Jr., Secretary
North Carolina Department of Environment and Natural Resources

Alan W. Klimek, P.E. Director
Division of Water Quality

December 6, 2005

Beauregard
RECEIVED
DEC 9 2005
DIVISION OF HIGHWAYS
PDEA-OFFICE OF NATURAL ENVIRONMENT

Dr. Gregory J. Thorpe, PhD., Manager
Planning and Environmental Branch
North Carolina Department of Transportation
1548 Mail Service Center
Raleigh, North Carolina, 27699-1548

Re: Modification of 401 Water Quality Certification Pursuant to Section 401 of the Federal Clean Water Act, Individual Permit for Bridge Nos. 74 and 76 Interchange Improvements over SR 1242 and Michaels Branch, TIP No. B-3157
Individual WQC No. 3467
Davidson County

Dear Dr. Thorpe:

Attached hereto is a copy of the Modification of Certification No. 3467 issued to The North Carolina Department of Transportation dated December 6, 2005. If we can be of further assistance, do not hesitate to contact us.

Sincerely,

Alan W. Klimek, P.E.
Director

Attachments

cc: John Thomas, US Army Corps of Engineers Raleigh Field Office
Rachelle Beauregard, NCDOT - PDEA
Diane Hampton, DEO, NCDOT Division 9
Marla Chambers, Wildlife Resources Commission
DWQ Winston-Salem Regional Office
DWQ Central Files
DWQ Wetlands/401 Transportation Unit File Copy

APPROVAL OF 401 Water Quality Certification Modification and Additional Conditions

THIS CERTIFICATION is issued in conformity with the requirements of Section 401 Public Laws 92-500 and 95-217 of the United States and subject to the North Carolina Division of Water Quality (DWQ) Regulations in 15 NCAC 2H, Section .0500. **This modification authorizes a temporary diversion channel for Michael's Branch to direct the flow into the new box culvert adjacent to site 1 segment #2 and the changes made to the natural channel design for site 1, segment #3 of Michael Branch dated November 18, 2005.** This modification is applicable only to the modified proposed activities. All the authorized activities and conditions of certification associated with the original Water Quality Certification dated July 28, 2004, the modification dated April 22, 2005, and all other corresponding modifications still apply except where superceded by this certification.

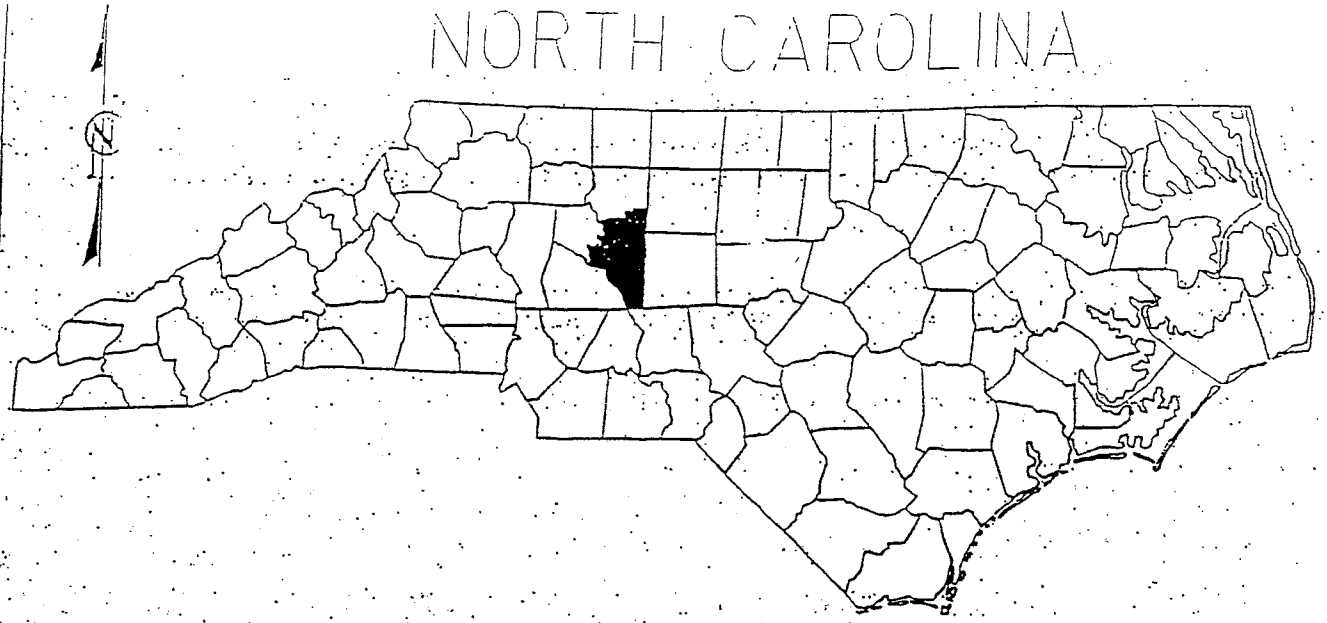
If this Certification is unacceptable to you have the right to an adjudicatory hearing upon written request within sixty (60) days following receipt of this Certification. This request must be in the form of a written petition conforming to Chapter 150B of the North Carolina General Statutes and filed with the Office of Administrative Hearings, P.O. Box 27447, Raleigh, N.C. 27611-7447. If modifications are made to an original Certification, you have the right to an adjudicatory hearing on the modifications upon written request within sixty (60) days following receipt of the Certification. Unless such demands are made, this Certification shall be final and binding.

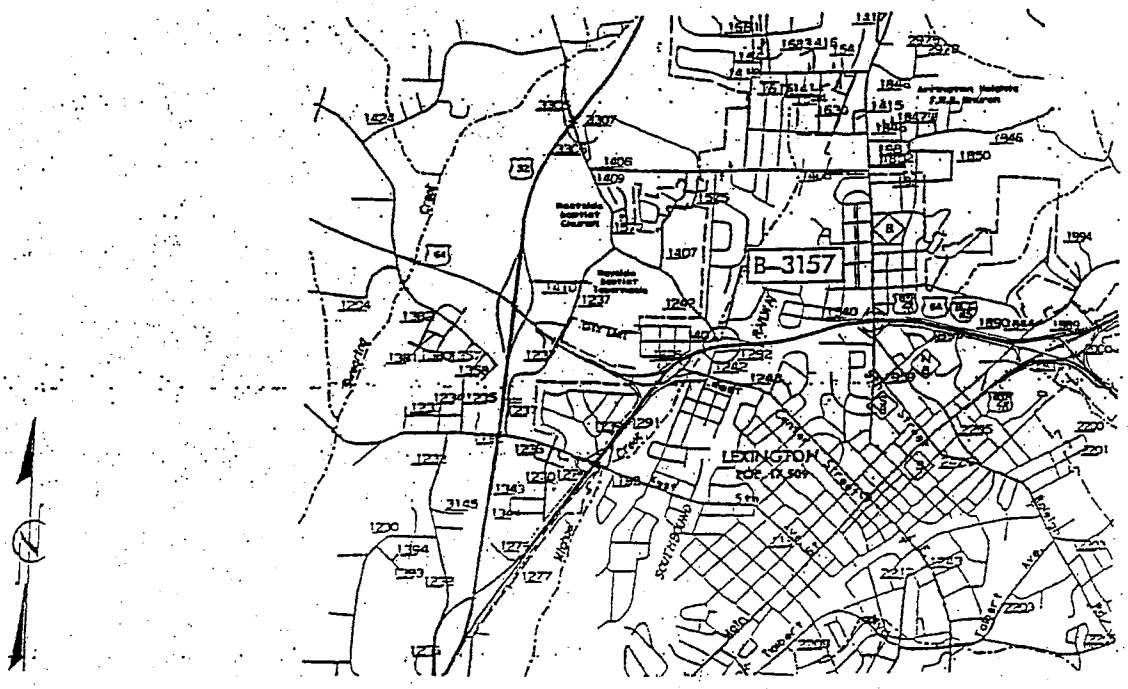
This the 6th day of December 2005

DIVISION OF WATER QUALITY

Alan W. Klimek, P.E.
Director

WQC No. 3467





VICINITY MAPS

NCDOT

DIVISION OF HIGHWAYS

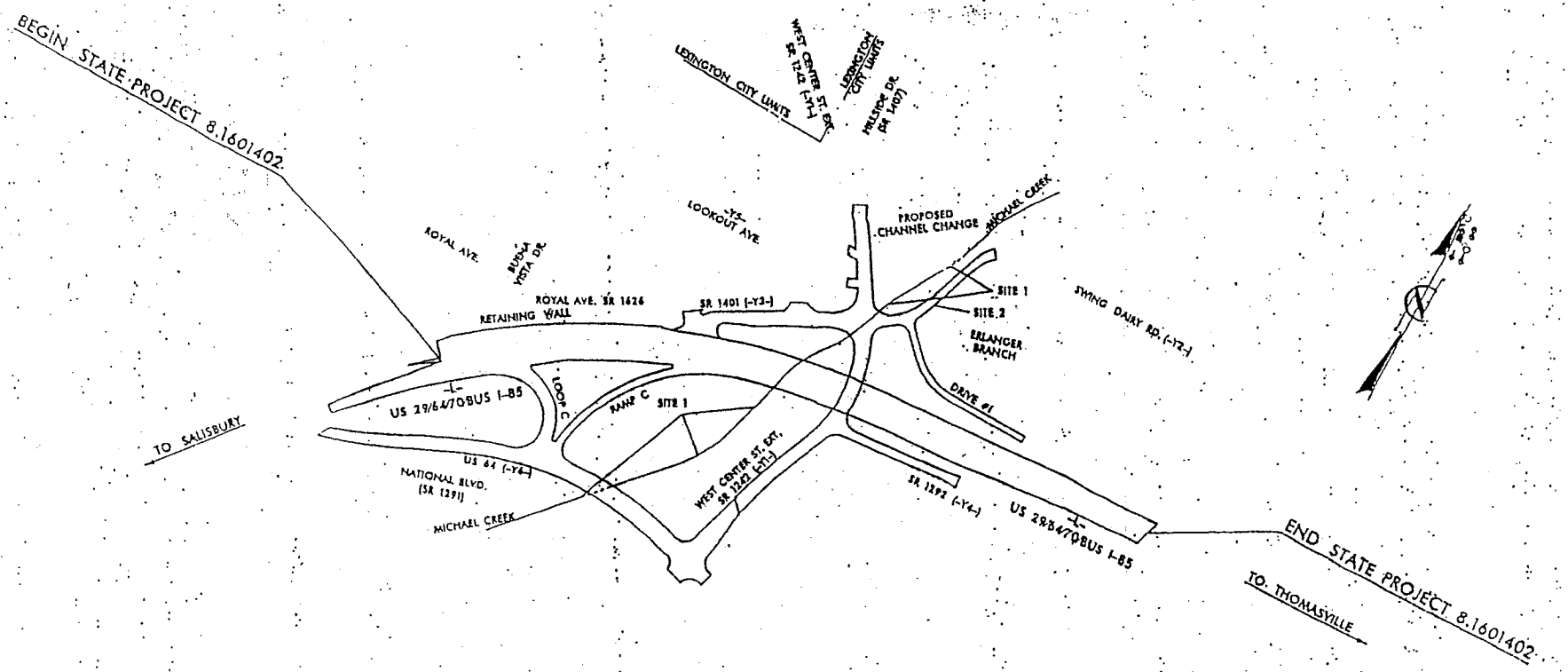
DAVIDSON COUNTY

PROJECT: 8.1631405 (B-3157)

BRIDGE NOS. 74 & 76 OVER SR1242 AND MICHAEL CREEK AND APPROACHES ON US 29/64/70 AND I-85 BUSINESS

SHEET 1 OF 31

5/27/05



SITE MAP

NCDOT
DIVISION OF HIGHWAYS
DAVIDSON COUNTY
PROJECT: 8.1631403 (B-3157)

BRIDGE NOS. 74 & 76 OVER SR1242 AND MICHAEL CREEK AND APPROACHES ON US 29/64/70 AND I-85 BUSINESS

SHEET 3 OF 31

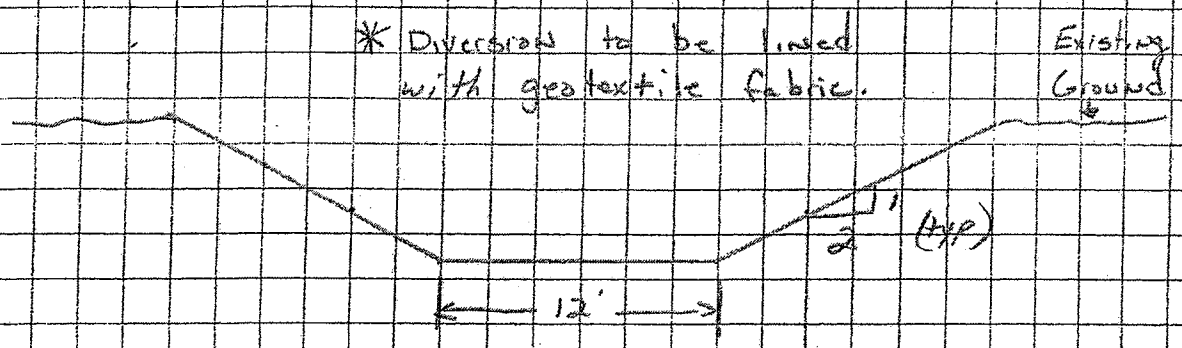
10/28/03

DLB, INC.
P.O. BOX 1239
HILLSVILLE, VA 24343
(276) 728-2137

PROJECT Davidson County C200781

PAGE 1 OF FILE

BY Rob Underwood DATE 11/3/05



Sect A-A

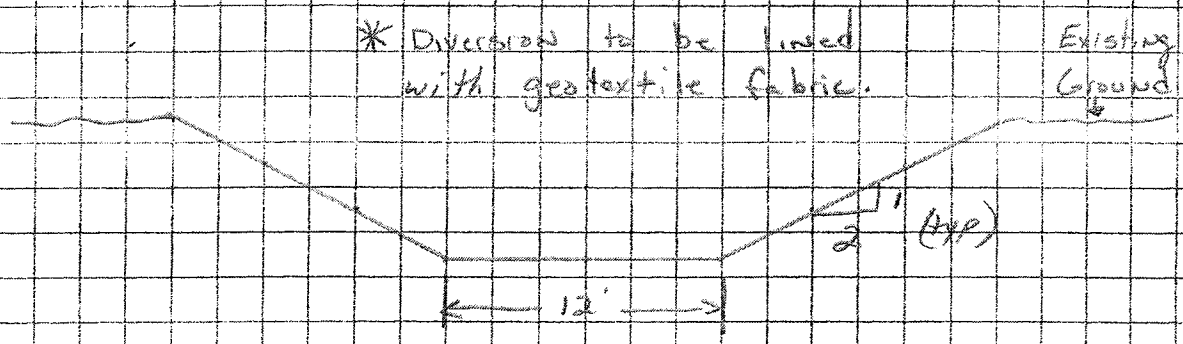
Typical Diversion Section

DLB, INC.
P.O. BOX 1239
HILLSVILLE, VA 24343
(276) 728-2137

PROJECT Davidson County CE00781

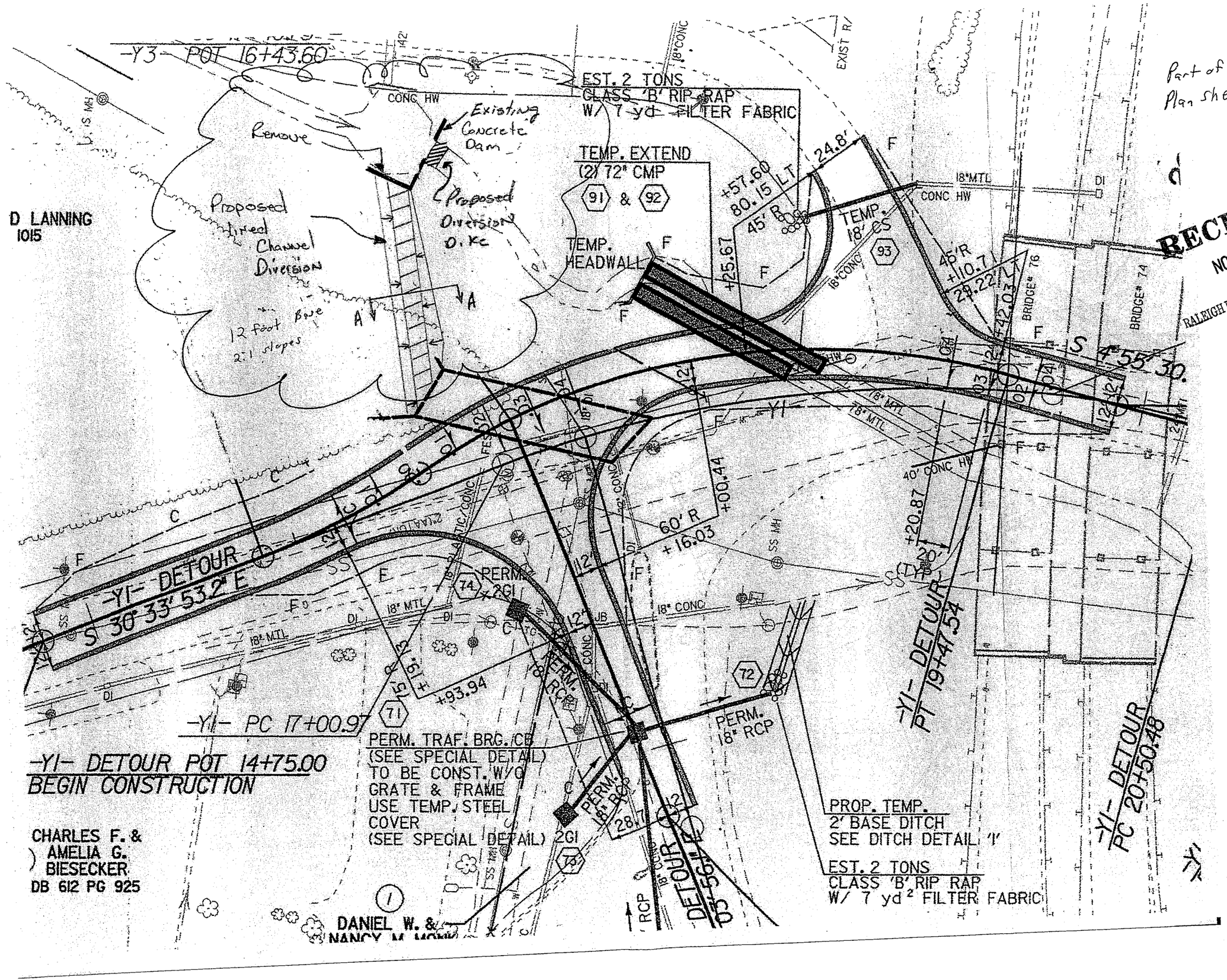
PAGE 1 OF FILE

BY Rob Underwood DATE 11/3/05



Sect A-A

Typical Diversion Section



RECEIVED
NOV 21 2005
RALEIGH REGULATORY FIELD OFFICE

PROJECT REFERENCE NO.	SHEET NO.
B-3157	5

HYDRAULICS ENGINEER

ROADWAY DESIGN ENGINEER

stream impact drawing sheet 29 of 31

INCOMPLETE PLANS
DO NOT USE FOR CONSTRUCTION

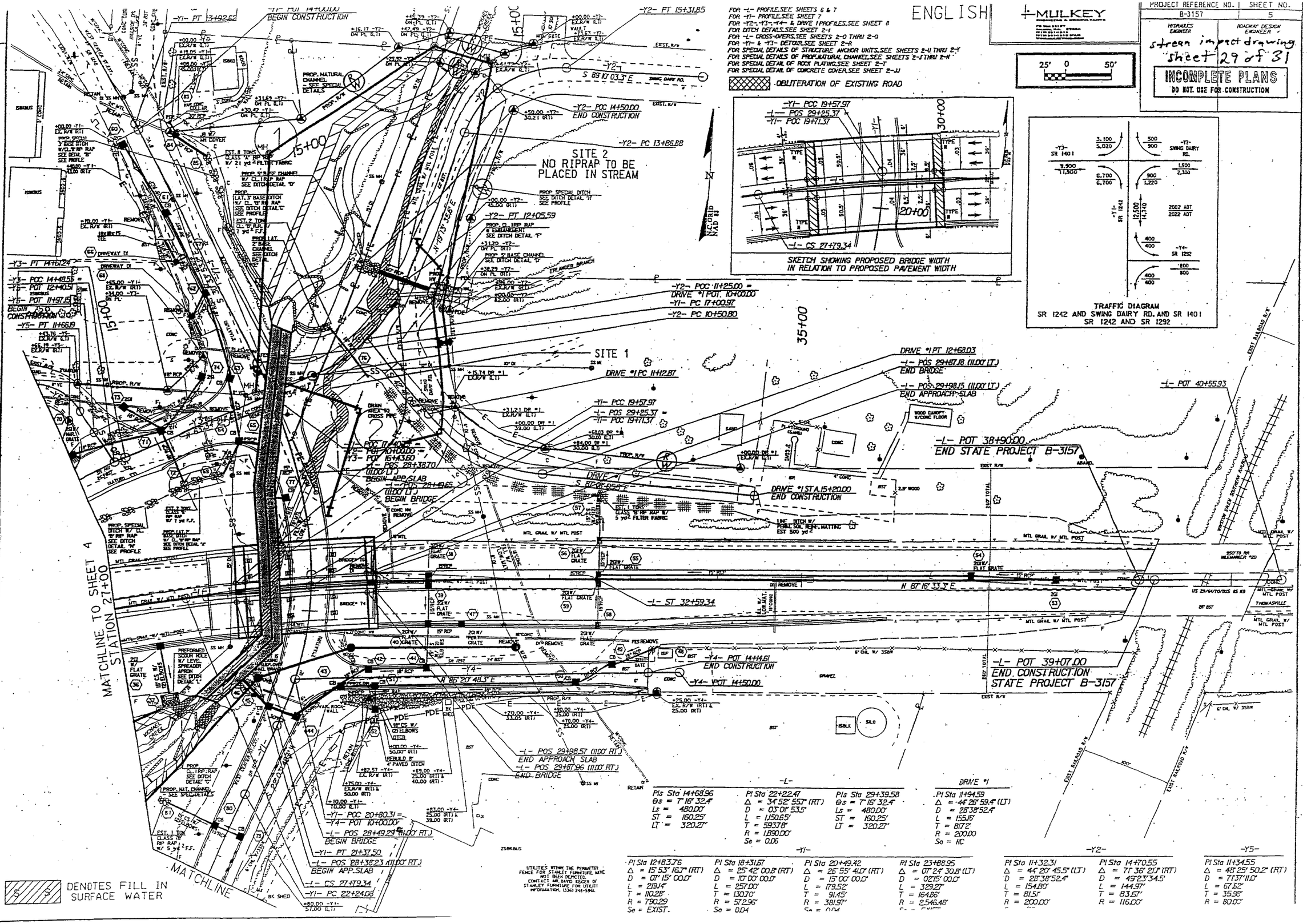
ENGLISH

MULKEY ENGINEERS & CONSULTANTS

FOR -L- PROFILE SEE SHEETS 6 & 7
FOR -Y1- PROFILE SEE SHEET 7
FOR -Y2-, -Y3-, -Y4- & DRIVE 1 PROFILES SEE SHEET 8
FOR DITCH DETAILS SEE SHEET 2-I
FOR -L- CROSS-OVERS SEE SHEETS 2-O THRU 2-Q
FOR -Y1- & -Y3- DETOUR SEE SHEET 2-R
FOR SPECIAL DETAILS OF STRUCTURE ANCHOR UNITS SEE SHEETS 2-U THRU 2-Y
FOR SPECIAL DETAILS OF PROP. NATURAL CHANNEL SEE SHEETS 2-F THRU 2-H
FOR SPECIAL DETAIL OF ROCK PLATING SEE SHEET 2-T
FOR SPECIAL DETAIL OF CONCRETE COVER SEE SHEET 2-JJ

OBLITERATION OF EXISTING ROAD

25' 0 50'



SKETCH SHOWING PROPOSED BRIDGE WIDTH IN RELATION TO PROPOSED PAVEMENT WIDTH

TRAFFIC DIAGRAM
SR 1242 AND SWING DAIRY RD. AND SR 1401
SR 1242 AND SR 1292

-L-

PI Sta 14+68.96	PI Sta 22+22.47	PI Sta 29+39.58
θs = 7°16'32.4"	Δ = 34°52'55.7" (RT)	θs = 7°16'32.4"
Ls = 480.00'	D = 03°01'53.5"	Ls = 480.00'
ST = 160.25'	L = 1,150.65'	ST = 160.25'
LT = 320.27'	T = 593.78'	LT = 320.27'
	R = 1,890.00'	
	Se = 0.06	

DRIVE #1

PI Sta 11+94.59
Δ = 44°26'59.4" (LT)
D = 28°38'52.4"
L = 155.16'
T = 81.72'
R = 200.00
Se = NC

-Y1-

PI Sta 12+83.76	PI Sta 18+31.67	PI Sta 20+49.42	PI Sta 23+88.95
Δ = 15°53'16.7" (RT)	Δ = 25°42'00.8" (RT)	Δ = 26°55'41.0" (RT)	Δ = 07°24'30.8" (LT)
D = 07°15'00.0"	D = 10°00'00.0"	D = 15°00'00.0"	D = 02°15'00.0"
L = 219.14'	L = 257.00'	L = 179.52'	L = 329.27'
T = 110.28'	T = 130.70'	T = 91.45'	T = 164.86'
R = 790.29	R = 572.96'	R = 381.97'	R = 2,546.48'
Se = EXIST.	Se = 0.04	Se = 0.04	Se = EXIST.

-Y2-

PI Sta 11+32.31	PI Sta 14+70.55
Δ = 44°20'45.5" (LT)	Δ = 71°36'21.1" (RT)
D = 28°38'52.4"	D = 49°23'34.5"
L = 154.80'	L = 144.97'
T = 81.51'	T = 83.57'
R = 200.00'	R = 116.00'

-Y5-

PI Sta 11+34.55
Δ = 48°25'50.2" (RT)
D = 71°37'11.0"
L = 67.62'
T = 35.98'
R = 80.00'

REVISIONS

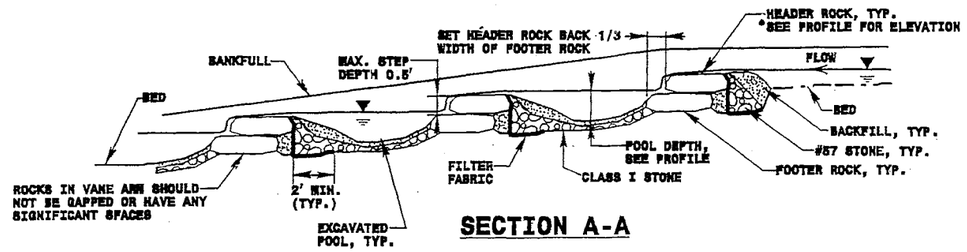
11/28/2003
C:\10_SR\Jobs\P-R\MULKEY\PSH05.DGN
12:56:19 PM

PROJECT REFERENCE NO.	SHEET NO.
B-3157	2-M
HYDRAULICS ENGINEER	ROADWAY DESIGN ENGINEER

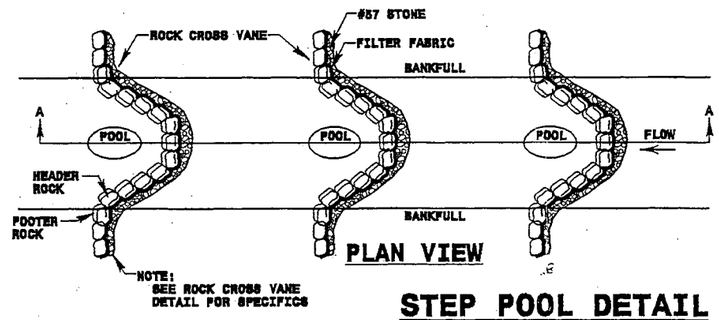
SHEET 20 OF 31
REV. 4/21/05

NATURAL CHANNEL DESIGN TYPICALS

NOT TO SCALE



SECTION A-A

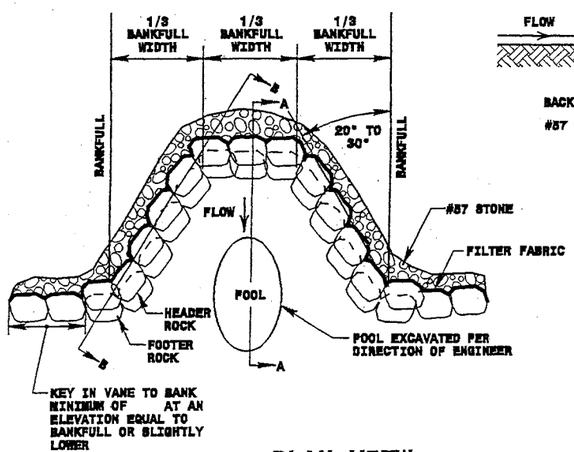


PLAN VIEW

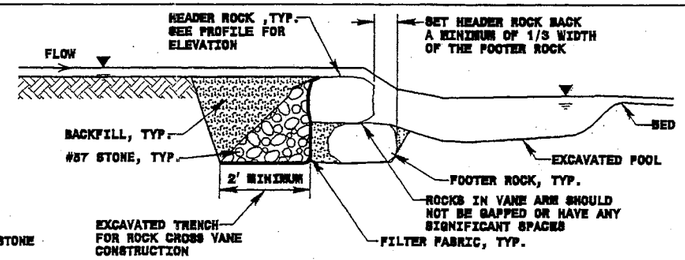
STEP POOL DETAIL

NOT TO SCALE

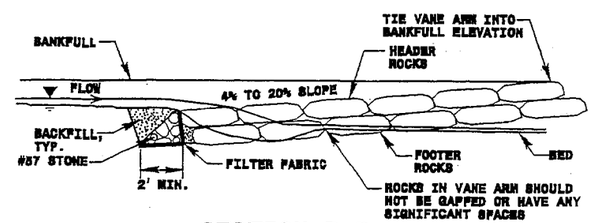
NOTES:
1. STEPS TO BE SHORT, FREQUENT, AND CLOSELY SPACED.
2. POOL SPACING SHALL BE INVERSELY PROPORTIONAL TO STREAM SLOPE, AND DIRECTLY PROPORTIONAL TO BANKFULL WIDTH.
3. POOL DEPTHS AT BANKFULL ELEVATION SHALL BE TYPICALLY 2 TO 3 TIMES DEEPER THAN STEP DEPTHS AT BANKFULL ELEVATION.
4. ADEQUATE NUMBER OF FOOTER BOULDERS TO BE USED IN ORDER TO HOLD UP THE BOULDERS AT HEAD OF STEPS DURING HIGH ENERGY/HIGH FLOW EVENTS.
5. STEP POOL DEPTH SHOULD BE 2 TO 3 TIMES BANKFULL DEPTH.



PLAN VIEW



SECTION A-A



SECTION B-B

	BOULDER DIMENSIONS (FEET)		
STATION	HEIGHT	LENGTH	WIDTH
BEGIN	2	4	3
TO END	2	4	3

ROCK CROSS VANE DETAIL FOR STEP POOLS

NOT TO SCALE

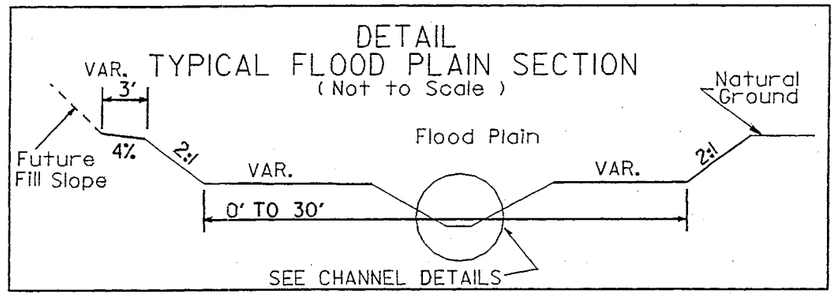
NOTES:
1. DEEPEST PART OF POOL TO BE IN LINE WITH WHERE VANE ARM TIES INTO BANKFULL.
2. DO NOT EXCAVATE POOL TOO CLOSE TO FOOTER BOULDERS.
3. CLASS "A" STONE CAN BE USED TO REDUCE VOIDS BETWEEN HEADERS AND FOOTERS.
4. COMPACT BANKFULL TO EXTENT POSSIBLE OR AT THE DIRECTION OF THE ENGINEER.
5. POOL DEPTH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

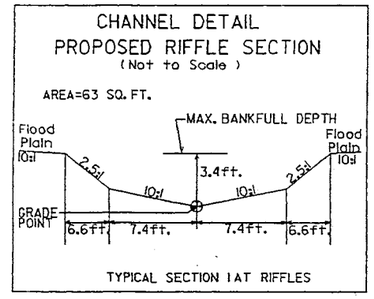
REVISIONS

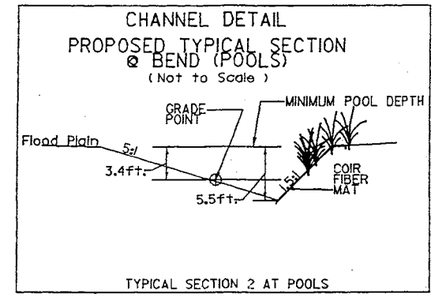
PROJECT REFERENCE NO.	SHEET NO.
B-3157	2-M
HYDRAULICS ENGINEER	ROADWAY DESIGN ENGINEER

NATURAL CHANNEL DESIGN TYPICALS

NOT TO SCALE



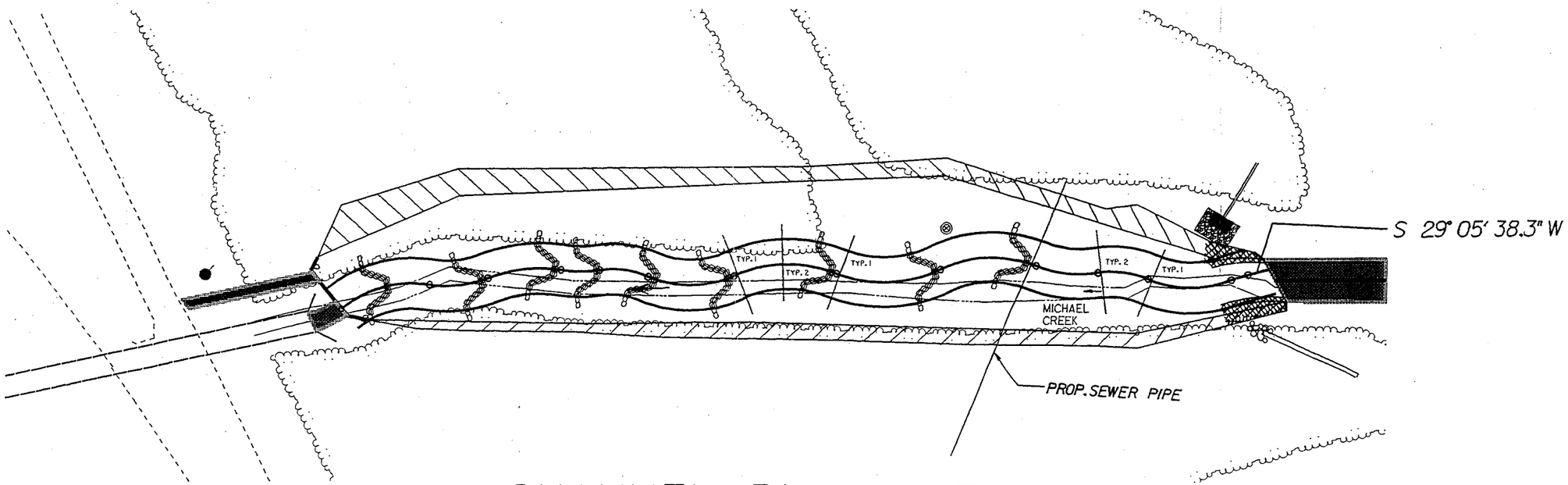




QUANTITES

DDE = 14500CY
BOULDERS = 300@4000LB.
270@2000LB.
COIR FIBER MAT = 850SY
GEOTEXTILE FABRIC = 600SY

SHEET 23 OF 31
REV. 10/26/05



CHANNEL PLAN VIEW

SEGMENT #3

STA. 21+45 TO 25+93.3 -Y1- RIGHT

REVISIONS

PROJECT REFERENCE NO.	SHEET NO.
B-3157	2-N
HYDRAULICS ENGINEER	ROADWAY DESIGN ENGINEER

REVISIONS

SEGMENT #1

	STA. (-NCD-)	ELEV.
CV 1	10+00	715.5
CV 2	10+50	715.0
CV 3	11+00	714.5
CV 4	11+50	714.0
CV 5	12+00	713.5
CV 6	12+50	713.0

SEGMENT #2

	STA. (-NCD-)	ELEV.
CV 7	13+00	712.5
CV 8	13+50	712.0

SEGMENT #3

	STA. (-NCD-)	ELEV.
CV 1	11+35	713.00
CV 2	11+90	712.50
CV 3	12+45	712.00
CV 4	13+05	711.50
CV 5	13+50	711.00
CV 6	13+80	710.5
CV 7	14+10	710.00
CV 8	14+45	709.50
CV 9	15+00	709.15

CURVE DATA SEGMENT #1 & #2

PI Sta 10+30.98
Δ = 16° 17' 35.0" (LT)
D = 76° 23' 39.7"
L = 21.33'
T = 10.74'
R = 75.00'

PI Sta 10+63.08
Δ = 32° 00' 06.9" (RT)
D = 76° 23' 39.7"
L = 41.89'
T = 21.51'
R = 75.00'

PI Sta 11+09.28
Δ = 46° 33' 20.5" (LT)
D = 95° 29' 34.7"
L = 48.75'
T = 25.81'
R = 60.00'

PI Sta 11+46.92
Δ = 32° 46' 16.4" (RT)
D = 114° 35' 29.6"
L = 28.60'
T = 14.70'
R = 50.00'

PI Sta 11+80.93
Δ = 34° 23' 38.1" (LT)
D = 88° 08' 50.5"
L = 39.02'
T = 20.12'
R = 65.00'

PI Sta 12+14.58
Δ = 22° 14' 58.1" (RT)
D = 76° 23' 39.7"
L = 29.12'
T = 14.75'
R = 75.00'

PI Sta 12+36.46
Δ = 15° 31' 29.3" (LT)
D = 104° 10' 26.9"
L = 14.90'
T = 7.50'
R = 55.00'

PI Sta 12+70.33
Δ = 44° 18' 59.4" (RT)
D = 88° 08' 50.5"
L = 50.28'
T = 26.47'
R = 65.00'

PI Sta 13+19.91
Δ = 40° 25' 08.7" (LT)
D = 81° 51' 04.0"
L = 49.38'
T = 25.77'
R = 70.00'

CURVE DATA SEGMENT #3

PI Sta 10+18.97
Δ = 6° 17' 22.1" (LT)
D = 114° 35' 29.6"
L = 5.49'
T = 2.75'
R = 50.00'

PI Sta 10+46.38
Δ = 44° 41' 26.1" (RT)
D = 95° 29' 34.7"
L = 46.80'
T = 24.66'
R = 60.00'

PI Sta 10+83.13
Δ = 32° 35' 47.1" (LT)
D = 114° 35' 29.6"
L = 28.45'
T = 14.62'
R = 50.00'

PI Sta 11+14.97
Δ = 30° 58' 44.9" (RT)
D = 88° 08' 50.5"
L = 35.14'
T = 18.01'
R = 65.00'

PI Sta 11+60.94
Δ = 47° 50' 35.9" (LT)
D = 88° 08' 50.5"
L = 54.28'
T = 28.83'
R = 65.00'

PI Sta 12+17.08
Δ = 47° 21' 52.0" (RT)
D = 81° 51' 04.0"
L = 57.87'
T = 30.70'
R = 70.00'

PI Sta 12+75.31
Δ = 44° 59' 35.3" (LT)
D = 76° 23' 39.7"
L = 58.90'
T = 31.06'
R = 75.00'

PI Sta 13+29.25
Δ = 47° 01' 50.0" (RT)
D = 95° 29' 34.7"
L = 49.25'
T = 26.11'
R = 60.00'

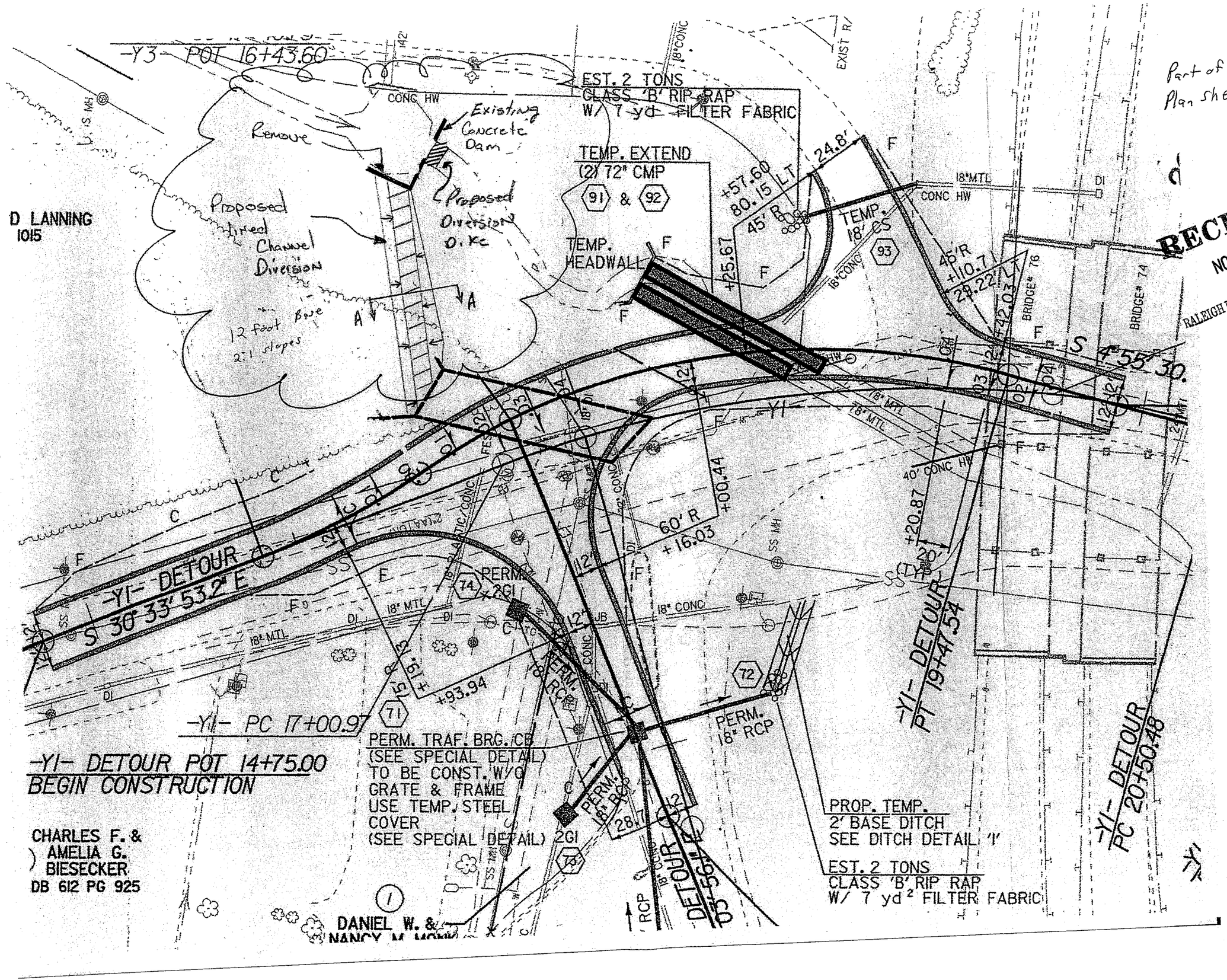
PI Sta 13+66.55
Δ = 31° 36' 46.4" (LT)
D = 114° 35' 29.6"
L = 27.59'
T = 14.15'
R = 50.00'

PI Sta 13+91.42
Δ = 17° 20' 32.3" (RT)
D = 76° 23' 39.7"
L = 22.70'
T = 11.44'
R = 75.00'

PI Sta 14+23.29
Δ = 30° 43' 49.3" (LT)
D = 76° 23' 39.7"
L = 40.23'
T = 20.61'
R = 75.00'

PI Sta 14+59.47
Δ = 30° 51' 23.1" (RT)
D = 95° 29' 34.7"
L = 32.31'
T = 16.56'
R = 60.00'

PI Sta 15+02.69
Δ = 49° 11' 55.4" (LT)
D = 95° 29' 34.7"
L = 51.52'
T = 27.47'
R = 60.00'



RECEIVED
NOV 21 2005
RALEIGH REGULATORY FIELD OFFICE

PROJECT REFERENCE NO.	SHEET NO.
B-3157	5

HYDRAULICS ENGINEER

ROADWAY DESIGN ENGINEER

stream impact drawing sheet 29 of 31

INCOMPLETE PLANS
DO NOT USE FOR CONSTRUCTION

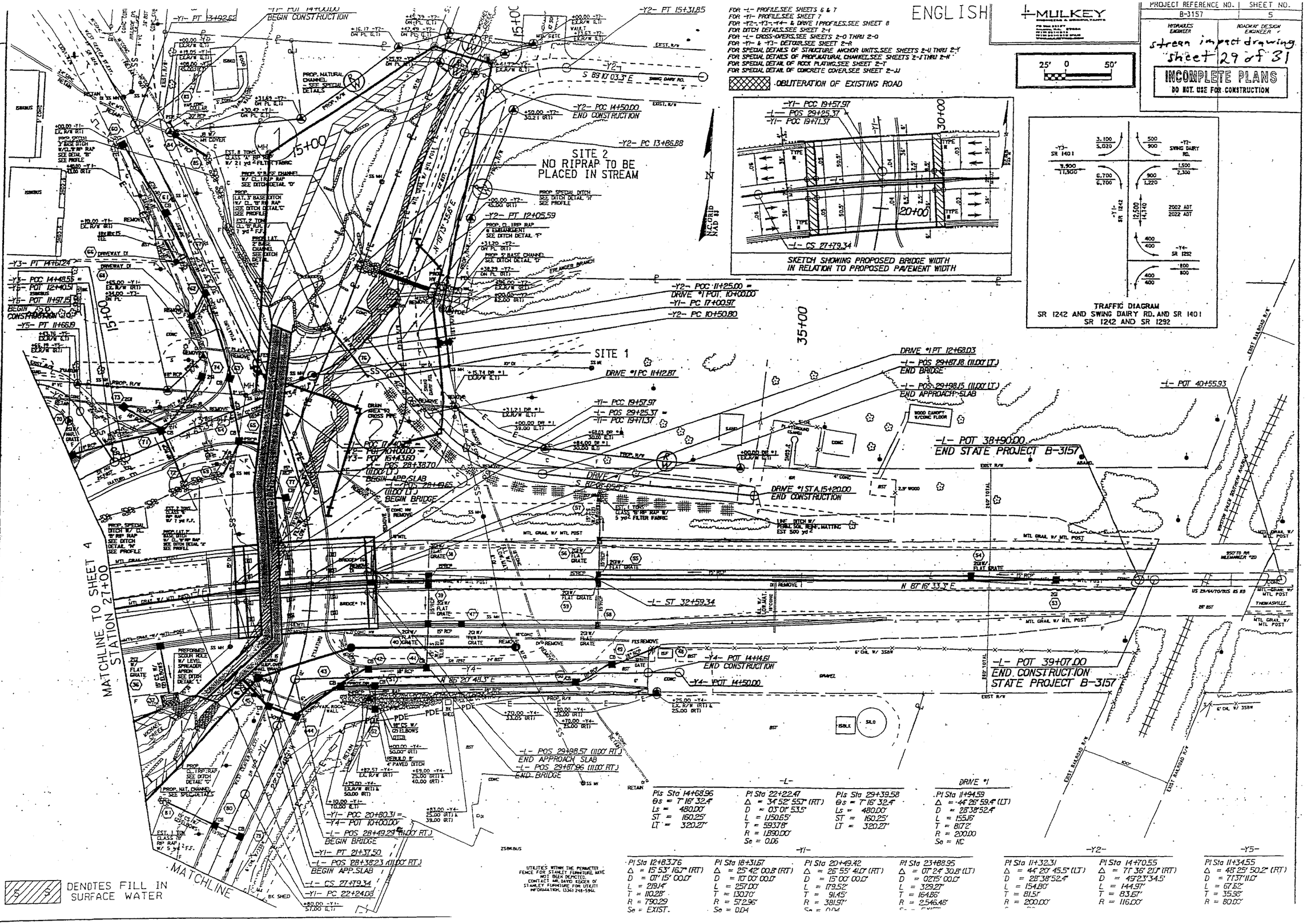
ENGLISH

MULKEY ENGINEERS & CONSULTANTS

FOR -L- PROFILE SEE SHEETS 6 & 7
FOR -Y1- PROFILE SEE SHEET 7
FOR -Y2-, -Y3-, -Y4- & DRIVE 1 PROFILES SEE SHEET 8
FOR DITCH DETAILS SEE SHEET 2-I
FOR -L- CROSS-OVERS SEE SHEETS 2-O THRU 2-Q
FOR -Y1- & -Y3- DETOUR SEE SHEET 2-R
FOR SPECIAL DETAILS OF STRUCTURE ANCHOR UNITS SEE SHEETS 2-U THRU 2-Y
FOR SPECIAL DETAILS OF PROP. NATURAL CHANNEL SEE SHEETS 2-F THRU 2-H
FOR SPECIAL DETAIL OF ROCK PLATING SEE SHEET 2-T
FOR SPECIAL DETAIL OF CONCRETE COVER SEE SHEET 2-JJ

OBLITERATION OF EXISTING ROAD

25' 0 50'



SKETCH SHOWING PROPOSED BRIDGE WIDTH IN RELATION TO PROPOSED PAVEMENT WIDTH

TRAFFIC DIAGRAM
SR 1242 AND SWING DAIRY RD. AND SR 1401
SR 1242 AND SR 1292

-L-

PI Sta 14+68.96	PI Sta 22+22.47	PI Sta 29+39.58
θs = 7°16'32.4"	Δ = 34°52'55.7" (RT)	θs = 7°16'32.4"
Ls = 480.00'	D = 03°01'53.5"	Ls = 480.00'
ST = 160.25'	L = 1,150.65'	ST = 160.25'
LT = 320.27'	T = 593.78'	LT = 320.27'
	R = 1,890.00'	
	Se = 0.06	

DRIVE #1

PI Sta 11+94.59
Δ = 44°26'59.4" (LT)
D = 28°38'52.4"
L = 155.16'
T = 81.72'
R = 200.00
Se = NC

-Y1-

PI Sta 12+83.76	PI Sta 18+31.67	PI Sta 20+49.42	PI Sta 23+88.95
Δ = 15°53'16.7" (RT)	Δ = 25°42'00.8" (RT)	Δ = 26°55'41.0" (RT)	Δ = 07°24'30.8" (LT)
D = 07°15'00.0"	D = 10°00'00.0"	D = 15°00'00.0"	D = 02°15'00.0"
L = 219.14'	L = 257.00'	L = 179.52'	L = 329.27'
T = 110.28'	T = 130.70'	T = 91.45'	T = 164.86'
R = 790.29	R = 572.96'	R = 381.97'	R = 2,546.48'
Se = EXIST.	Se = 0.04	Se = 0.04	Se = EXIST.

-Y2-

PI Sta 11+32.31	PI Sta 14+70.55
Δ = 44°20'45.5" (LT)	Δ = 71°36'21.1" (RT)
D = 28°38'52.4"	D = 49°23'34.5"
L = 154.80'	L = 144.97'
T = 81.51'	T = 83.57'
R = 200.00'	R = 116.00'

-Y5-

PI Sta 11+34.55
Δ = 48°25'50.2" (RT)
D = 71°37'11.0"
L = 67.62'
T = 35.98'
R = 80.00'

REVISIONS

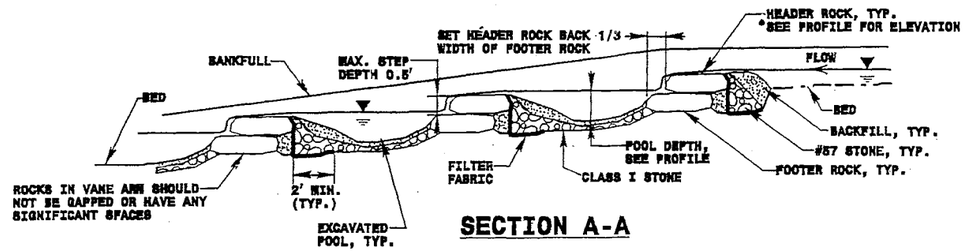
11/28/2003
C:\10_SR\Jobs\P-R\MULKEY\PSH05.DGN
12:56:19 PM

PROJECT REFERENCE NO.	SHEET NO.
B-3157	2-M
HYDRAULICS ENGINEER	ROADWAY DESIGN ENGINEER

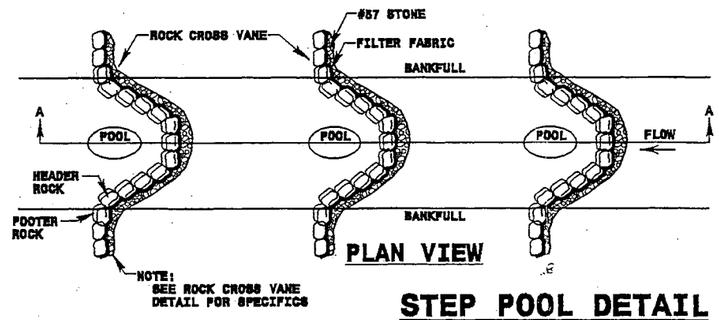
SHEET 20 OF 31
REV. 4/21/05

NATURAL CHANNEL DESIGN TYPICALS

NOT TO SCALE



SECTION A-A

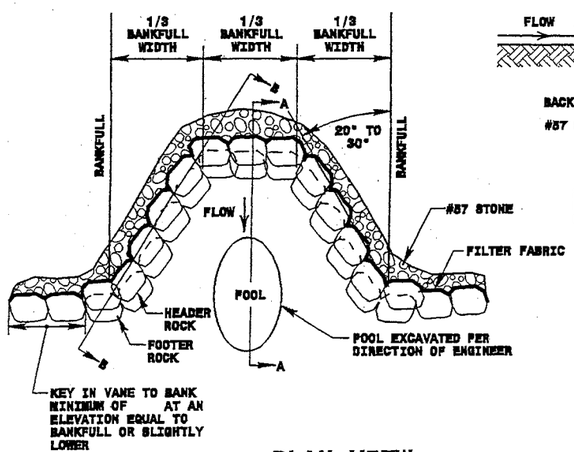


PLAN VIEW

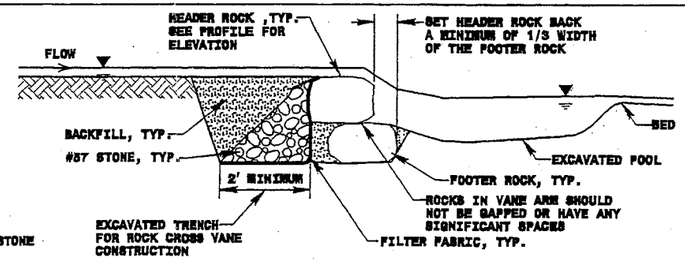
STEP POOL DETAIL

NOT TO SCALE

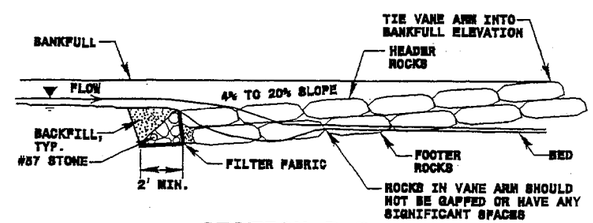
NOTES:
1. STEPS TO BE SHORT, FREQUENT, AND CLOSELY SPACED.
2. POOL SPACING SHALL BE INVERSELY PROPORTIONAL TO STREAM SLOPE, AND DIRECTLY PROPORTIONAL TO BANKFULL WIDTH.
3. POOL DEPTHS AT BANKFULL ELEVATION SHALL BE TYPICALLY 2 TO 3 TIMES DEEPER THAN STEP DEPTHS AT BANKFULL ELEVATION.
4. ADEQUATE NUMBER OF FOOTER BOULDERS TO BE USED IN ORDER TO HOLD UP THE BOULDERS AT HEAD OF STEPS DURING HIGH ENERGY/HIGH FLOW EVENTS.
5. STEP POOL DEPTH SHOULD BE 2 TO 3 TIMES BANKFULL DEPTH.



PLAN VIEW



SECTION A-A



SECTION B-B

	BOULDER DIMENSIONS (FEET)		
STATION	HEIGHT	LENGTH	WIDTH
BEGIN	2	4	3
TO END	2	4	3

ROCK CROSS VANE DETAIL FOR STEP POOLS

NOT TO SCALE

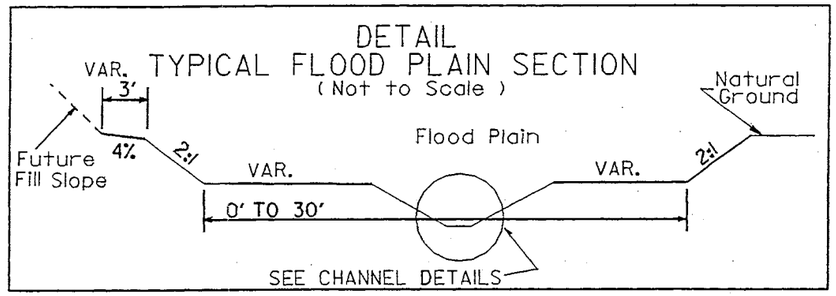
NOTES:
1. DEEPEST PART OF POOL TO BE IN LINE WITH WHERE VANE ARM TIES INTO BANKFULL.
2. DO NOT EXCAVATE POOL TOO CLOSE TO FOOTER BOULDERS.
3. CLASS "A" STONE CAN BE USED TO REDUCE VOIDS BETWEEN HEADERS AND FOOTERS.
4. COMPACT BANKFULL TO EXTENT POSSIBLE OR AT THE DIRECTION OF THE ENGINEER.
5. POOL DEPTH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

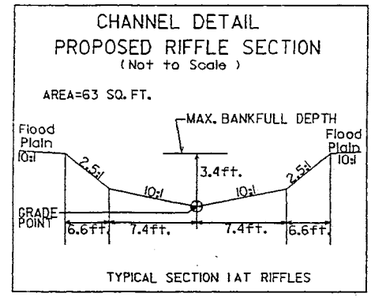
REVISIONS

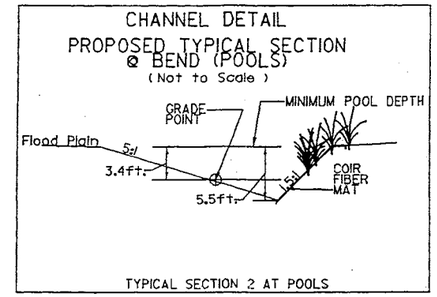
PROJECT REFERENCE NO.	SHEET NO.
B-3157	2-M
HYDRAULICS ENGINEER	ROADWAY DESIGN ENGINEER

NATURAL CHANNEL DESIGN TYPICALS

NOT TO SCALE



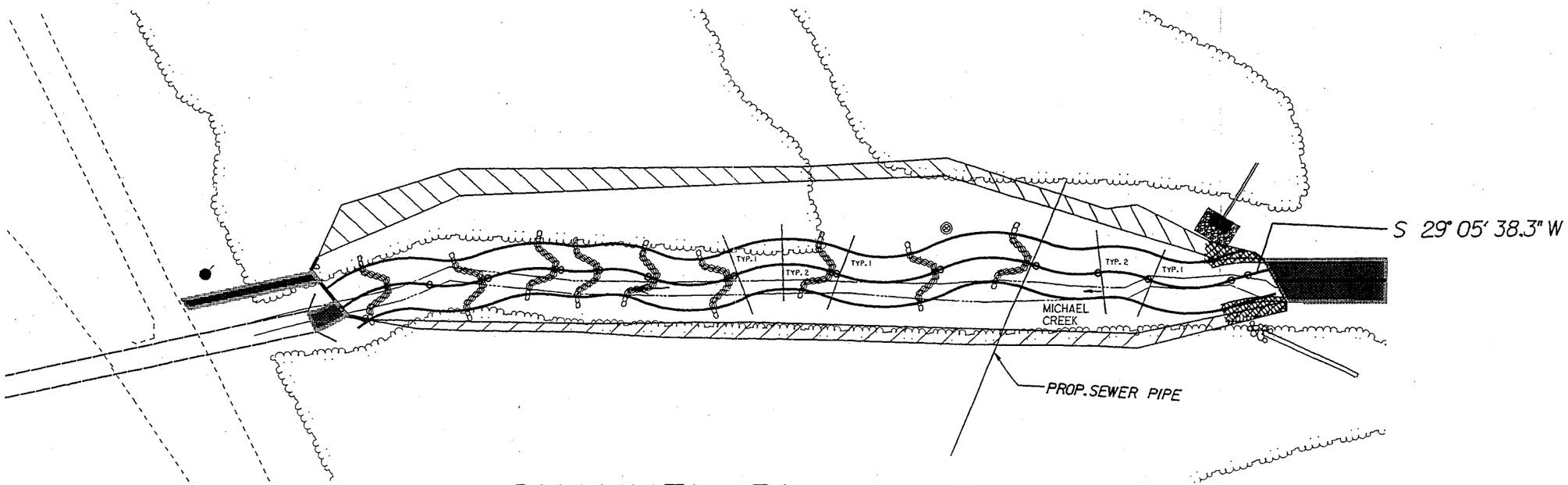




QUANTITES

DDE = 14500CY
BOULDERS = 300@4000LB.
270@2000LB.
COIR FIBER MAT = 850SY
GEOTEXTILE FABRIC = 600SY

SHEET 23 OF 31
REV. 10/26/05



CHANNEL PLAN VIEW

SEGMENT #3

STA. 21+45 TO 25+93.3 -Y1- RIGHT

REVISIONS

PROJECT REFERENCE NO.	SHEET NO.
B-3157	2-N
HYDRAULICS ENGINEER	ROADWAY DESIGN ENGINEER

REVISIONS

SEGMENT #1

	STA. (-NCD-)	ELEV.
CV 1	10+00	715.5
CV 2	10+50	715.0
CV 3	11+00	714.5
CV 4	11+50	714.0
CV 5	12+00	713.5
CV 6	12+50	713.0

SEGMENT #2

	STA. (-NCD-)	ELEV.
CV 7	13+00	712.5
CV 8	13+50	712.0

SEGMENT #3

	STA. (-NCD-)	ELEV.
CV 1	11+35	713.00
CV 2	11+90	712.50
CV 3	12+45	712.00
CV 4	13+05	711.50
CV 5	13+50	711.00
CV 6	13+80	710.5
CV 7	14+10	710.00
CV 8	14+45	709.50
CV 9	15+00	709.15

CURVE DATA SEGMENT #1 & #2

PI Sta 10+30.98
Δ = 16° 17' 35.0" (LT)
D = 76° 23' 39.7"
L = 21.33'
T = 10.74'
R = 75.00'

PI Sta 10+63.08
Δ = 32° 00' 06.9" (RT)
D = 76° 23' 39.7"
L = 41.89'
T = 21.51'
R = 75.00'

PI Sta 11+09.28
Δ = 46° 33' 20.5" (LT)
D = 95° 29' 34.7"
L = 48.75'
T = 25.81'
R = 60.00'

PI Sta 11+46.92
Δ = 32° 46' 16.4" (RT)
D = 114° 35' 29.6"
L = 28.60'
T = 14.70'
R = 50.00'

PI Sta 11+80.93
Δ = 34° 23' 38.1" (LT)
D = 88° 08' 50.5"
L = 39.02'
T = 20.12'
R = 65.00'

PI Sta 12+14.58
Δ = 22° 14' 58.1" (RT)
D = 76° 23' 39.7"
L = 29.12'
T = 14.75'
R = 75.00'

PI Sta 12+36.46
Δ = 15° 31' 29.3" (LT)
D = 104° 10' 26.9"
L = 14.90'
T = 7.50'
R = 55.00'

PI Sta 12+70.33
Δ = 44° 18' 59.4" (RT)
D = 88° 08' 50.5"
L = 50.28'
T = 26.47'
R = 65.00'

PI Sta 13+19.91
Δ = 40° 25' 08.7" (LT)
D = 81° 51' 04.0"
L = 49.38'
T = 25.77'
R = 70.00'

CURVE DATA SEGMENT #3

PI Sta 10+18.97
Δ = 6° 17' 22.1" (LT)
D = 114° 35' 29.6"
L = 5.49'
T = 2.75'
R = 50.00'

PI Sta 10+46.38
Δ = 44° 41' 26.1" (RT)
D = 95° 29' 34.7"
L = 46.80'
T = 24.66'
R = 60.00'

PI Sta 10+83.13
Δ = 32° 35' 47.1" (LT)
D = 114° 35' 29.6"
L = 28.45'
T = 14.62'
R = 50.00'

PI Sta 11+14.97
Δ = 30° 58' 44.9" (RT)
D = 88° 08' 50.5"
L = 35.14'
T = 18.01'
R = 65.00'

PI Sta 11+60.94
Δ = 47° 50' 35.9" (LT)
D = 88° 08' 50.5"
L = 54.28'
T = 28.83'
R = 65.00'

PI Sta 12+17.08
Δ = 47° 21' 52.0" (RT)
D = 81° 51' 04.0"
L = 57.87'
T = 30.70'
R = 70.00'

PI Sta 12+75.31
Δ = 44° 59' 35.3" (LT)
D = 76° 23' 39.7"
L = 58.90'
T = 31.06'
R = 75.00'

PI Sta 13+29.25
Δ = 47° 01' 50.0" (RT)
D = 95° 29' 34.7"
L = 49.25'
T = 26.11'
R = 60.00'

PI Sta 13+66.55
Δ = 31° 36' 46.4" (LT)
D = 114° 35' 29.6"
L = 27.59'
T = 14.15'
R = 50.00'

PI Sta 13+91.42
Δ = 17° 20' 32.3" (RT)
D = 76° 23' 39.7"
L = 22.70'
T = 11.44'
R = 75.00'

PI Sta 14+23.29
Δ = 30° 43' 49.3" (LT)
D = 76° 23' 39.7"
L = 40.23'
T = 20.61'
R = 75.00'

PI Sta 14+59.47
Δ = 30° 51' 23.1" (RT)
D = 95° 29' 34.7"
L = 32.31'
T = 16.56'
R = 60.00'

PI Sta 15+02.69
Δ = 49° 11' 55.4" (LT)
D = 95° 29' 34.7"
L = 51.52'
T = 27.47'
R = 60.00'