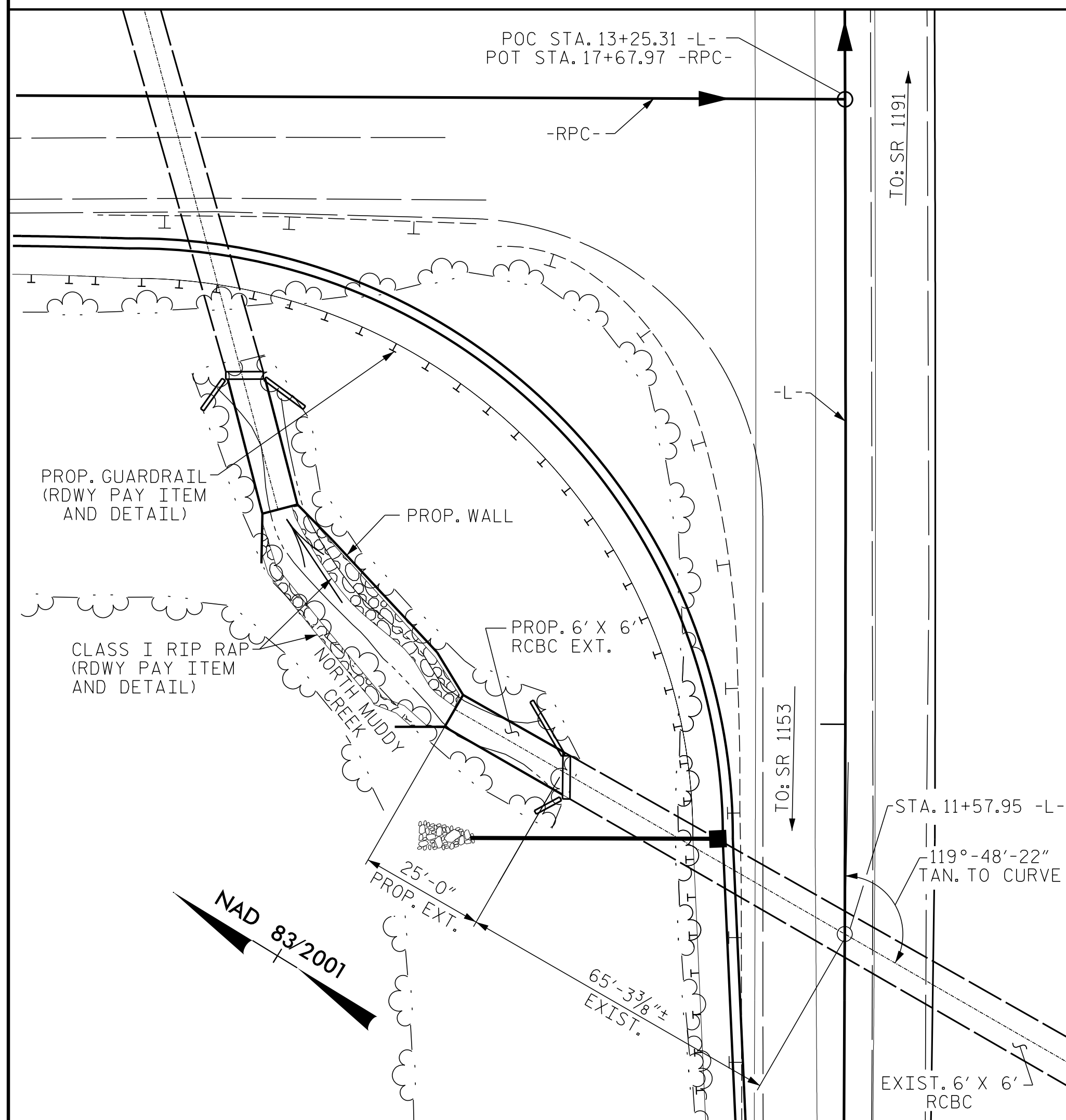


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Bm #2, NAIL IN 18" SWEET GUM, STA. 24+03.00 -BL-, 40.0' RT., EL. 1394.48 N703619, E1098038



LOCATION SKETCH

FOR UTILITY INFORMATION, SEE UTILITY PLANS AND SPECIAL PROVISIONS.

ROADWAY DATA

GRADE POINT ELEV. @ STA 11+57.95 -L- = 1398.90
 BED ELEV. @ STATION 11+57.95 -L- = 1373.88
 ROADWAY SLOPES = 2:1

HYDRAULIC DATA

DESIGN DISCHARGE = 230 CFS
 FREQUENCY OF DESIGN FLOOD = 50 YEARS
 DESIGN HIGH WATER ELEVATION = 1380.20
 DRAINAGE AREA = 0.35 SQ. MI.
 BASE DISCHARGE (Q100) = 270 CFS
 BASE HIGH WATER ELEVATION = 1380.80

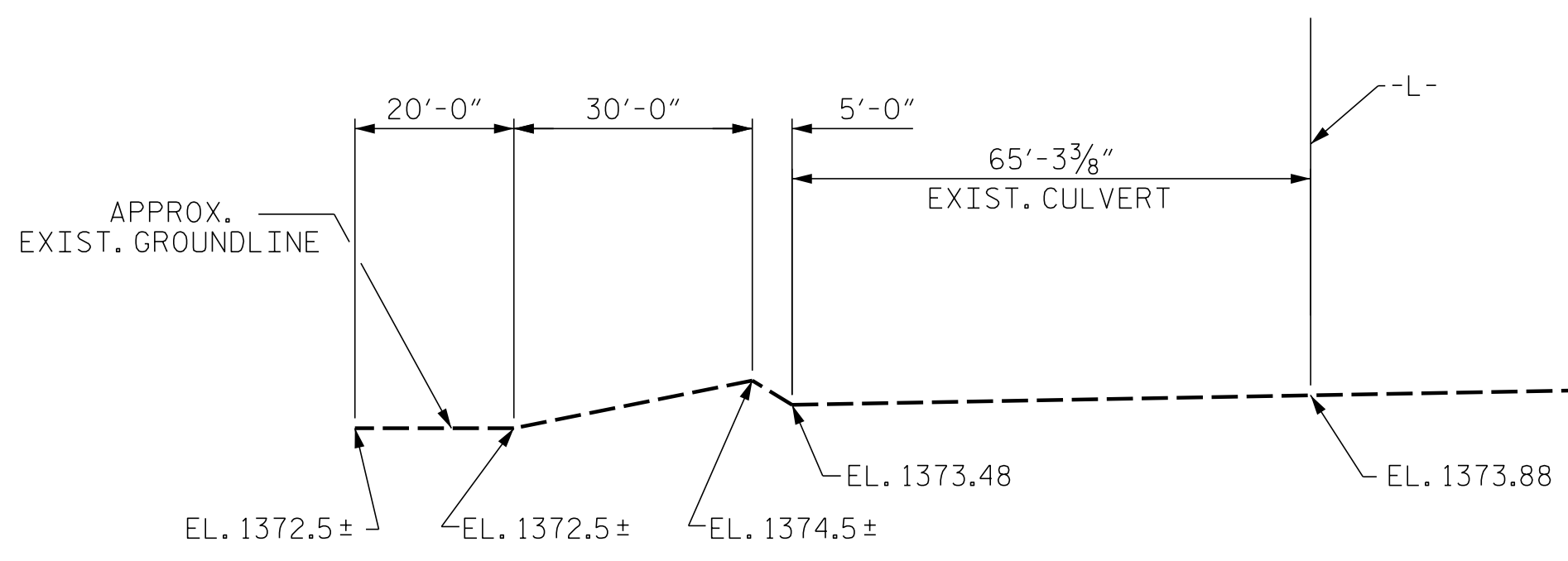
OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE = 380+ CFS
 FREQUENCY OF OVERTOPPING FLOOD = 500+ YEAR
 OVERTOPPING FLOOD ELEVATION = 1395.80
 OVERTOPPING OCCURS AT SAG LOW POINT STA. 1580.04 -RPC-

NOTES

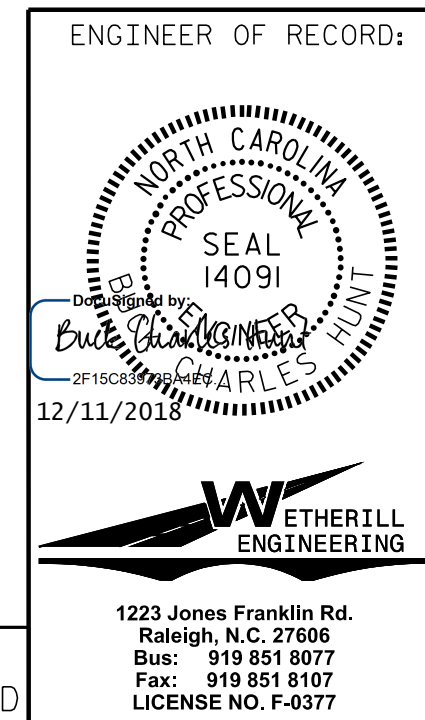
ASSUMED LIVE LOAD -----HL-93 OR ALTERNATE LOADING.
 DESIGN FILL TO BOTTOM OF TOP SLAB = 19.0'
 FOR OTHER DESIGN DATA AND NOTES SEE STANDARD NOTE SHEET.
 3" Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.
 CONCRETE IN THE CULVERT TO BE POURED IN THE FOLLOWING ORDER:
 1. WING FOOTINGS AND FLOOR SLAB INCLUDING 4" OF VERTICAL WALLS.
 2. THE REMAINING PORTIONS OF THE WALLS AND WINGS FULL HEIGHT.
 THE RESIDENT ENGINEER SHALL CHECK THE LENGTH OF CULVERT BEFORE STAKING IT OUT TO MAKE CERTAIN THAT IT WILL PROPERLY TAKE CARE OF THE FILL.
 DIMENSIONS FOR WING LAYOUT AS WELL AS ADDITIONAL REINFORCING STEEL EMBEDDED IN BARREL ARE SHOWN ON WING SHEET.
 AT THE CONTRACTOR'S OPTION, HE MAY SPLICE THE VERTICAL REINFORCING STEEL IN THE INTERIOR FACE OF EXTERIOR WALL ABOVE LOWER WALL CONSTRUCTION JOINT. THE SPLICE LENGTH SHALL BE AS PROVIDED IN THE SPLICE LENGTH CHART SHOWN ON THE PLANS. EXTRA WEIGHT OF STEEL DUE TO THE SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.
 THE EXISTING STRUCTURE CONSISTING OF A 6'X6' SINGLE BARREL REINFORCED CONCRETE BOX CULVERT 155.28' LONG ALONG CENTERLINE OF CULVERT AND LOCATED AT PROPOSED STRUCTURE SHALL BE RETAINED AND EXTENDED. THE EXISTING CULVERT IS PRESENTLY NOT POSTED FOR LOAD LIMIT.
 FOR CULVERT DIVERSION DETAILS AND PAY ITEM, SEE EROSION CONTROL PLANS.
 A 3 FOOT STRIP OF FILTER FABRIC SHALL BE ATTACHED TO THE FILL FACE OF THE WING COVERING THE ENTIRE LENGTH OF EXPANSION JOINT.
 FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.
 FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.
 FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.
 FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.
 IF APPROVED BY THE ENGINEER, THE CONTRACTOR MAY USE THE EXISTING WINGS AS TEMPORARY SHORING FOR THE CONSTRUCTION OF THE CULVERT EXTENSIONS. IN THIS CASE, THE BOTTOM SLAB OF THE EXTENSION SHALL BE POURED AT LEAST 72 HOURS PRIOR TO CUTTING THE WINGS. THE WINGS MAY BE CUT EARLIER PROVIDED THE SLAB CONCRETE STRENGTH HAS REACHED A MINIMUM COMPRESSIVE STRENGTH OF 1500 PSI.
 DOWELS SHALL BE USED TO CONNECT THE CULVERT EXTENSION TO THE EXISTING CULVERT AS SHOWN. FOR NOTE REGARDING SETTING OF DOWELS, SEE SHEET SN.

TOTAL BILL OF MATERIAL		
MATERIAL	ELEMENT	QUANTITY
CLASS A CONCRETE (CU. YDS.)	BARREL	17.1
	HEADWALLS	0.3
	CURTAIN WALLS	0.3
	EDGE BEAMS	0.6
	WINGS	9.1
	TOTAL	27.4
REINFORCING STEEL (LBS.)	BARREL	3080
	WINGS	740
	TOTAL	3820
FOUNDATION COND. MAT'L (TONS)		13
CULVERT EXCAVATION		LUMP SUM



PROFILE ALONG C CULVERT

PROJECT NO. U-5818
MCDOWELL COUNTY
 STATION: 11+57.95 -L-



ENGINEER OF RECORD:

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
 SINGLE
 6 FT. X 6 FT.
 CONCRETE
 BOX CULVERT
 LEFT EXTENSION

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C1-1
1			3			TOTAL SHEETS 6
2			4			

DOCUMENT NOT CONSIDERED FINAL
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DRAWN BY: B.C. HUNT DATE: 7-18
 CHECKED BY: T.K. KOCH DATE: 9-18

1223 Jones Franklin Rd.
 Raleigh, N.C. 27606
 Bus: 919 851 8077
 Fax: 919 851 8107
 LICENSE NO. F-0377

LOAD FACTORS:

DESIGN LOAD RATING FACTORS

LOAD TYPE	MAX FACTOR	MIN FACTOR
DC	1.25	0.90
DW	1.50	0.65
EV	1.30	0.90
EH	1.35	0.90
ES	1.35	0.90
LS	1.75	--
WA	1.00	--

NOTE:

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

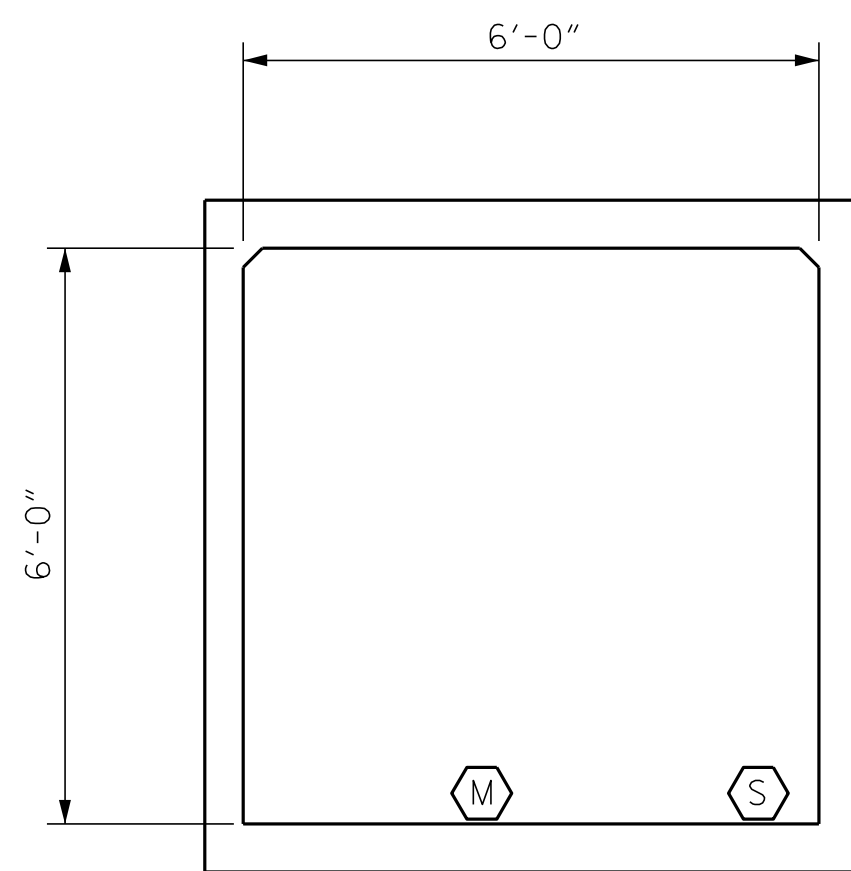
FILL HEIGHT (19.0') EXCEEDS THE DISTANCE BETWEEN FACES OF END WALLS (6'-0"). DESIGN CONTROLLED BY DEAD LOAD ONLY. SEE AASHTO 3.6.1.2.6

CULVERT LOAD RATED FOR PERMANENT LOAD ONLY.

COMMENTS:

1. CALCULATED MOMENT RATING FACTOR EQUALS MOMENT CAPACITY DIVIDED BY DEAD LOAD MOMENT.
2. CALCULATED SHEAR RATING FACTOR EQUALS SHEAR CAPACITY DIVIDED BY DEAD LOAD SHEAR.

LOAD AND RESISTANCE FACTOR RATING (LRFR) SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS															
LEVEL	VEHICLE	WEIGHT (W) (TONS)	CONTROLLING LOAD RATING #	MINIMUM RATING FACTORS (RF)	TONS = W x RF	STRENGTH I LIMIT STATE								COMMENT NUMBER	
						LIVE-LOAD FACTORS (γ _{LL})	MOMENT				SHEAR				
							RATING FACTOR	BOX NO.	ELEMENT TYPE	DISTANCE FROM LEFT END OF ELEMENT (FT)	RATING FACTOR	BOX NO.	ELEMENT TYPE		DISTANCE FROM LEFT END OF ELEMENT (FT)
DESIGN LOAD RATING	PERMANENT LOAD	N/A	S	1.07	--	N/A	1.29	1	BOTTOM SLAB	3.71	1.07	1	BOTTOM SLAB	6.25	1,2



LRFR SUMMARY

M MOMENT RATING FACTOR
S SHEAR RATING FACTOR

PROJECT NO. U-5818
MCDOWELL COUNTY
STATION: 11+57.95 -L-

P:\2016\1616201-U-5818\Structures\DM\Culvert 1\U5818-SMU-CUL1.dgn 12/10/2018 3:17:40 PM

ASSEMBLED BY : B.C. HUNT	DATE : 7-18
CHECKED BY : T.K. KOCH	DATE : 9-18
DRAWN BY : WMC 7/11	REV. 10/1/11 MAA/GM
CHECKED BY : 7/11	REV. 12/17 MAA/THC

ENGINEER OF RECORD:

12/11/2018

ETHERILL ENGINEERING

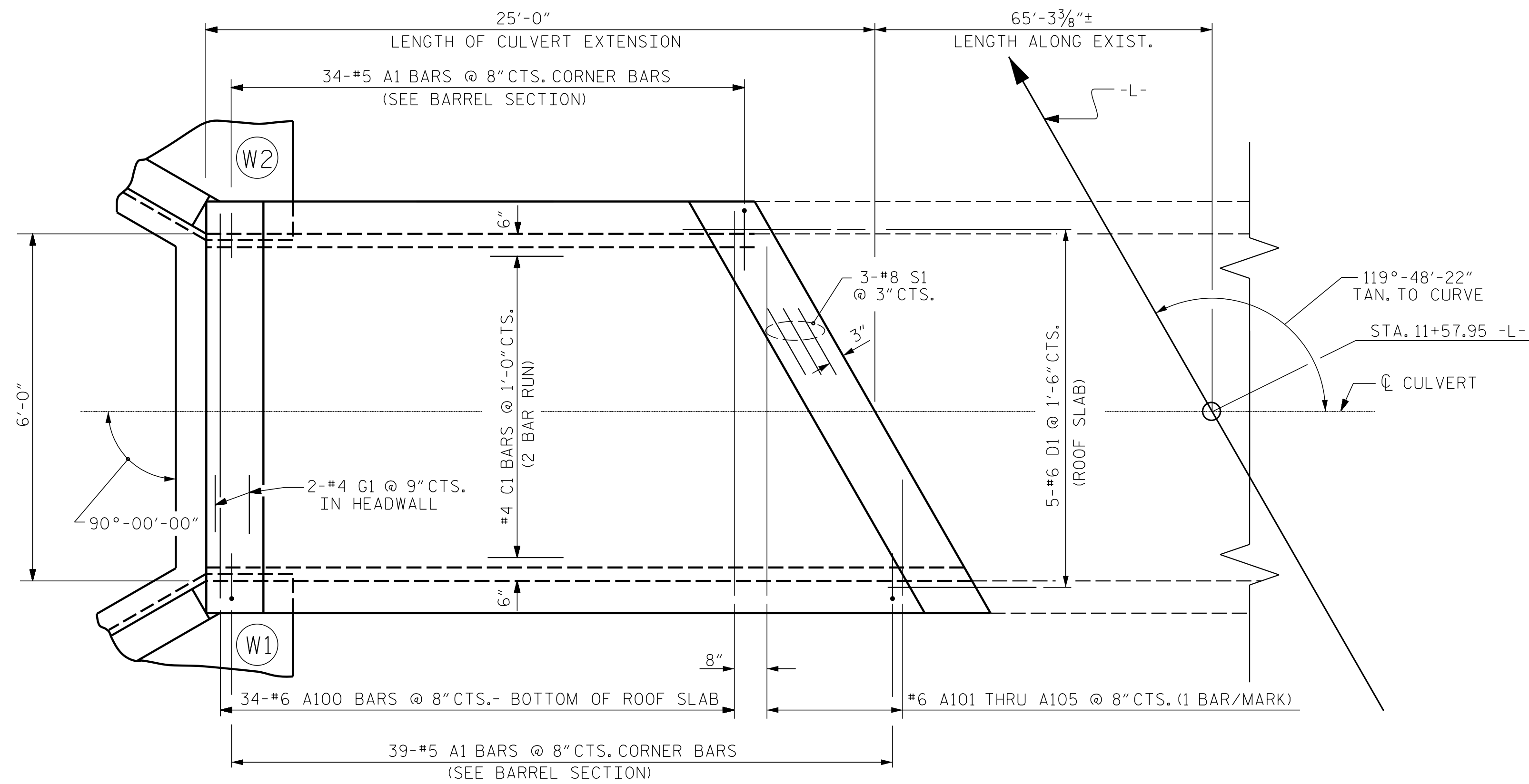
1223 Jones Franklin Rd.
Raleigh, N.C. 27606
Bus: 919 851 8077
Fax: 919 851 8107
LICENSE NO. F-0377

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

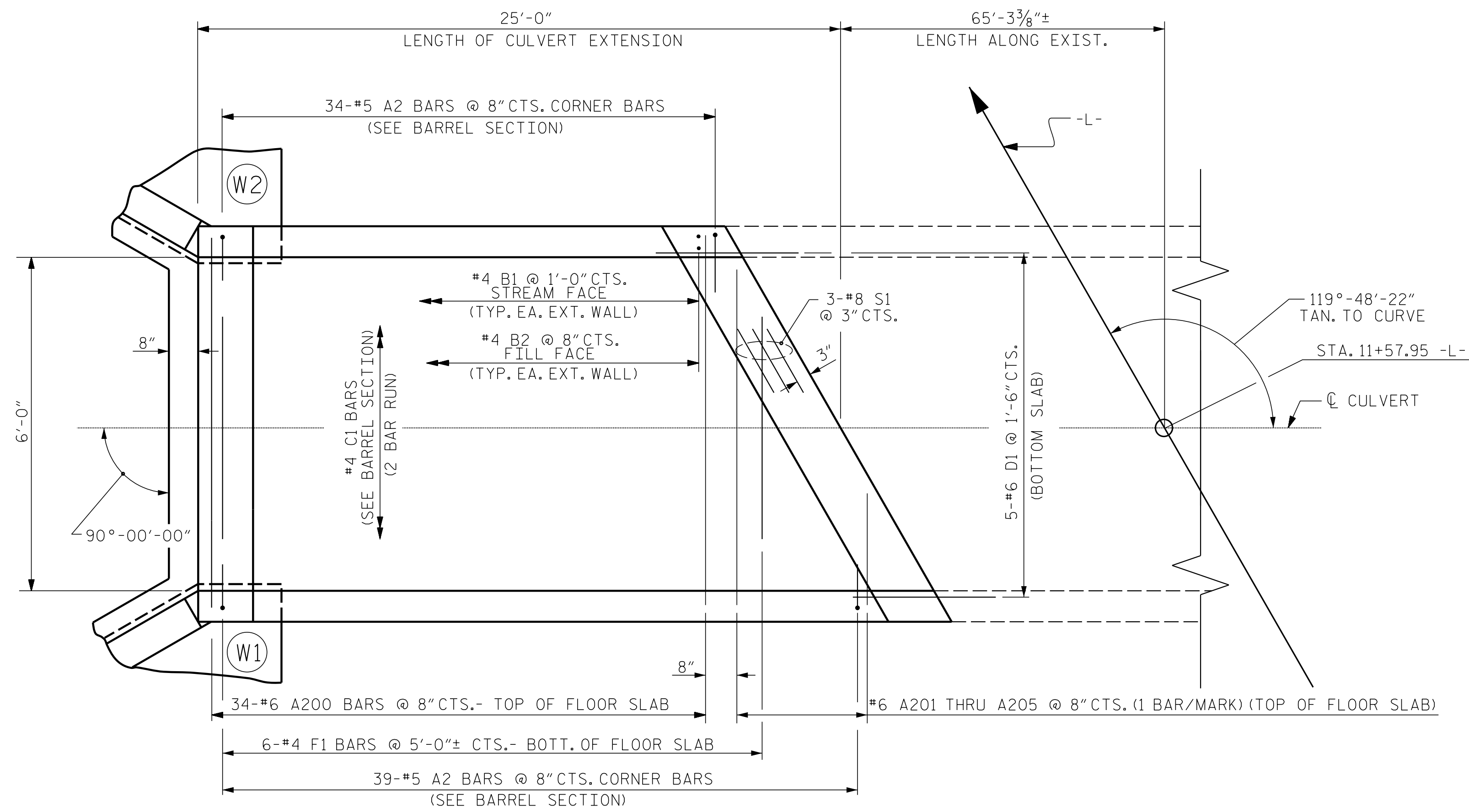
LRFR SUMMARY FOR
REINFORCED CONCRETE
BOX CULVERTS
(NON-INTERSTATE TRAFFIC)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C1-2
1			3			TOTAL SHEETS
2			4			6

DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED



PLAN ROOF SLAB



PLAN FLOOR SLAB

PROJECT NO. U-5818
MCDOWELL COUNTY
 STATION: 11+57.95 -L-

ENGINEER OF RECORD:

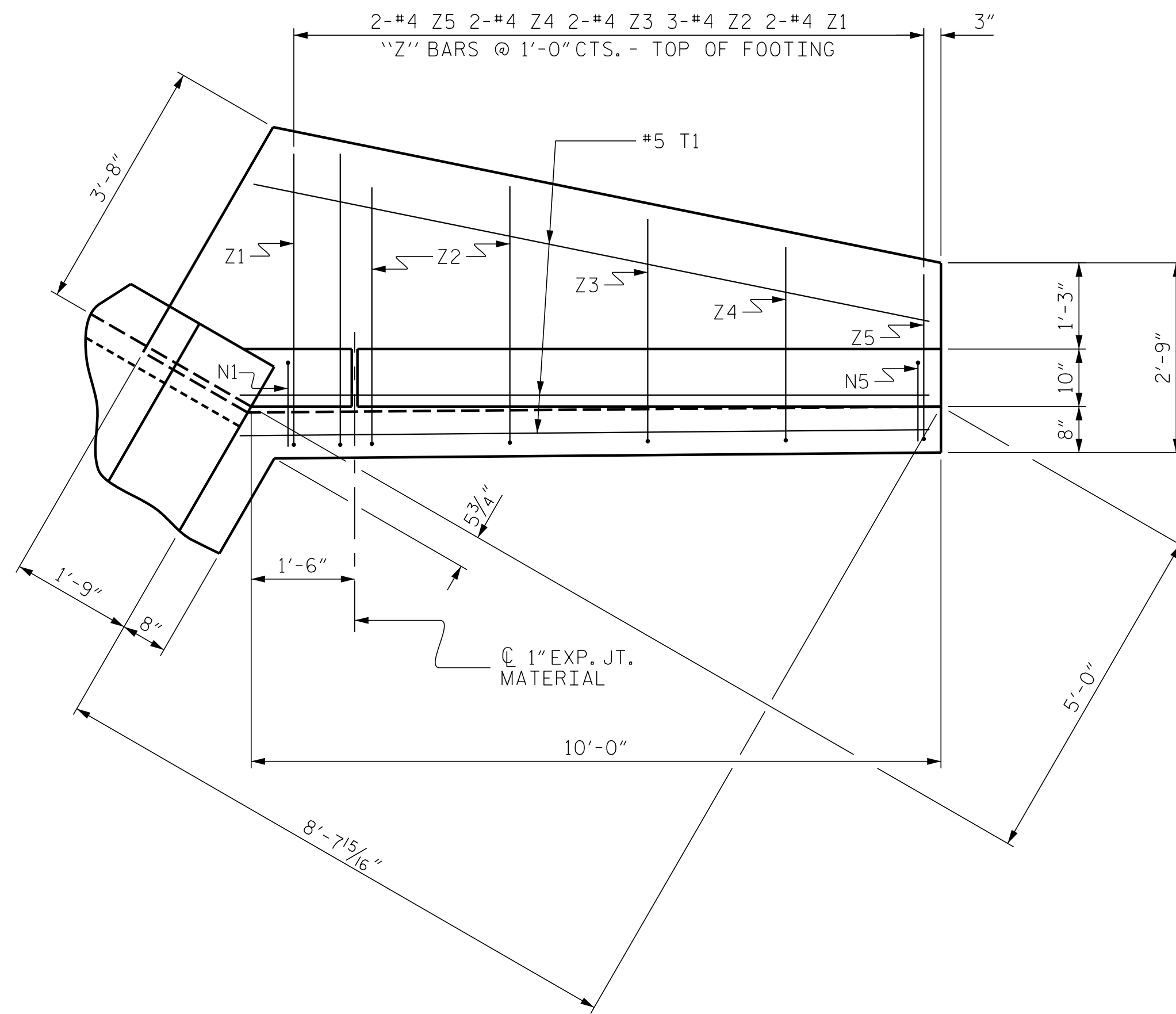
1223 Jones Franklin Rd.
 Raleigh, N.C. 27606
 Bus: 919 851 8077
 Fax: 919 851 8107
 LICENSE NO. F-0377

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH					
SINGLE 6 FT. X 6 FT. CONCRETE BOX CULVERT LEFT EXTENSION					
REVISIONS					
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		
					SHEET NO. C1-4
					TOTAL SHEETS 6

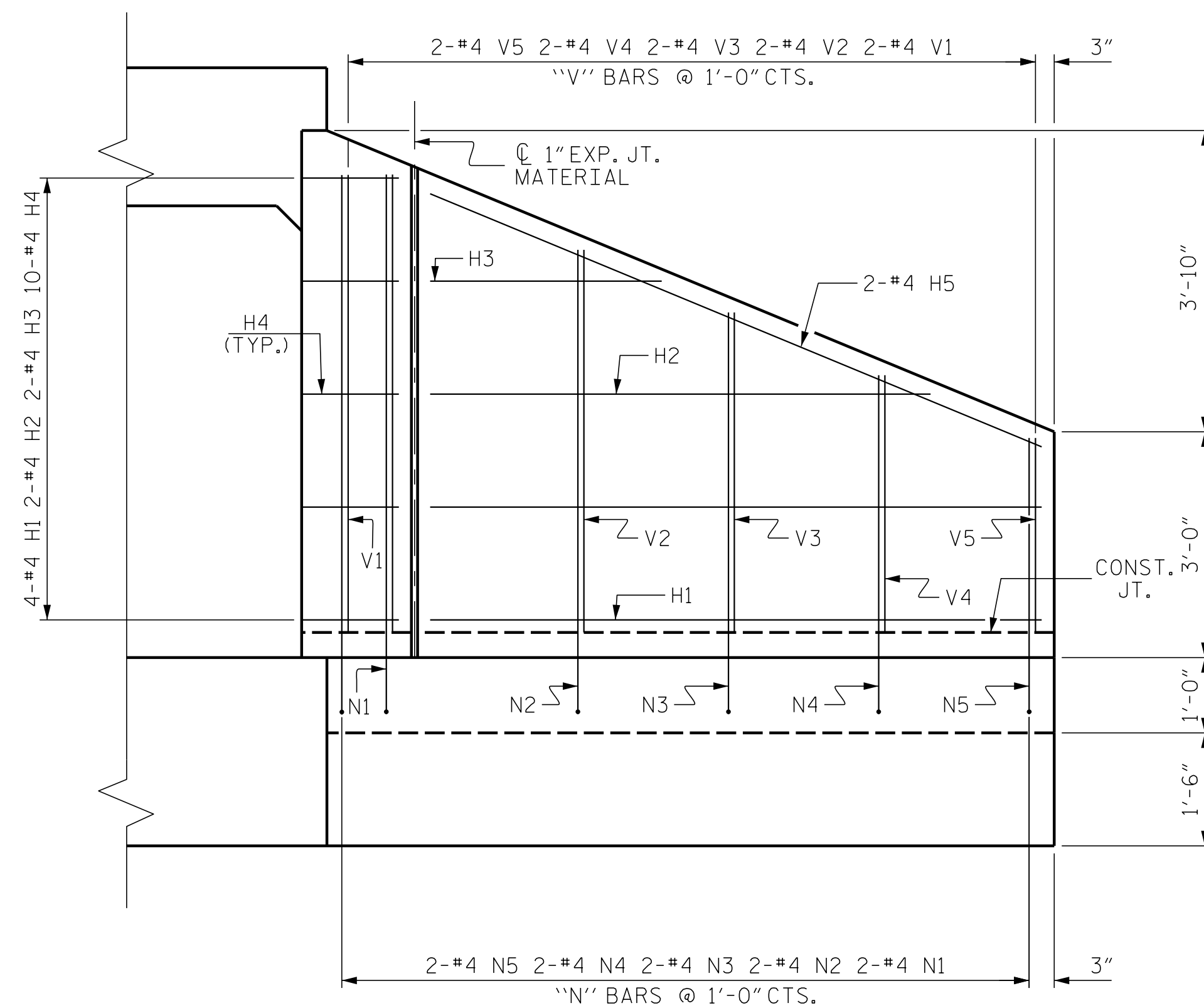
DRAWN BY : B.C. HUNT DATE : 7-18
 CHECKED BY : _____ DATE : _____

DOCUMENT NOT CONSIDERED FINAL
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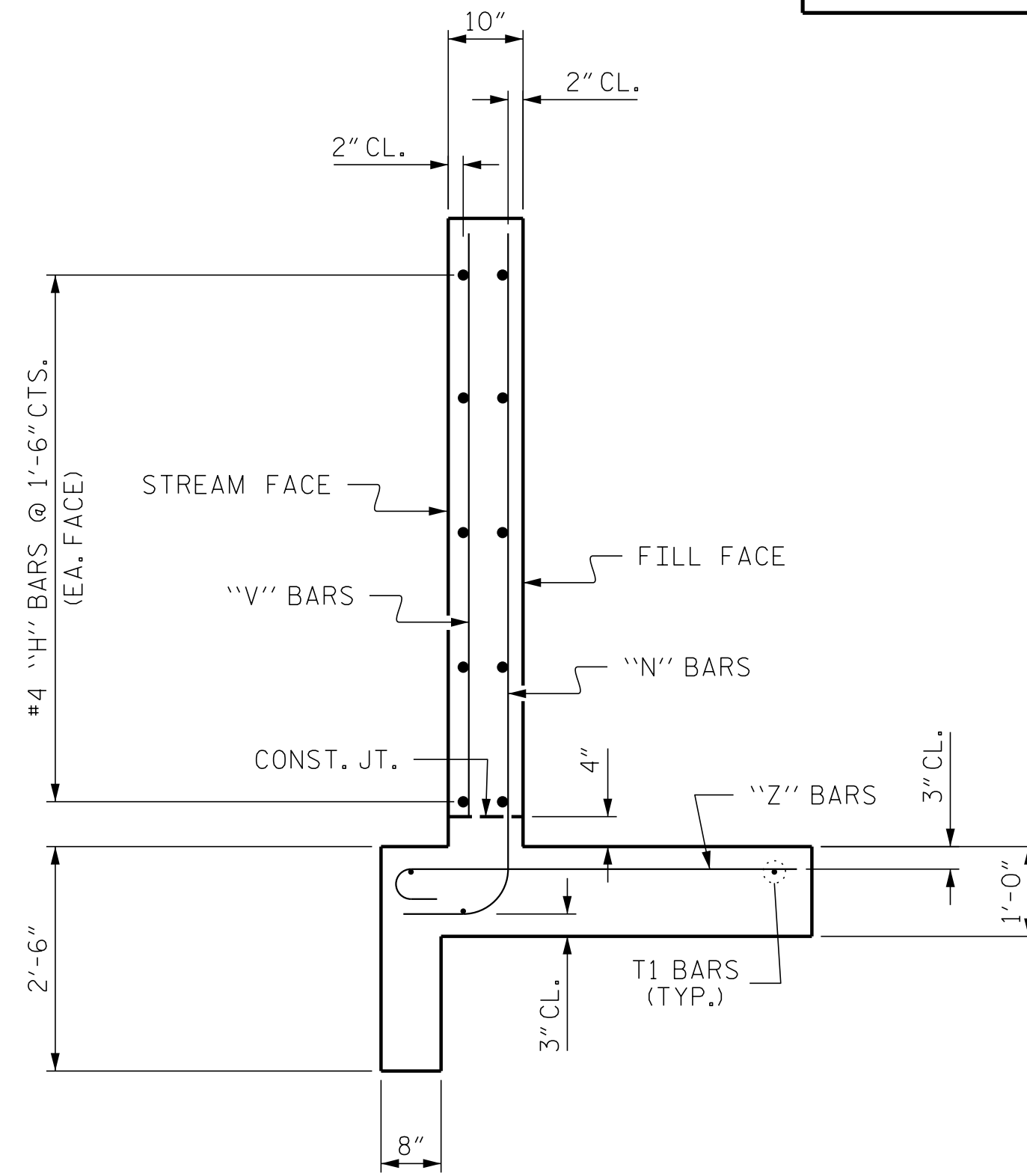
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PLAN

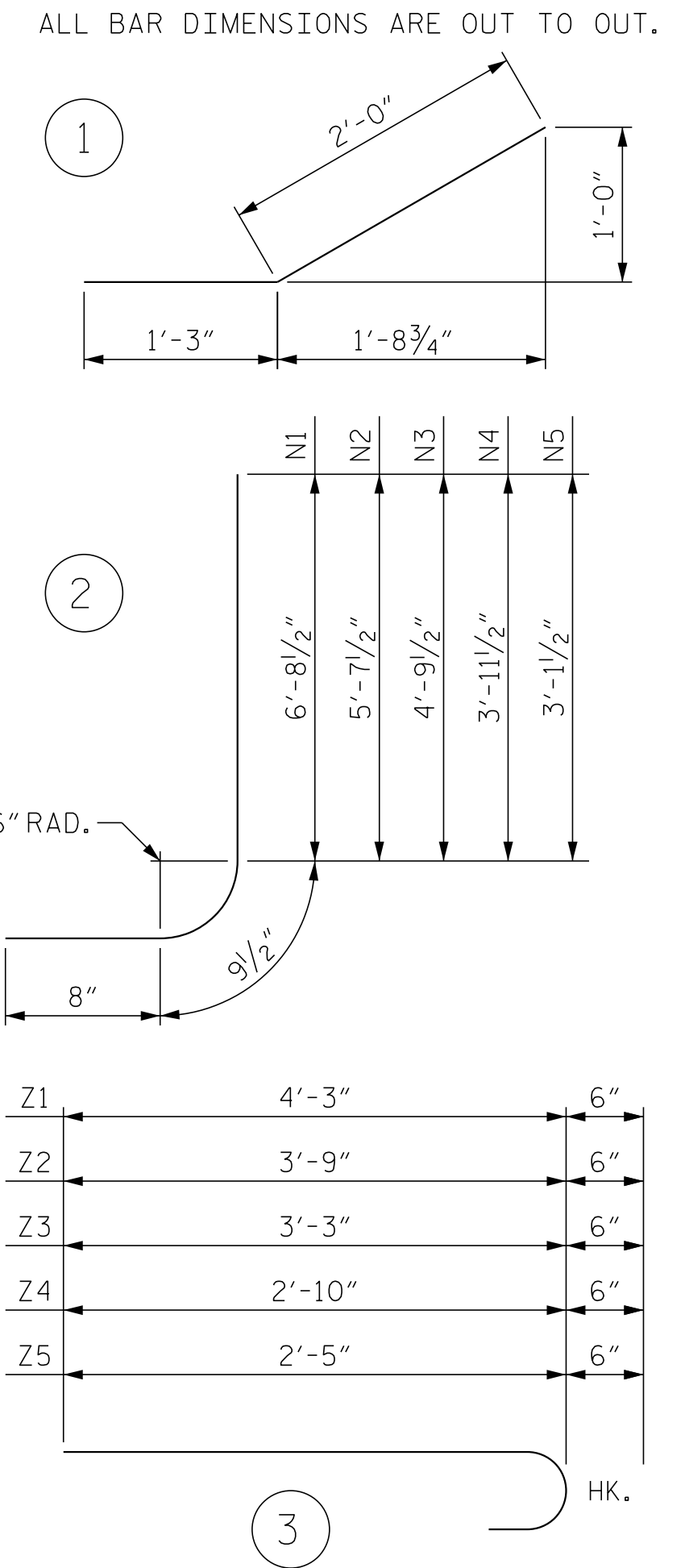


ELEVATION



TYPICAL WING SECTION

BAR TYPES



BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	4	#4	STR	8'-1"	22
H2	2	#4	STR	6'-8"	9
H3	2	#4	STR	3'-1"	4
H4	10	#4	1	3'-3"	22
H5	2	#4	STR	8'-9"	12
N1	2	#4	2	8'-2"	11
N2	2	#4	2	7'-1"	10
N3	2	#4	2	6'-3"	8
N4	2	#4	2	5'-5"	7
N5	2	#4	2	4'-7"	6
T1	3	#5	STR	10'-0"	31
V1	2	#4	STR	6'-1"	8
V2	2	#4	STR	5'-1"	7
V3	2	#4	STR	4'-3"	6
V4	2	#4	STR	3'-5"	5
V5	2	#4	STR	2'-7"	3
Z1	2	#4	3	4'-9"	6
Z2	3	#4	3	4'-3"	9
Z3	2	#4	3	3'-9"	5
Z4	2	#4	3	3'-4"	4
Z5	2	#4	3	2'-11"	4

REINFORCING STEEL 199 LBS
CLASS A CONCRETE 3.5 CY

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DRAWN BY : B.C. HUNT DATE : 7-18
 CHECKED BY : T.K. KOCH DATE : 9-18

DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED

ENGINEER OF RECORD:

12/11/2018

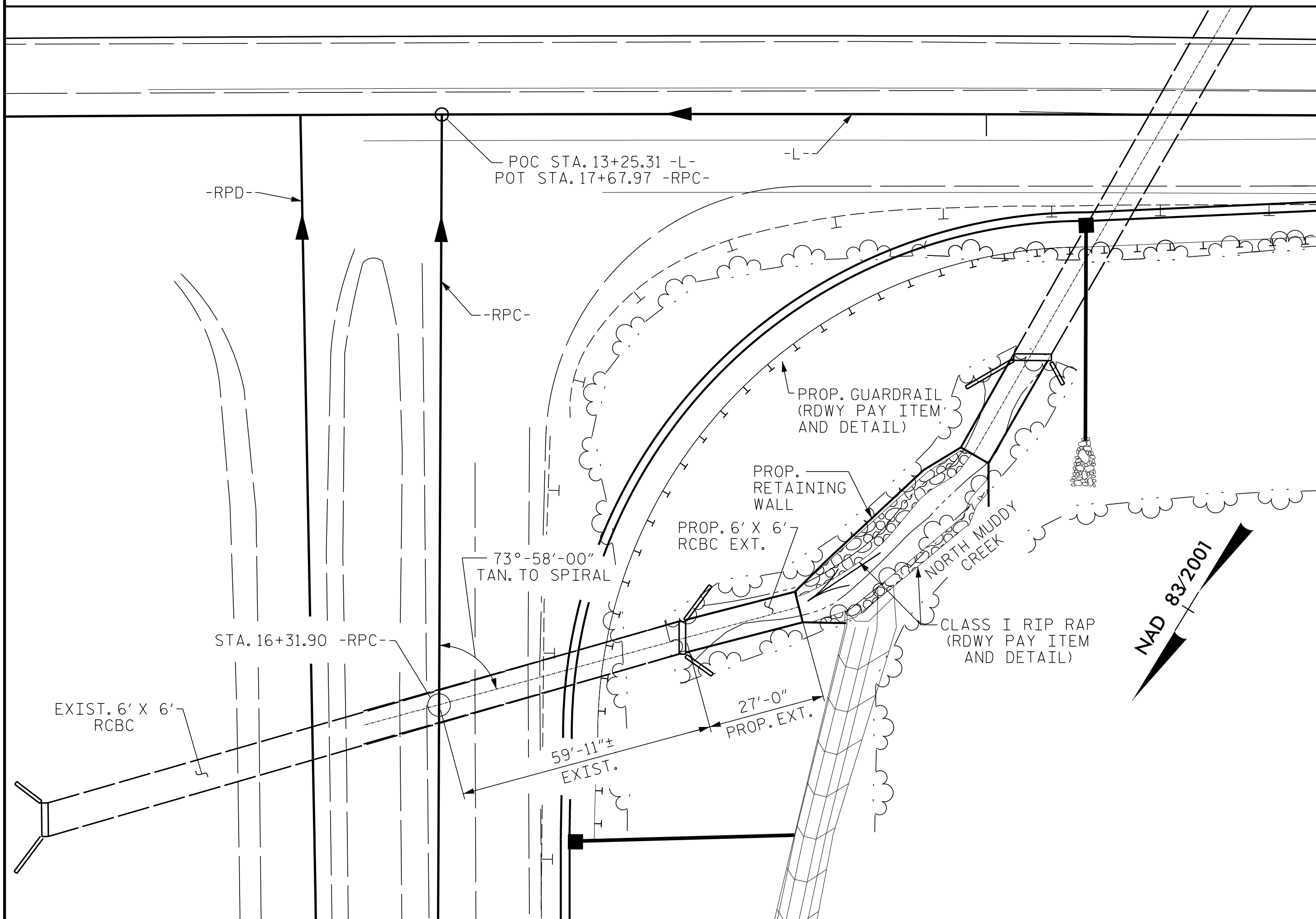
ETHERILL ENGINEERING

1223 Jones Franklin Rd.
Raleigh, N.C. 27606
Bus: 919 851 8077
Fax: 919 851 8107
LICENSE NO. F-0377

PROJECT NO. U-5818
MCDOWELL COUNTY
STATION: 11+57.95 -L-

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C1-5
1			3			TOTAL SHEETS
2			4			6

Bm #2, NAIL IN 18" SWEET GUM, STA. 24+03.00 -BL-, 40.0' RT., EL. 1394.48 N703619, E1098038



LOCATION SKETCH

FOR UTILITY INFORMATION, SEE UTILITY PLANS AND SPECIAL PROVISIONS.

ROADWAY DATA

GRADE POINT ELEV. @ STA 16+31.90 -RPC- = 1396.05
 BED ELEV. @ STATION 16+31.90 -RPC- = 1371.62
 ROADWAY SLOPES = 2:1

HYDRAULIC DATA

DESIGN DISCHARGE = 230 CFS
 FREQUENCY OF DESIGN FLOOD = 50 YEARS
 DESIGN HIGH WATER ELEVATION = 1378.10
 DRAINAGE AREA = 0.35 SQ. MI.
 BASE DISCHARGE (Q100) = 270 CFS
 BASE HIGH WATER ELEVATION = 1378.80

OVERTOPPING FLOOD DATA

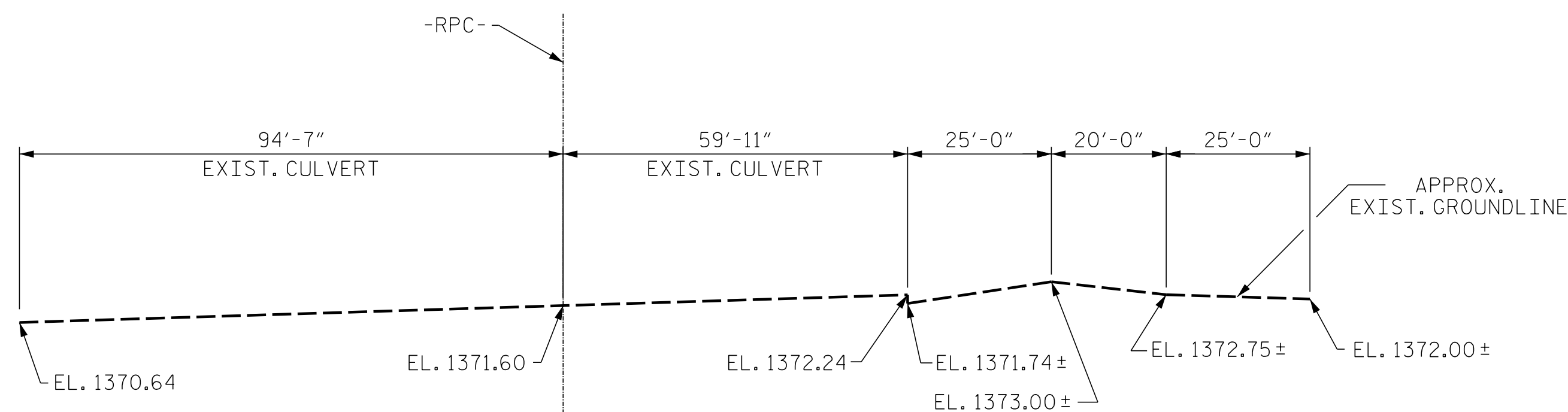
OVERTOPPING DISCHARGE = 380+ CFS
 FREQUENCY OF OVERTOPPING FLOOD = 500+ YEAR
 OVERTOPPING FLOOD ELEVATION = 1395.80
 OVERTOPPING OCCURS AT SAG LOW POINT STA. 15+80.04 -RPC-

NOTES

- ASSUMED LIVE LOAD -----HL-93 OR ALTERNATE LOADING.
- DESIGN FILL TO BOTTOM OF TOP SLAB = 18.2'
- FOR OTHER DESIGN DATA AND NOTES SEE STANDARD NOTE SHEET.
- 3"Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.
- CONCRETE IN THE CULVERT TO BE POURED IN THE FOLLOWING ORDER:
 1. WING FOOTINGS AND FLOOR SLAB INCLUDING 4"Ø VERTICAL WALLS.
 2. THE REMAINING PORTIONS OF THE WALLS AND WINGS FULL HEIGHT.
- THE RESIDENT ENGINEER SHALL CHECK THE LENGTH OF CULVERT BEFORE STAKING IT OUT TO MAKE CERTAIN THAT IT WILL PROPERLY TAKE CARE OF THE FILL.
- DIMENSIONS FOR WING LAYOUT AS WELL AS ADDITIONAL REINFORCING STEEL EMBEDDED IN BARREL ARE SHOWN ON WING SHEET.
- AT THE CONTRACTOR'S OPTION, HE MAY SPLICE THE VERTICAL REINFORCING STEEL IN THE INTERIOR FACE OF EXTERIOR WALL ABOVE LOWER WALL CONSTRUCTION JOINT. THE SPLICE LENGTH SHALL BE AS PROVIDED IN THE SPLICE LENGTH CHART SHOWN ON THE PLANS. EXTRA WEIGHT OF STEEL DUE TO THE SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.
- THE EXISTING STRUCTURE CONSISTING OF A 6'x6' SINGLE BARREL REINFORCED CONCRETE BOX CULVERT 154.50' LONG ALONG CENTERLINE OF CULVERT AND LOCATED AT PROPOSED STRUCTURE SHALL BE RETAINED AND EXTENDED. THE EXISTING CULVERT IS PRESENTLY NOT POSTED FOR LOAD LIMIT.
- FOR CULVERT DIVERSION DETAILS AND PAY ITEM, SEE EROSION CONTROL PLANS.
- A 3 FOOT STRIP OF FILTER FABRIC SHALL BE ATTACHED TO THE FILL FACE OF THE WING COVERING THE ENTIRE LENGTH OF EXPANSION JOINT.
- FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.
- FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.
- FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.
- FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.
- PLAN AND QUANTITIES FOR THE CANTILEVER RETAINING WALL BETWEEN THE CULVERTS AT STATIONS 11+57.95 -L- AND 16+31.90 -RPC- ARE INCLUDED IN THE PLANS FOR THE CULVERT AT STA. 16+31.90 -RPC-.
- A MINIMUM 1 FOOT DEEP LAYER OF FOUNDATION CONDITIONING MATERIAL SHALL BE PLACED UNDER THE FOOTING FOR THE CANTILEVER RETAINING WALL.
- IF APPROVED BY THE ENGINEER, THE CONTRACTOR MAY USE THE EXISTING WINGS AS TEMPORARY SHORING FOR THE CONSTRUCTION OF THE CULVERT EXTENSIONS. IN THIS CASE, THE BOTTOM SLAB OF THE EXTENSION SHALL BE POURED AT LEAST 72 HOURS PRIOR TO CUTTING THE WINGS. THE WINGS MAY BE CUT EARLIER PROVIDED THE SLAB CONCRETE STRENGTH HAS REACHED A MINIMUM COMPRESSIVE STRENGTH OF 1500 PSI.

DOWELS SHALL BE USED TO CONNECT THE CULVERT EXTENSION TO THE EXISTING CULVERT AS SHOWN. FOR NOTE REGARDING SETTING OF DOWELS, SEE SHEET SN.

TOTAL BILL OF MATERIAL		
MATERIAL	ELEMENT	QUANTITY
CLASS A CONCRETE (CU. YDS.)	BARREL	18.5
	HEADWALLS	0.3
	CURTAIN WALLS	0.3
	EDGE BEAMS	0.6
	WINGS	9.1
	RETAINING WALL	16.1
	TOTAL	44.9
REINFORCING STEEL (LBS.)	BARREL	3296
	WINGS	740
	RETAINING WALL	1429
	TOTAL	5465
FOUNDATION COND. MAT'L (TONS)	BARREL	15
	CANTILEVER RETAINING WALL	15
	TOTAL	30
CULVERT EXCAVATION	LUMP SUM	



PROFILE ALONG CULVERT

PROJECT NO. U-5818
MCDOWELL COUNTY
 STATION: 16+31.90 -RPC-

ENGINEER OF RECORD:

ETHERILL ENGINEERING
 1223 Jones Franklin Rd.
 Raleigh, N.C. 27606
 Bus: 919 851 8077
 Fax: 919 851 8107
 LICENSE NO. F-0377

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

**SINGLE
 6 FT. X 6 FT.
 CONCRETE
 BOX CULVERT
 RIGHT EXTENSION**

REVISIONS				SHEET NO.	
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

TOTAL SHEETS: 7

DRAWN BY: B.C. HUNT DATE: 7-18
 CHECKED BY: T.K. KOCH DATE: 9-18

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LOAD AND RESISTANCE FACTOR RATING (LRFR) SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS

LEVEL	VEHICLE	WEIGHT (W) (TONS)	CONTROLLING LOAD RATING	MINIMUM RATING FACTORS (RF)	TONS = W × RF	STRENGTH I LIMIT STATE								COMMENT NUMBER	
						LIVE-LOAD FACTORS (γ _{LL})	MOMENT				SHEAR				
							RATING FACTOR	BOX NO.	ELEMENT TYPE	DISTANCE FROM LEFT END OF ELEMENT (ft)	RATING FACTOR	BOX NO.	ELEMENT TYPE		DISTANCE FROM LEFT END OF ELEMENT (ft)
DESIGN LOAD RATING	PERMANENT LOAD	N/A		1.11	--	N/A	1.33	1	BOTTOM SLAB	3.71	1.11	1	BOTTOM SLAB	6.25	1,2

LOAD FACTORS:

DESIGN LOAD RATING FACTORS		
LOAD TYPE	MAX FACTOR	MIN FACTOR
DC	1.25	0.90
DW	1.50	0.65
EV	1.30	0.90
EH	1.35	0.90
ES	1.35	0.90
LS	1.75	--
WA	1.00	--

NOTE:

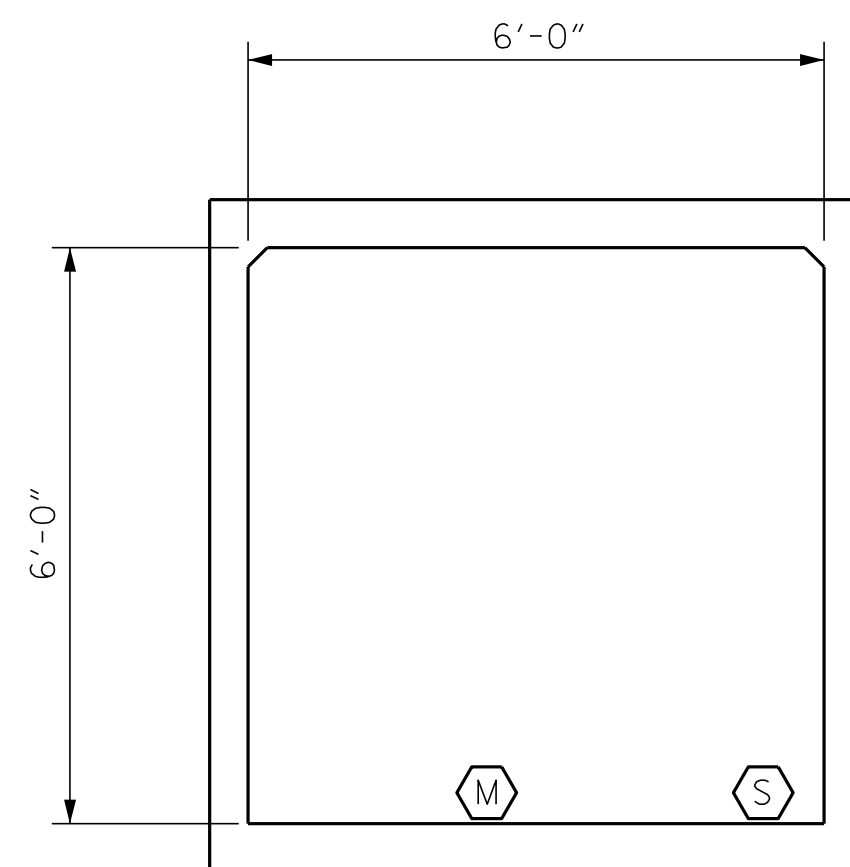
RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

FILL HEIGHT (18.2') EXCEEDS THE DISTANCE BETWEEN FACES OF END WALLS (6'-0").
DESIGN CONTROLLED BY DEAD LOAD ONLY. SEE AASHTO 3.6.1.2.6

CULVERT LOAD RATED FOR PERMANENT LOAD ONLY.

COMMENTS:

1. CALCULATED MOMENT RATING FACTOR EQUALS MOMENT CAPACITY DIVIDED BY DEAD LOAD MOMENT.
2. CALCULATED SHEAR RATING FACTOR EQUALS SHEAR CAPACITY DIVIDED BY DEAD LOAD SHEAR.



LRFR SUMMARY

MOMENT RATING FACTOR
 SHEAR RATING FACTOR

PROJECT NO. U-5818
MCDOWELL COUNTY
 STATION: 16+31.90 -RPC-

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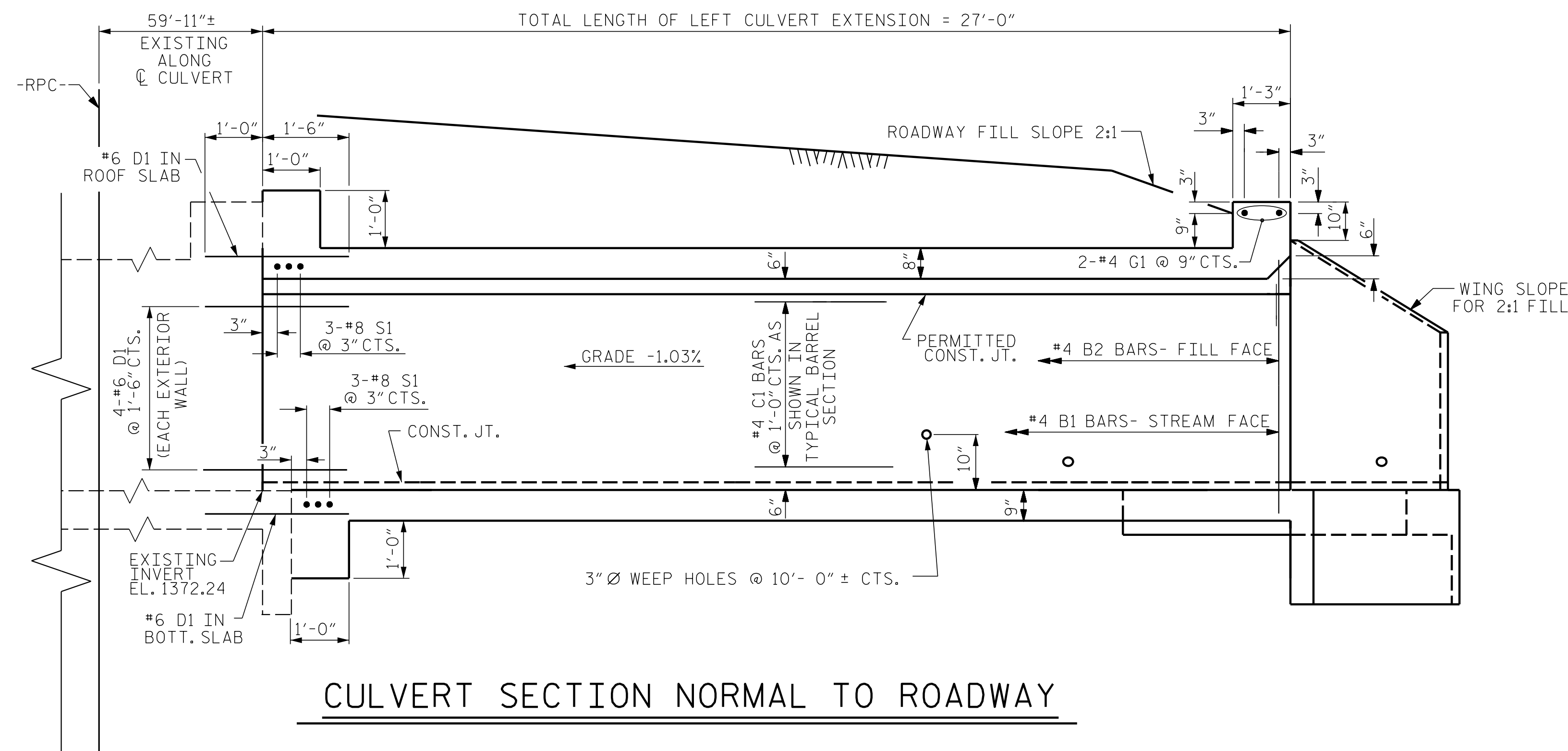
ASSEMBLED BY : B.C. HUNT	DATE : 7-18
CHECKED BY : T.K. KOCH	DATE : 9-18
DRAWN BY : WMC 7/11	REV. 10/1/11 MAA/GM
CHECKED BY : 7/11	REV. 12/17 MAA/THC

ENGINEER OF RECORD:

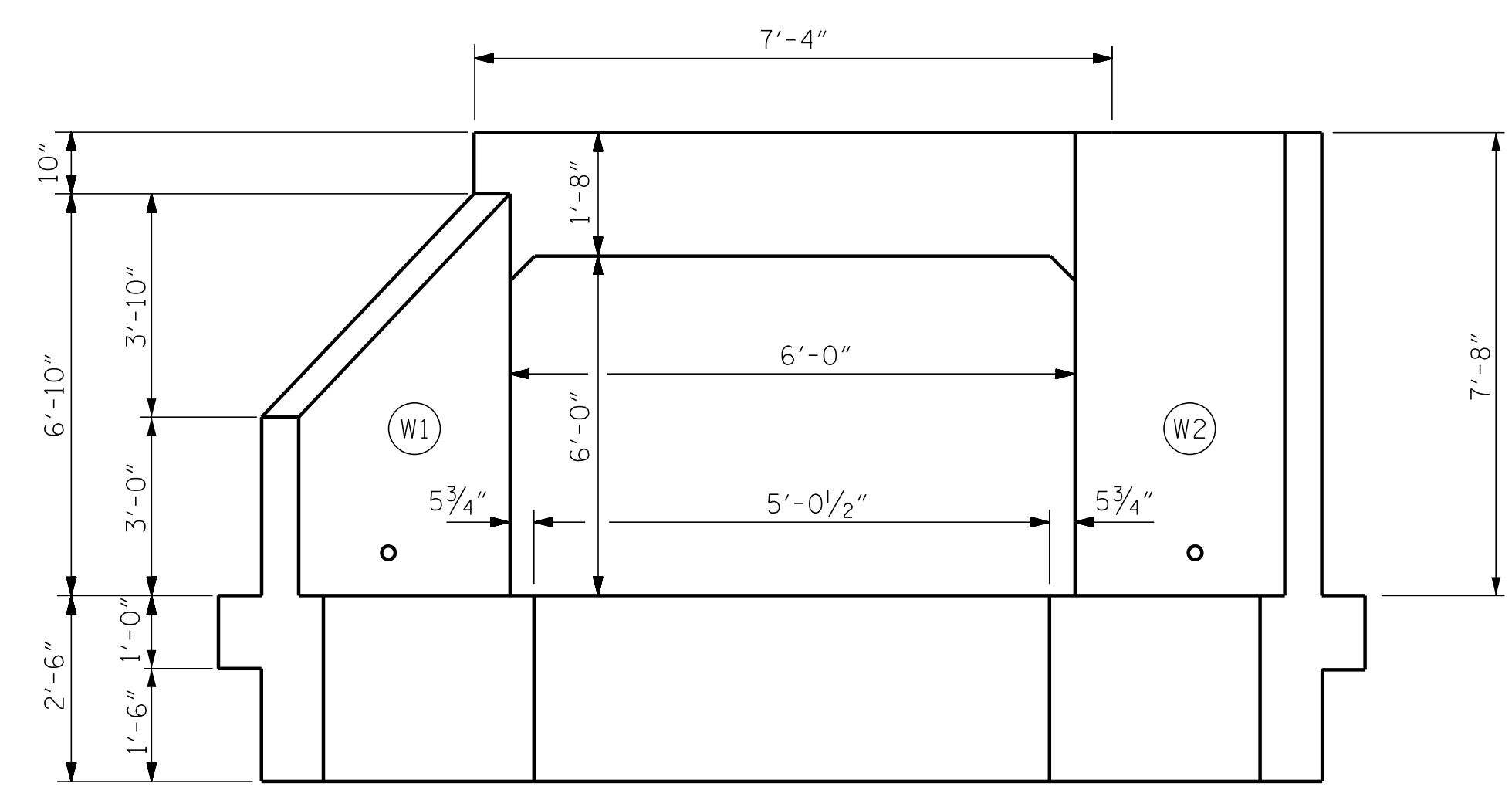
12/11/2018

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH					
LRFR SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS (NON-INTERSTATE TRAFFIC)					
REVISIONS					
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

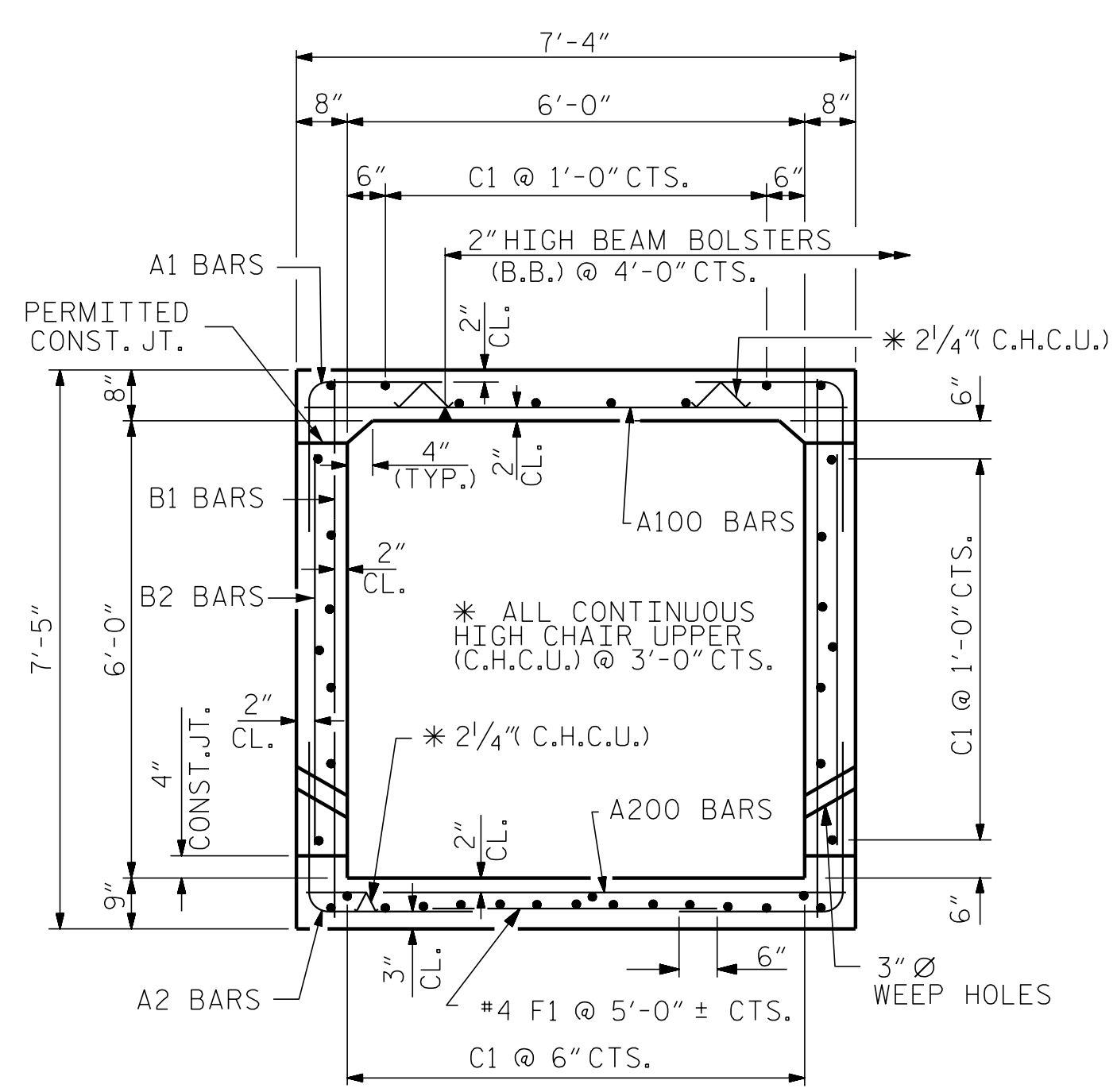
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	SHEET NO. C2-2 TOTAL SHEETS 7
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CULVERT SECTION NORMAL TO ROADWAY



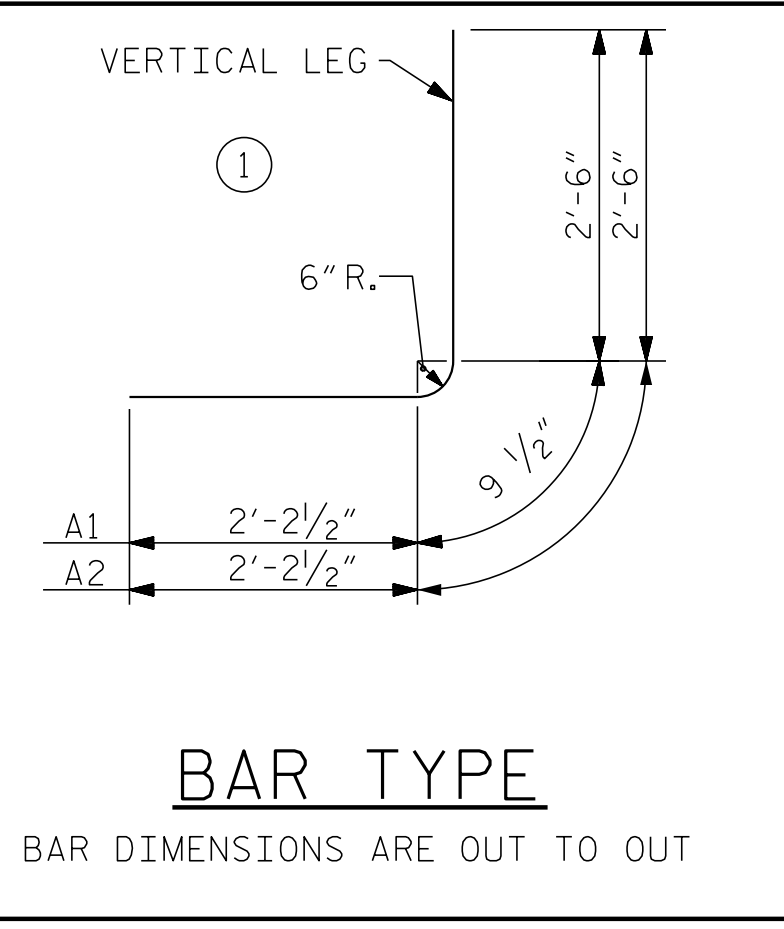
END ELEVATION
LOOKING UPSTREAM



RIGHT ANGLE SECTION OF BARREL
THERE ARE 38 "C" BARS IN SECTION OF BARREL

BARREL REINFORCING STEEL

BAR	NO	SIZE	TYPE	LENGTH	WEIGHT
A1	80	5	1	5'-6"	459
A2	80	5	1	5'-6"	459
A100	39	6	STR	7'-0"	410
A101	1	6	STR	5'-3"	8
A102	1	6	STR	2'-11"	4
A200	39	6	STR	7'-0"	410
A201	1	6	STR	5'-3"	8
A202	1	6	STR	2'-11"	4
B1	54	4	STR	7'-1"	256
B2	80	4	STR	5'-8"	303
C1	76	4	STR	14'-10"	753
D1	18	6	STR	2'-6"	68
F1	6	4	STR	4'-0"	16
G1	2	4	STR	7'-0"	9
S1	6	8	STR	8'-1"	129
REINFORCING STEEL				3,296 LBS	



SPLICE LENGTHS CHART

BAR	SIZE	SPLICE LENGTH
B1	#4	1'-9"
C1	#4	1'-11"

PROJECT NO. U-5818
MCDOWELL COUNTY
 STATION: 16+31.90 -RPC-

ENGINEER OF RECORD:

12/11/2018

ETHERILL ENGINEERING

1223 Jones Franklin Rd.
 Raleigh, N.C. 27606
 Bus: 919 851 8077
 Fax: 919 851 8107
 LICENSE NO. F-0377

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

**SINGLE
 6 FT. X 6 FT.
 CONCRETE
 BOX CULVERT
 RIGHT EXTENSION**

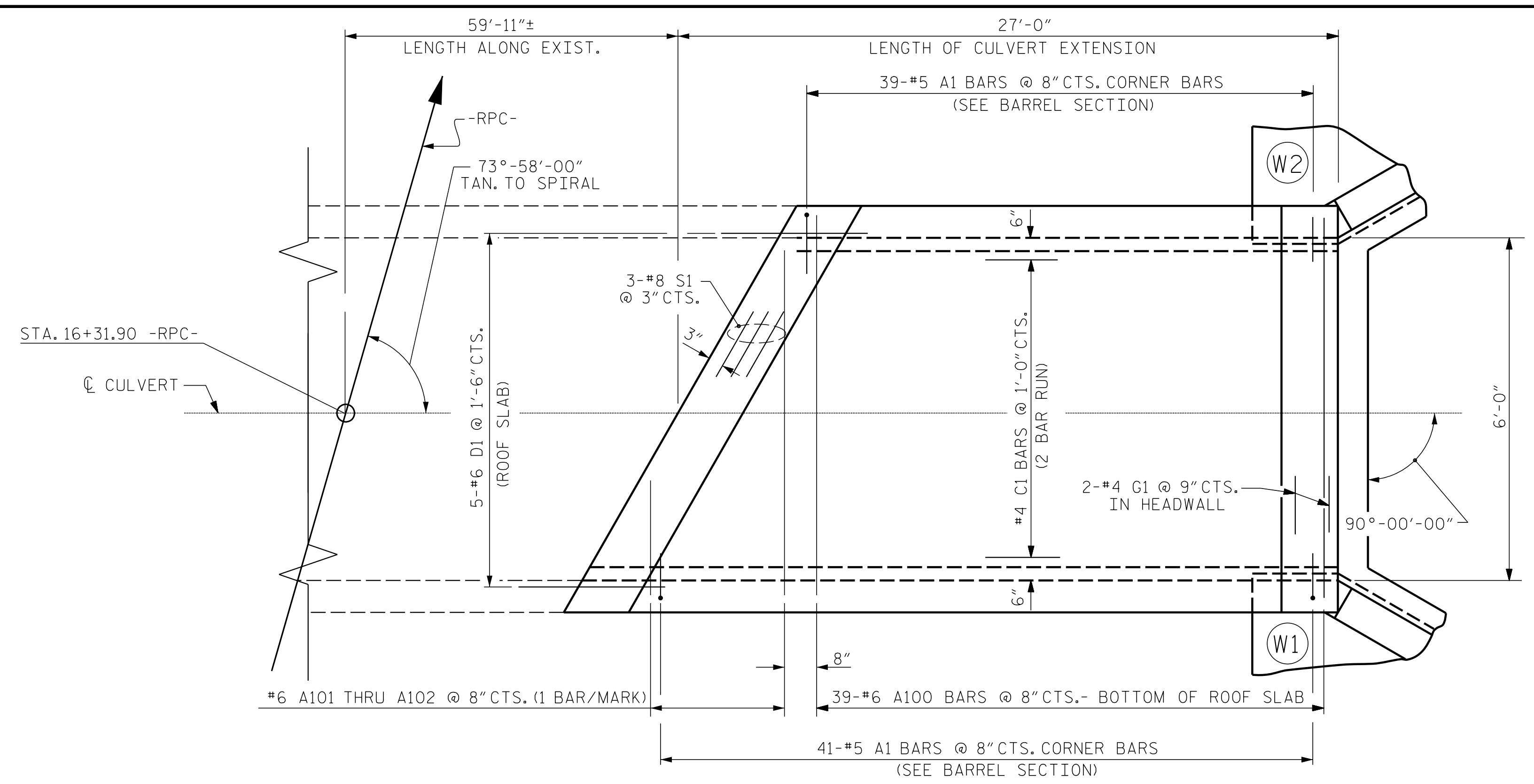
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NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

SHEET NO. C2-3
 TOTAL SHEETS 7

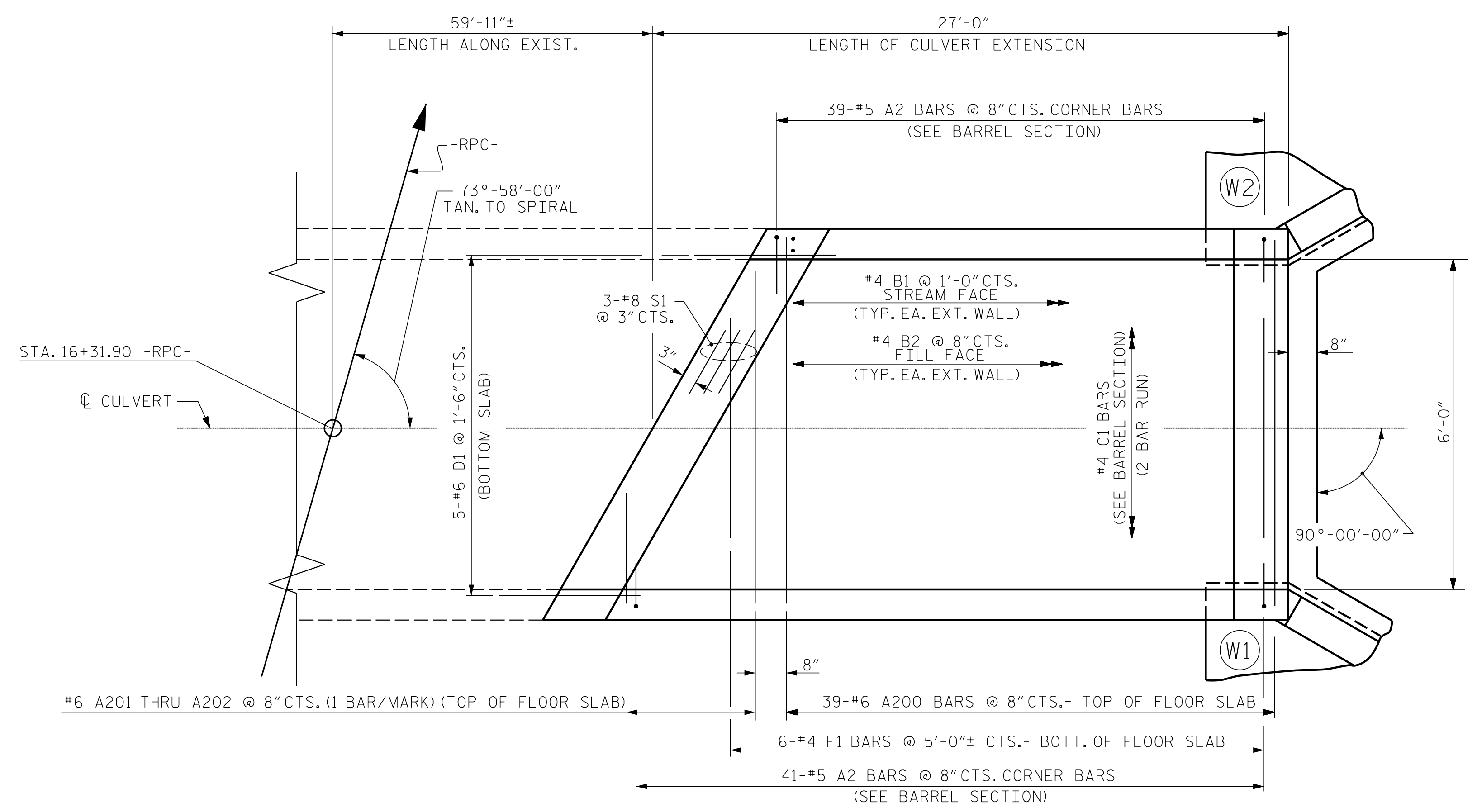
DRAWN BY: B.C. HUNT DATE: 7-18
 CHECKED BY: T.K. KOCH DATE: 9-18

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PLAN ROOF SLAB



PLAN FLOOR SLAB

PROJECT NO. U-5818
MCDOWELL COUNTY
 STATION: 16+31.90 -RPC-

ENGINEER OF RECORD:

2/11/2018

ETHERILL ENGINEERING

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**SINGLE
 6 FT. X 6 FT.
 CONCRETE
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 RIGHT EXTENSION**

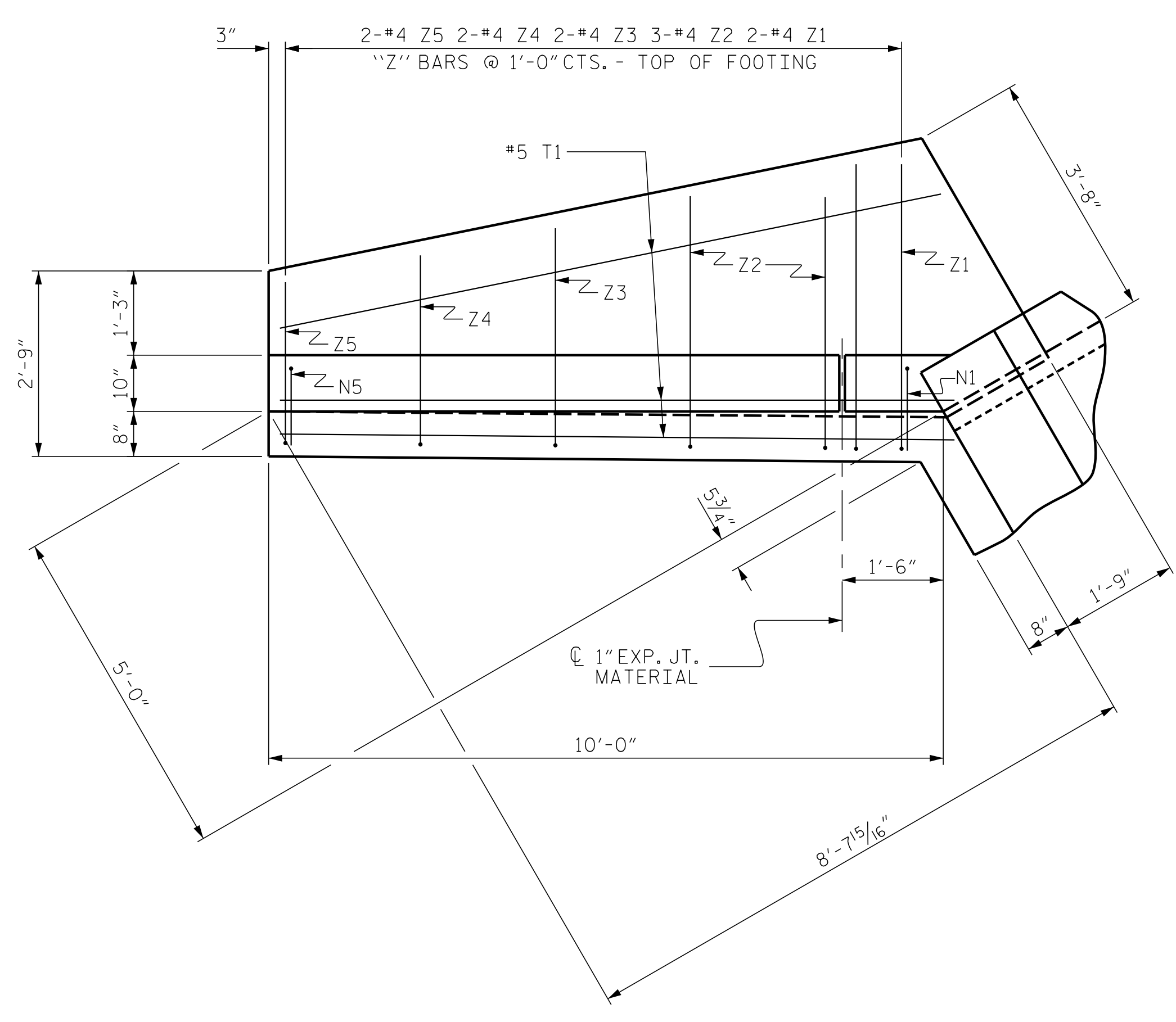
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SHEET NO. C2-4
 TOTAL SHEETS 7

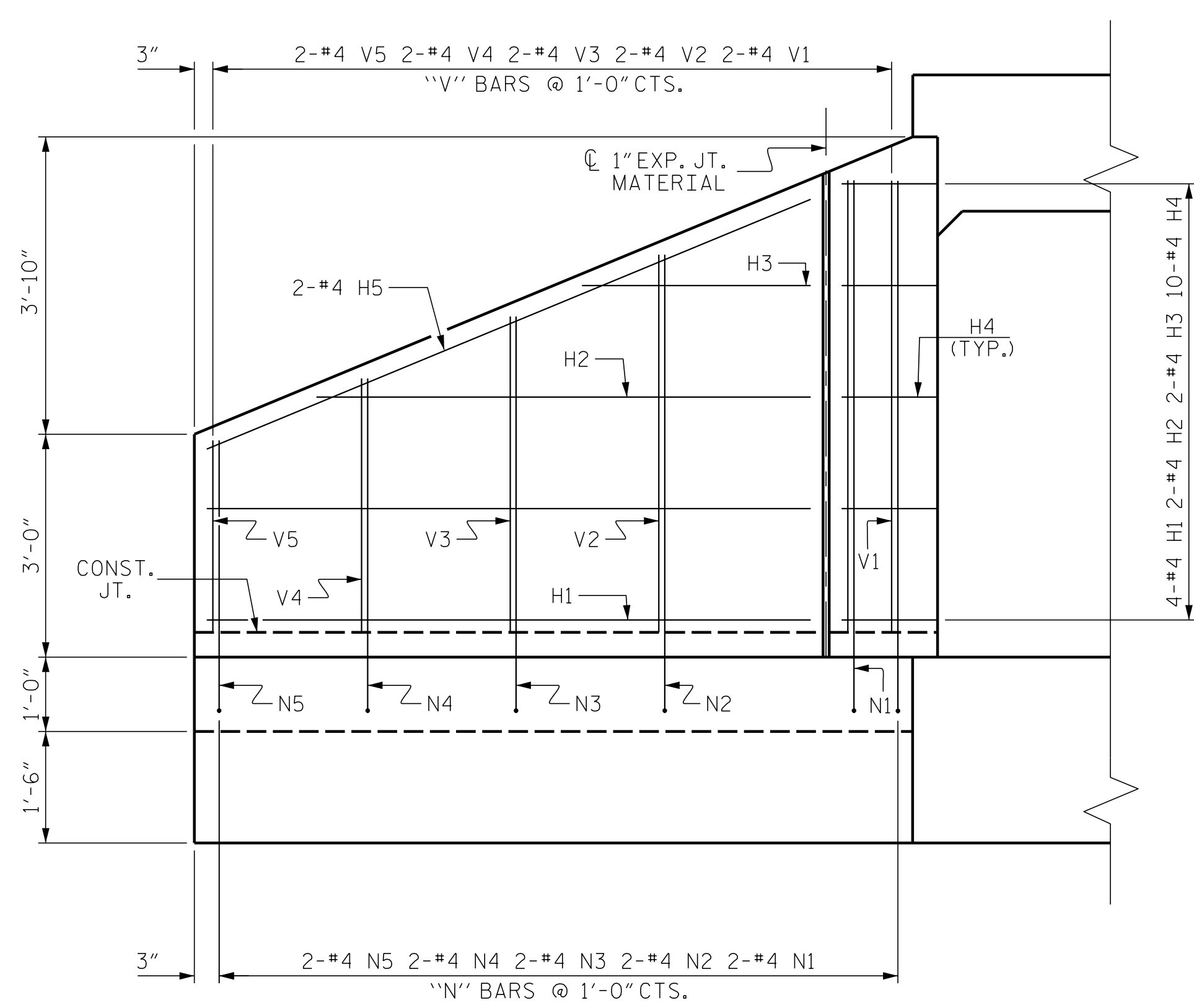
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 CHECKED BY : T.K. KOCH DATE : 9-18

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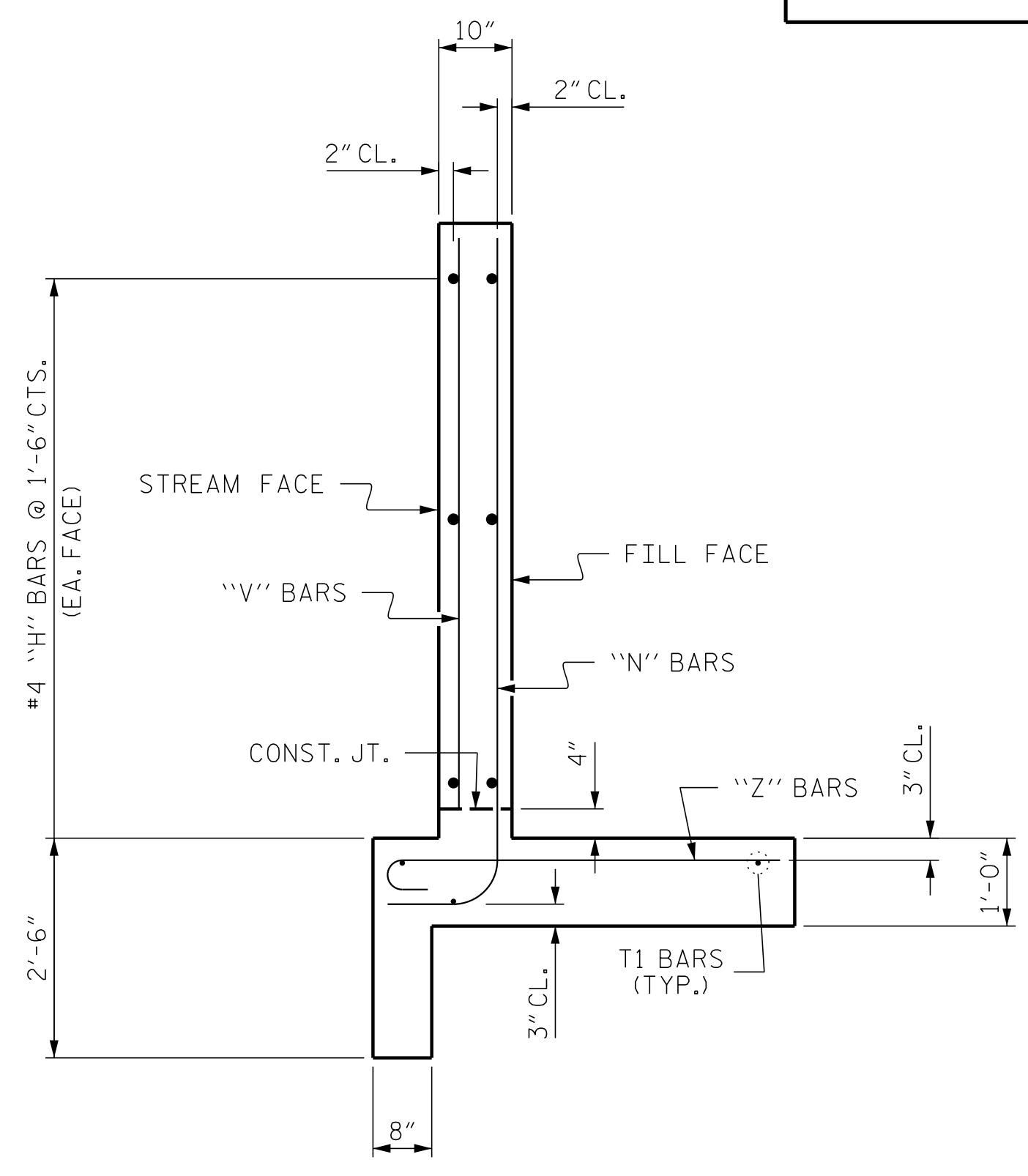
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PLAN



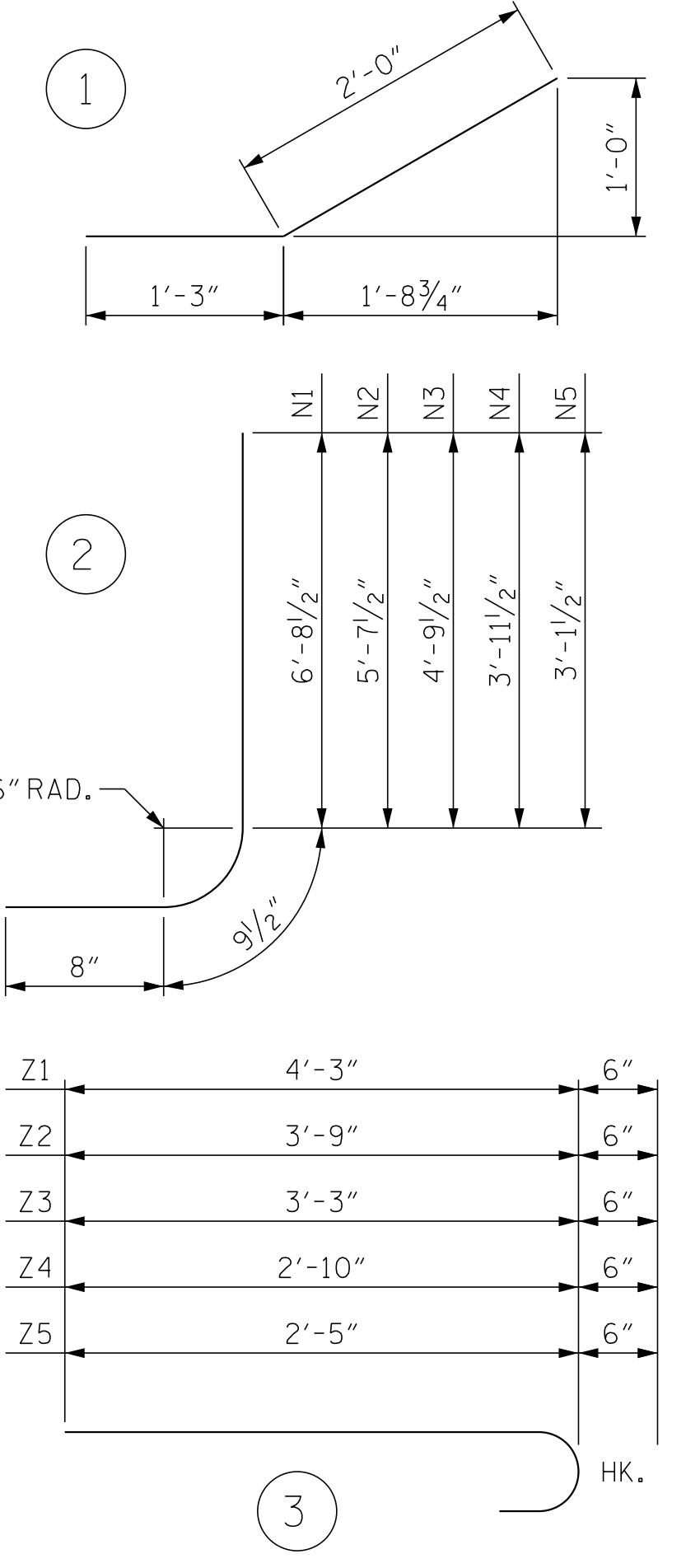
ELEVATION



TYPICAL WING SECTION

BAR TYPES

ALL BAR DIMENSIONS ARE OUT TO OUT.



BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	4	#4	STR	8'-1"	22
H2	2	#4	STR	6'-8"	9
H3	2	#4	STR	3'-1"	4
H4	10	#4	1	3'-3"	22
H5	2	#4	STR	8'-9"	12
N1	2	#4	2	8'-2"	11
N2	2	#4	2	7'-1"	10
N3	2	#4	2	6'-3"	8
N4	2	#4	2	5'-5"	7
N5	2	#4	2	4'-7"	6
T1	3	#5	STR	10'-0"	31
V1	2	#4	STR	6'-1"	8
V2	2	#4	STR	5'-1"	7
V3	2	#4	STR	4'-3"	6
V4	2	#4	STR	3'-5"	5
V5	2	#4	STR	2'-7"	3
Z1	2	#4	3	4'-9"	6
Z2	3	#4	3	4'-3"	9
Z3	2	#4	3	3'-9"	5
Z4	2	#4	3	3'-4"	4
Z5	2	#4	3	2'-11"	4

REINFORCING STEEL	199	LBS
CLASS A CONCRETE	3.5	CY

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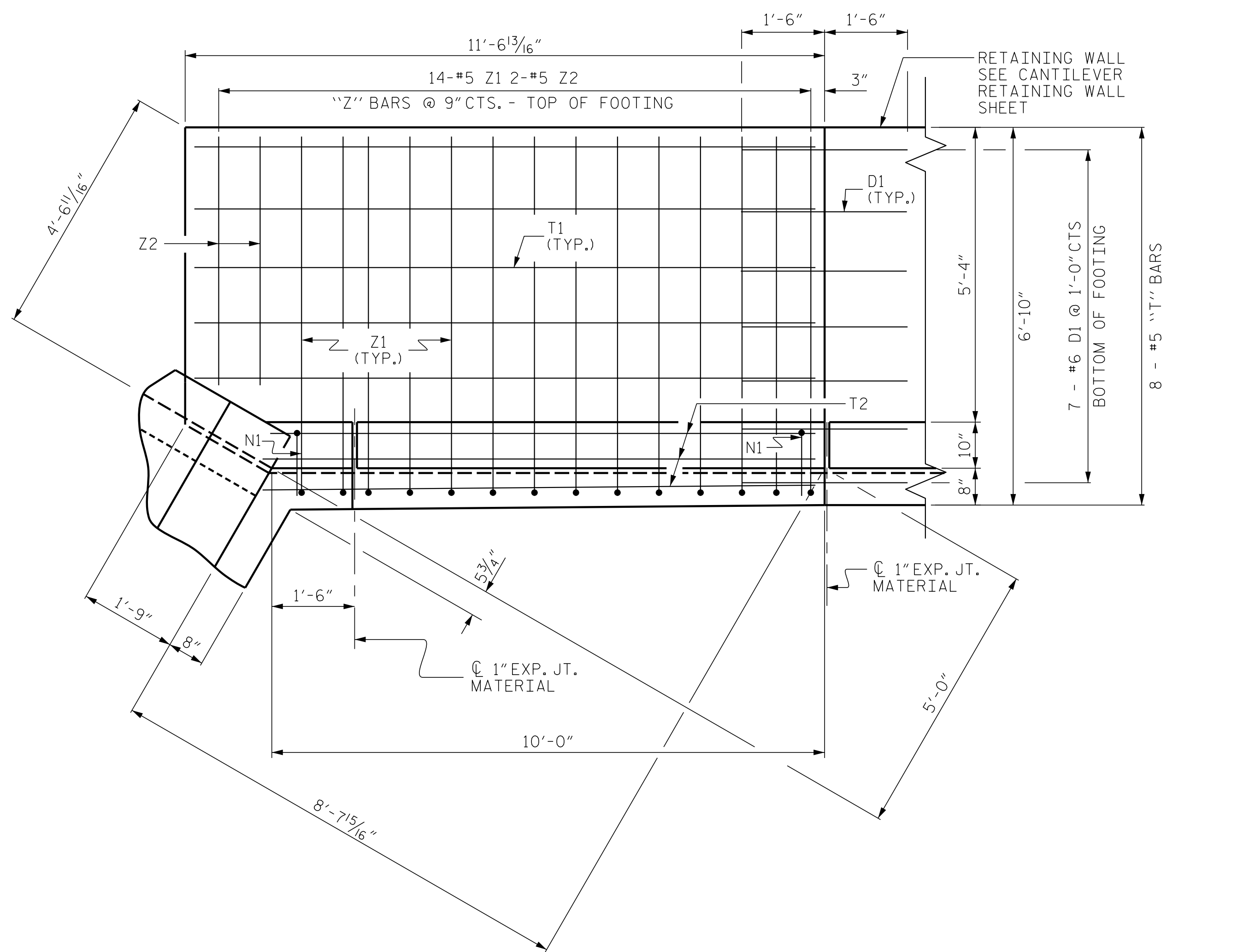
12/11/2018

ETHERILL ENGINEERING

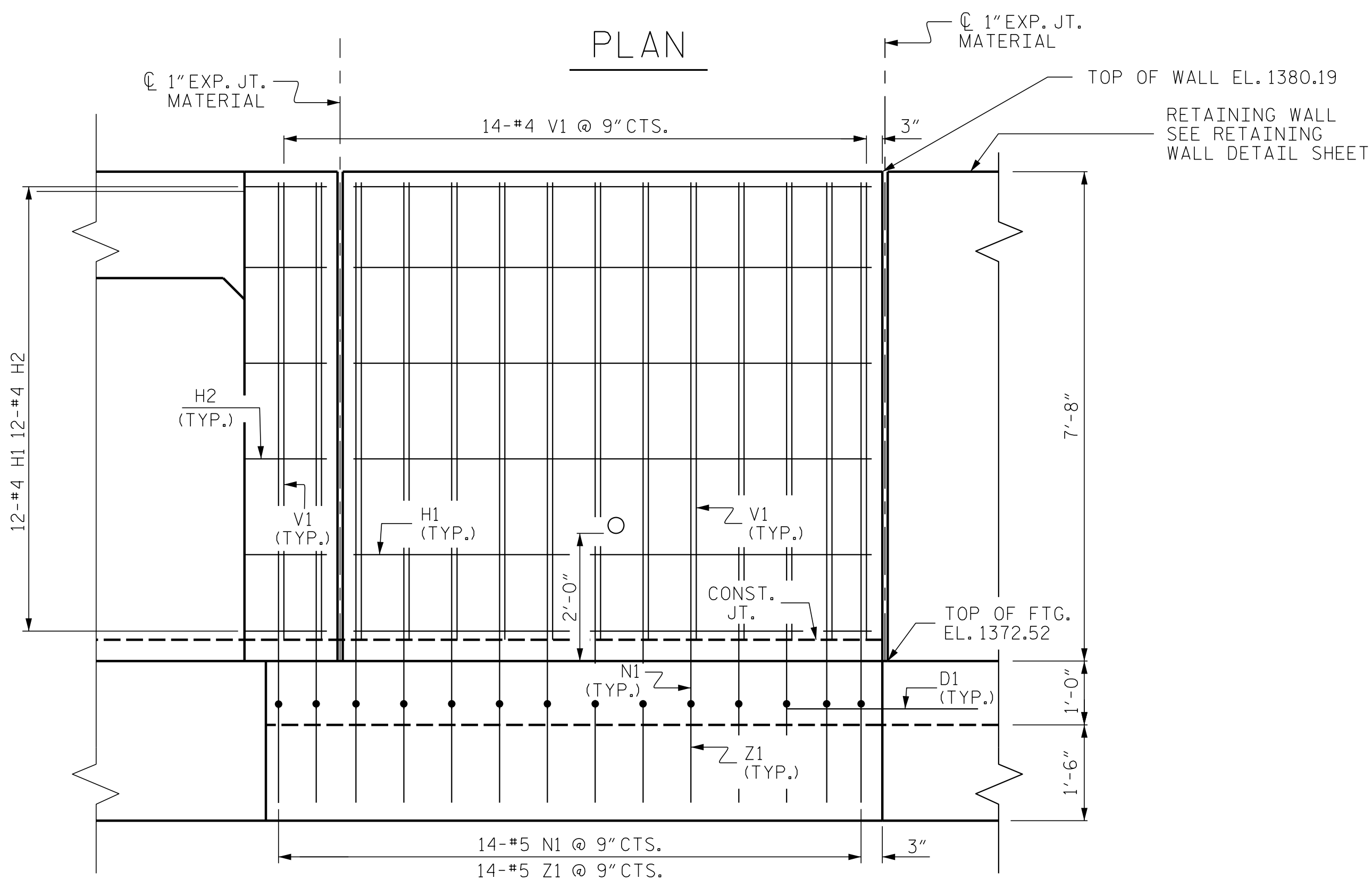
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PROJECT NO. U-5818
 MCDOWELL COUNTY
 STATION: 16+31.90 -RPC-

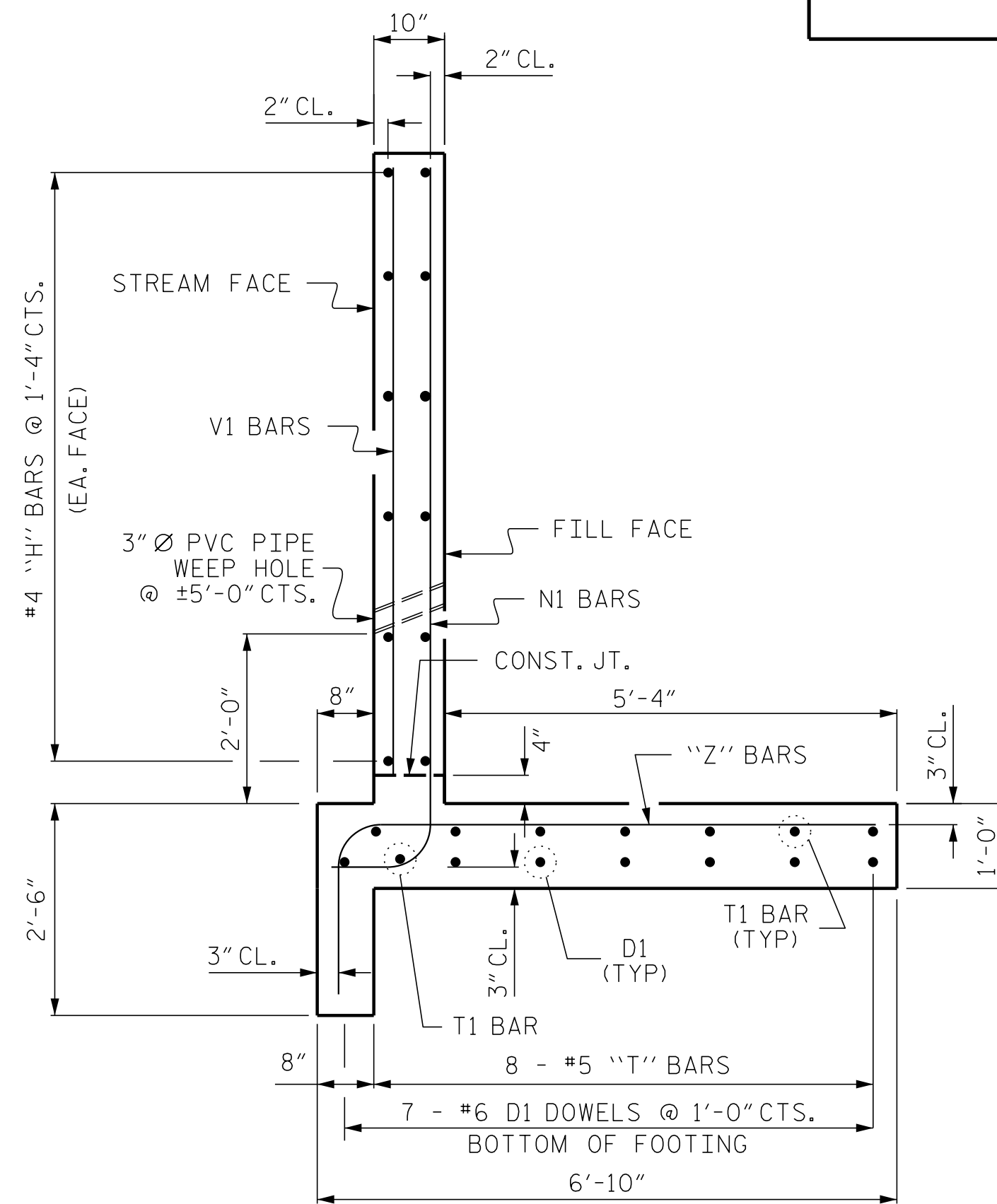
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NO.	BY:	DATE:	NO.	BY:	DATE:	C2-5
1			3			TOTAL SHEETS
2			4			7



PLAN



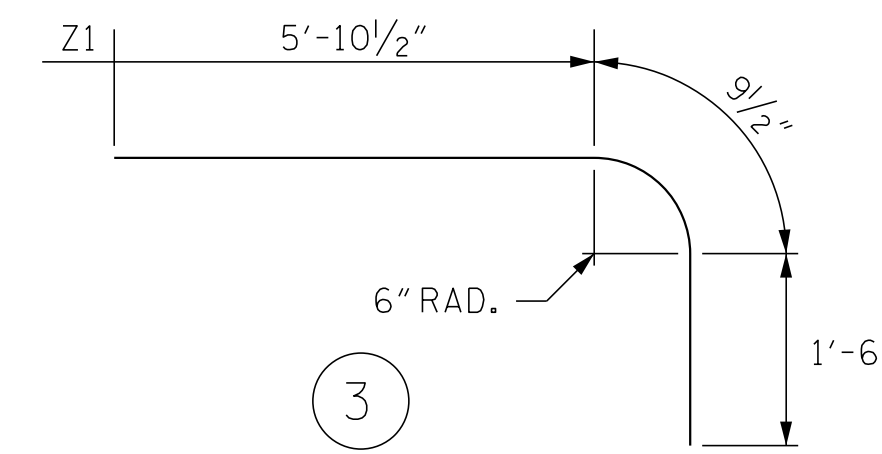
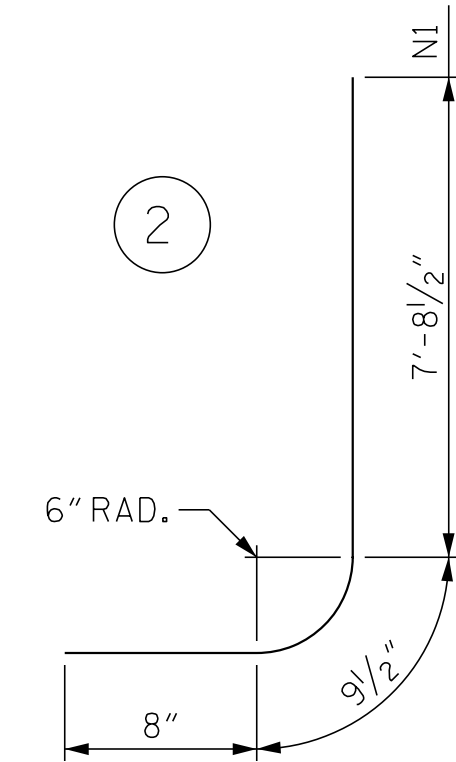
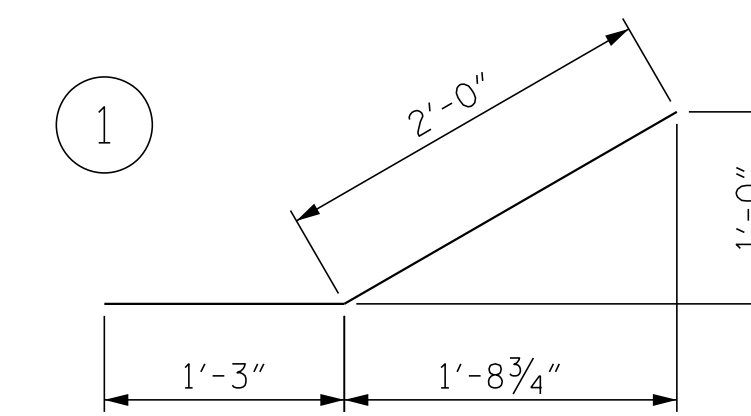
ELEVATION



TYPICAL WING SECTION

BAR TYPES

ALL BAR DIMENSIONS ARE OUT TO OUT.



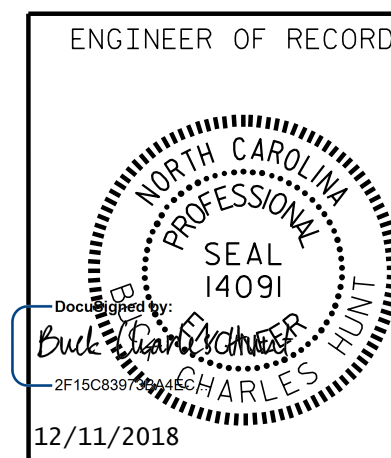
BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	12	#4	STR	8'-1"	65
H2	12	#4	1	3'-3"	26
N1	14	#5	2	9'-2"	134
T1	5	#5	STR	11'-2"	58
T2	3	#5	STR	10'-0"	31
V1	14	#4	STR	7'-2"	67
Z1	14	#5	3	8'-2"	119
Z2	2	#5	STR	4'-6"	9
D1	7	#6	STR	3'-0"	32

REINFORCING STEEL FOR 1 WING 541 LBS

CLASS A CONCRETE 1 WING 5.6 CY

PROJECT NO. U-5818
 MCDOWELL COUNTY
 STATION: 16+31.90 -RPC-



STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

WING
 W2

REVISIONS

NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

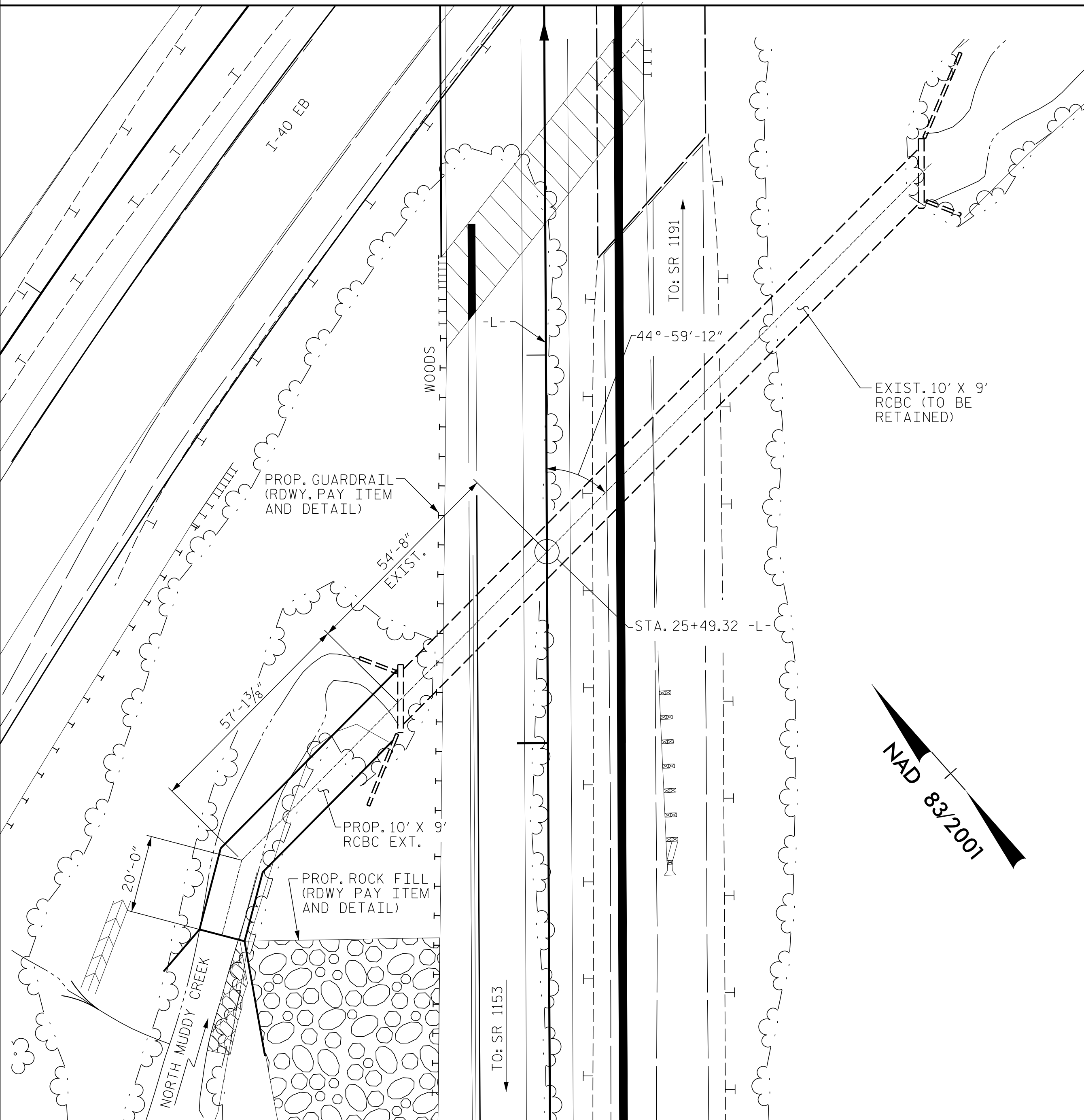
SHEET NO.
 C2-6
 TOTAL SHEETS
 7

DRAWN BY: A.J. KLINK DATE: 7-18
 CHECKED BY: J.A. DILWORTH DATE: 9-18

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Bm #2, NAIL IN 18" SWEET GUM, STA. 24+03.00 -BL-, 40.0' RT., EL. 1394.48 N703619, E1098038



ROADWAY DATA

GRADE POINT ELEV. @ STA 25+49.32 -L- = 1391.97
 BED ELEV. @ STATION 25+49.32 -L- = 1354.52
 ROADWAY SLOPES = 2:1

HYDRAULIC DATA

DESIGN DISCHARGE = 540 CFS
 FREQUENCY OF DESIGN FLOOD = 50 YEARS
 DESIGN HIGH WATER ELEVATION = 1363.70
 DRAINAGE AREA = 1.18 SQ. MI.
 BASE DISCHARGE (Q100) = 650 CFS
 BASE HIGH WATER ELEVATION = 1364.60

OVERTOPPING FLOOD DATA

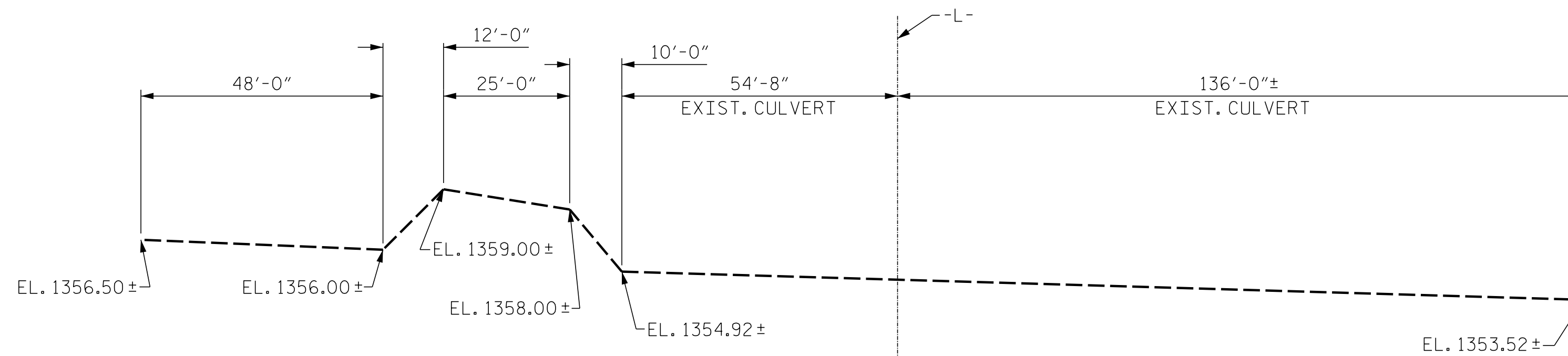
OVERTOPPING DISCHARGE = 890+ CFS
 FREQUENCY OF OVERTOPPING FLOOD = 500+ YEAR
 OVERTOPPING FLOOD ELEVATION = 1388.50
 OVERTOPPING OCCURS AT SAG LOW POINT STA. 22+48.63 -L-

TOTAL BILL OF MATERIAL

MATERIAL	ELEMENT	QUANTITY
CLASS A CONCRETE (CU. YDS.)	BARREL	143.1
	HEADWALLS	0.6
	CURTAIN WALLS	0.6
	EDGE BEAMS	1.3
	WINGS	32.6
	TOTAL	178.2
REINFORCING STEEL (LBS.)	BARREL	16256
	WINGS	3848
	TOTAL	20104
FOUNDATION COND. MAT'L (TONS)		66
CULVERT EXCAVATION	LUMP SUM	

NOTES

ASSUMED LIVE LOAD -----HL-93 OR ALTERNATE LOADING.
 DESIGN FILL TO BOTTOM OF TOP SLAB = 27.83'
 FOR OTHER DESIGN DATA AND NOTES SEE STANDARD NOTE SHEET.
 3" Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.
 CONCRETE IN THE CULVERT TO BE POURED IN THE FOLLOWING ORDER:
 1. WING FOOTINGS AND FLOOR SLAB INCLUDING 4" OF VERTICAL WALLS.
 2. THE REMAINING PORTIONS OF THE WALLS AND WINGS FULL HEIGHT.
 THE RESIDENT ENGINEER SHALL CHECK THE LENGTH OF CULVERT BEFORE STAKING IT OUT TO MAKE CERTAIN THAT IT WILL PROPERLY TAKE CARE OF THE FILL.
 DIMENSIONS FOR WING LAYOUT AS WELL AS ADDITIONAL REINFORCING STEEL EMBEDDED IN BARREL ARE SHOWN ON WING SHEET.
 AT THE CONTRACTOR'S OPTION, HE MAY SPLICE THE VERTICAL REINFORCING STEEL IN THE INTERIOR FACE OF EXTERIOR WALL ABOVE LOWER WALL CONSTRUCTION JOINT. THE SPLICE LENGTH SHALL BE AS PROVIDED IN THE SPLICE LENGTH CHART SHOWN ON THE PLANS. EXTRA WEIGHT OF STEEL DUE TO THE SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.
 THE EXISTING STRUCTURE CONSISTING OF A 10'x9' SINGLE BARREL REINFORCED CONCRETE BOX CULVERT 192.80' LONG ALONG CENTERLINE OF CULVERT AND LOCATED AT PROPOSED STRUCTURE SHALL BE RETAINED AND EXTENDED. THE EXISTING CULVERT IS PRESENTLY NOT POSTED FOR LOAD LIMIT.
 FOR CULVERT DIVERSION DETAILS AND PAY ITEM, SEE EROSION CONTROL PLANS.
 A 3 FOOT STRIP OF FILTER FABRIC SHALL BE ATTACHED TO THE FILL FACE OF THE WING COVERING THE ENTIRE LENGTH OF EXPANSION JOINT.
 FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.
 FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.
 FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.
 FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.
 IF APPROVED BY THE ENGINEER, THE CONTRACTOR MAY USE THE EXISTING WINGS AS TEMPORARY SHORING FOR THE CONSTRUCTION OF THE CULVERT EXTENSIONS. IN THIS CASE, THE BOTTOM SLAB OF THE EXTENSION SHALL BE POURED AT LEAST 72 HOURS PRIOR TO CUTTING THE WINGS. THE WINGS MAY BE CUT EARLIER PROVIDED THE SLAB CONCRETE STRENGTH HAS REACHED A MINIMUM COMPRESSIVE STRENGTH OF 1500 PSI.
 DOWELS SHALL BE USED TO CONNECT THE CULVERT EXTENSION TO THE EXISTING CULVERT AS SHOWN. FOR NOTE REGARDING SETTING OF DOWELS, SEE SHEET SN.



PROFILE ALONG C CULVERT

PROJECT NO. U-5818
MCDOWELL COUNTY
 STATION: 25+49.32 -L-

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DRAWN BY : B.C. HUNT DATE : 8-18
 CHECKED BY : T.K. KOCH DATE : 9-18

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ENGINEER OF RECORD:

12/11/2018
 W. ETHERILL ENGINEERING
 1223 Jones Franklin Rd.
 Raleigh, N.C. 27606
 Bus: 919 851 8077
 Fax: 919 851 8107
 LICENSE NO. F-0377

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
**SINGLE
 10 FT. X 9 FT.
 CONCRETE
 BOX CULVERT
 EXTENSION**

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C3-1
1			3			TOTAL SHEETS
2			4			7

LOAD AND RESISTANCE FACTOR RATING (LRFR) SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS

LEVEL	VEHICLE	WEIGHT (W) (TONS)	CONTROLLING LOAD RATING	MINIMUM RATING FACTORS (RF)	TONS = W x RF	STRENGTH I LIMIT STATE								COMMENT NUMBER	
						LIVE-LOAD FACTORS (γ _{LL})	MOMENT				SHEAR				
							RATING FACTOR	BOX NO.	ELEMENT TYPE	DISTANCE FROM LEFT END OF ELEMENT (ft)	RATING FACTOR	BOX NO.	ELEMENT TYPE		DISTANCE FROM LEFT END OF ELEMENT (ft)
DESIGN LOAD RATING	PERMANENT LOAD	N/A	(M) (S)	1.01	--	N/A	1.01	1	BOTTOM SLAB	6.00	1.01	1	BOTTOM SLAB	10.04	1,2

LOAD FACTORS:

DESIGN LOAD RATING FACTORS

LOAD TYPE	MAX FACTOR	MIN FACTOR
DC	1.25	0.90
DW	1.50	0.65
EV	1.30	0.90
EH	1.35	0.90
ES	1.35	0.90
LS	1.75	--
WA	1.00	--

NOTE:

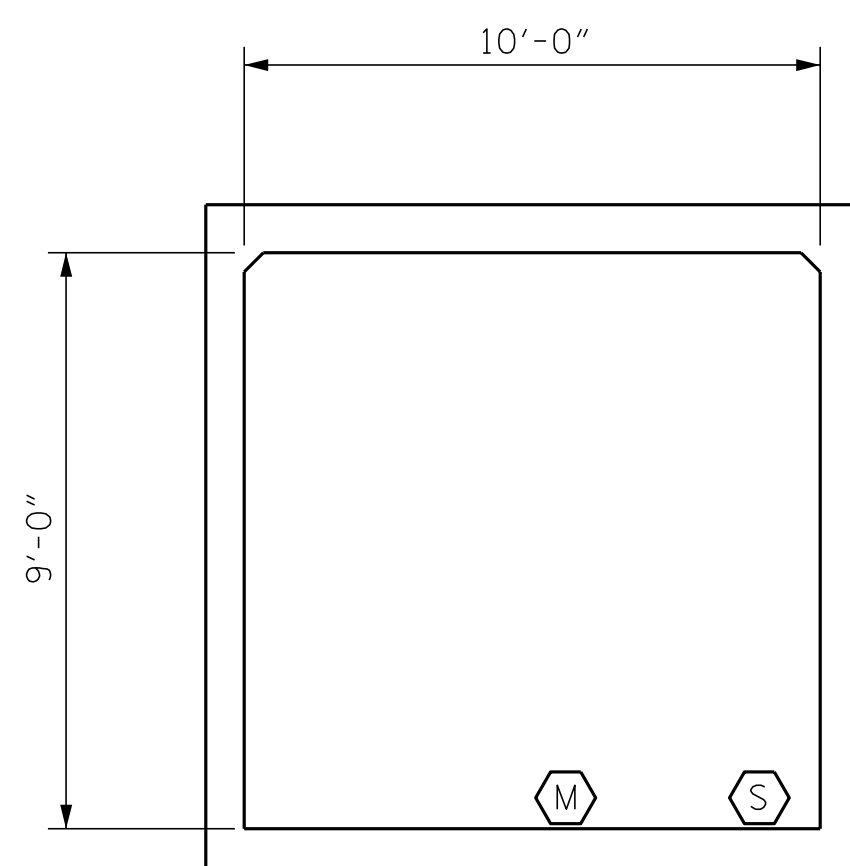
RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

FILL HEIGHT (27.50') EXCEEDS THE DISTANCE BETWEEN FACES OF END WALLS (10'-0"). DESIGN CONTROLLED BY DEAD LOAD ONLY. SEE AASHTO 3.6.1.2.6

CULVERT LOAD RATED FOR PERMANENT LOAD ONLY.

COMMENTS:

1. CALCULATED MOMENT RATING FACTOR EQUALS MOMENT CAPACITY DIVIDED BY DEAD LOAD MOMENT.
2. CALCULATED SHEAR RATING FACTOR EQUALS SHEAR CAPACITY DIVIDED BY DEAD LOAD SHEAR.



LRFR SUMMARY

(M) MOMENT RATING FACTOR

(S) SHEAR RATING FACTOR

PROJECT NO. U-5818
MCDOWELL COUNTY
 STATION: 25+49.32 -L-

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ASSEMBLED BY : B.C. HUNT	DATE : 7-18
CHECKED BY : T.K. KOCH	DATE : 7-18
DRAWN BY : WMC 7/11	REV. 10/1/11 MAA/GM
CHECKED BY : 7/11	REV. 12/17 MAA/THC

ENGINEER OF RECORD:

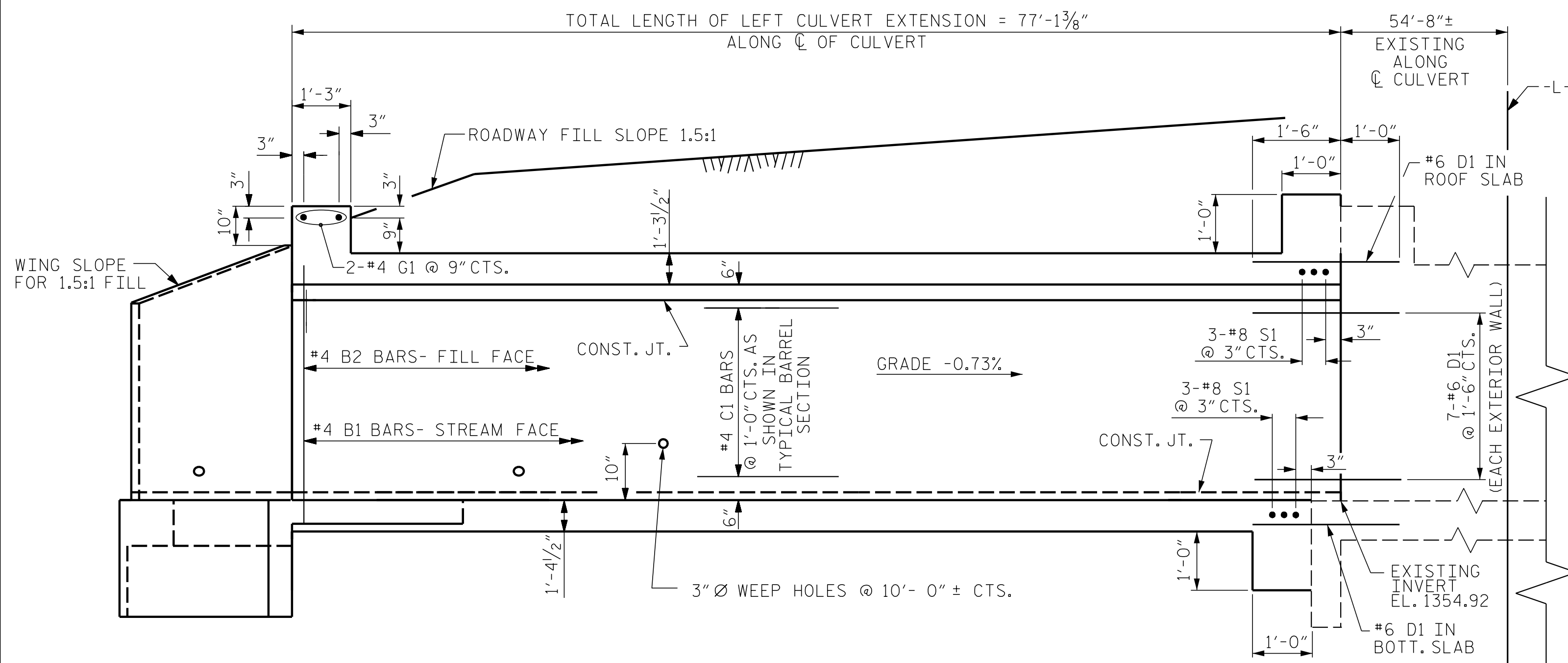
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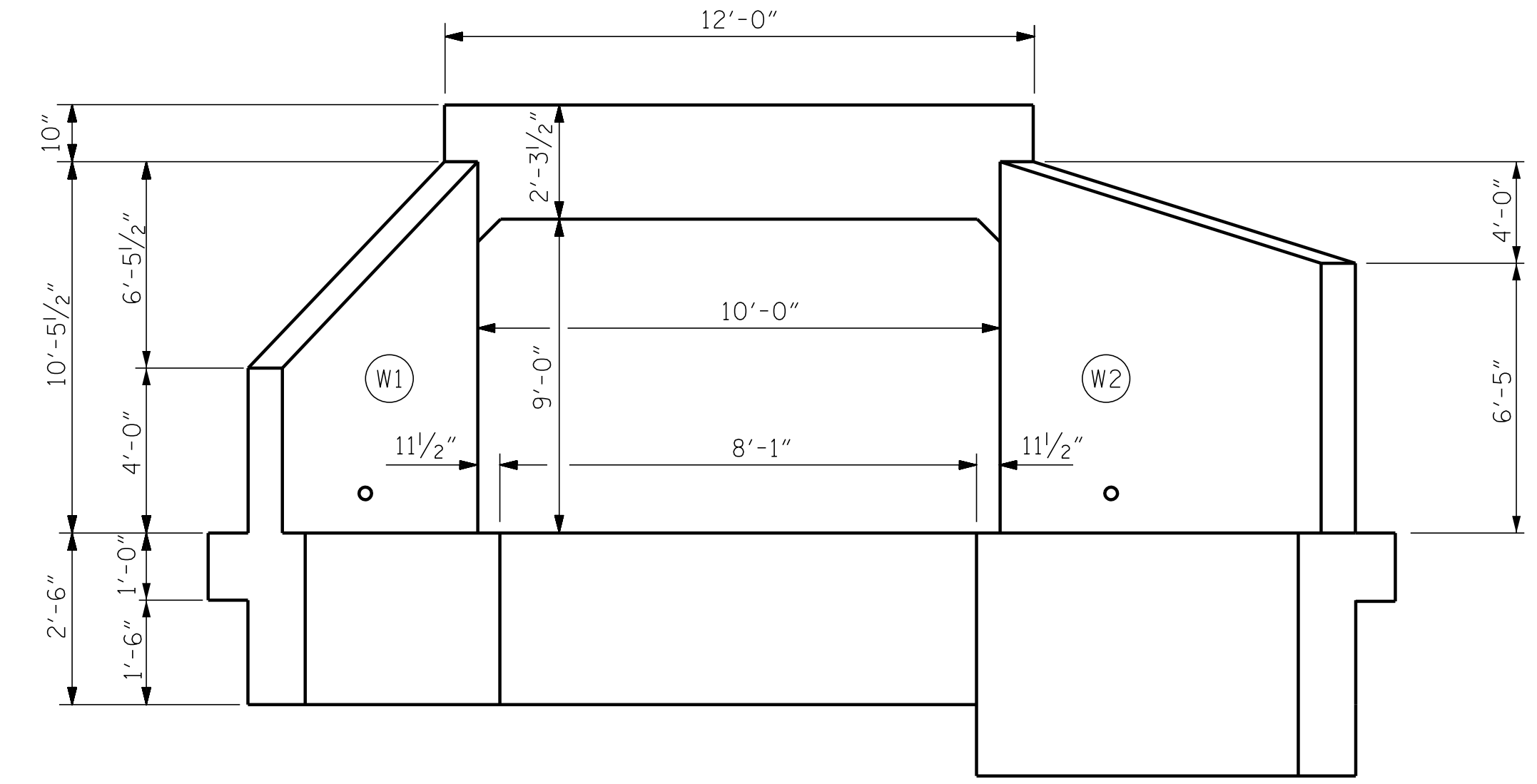
LRFR SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS (NON-INTERSTATE TRAFFIC)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C3-2
1			3			TOTAL SHEETS
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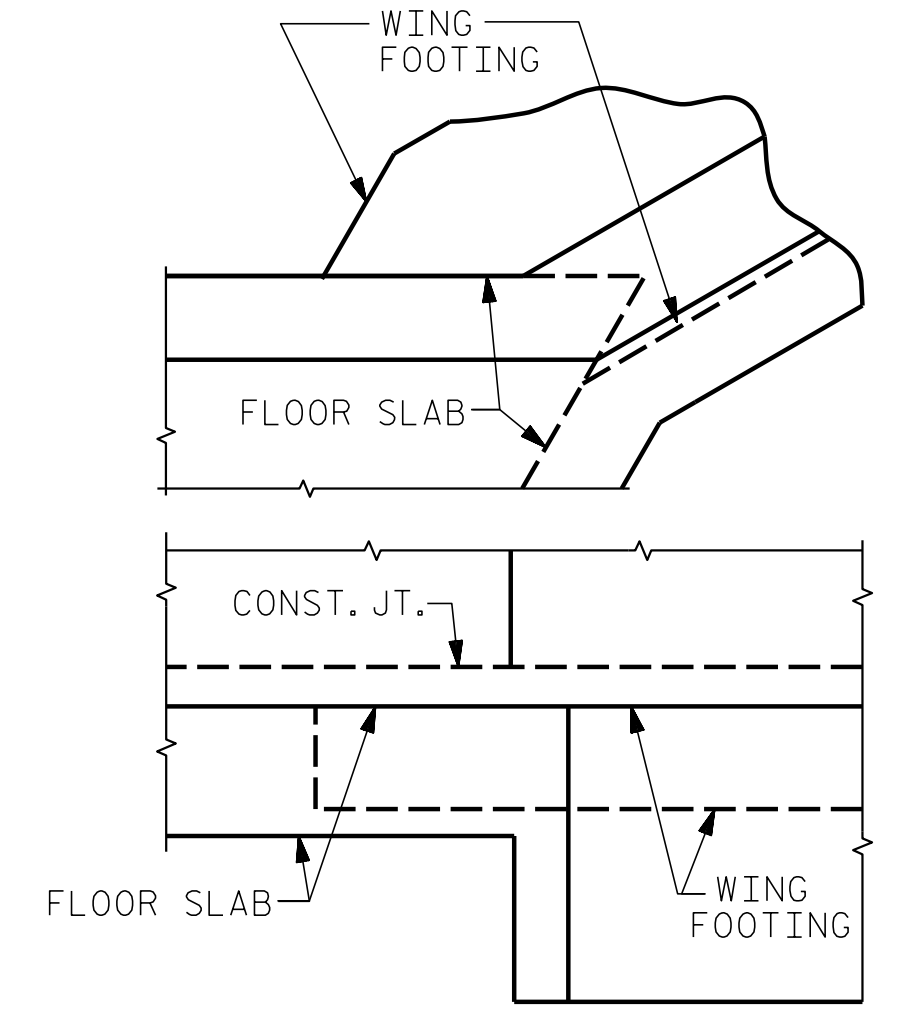


CULVERT SECTION NORMAL TO ROADWAY

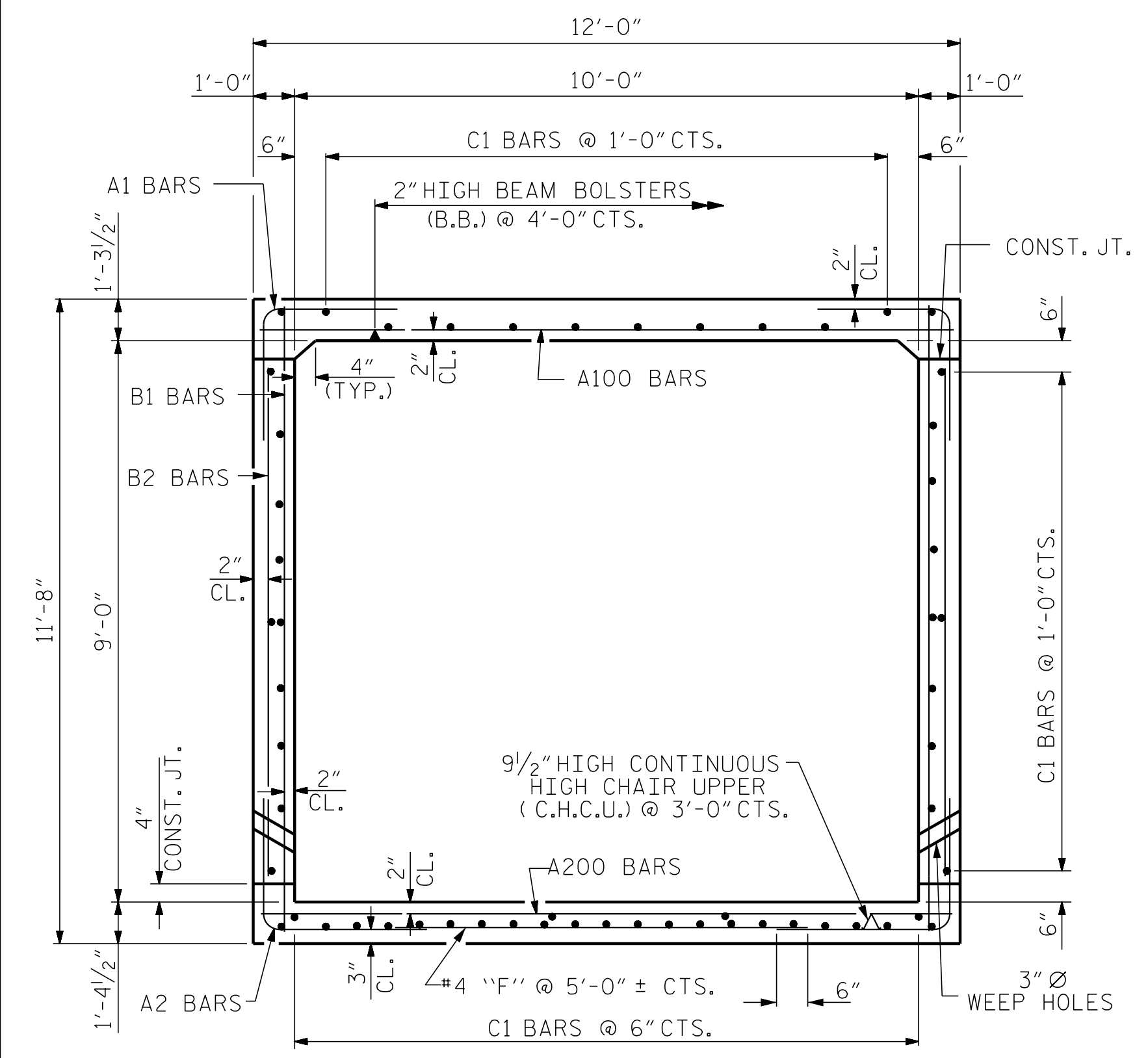


END ELEVATION

LOOKING UPSTREAM



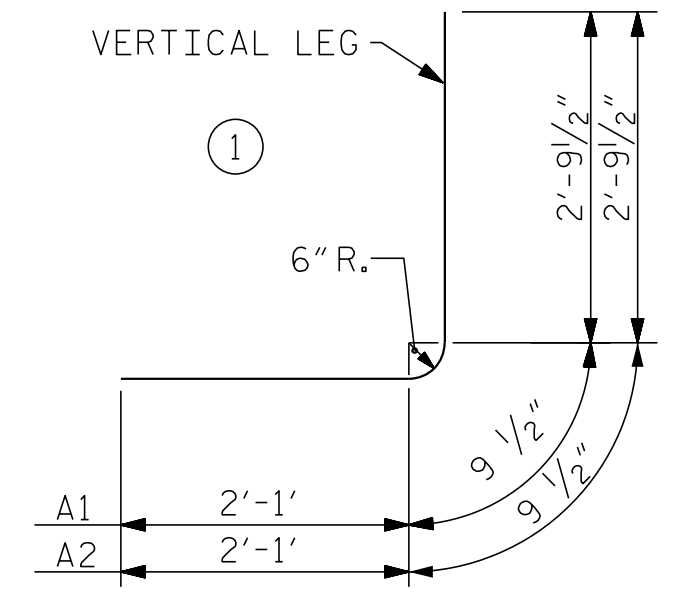
DETAIL CONNECTION OF WING FOOTING AND FLOOR SLAB WHEN SLAB IS THICKER THAN FOOTING



RIGHT ANGLE SECTION OF BARREL
THERE ARE 57 "C" BARS IN SECTION OF BARREL

BARREL REINFORCING STEEL											
BAR	NO	SIZE	TYPE	LENGTH	WEIGHT	BAR	NO	SIZE	TYPE	LENGTH	WEIGHT
A1	366	4	1	5'-8"	1385	B1	155	4	STR	11'-2"	1156
A2	366	4	1	5'-8"	1385	B2	366	4	STR	8'-0"	1956
A100	166	6	STR	11'-8"	2909	C1	171	4	STR	29'-10"	3408
A101	2	6	STR	10'-10"	33						
A102	2	6	STR	10'-0"	30	D1	28	6	STR	2'-6"	105
A103	2	6	STR	9'-2"	28						
A104	2	6	STR	8'-4"	25	F1	16	4	STR	7'-6"	80
A105	2	6	STR	7'-6"	23	F2	1	4	STR	4'-2"	3
A106	2	6	STR	6'-8"	20						
A107	2	6	STR	5'-10"	18	G1	2	4	STR	11'-8"	16
A108	2	6	STR	5'-0"	15						
A109	2	6	STR	4'-2"	13	S1	6	8	STR	16'-6"	264
A110	2	6	STR	3'-4"	10						
A111	2	6	STR	2'-6"	8						
A130	12	6	STR	6'-6"	117						
REINFORCING STEEL					16,256 LBS						
A200	166	6	STR	11'-8"	2909						
A201	2	6	STR	10'-10"	33						
A202	2	6	STR	10'-0"	30						
A203	2	6	STR	9'-2"	28						
A204	2	6	STR	8'-4"	25						
A205	2	6	STR	7'-6"	23						
A206	2	6	STR	6'-8"	20						
A207	2	6	STR	5'-10"	18						
A208	2	6	STR	5'-0"	15						
A209	2	6	STR	4'-2"	13						
A210	2	6	STR	3'-4"	10						
A211	2	6	STR	2'-6"	8						
A230	12	6	STR	6'-6"	117						

SPlice LENGTHS CHART		
BAR	SIZE	SPlice LENGTH
B1	#4	1'-9"
C1	#4	1'-11"



BAR TYPE
BAR DIMENSIONS ARE OUT TO OUT

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PROJECT NO. U-5818
MCDOWELL COUNTY
 STATION: 25+49.32 -L-

ENGINEER OF RECORD:

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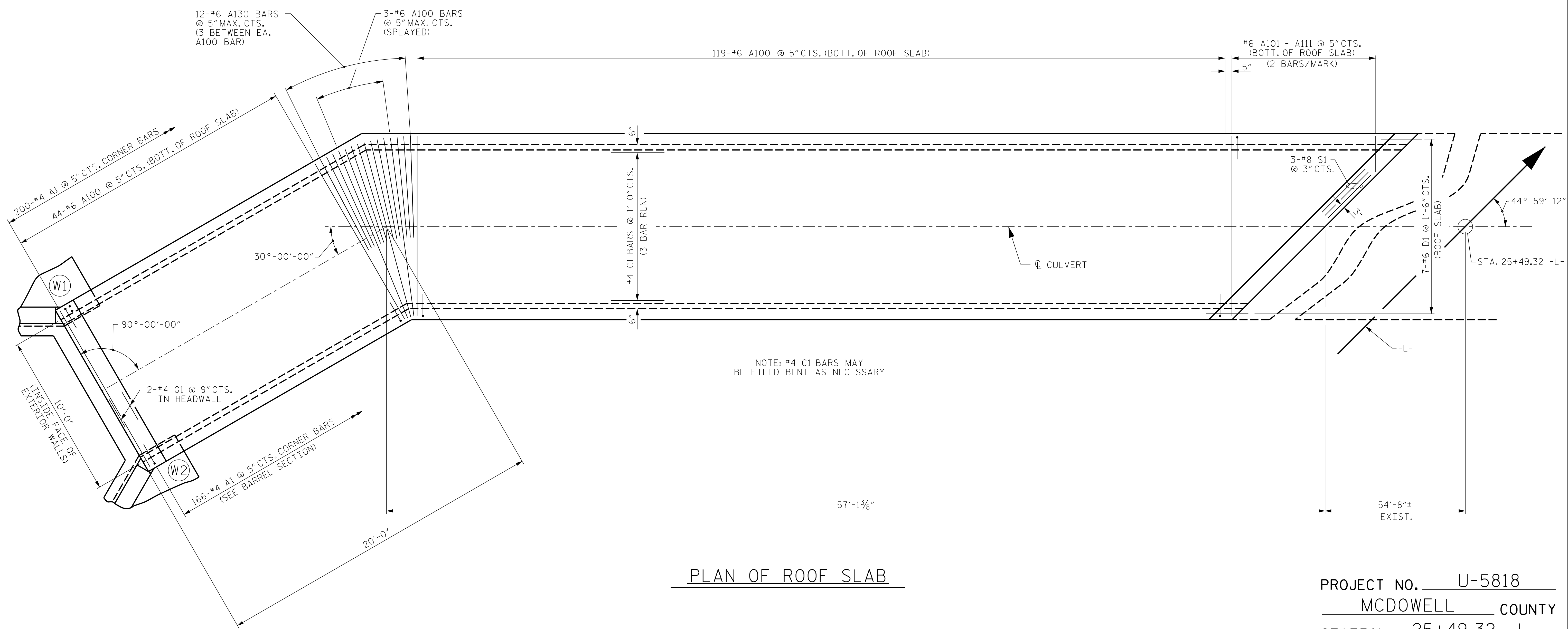
SINGLE 10 FT. X 9 FT. CONCRETE BOX CULVERT EXTENSION

REVISIONS					
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

SHEET NO. **C3-3**
 TOTAL SHEETS **7**

DRAWN BY: B.C. HUNT DATE: 7-18
 CHECKED BY: T.K. KOCH DATE: 7-18

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PROJECT NO. U-5818
 MCDOWELL COUNTY
 STATION: 25+49.32 -L-

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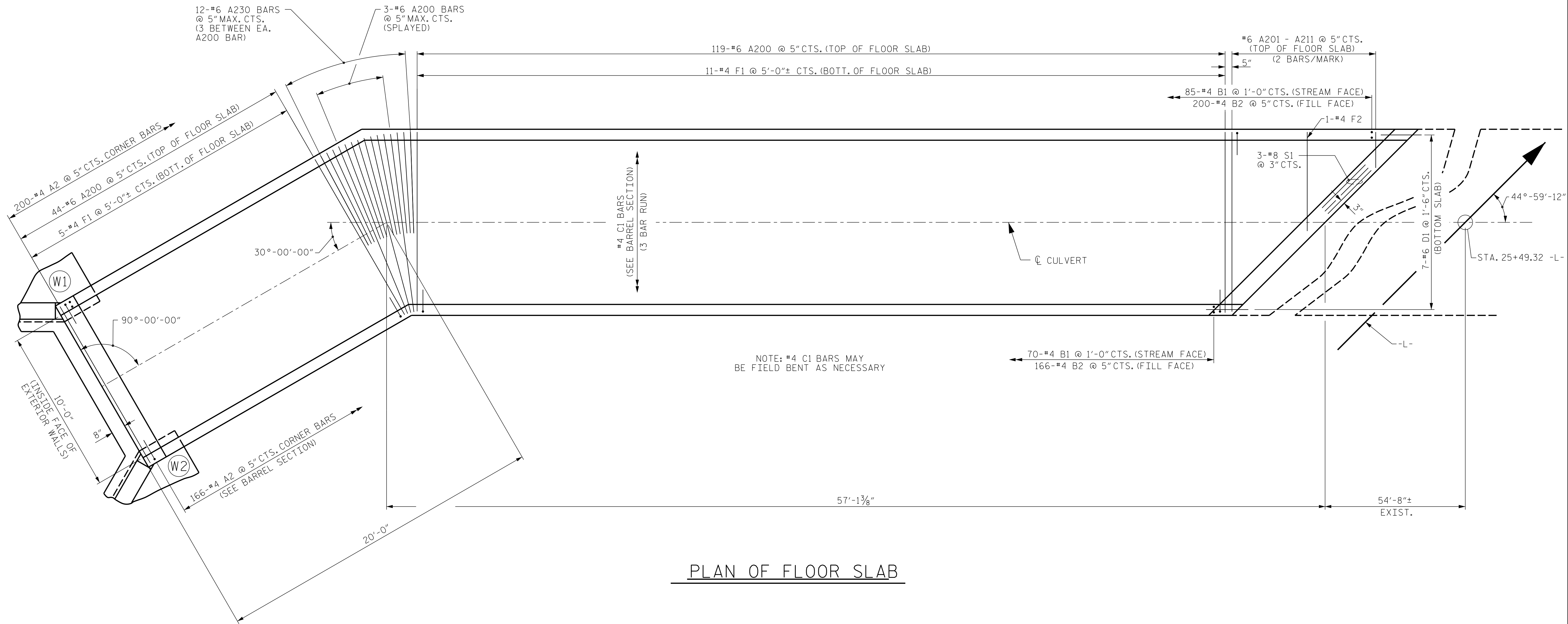
ENGINEER OF RECORD:

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STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
 SINGLE
 10 FT. X 9 FT.
 CONCRETE
 BOX CULVERT
 EXTENSION

REVISIONS					
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

SHEET NO. C3-4
 TOTAL SHEETS 7



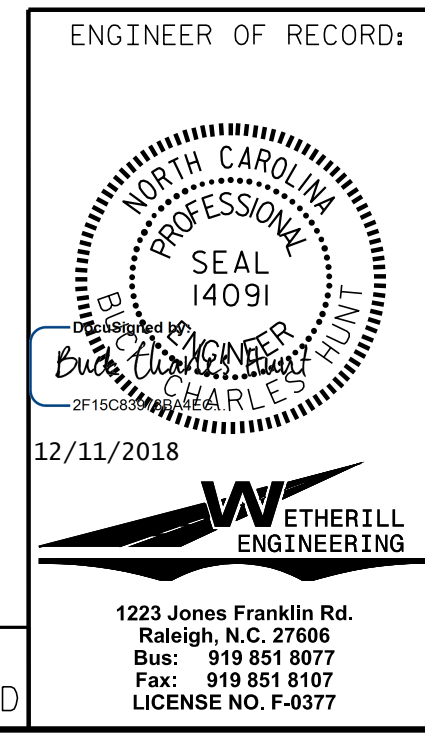
PLAN OF FLOOR SLAB

PROJECT NO. U-5818
MCDOWELL COUNTY
 STATION: 25+49.32 -L-

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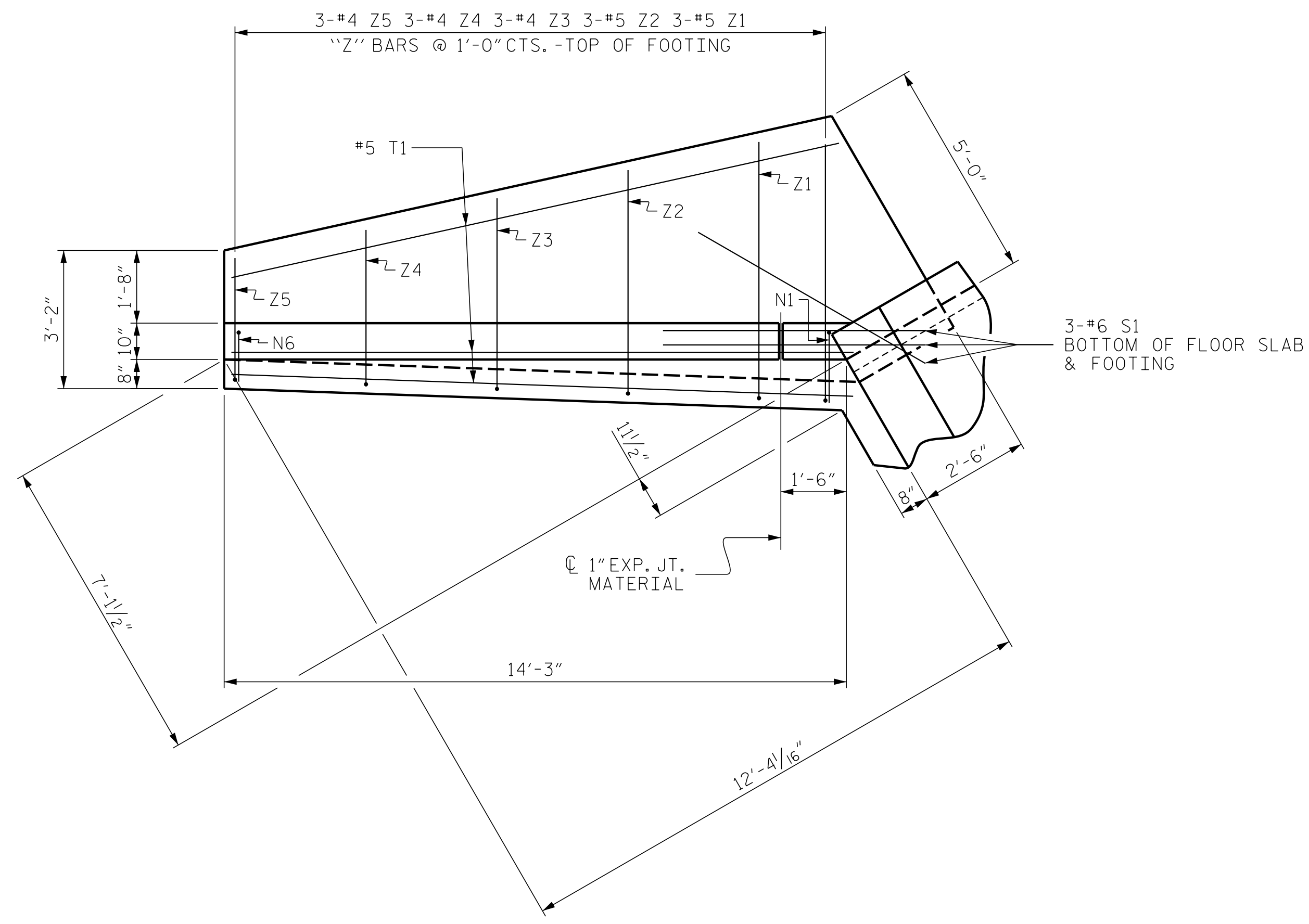
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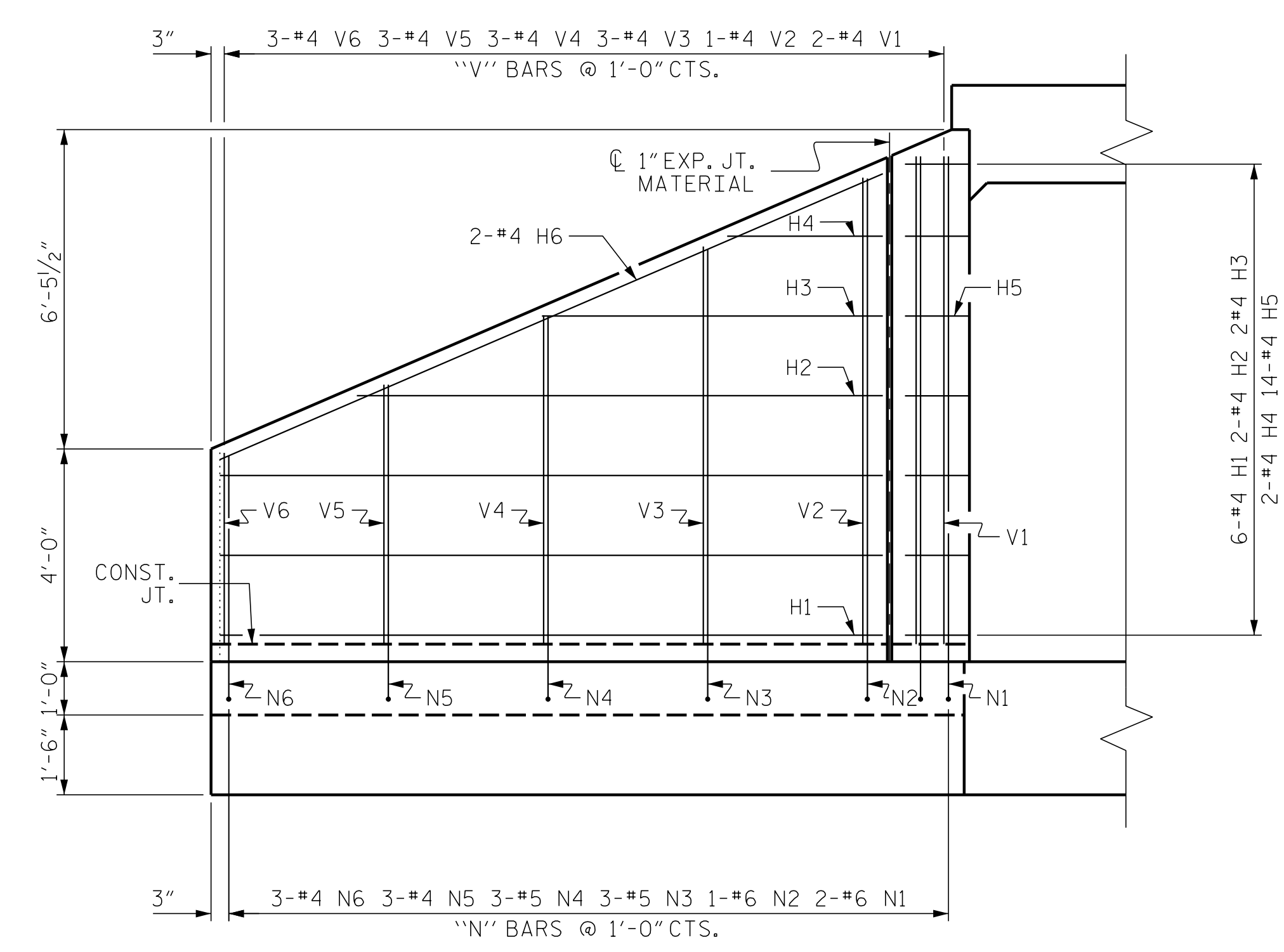


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 Fax: 919 851 8107
 LICENSE NO. F-0377

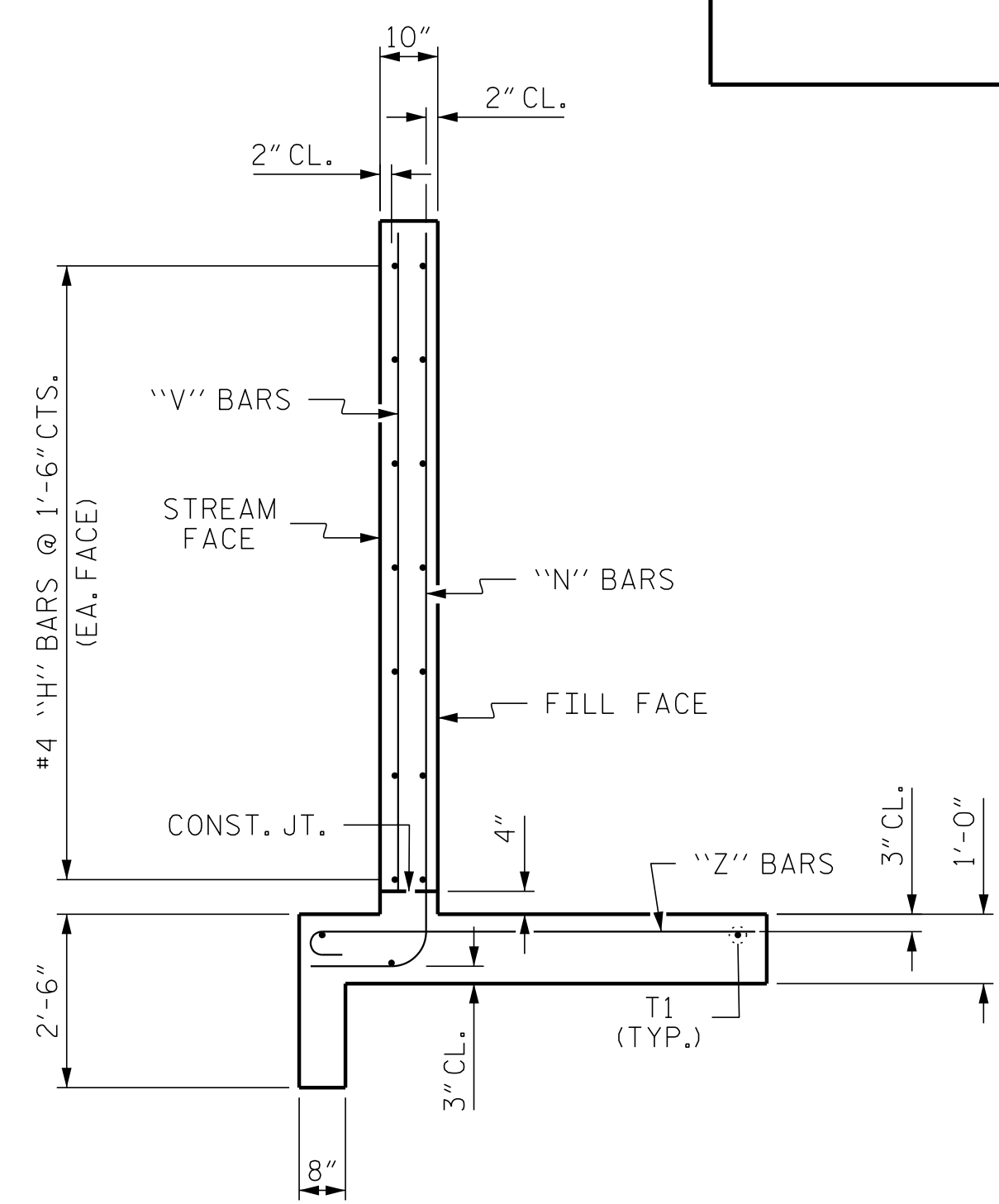
ENGINEER OF RECORD: STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH SINGLE 10 FT. X 9 FT. CONCRETE BOX CULVERT EXTENSION					
REVISIONS					
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		
SHEET NO.					C3-5
TOTAL SHEETS					7



PLAN



ELEVATION



TYPICAL WING SECTION

BAR TYPES

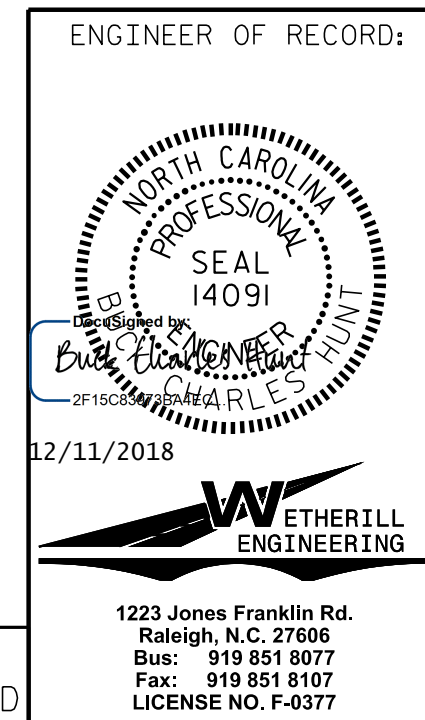
ALL BAR DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	6	#4	STR	12'-5"	50
H2	2	#4	STR	9'-10"	13
H3	2	#4	STR	6'-5"	9
H4	2	#4	STR	2'-11"	4
H5	14	#4	1	3'-3"	30
H6	2	#4	STR	13'-6"	18
N1	2	#6	2	11'-2"	34
N2	1	#6	2	10'-10"	16
N3	3	#5	2	9'-6"	30
N4	3	#5	2	8'-3"	26
N5	3	#4	2	6'-11"	14
N6	3	#4	2	5'-7"	11
S1	3	#6	STR	6'-0"	27
T1	3	#5	STR	14'-3"	45
V1	2	#4	STR	9'-2"	12
V2	1	#4	STR	8'-9"	6
V3	3	#4	STR	7'-5"	15
V4	3	#4	STR	6'-2"	12
V5	3	#4	STR	4'-10"	10
V6	3	#4	STR	3'-7"	7
Z1	3	#5	3	6'-6"	20
Z2	3	#5	3	5'-9"	18
Z3	3	#4	3	4'-11"	10
Z4	3	#4	3	4'-1"	8
Z5	3	#4	3	3'-4"	7

REINFORCING STEEL 452 LBS

CLASS A CONCRETE 1 WING 6.6 CY

PROJECT NO. U-5818
 MCDOWELL COUNTY
 STATION: 25+49.32 -L-



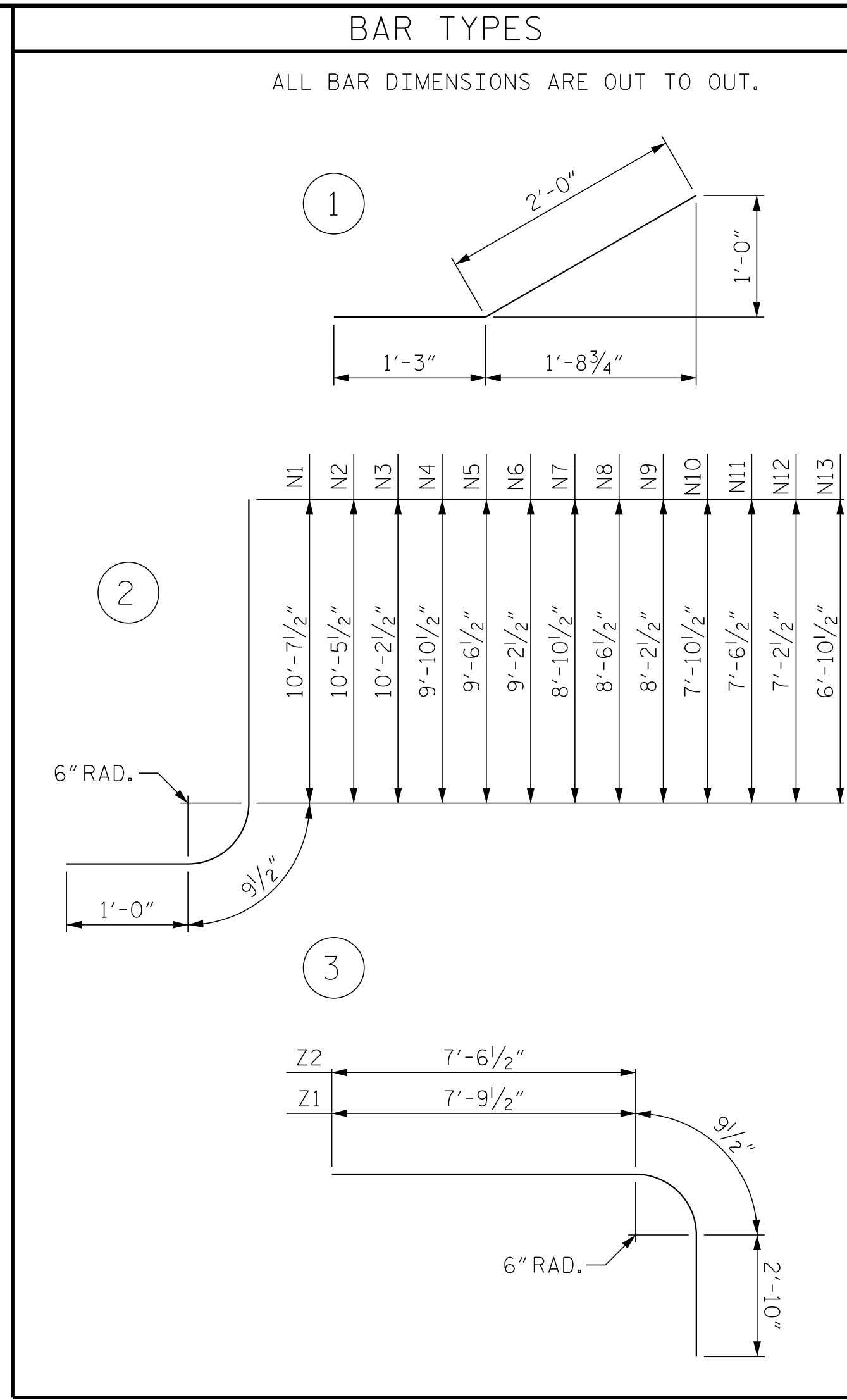
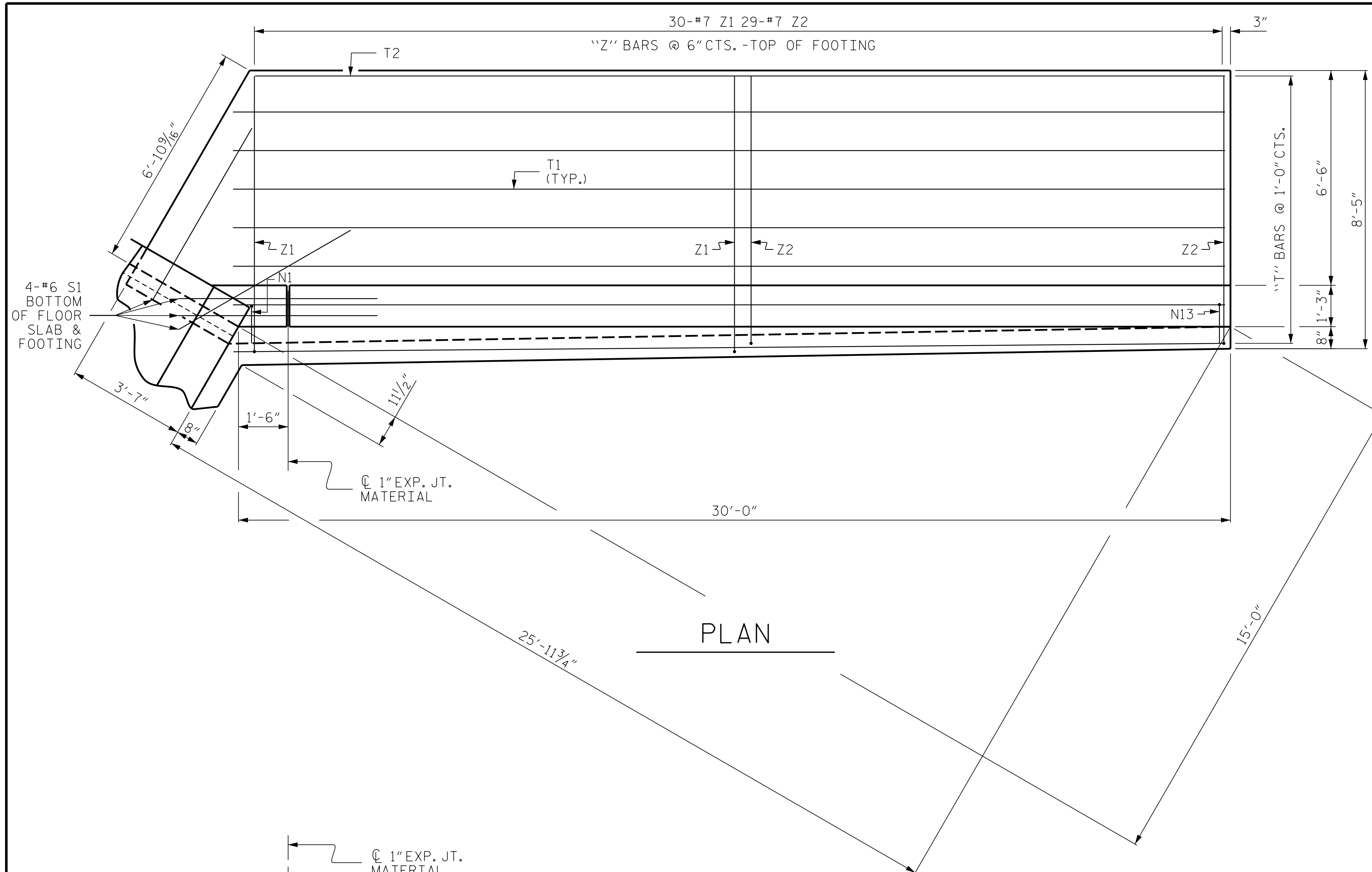
REVISIONS					
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

SHEET NO. C3-6
 TOTAL SHEETS 7

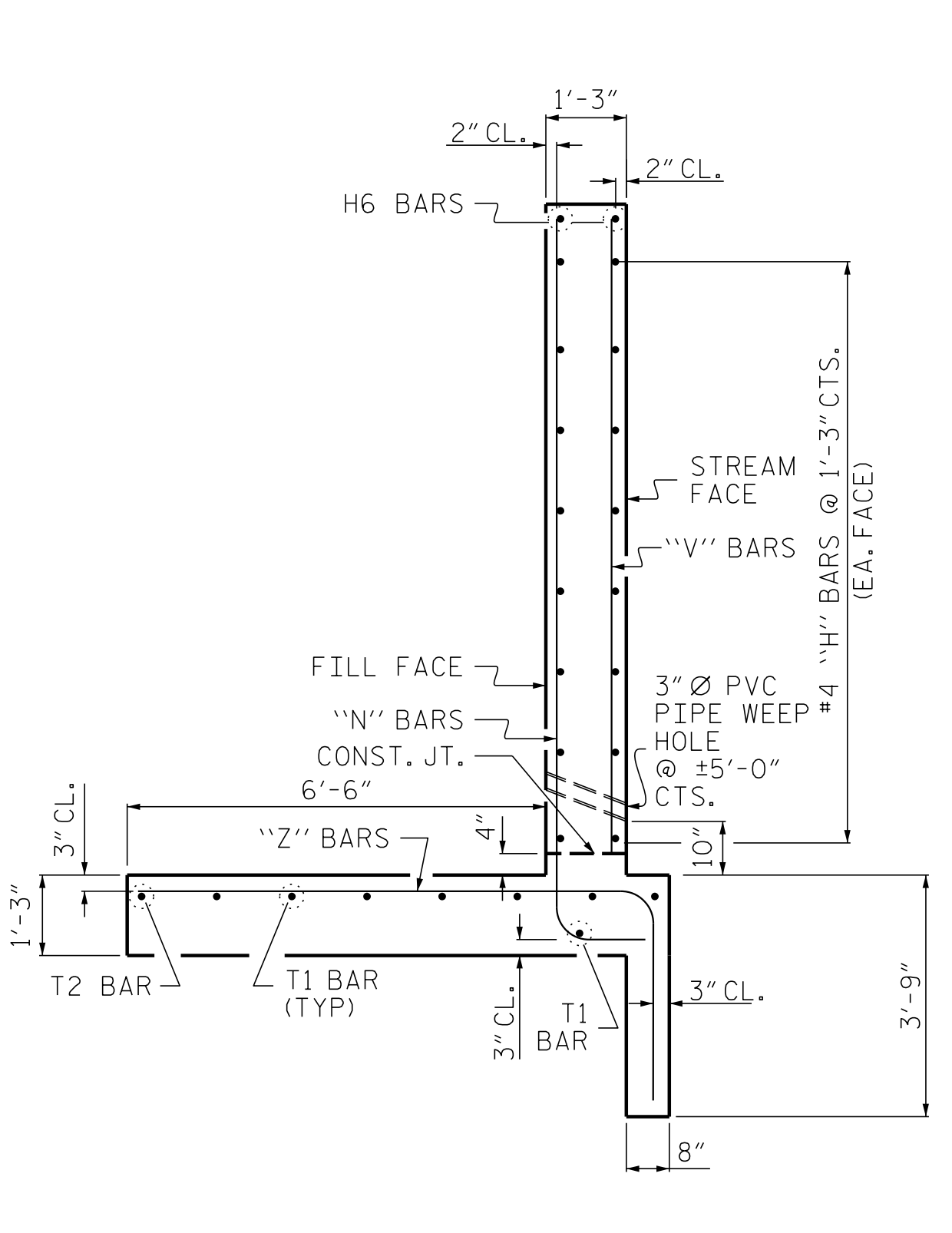
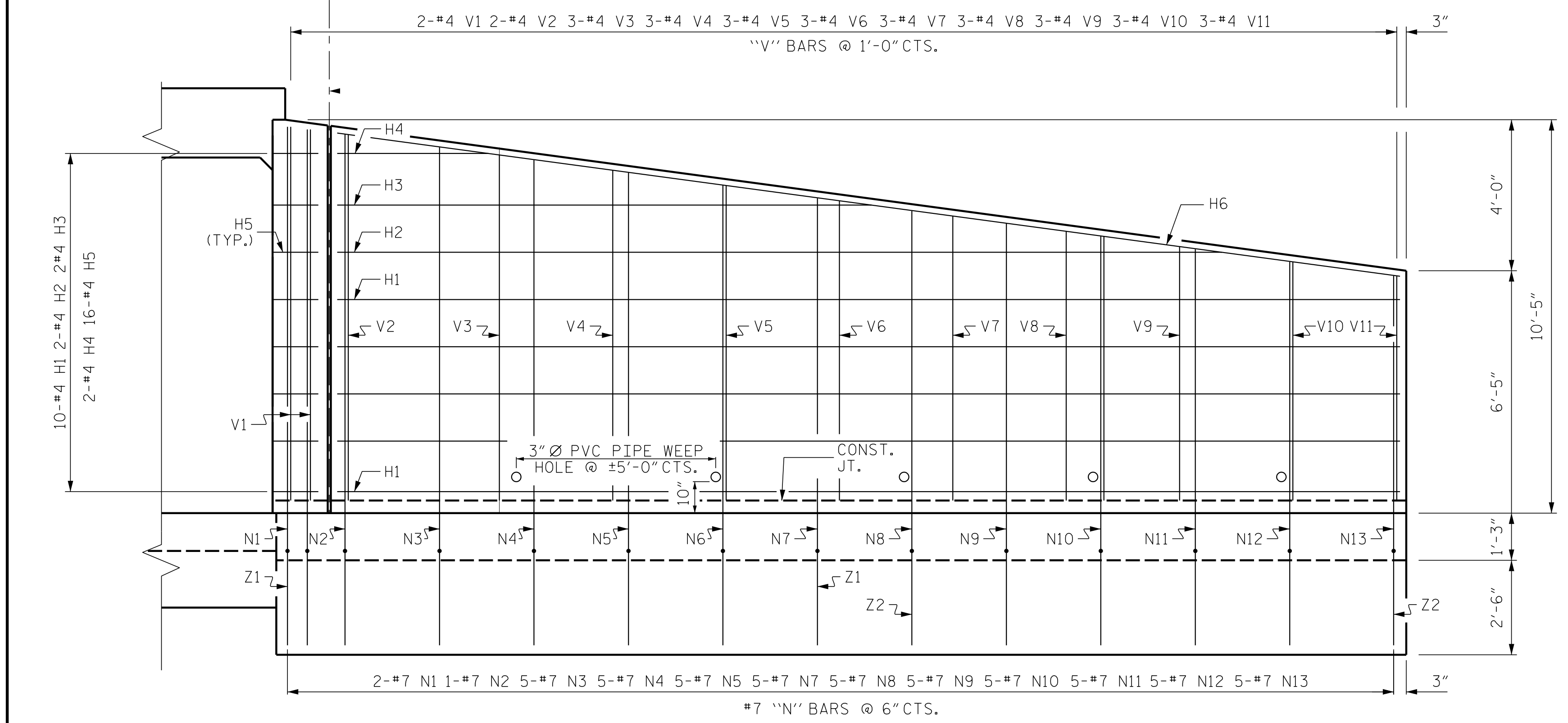
DRAWN BY: B.C. HUNT DATE: 8-18
 CHECKED BY: J.K. KOCH DATE: 9-18

DOCUMENT NOT CONSIDERED FINAL
 UNLESS ALL SIGNATURES COMPLETED

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BILL OF MATERIAL					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	10	#4	STR	28'-1"	188
H2	2	#4	STR	23'-5"	31
H3	2	#4	STR	14'-2"	19
H4	2	#4	STR	4'-0"	5
H5	16	#4	1	3'-3"	35
H6	2	#4	STR	28'-5"	38
N1	2	#7	2	12'-5"	51
N2	1	#7	2	12'-3"	25
N3	5	#7	2	12'-0"	123
N4	5	#7	2	11'-8"	119
N5	5	#7	2	11'-4"	116
N6	5	#7	2	11'-0"	112
N7	5	#7	2	10'-8"	109
N8	5	#7	2	10'-4"	106
N9	5	#7	2	10'-0"	102
N10	5	#7	2	9'-8"	99
N11	5	#7	2	9'-4"	95
N12	5	#7	2	9'-0"	92
N13	5	#7	2	8'-8"	89
S1	4	#6	STR	6'-0"	36
T1	8	#5	STR	30'-0"	250
T2	1	#5	STR	29'-4"	31
V1	2	#4	STR	9'-9"	13
V2	2	#4	STR	9'-6"	13
V3	3	#4	STR	9'-1"	18
V4	3	#4	STR	8'-9"	18
V5	3	#4	STR	8'-4"	17
V6	3	#4	STR	7'-11"	16
V7	3	#4	STR	7'-6"	15
V8	3	#4	STR	7'-1"	14
V9	3	#4	STR	6'-9"	14
V10	3	#4	STR	6'-4"	13
V11	3	#4	STR	5'-11"	12
Z1	30	#7	3	11'-5"	700
Z2	29	#7	3	11'-2"	662



REINFORCING STEEL	3396 LBS
CLASS A CONCRETE 1 WING	26.0 CY

PROJECT NO. U-5818
MCDOWELL COUNTY
STATION: 25+49.32 -L-



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

WING
W2

REVISIONS					
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

DRAWN BY: A.J. KLINK DATE: 8-18
CHECKED BY: J.D. DILWORTH DATE: 10-18

ELEVATION

DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED

1223 Jones Franklin Rd.
Raleigh, N.C. 27606
Bus: 919 851 8077
Fax: 919 851 8107
LICENSE NO. F-0377

SHEET NO.
C3-7
TOTAL SHEETS
7

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