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## Index 430-001 Miscellaneous Drainage Details

### ORIGINATION

**Date:** 8-1-2020

**Name:** Cheryl Hudson

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### COMMENTARY

Per requests from Districts, Double Pipe End Guards added to accommodate larger pipe diameters while keeping the grate weight manageable.

### COMMENTS AND RESPONSES

**BLACK** = Internal Review Comments    **RED** = Standard Plans Response

**Name:** Pablo Alonso

**Date:** 8-21-20

**COMMENT:** Various markups were submitted for sheet 5 and sheet 6. A summary are as follows:

- Sheet 5 –The top detail states that “30” Guard Shown” but it is actually a 30” pipe. Table 2 “number of vertical bars” are incorrect.
- Sheet 6 - Add more dimensions to End Elevation Detail. The top detail states that “60” Guard Shown” but it is actually a 60” pipe. Table 3 “Number of Holes” is actually total number of holes.

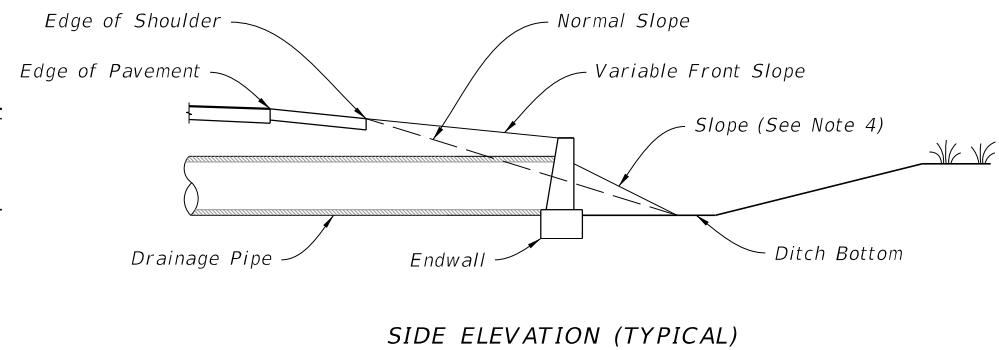
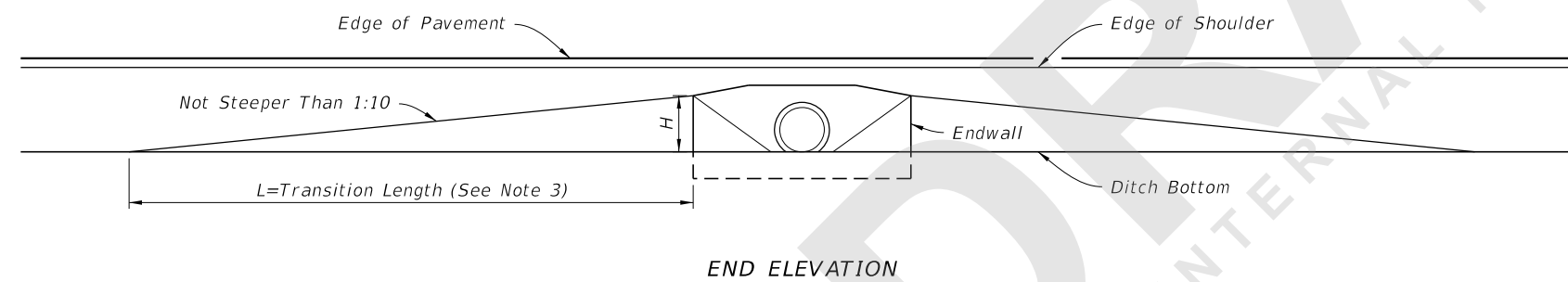
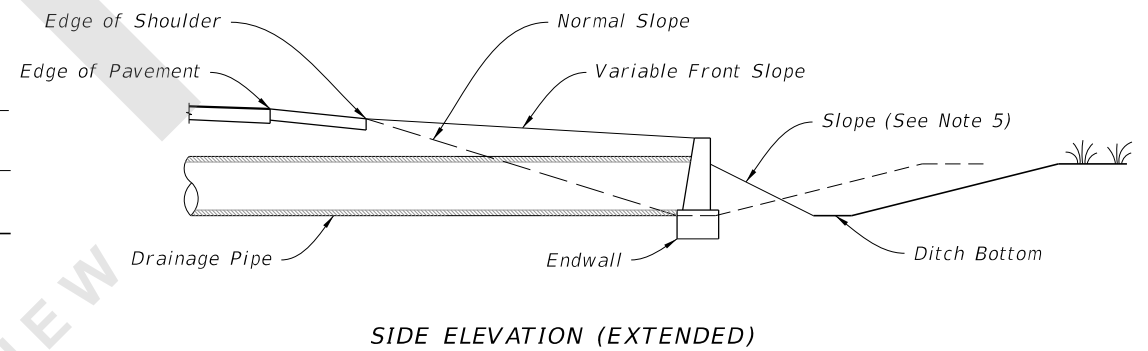
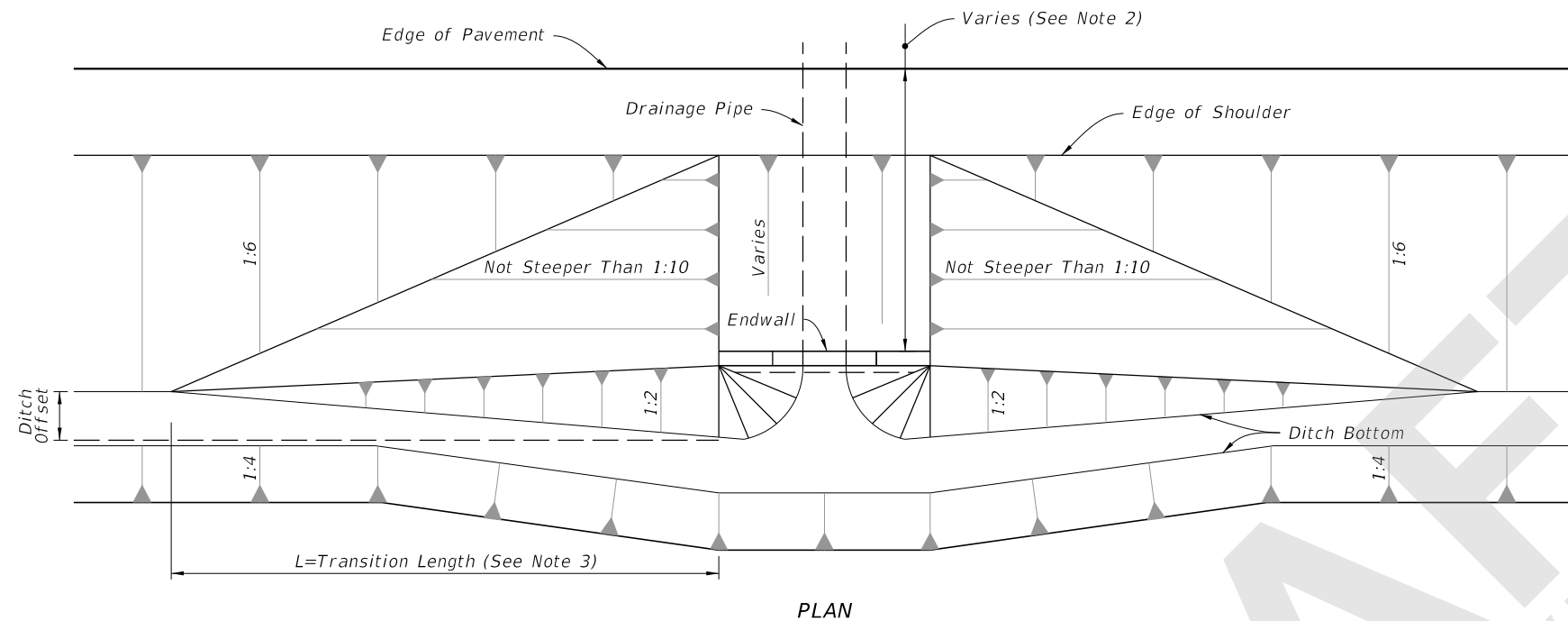
**RESPONSE:** Agreed.

**Changes made to Index:** Updated guard details to clarify that 30” and 60” pipes are shown, not guards. Updated the number of vertical bars in Table 2 on Sheet 5. Added an additional dimension to the end elevation detail on Sheet 6 for consistency with Sheet 5. Updated Table 3 on Sheet 6 to clarify that the total number of holes is represented.

**Date:** 9-3-20

**NOTES:**

1. Fill or excavate variable slopes during normal grading operations.
2. Minimum distance as required to comply with safety criteria.
3. Use Larger Value Of Either:  
 $L=10 \times H$  (No Maximum)  
 $L=10 \times \text{Ditch Offset}$  (Maximum  $L=100'$ )
4. Slope to normal slope if possible. Slope not to be steeper than 1:2. See side elevation (extended) below if 1:2 slope must go beyond toe of normal slope.
5. 1:2 slope if necessary to go beyond normal toe of slope and maintain ditch width by moving out back slope.



**FRONT SLOPES AT DRAINAGE STRUCTURES**

**TABLE OF CONTENTS:**

Sheet	Description
1	Limits of Variable Front Slopes at Drainage Structures
2	Round and Elliptical Concrete Pipe Joint
3	Filter Fabric Jacket, Concrete Jacket, and Pipe Plug
4	Concrete Collars
5	Single Pipe End Guard
6	Double Pipe End Guard
7	Retaining Wall Concrete Gutter and Drains

**LIMITS OF VARIABLE FRONT SLOPES AT DRAINAGE STRUCTURES**

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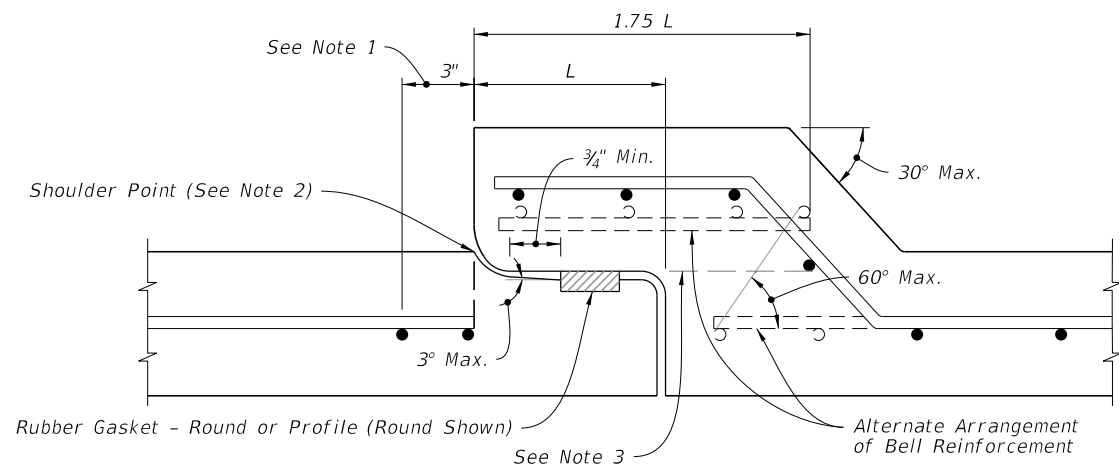


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**MISCELLANEOUS DRAINAGE DETAILS**

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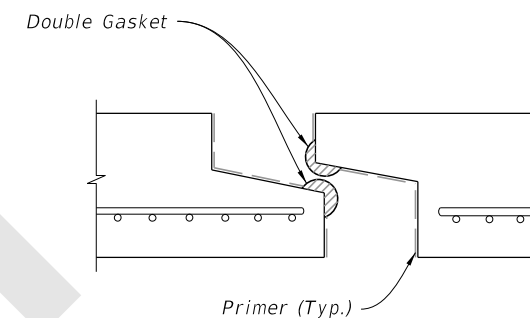
**TABLE 1  
SCHEDULE OF BELL REINFORCEMENT  
Classes II,III,IV,V; Wall A,B,C**

Nominal Pipe Diameter	Design Bell Reinforcement	Maximum Reinforcement Under Tolerance
	in <sup>2</sup> per foot	in <sup>2</sup> per foot
15"	0.07	0.010
18"	0.07	0.010
24"	0.09	0.010
30"	0.12	0.010
36"	0.14	0.010
42"	0.16	0.010
48"	0.19	0.011
54"	0.21	0.012
60"	0.23	0.0135
66"	0.26	0.015
72"	0.28	0.0165
78"	0.30	0.018
84"	0.33	0.0195
90"	0.35	0.021
96"	0.37	0.0225
102"	0.40	0.024
108"	0.42	0.0255

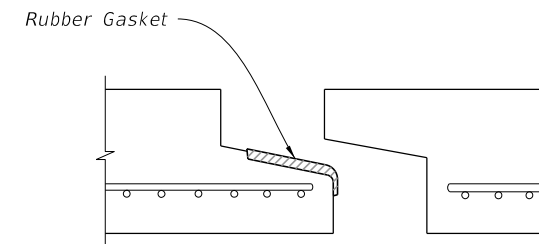
**NOTES:**

1. Allowable Tolerance for the last full wrap of reinforcing when using single elliptical cage.
2. Extend the last full wrap of reinforcing to the shoulder point and meet ASTM C-76 requirements.
3. All circumferential steel located above this line and within the 1.75 L is defined as bell reinforcement.

=====**ROUND CONCRETE PIPE JOINT DETAIL**=====



**PREFORMED PLASTIC JOINT**



**PROFILE RUBBER GASKET**

**NOTES:**

1. Filter Fabric Jacket is required on both type of joints.
2. Details shown before pull-up.

=====**ELLIPTICAL CONCRETE PIPE JOINT DETAIL**=====

**ROUND AND ELLIPTICAL CONCRETE PIPE JOINT**

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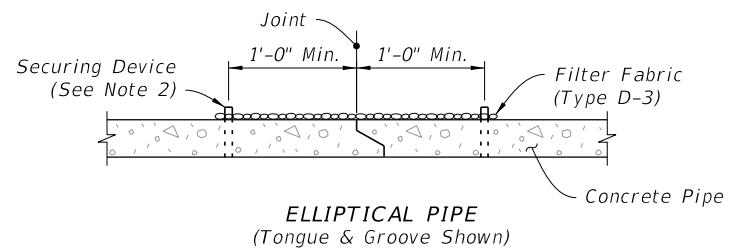


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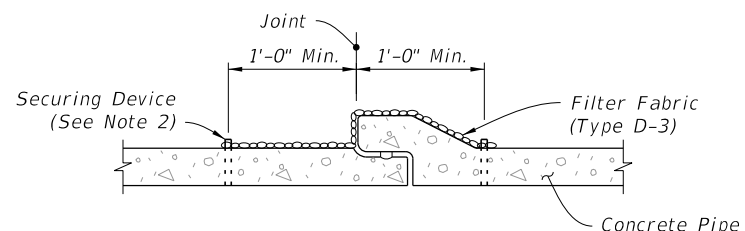
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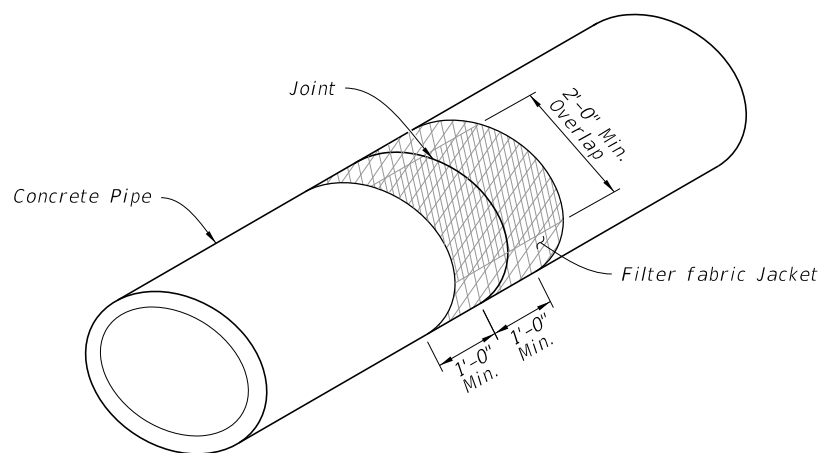


**ELLIPTICAL PIPE**  
(Tongue & Groove Shown)



**ROUND PIPE**  
(Bell & Spigot Shown)

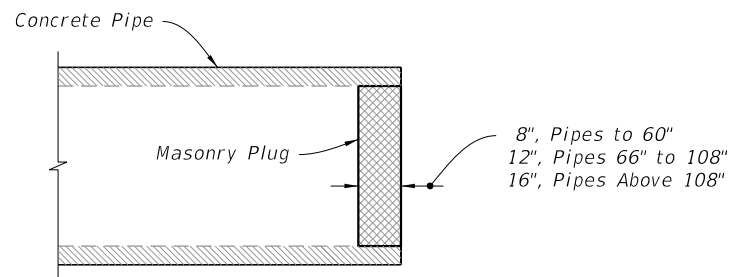
**SECTION VIEW**



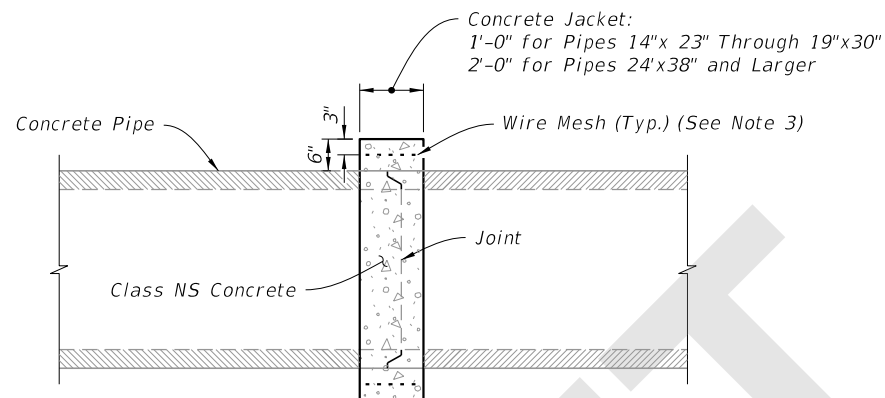
**ISOMETRIC VIEW**

**FILTER FABRIC JACKET**

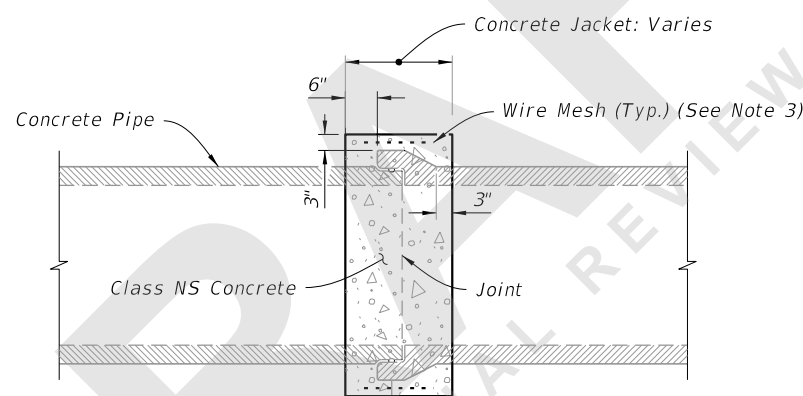
(For All Pipe Types - Concrete Elliptical Pipe Shown)



**PIPE PLUG**



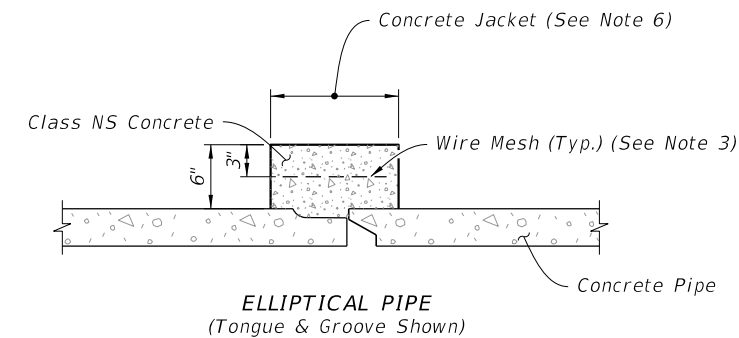
**ELLIPTICAL PIPE**



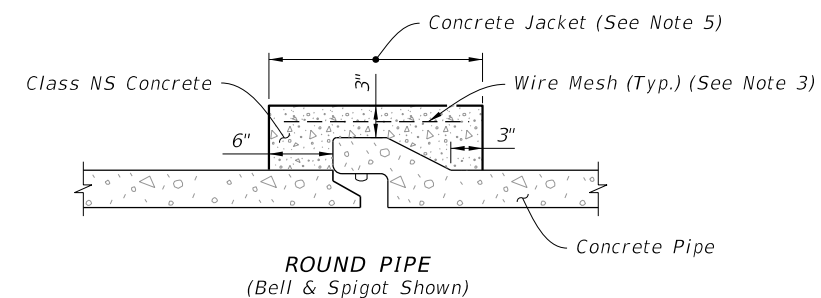
**ROUND PIPE**

**SIMILAR TYPES**

(Only When Called For In The Plans)

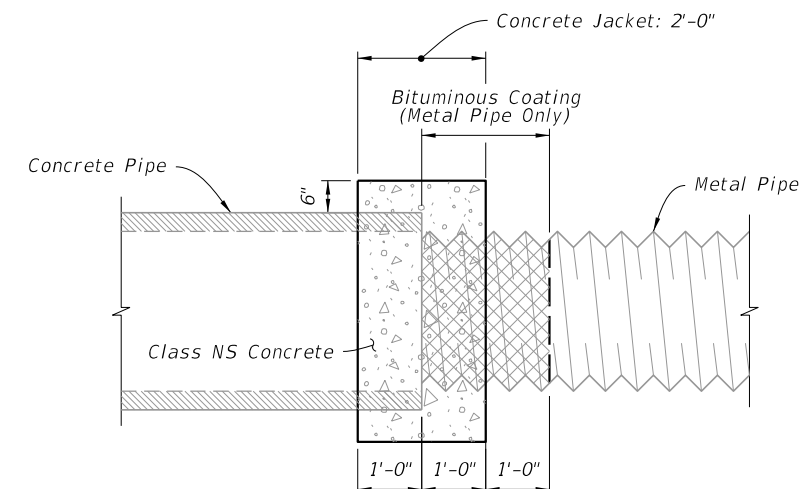


**ELLIPTICAL PIPE**  
(Tongue & Groove Shown)



**ROUND PIPE**  
(Bell & Spigot Shown)

**DISSIMILAR JOINTS**



**CONCRETE AND METAL PIPE SHOWN**

(Others Similar)

**DISSIMILAR TYPES**

**CONCRETE JACKET**

**NOTES:**

1. Alternate connection must be approved by the Engineer.
2. Install securing device in accordance with Specification 985.
3. Any wire mesh arrangement which provides 0.126 square inches of steel area per linear foot both ways may be used, provided the wires are spaced a minimum of 2" and/or a maximum of 6" on centers.
4. Do not use a concrete jacket to join dissimilar metal pipes.
5. 12" for pipes 15" through 24"; 24" for pipes 30" and larger.
6. 12" for pipes 14" x 23" through 19" x 30"; 24" for pipes 24" x 38" and larger.

**FILTER FABRIC JACKET, CONCRETE JACKET, AND PIPE PLUG**

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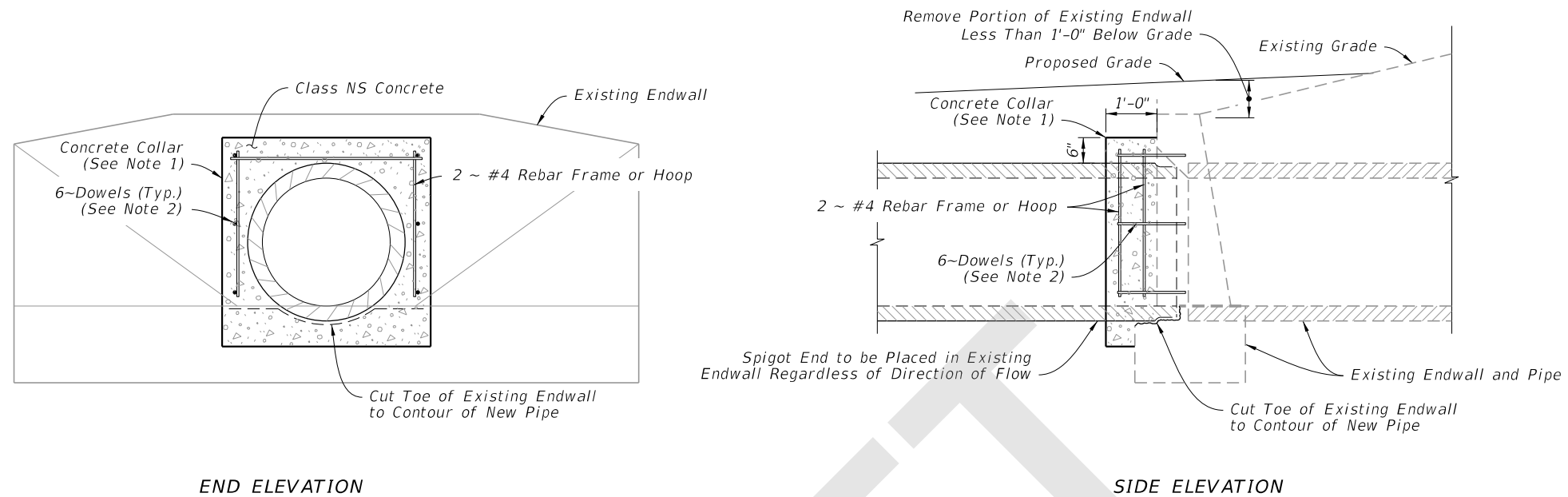


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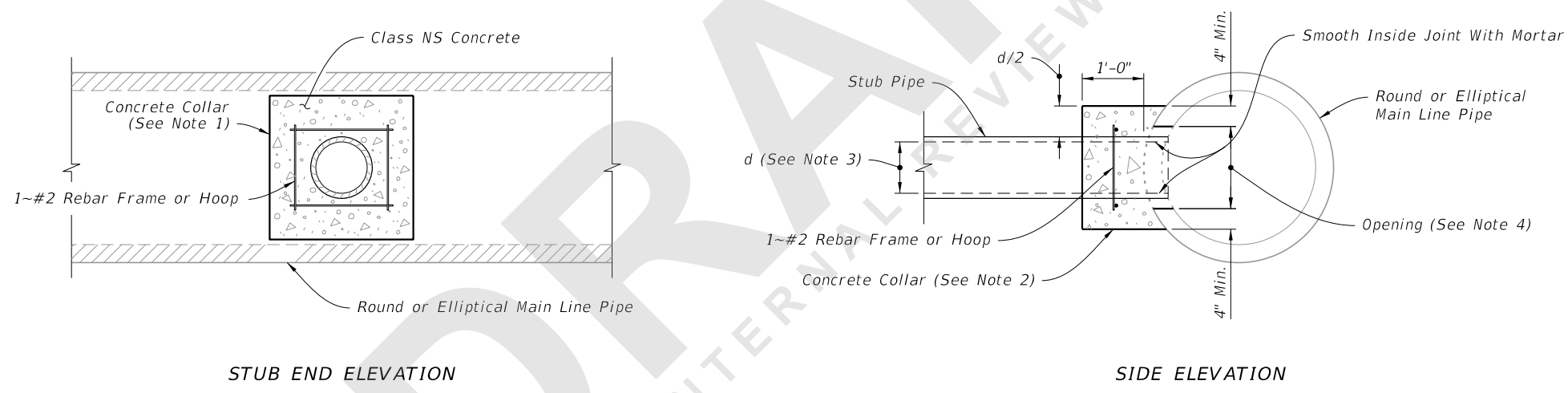
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EXTENSION OF EXISTING PIPE CULVERTS



JOINING MAINLINE PIPE TO STUB PIPE

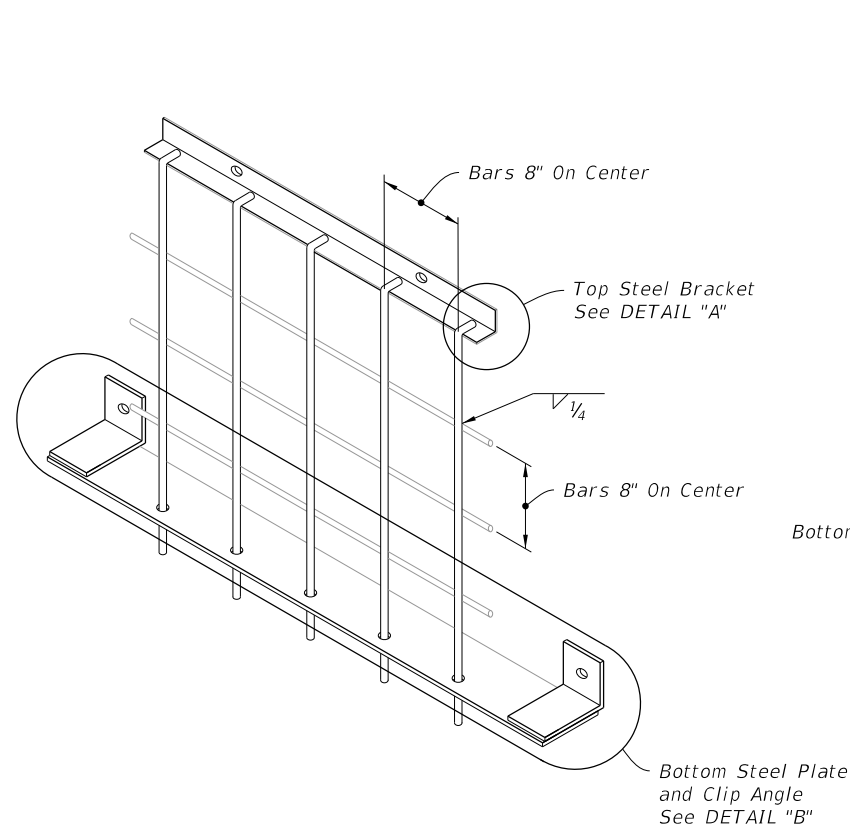
NOTES:

1. The collar may be formed by any method approved by the Engineer.
2. Install 1/2"x16" dowels in adhesive bond material.
3. Stub Pipes maximum diameter: 1/2 of a round main line pipe diameter, or 1/2 the height of elliptical main line pipes.
4. Opening by Pipe Manufacturer.
5. Install riser reinforcement using #5 Bars @ 18" centers vertically and 6" centers horizontally. Bend pipe steel to riser.
6. Reinforced concrete top required when inlet: manhole or junction box riser is less than 4 feet in diameter; or when 3'-6", alt. b inlet, manhole or junction box riser is used; or when rectangular inlet is used.
7. See Index 425-001 for optional construction joints.

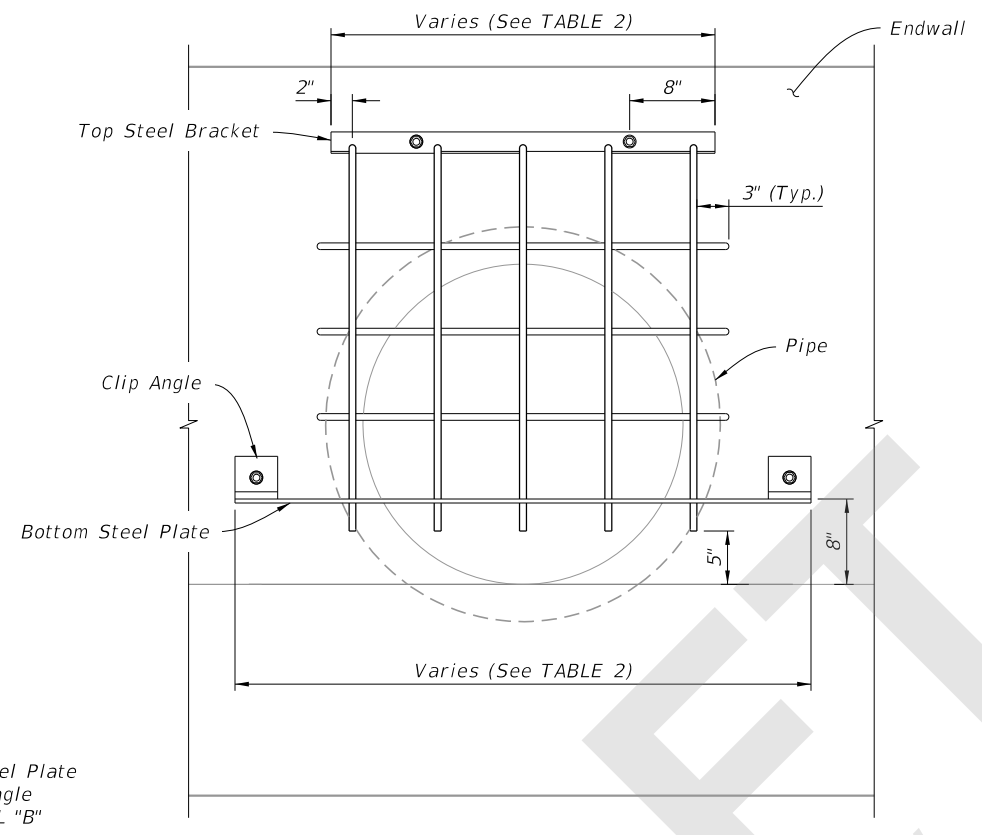
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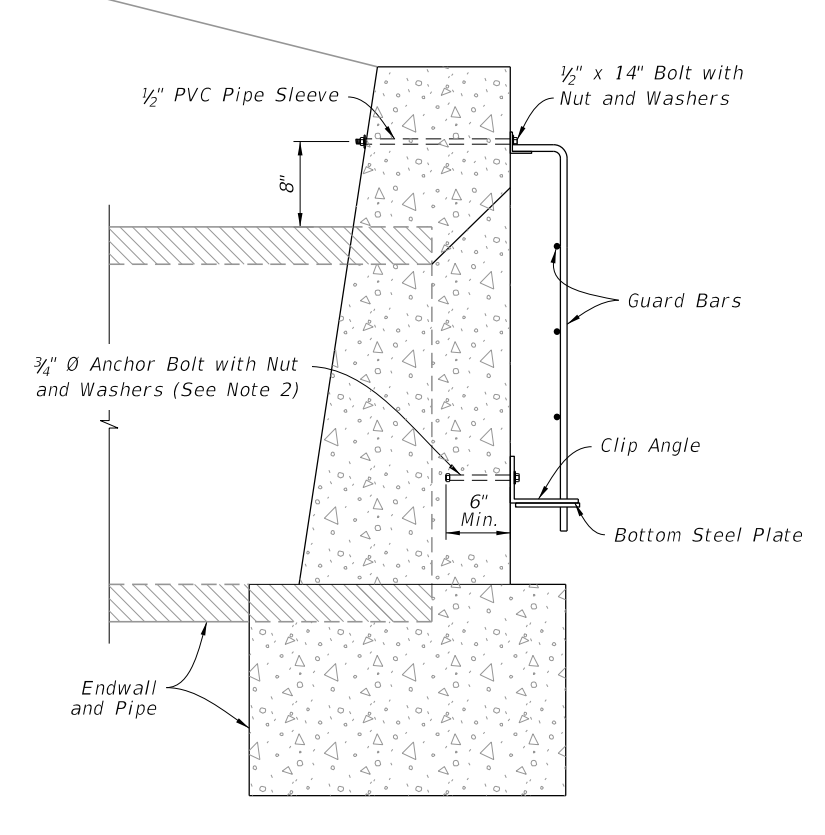
CONCRETE COLLARS



ISOMETRIC VIEW

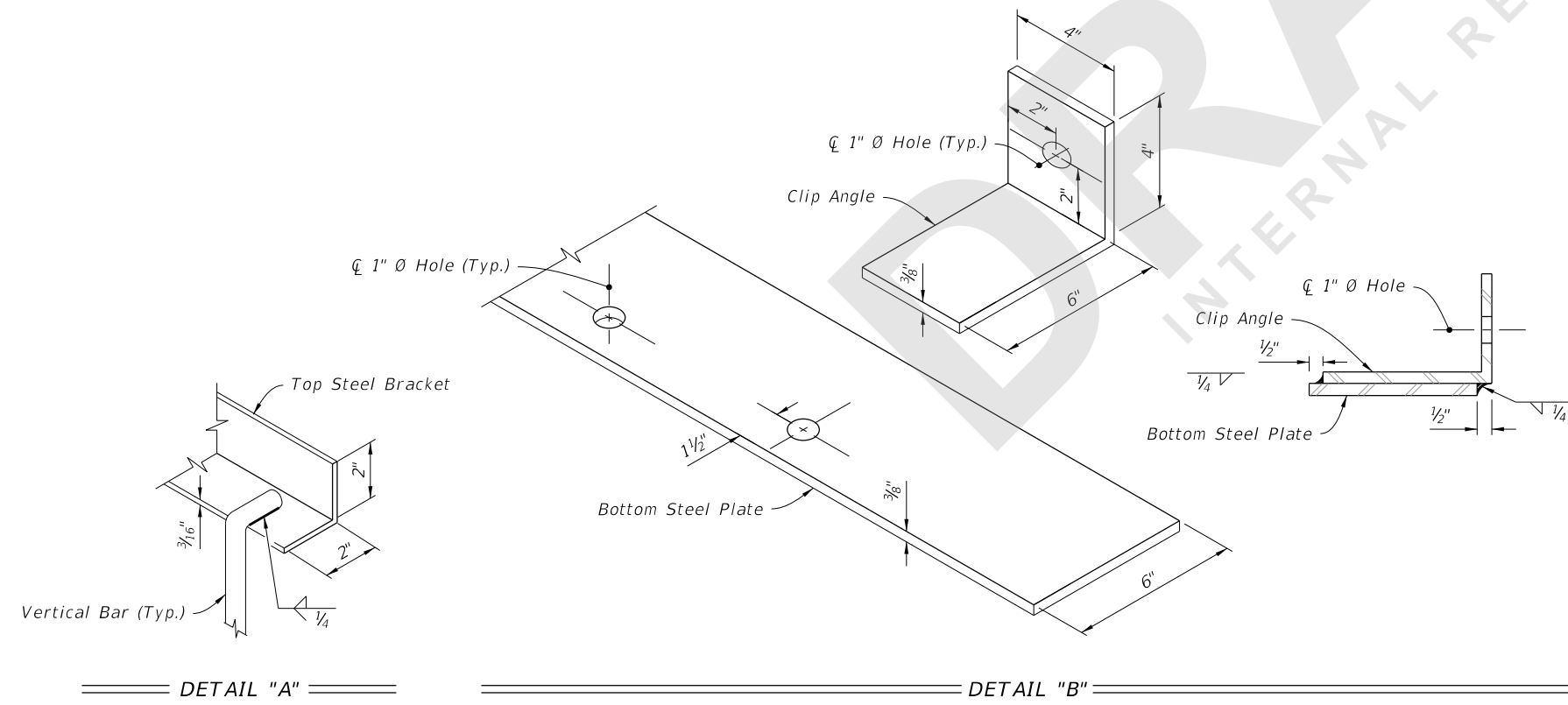


END ELEVATION



SIDE ELEVATION

SINGLE GUARD  
(30" Pipe Shown)



DETAIL "A"

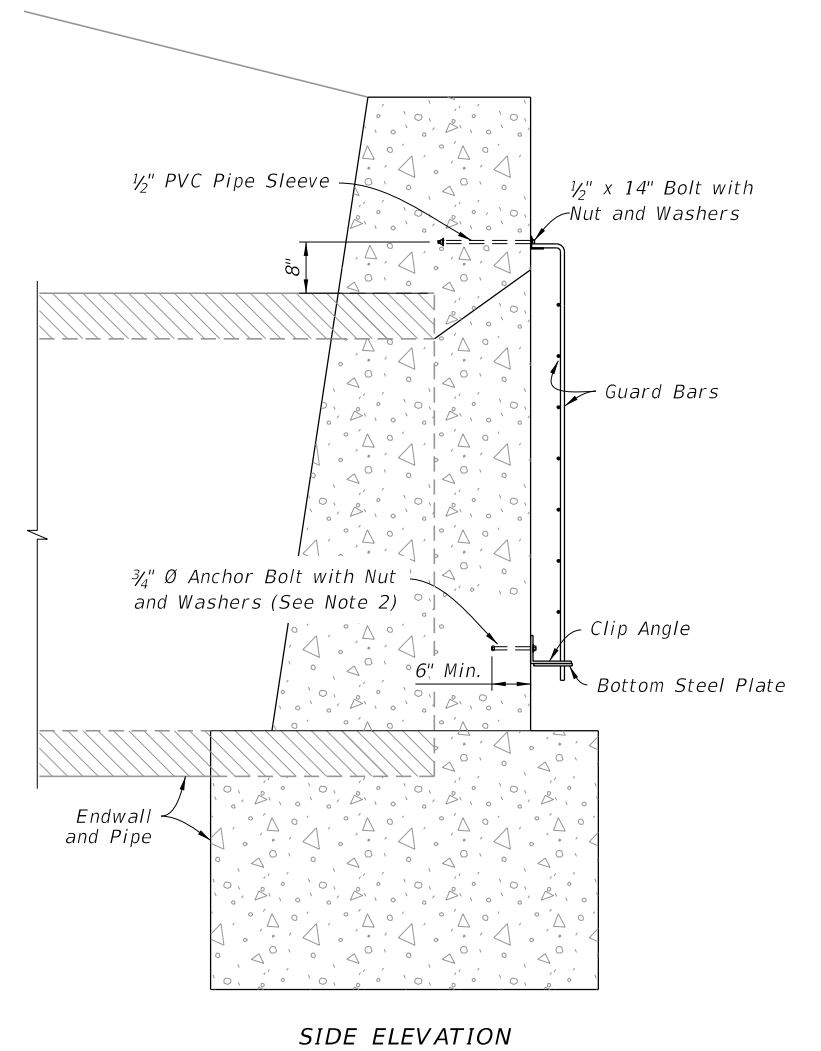
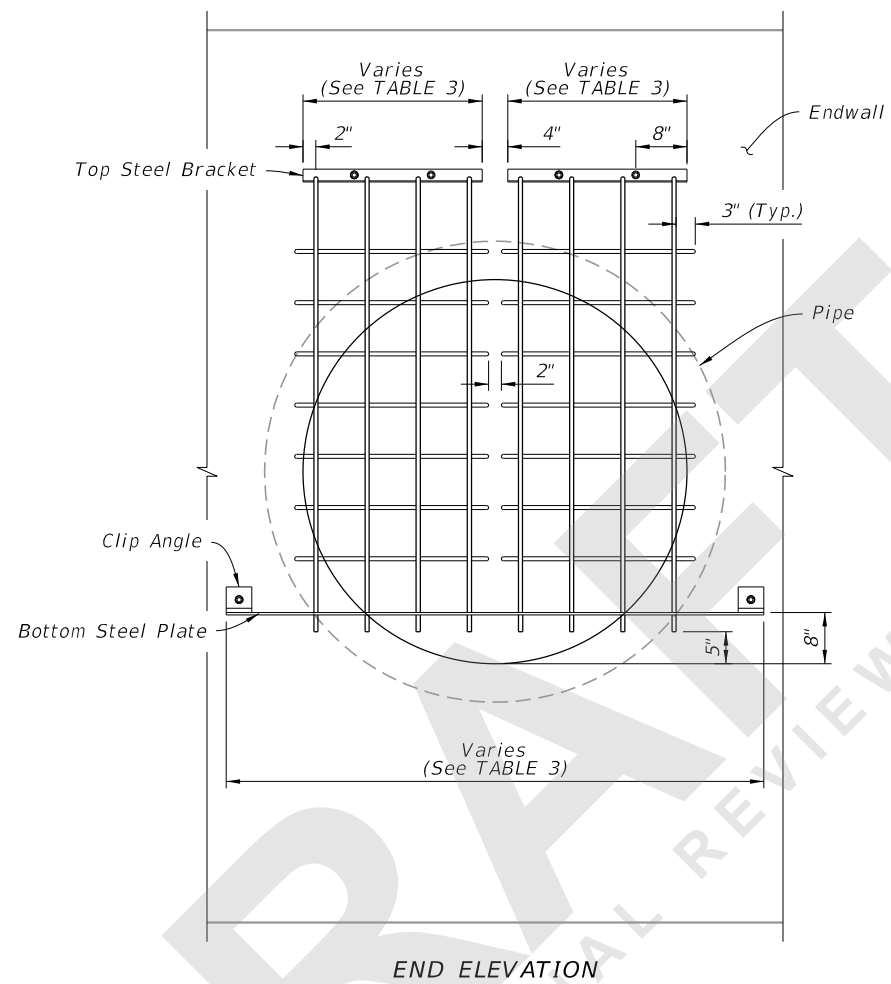
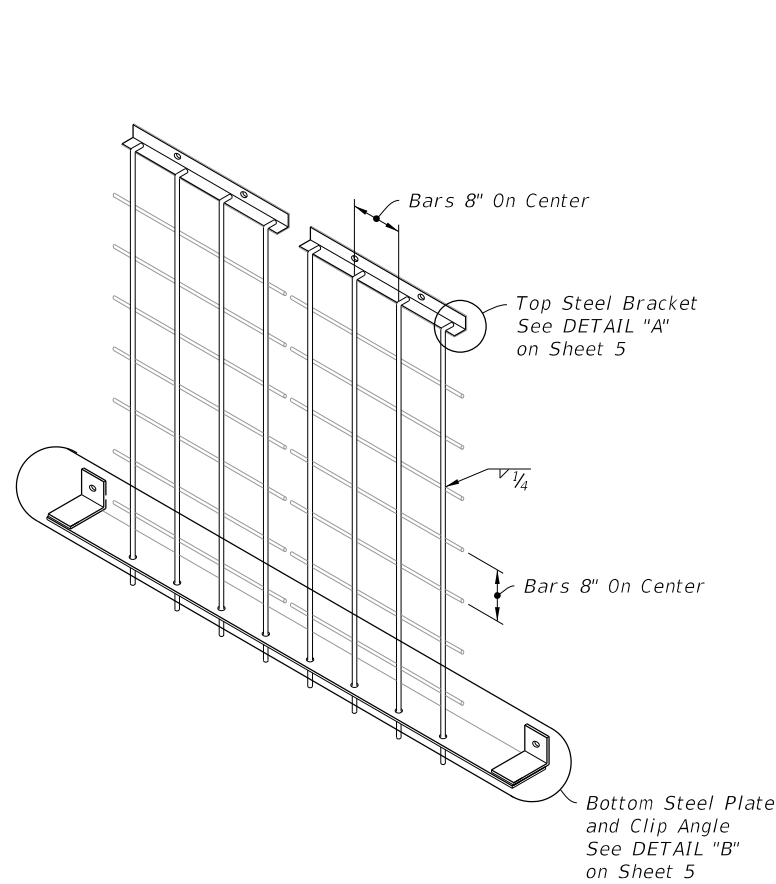
DETAIL "B"

Pipe Dia. (in)	Top Steel Bracket	Bottom Steel Plate	Number of Holes	Number of Vert. Bars	Vertical Bars Size	Number of Horiz. Bars	Horizontal Bars Size	Weight lbs.
18	2'-4"	3'-6"	4	4	1/2"	4	1/2"	48
24	3'-0"	4'-0"	5	5	1/2"	5	1/2"	58
30	3'-0"	4'-6"	5	5	5/8"	5	5/8"	74
36	3'-8"	5'-0"	6	6	5/8"	6	5/8"	90
42	4'-4"	5'-6"	7	7	5/8"	7	5/8"	111

NOTES:

- Construct guards only at locations specifically called for in Plans.
- Anchor Bolts (Galvanized): Use C-I-P Hex Head bolts or fully threaded adhesive anchors, installed in accordance with Specification 416.

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**DOUBLE GUARD**  
(60" Pipe Shown)

**NOTES:**

- Construct guards only at locations specifically called for in Plans.
- Anchor Bolts (Galvanized): Use C-I-P Hex Head bolts or fully threaded adhesive anchors, installed in accordance with Specification 416.

**TABLE 3 - DOUBLE GUARD**

Pipe Dia. (in)	Top Steel Bracket Grate 1	Top Steel Bracket Grate 2	Bottom Steel Plate	Number of Total Holes	Number of Vert. Bars Grate 1	Number of Vert. Bars Grate 2	Vertical Bars Size	Number of Horiz. Bars (each grate)	Horizontal Bars Size	Weight lbs.
48	2'-4"	2'-4"	6'-0"	8	4	4	5/8"	5	5/8"	127
54	2'-4"	2'-4"	6'-6"	8	4	4	3/4"	6	5/8"	157
60	2'-4"	2'-4"	7'-0"	8	4	4	3/4"	7	5/8"	172

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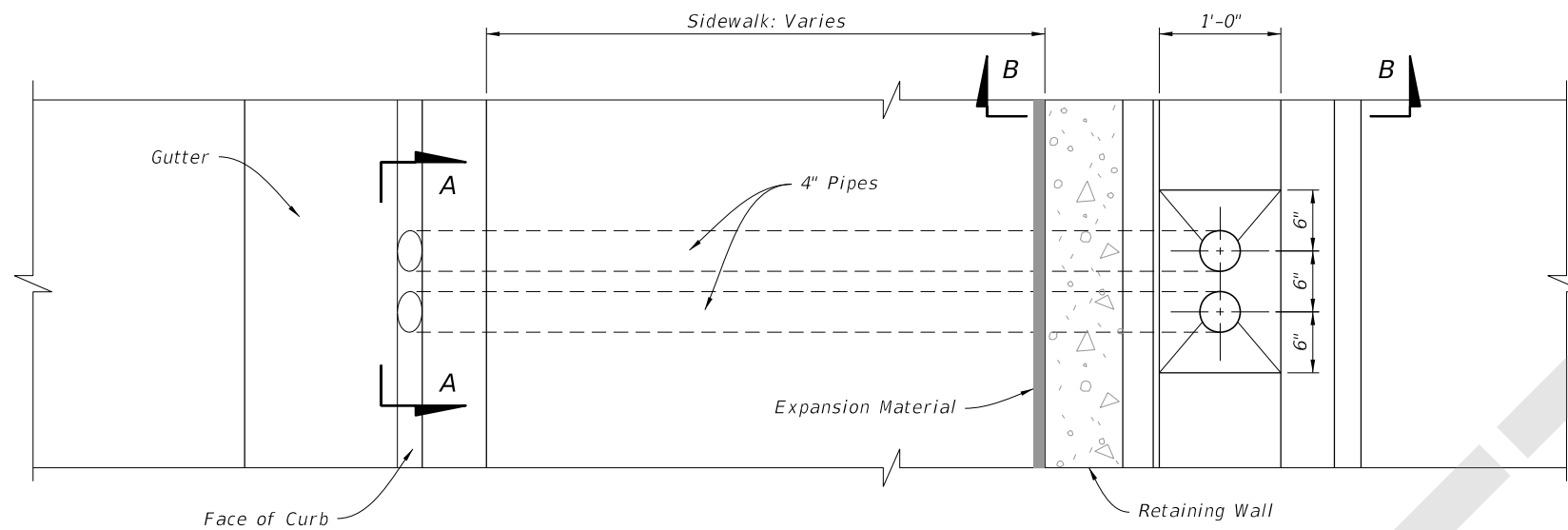
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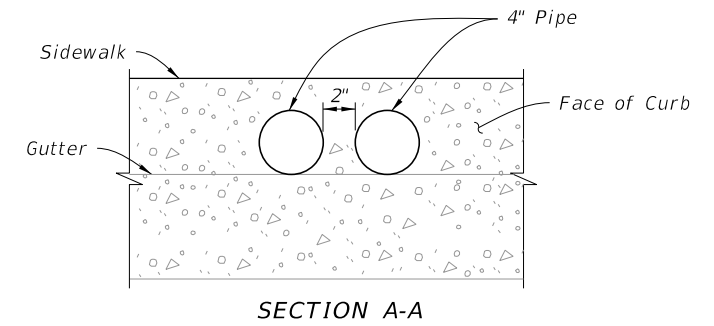
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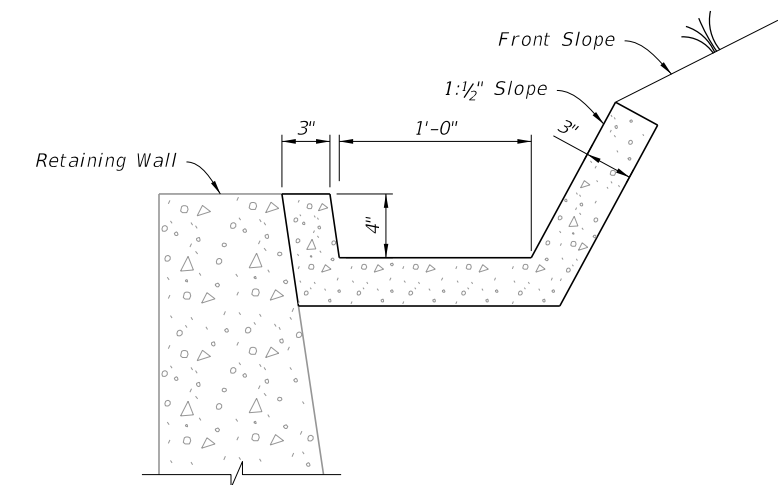
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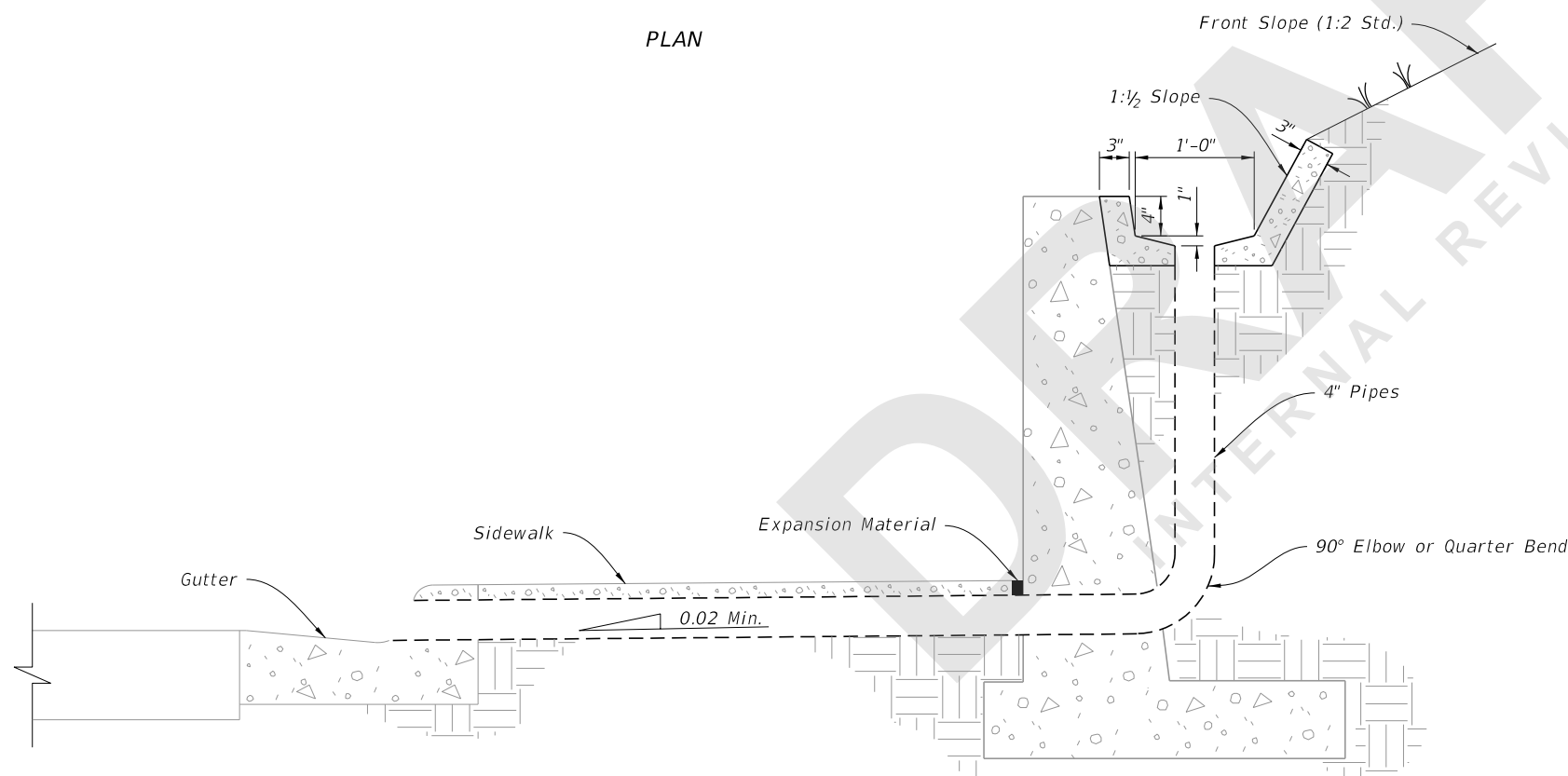
PLAN



SECTION A-A



SECTION B-B



ELEVATION

GUTTER AND DRAINS

RETAINING WALL CONCRETE GUTTER AND DRAINS

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