

**ISOMETRIC VIEW**  
NOT TO SCALE

**MATERIAL NOTES**

1. Concrete shall have a minimum compressive strength at 28 days equal to 3500 psi.
2. All reinforcing steel bars shall be Grade 60 - #4 bars.
3. The structure shall be fabricated from 12 gauge galvanized steel sheets conforming to ASTM A 929 with 3" by 1" corrugations.
4. Angles shall be ASTM A 36 structural steel, galvanized in accordance with ASTM A 123.
5. Bolts shall be 3/4" diameter galvanized carbon steel conforming to ASTM A 307.
6. Seam sealant shall be knife-grade asphalt mastic or polymer adhesive sealant tape, Manus-Bond 64-A, or equal.
7. Drainfill aggregate shall meet the standard gradation of ASTM C 33 size 57 or 67. Do not place geotextile between drainfill and the 1/2" weep holes.
8. Riprap shall consist of well-graded rock, minimum size of 4", maximum size of 8". Riprap shall be underlain with nonwoven geotextile bedding.
9. Weir length L varies from 14.2' to 49.5' in 1.6' increments. Check with manufacturer or refer to Iowa NRCS hydraulic design spreadsheet, "Semicircular\_Drop\_Structure.xlsx" for a table of available weir lengths, including straight portion of weir dimension B.

**STANDARD STRUCTURE SIZES**

D	1.9'			3.0'			4.0'					
H	1.8'			1.9'			2.1'					
A	4.2'			5.4'			6.6'					
S*	9.2'	11.3'	13.7'	15.8'	11.3'	13.7'	15.8'	18.2'	13.7'	15.8'	18.2'	20.3'
Wa	0.0'	2.0'	4.0'	6.0'	0.0'	2.0'	4.0'	6.0'	0.0'	2.0'	4.0'	6.0'

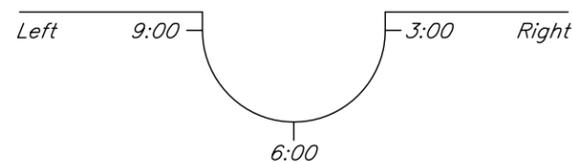
\* Minimum value of S for corresponding value of Wa.

**STRUCTURE DIMENSIONS**

Overfall Height (D)		ft.
Notch Depth (H)		ft.
Headwall Height (A)		ft.
Headwall Length (S)		ft.
Notch Width (W)		ft.
Weir Length (L)		ft.
Straight Portion of Weir (B)		ft.
Added U/S Channel Width (Wa)		ft.
U/S Channel Bottom Width (Wu)		ft.
D/S Riprap Length (RL)		ft.
D/S Riprap Height (Rh)		ft.
Concrete Apron Elevation		ft.
Weir Crest Elevation		ft.
Top of Headwall Elevation		ft.
Auxiliary Spillway Elevation		ft.
Top of Embankment Elevation		ft.

**BILL OF MATERIALS**

Item	Quantity	Unit
Galvanized Steel Drop Structure	1	each
Concrete (3500 psi)		cu.yd.
Reinforcing Steel, Grade 60 - #4 Bars		lb.
Drainfill		cu.yd.
Rock Riprap		cu.yd.
Excavation, Structure		cu.yd.
Earthfill		cu.yd.
Corrugated Steel Pipe, 16 Gauge		
_____ Dia.		lin.ft.
_____ Dia.		lin.ft.
Connecting Band, Steel		each
Animal Guard, Steel		each
Geotextile, Nonwoven		sq.yd.



**TILE OUTLET DESCRIPTION**

Tile outlet stubs (as required) shall be 2 ft. lengths of corrugated steel pipe, shop-welded to the structure as specified below:

1. \_\_\_\_\_ ft. from the left headwall at the \_\_\_\_\_ o'clock position (6:00-9:00)  
\_\_\_\_\_ inch diameter  
\_\_\_\_\_ ft. below the weir at flowline of C.M. Pipe
2. \_\_\_\_\_ ft. from the right headwall at the \_\_\_\_\_ o'clock position (3:00-6:00)  
\_\_\_\_\_ inch diameter  
\_\_\_\_\_ ft. below the weir at flowline of C.M. Pipe

STANDARD DWG. IA-1409

Date \_\_\_\_\_  
Designed \_\_\_\_\_  
Drawn J.Gibbs/J.Sandstrom 4/12  
Checked \_\_\_\_\_  
Approved \_\_\_\_\_

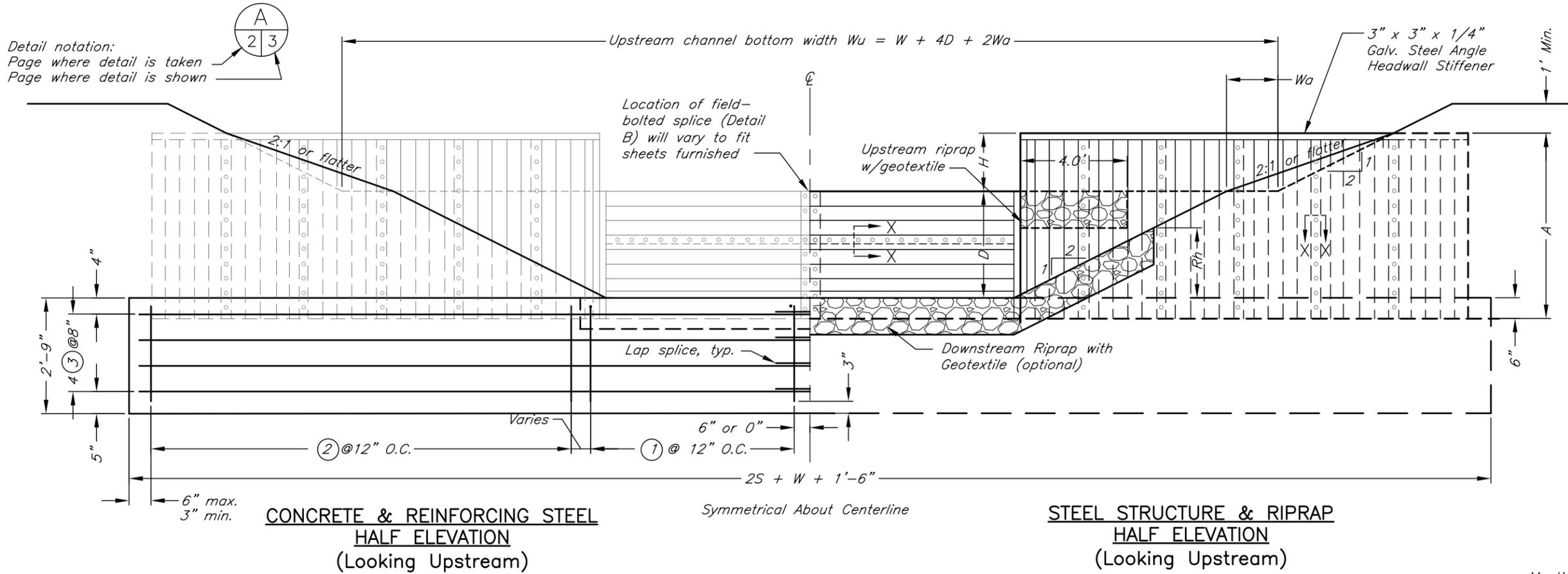
STEEL DROP SPILLWAY



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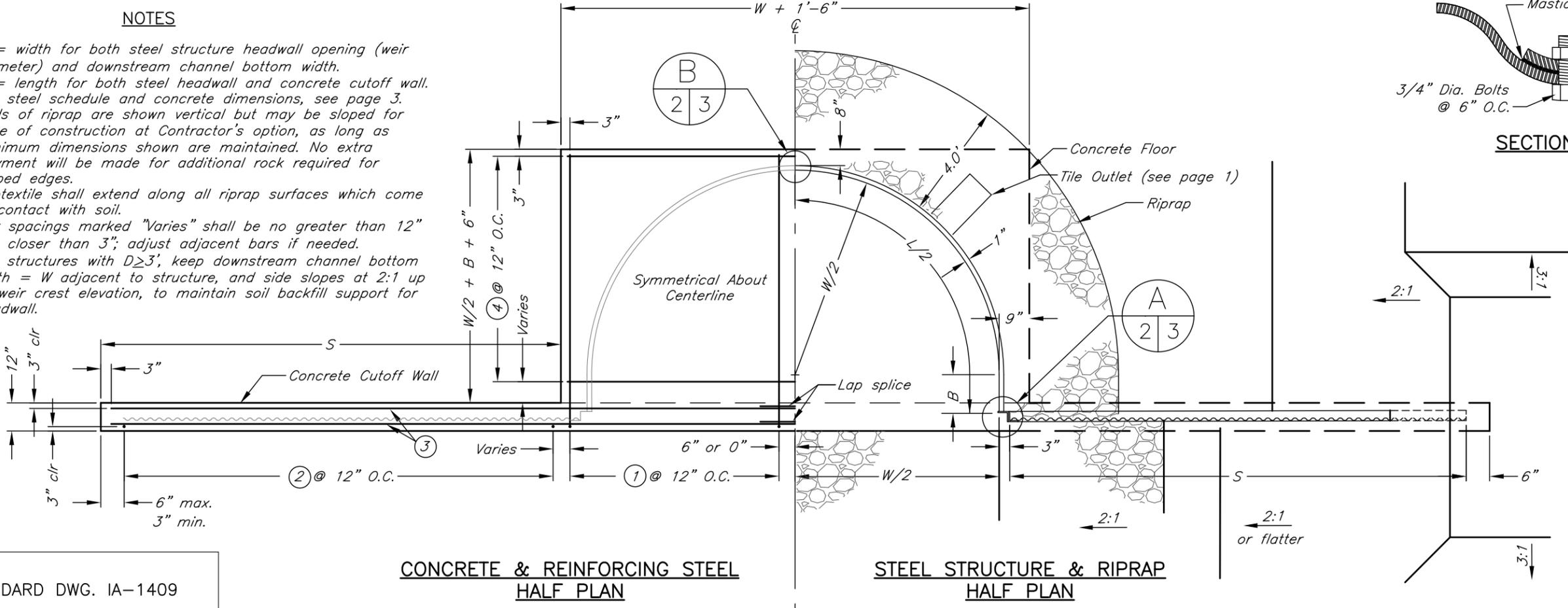
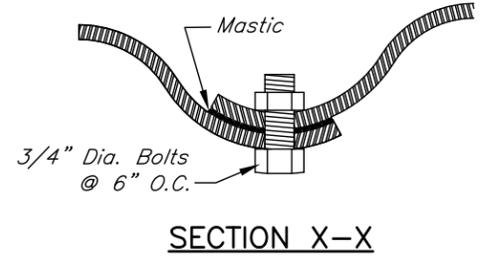


**CONCRETE & REINFORCING STEEL  
HALF ELEVATION  
(Looking Upstream)**

**STEEL STRUCTURE & RIPRAP  
HALF ELEVATION  
(Looking Upstream)**

**NOTES**

1.  $W$  = width for both steel structure headwall opening (weir diameter) and downstream channel bottom width.
2.  $S$  = length for both steel headwall and concrete cutoff wall.
3. For steel schedule and concrete dimensions, see page 3.
4. Ends of riprap are shown vertical but may be sloped for ease of construction at Contractor's option, as long as minimum dimensions shown are maintained. No extra payment will be made for additional rock required for sloped edges.
5. Geotextile shall extend along all riprap surfaces which come in contact with soil.
6. Bar spacings marked "Varies" shall be no greater than 12" nor closer than 3"; adjust adjacent bars if needed.
7. For structures with  $D \geq 3'$ , keep downstream channel bottom width =  $W$  adjacent to structure, and side slopes at 2:1 up to weir crest elevation, to maintain soil backfill support for headwall.



**CONCRETE & REINFORCING STEEL  
HALF PLAN**

**STEEL STRUCTURE & RIPRAP  
HALF PLAN**

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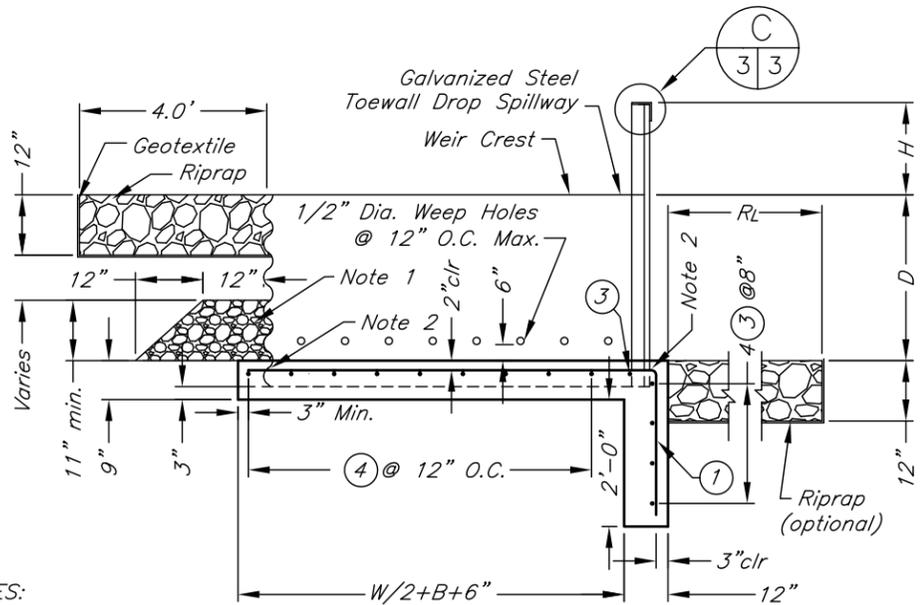
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Drawn	J. Gibbs/J. Sandstrom
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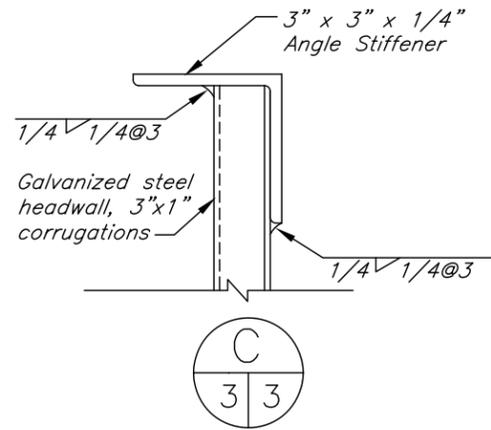
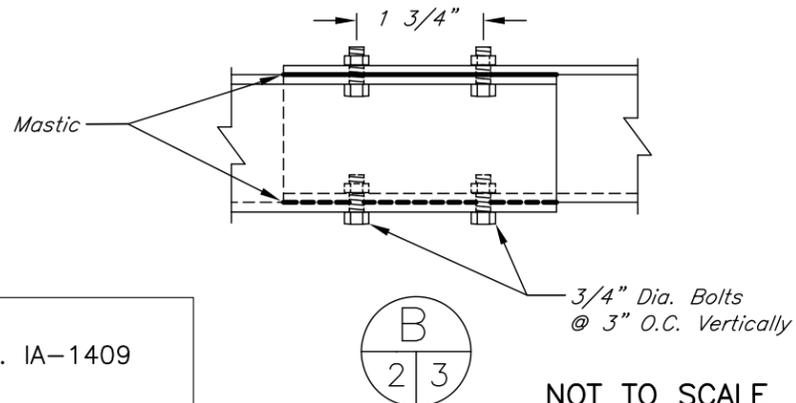
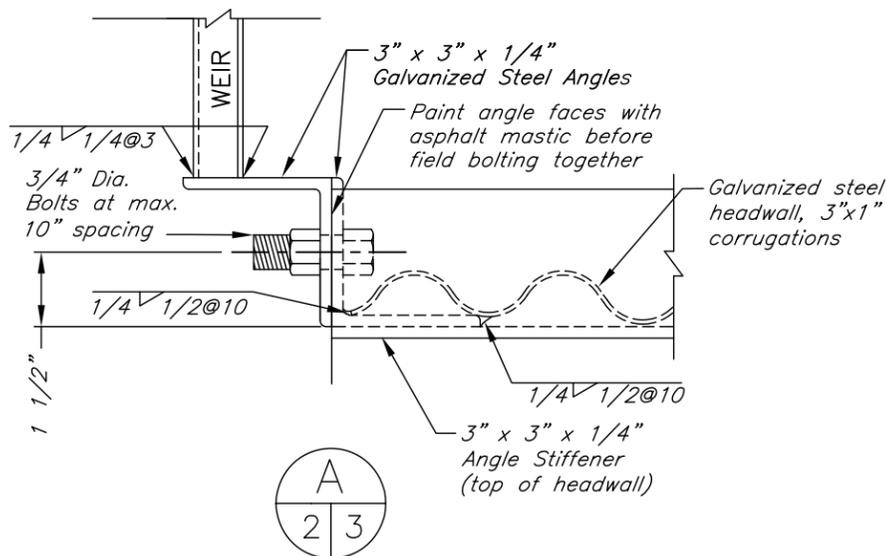
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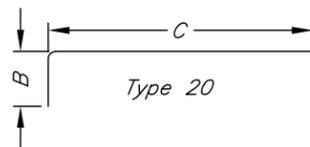
1. Drainfill extends completely around weir.
2. Field drill 7/8" holes as required in the steel structure. Place steel reinforcement through holes. Wrap rebar as described in Construction Note 4.

**SECTION ON CENTERLINE**



**STEEL REINFORCING NOTES:**

1. Radius of bend for Type 20 bar = 2".
2. Alternate splice locations for Mark (3) bars may be used at Contractor's option, with Engineer's approval. Minimum splice length is 1'-9".
3. Minimum splice length for Mark (4) bars is 1'-4".



**CONSTRUCTION NOTES**

1. Forms are not required for concrete apron or cutoff wall if excavated soil will stand vertically. Side slopes above the top of the concrete shall be 1.5:1 or flatter.
2. When necessary, the site shall be dewatered in accordance with Iowa Construction Specification IA-11, Removal of Water. A sump pump and crushed rock may be needed.
3. Set steel structure to grade and place reinforcing bars. Apply asphalt mastic between steel sheets before bolting together. Check elevations of the weir, top of floor and bottom of cutoff trench. Check that the reinforcing steel has the required minimum cover.
4. Wrap reinforcing bars with three layers of electrical tape, or equal, where they pass through the steel structure.
5. Place the concrete floor and cutoff wall in one continuous pour.
6. After a minimum of 24 hours, place drainfill, attach C.M. pipe to tile outlet stubs, and install animal guards. Lay additional drain tile/tubing if needed to connect with existing surface drains.
7. Backfill around structure with moist soil. Place backfill in 6 inch layers and tamp to a density equivalent to the surrounding soil or, in the case of soft surrounding soil, tamp to a density equivalent to adjacent required earthfill. Remove dry soil from sides of excavations as backfill is placed so that moist soil is tamped against moist soil. Keep backfill approximately level around all parts of the structure.
8. Place riprap with geotextile bedding and complete grading and shaping.
9. Seed, fertilize and mulch all disturbed areas in accordance with the seeding plan provided by NRCS.

**QUANTITY FORMULAS:**

CONCRETE:  $[(W+1.5)(\frac{W}{2}+B+0.5)(0.75) + (W+2S+1.5)(2.75)]/27$  (CuYd)

DRAINFILL:  $\{\frac{\pi}{2}[(\frac{W}{2}+1.5)^2 - (\frac{W}{2})^2] + 3B\}/27$  (CuYd)

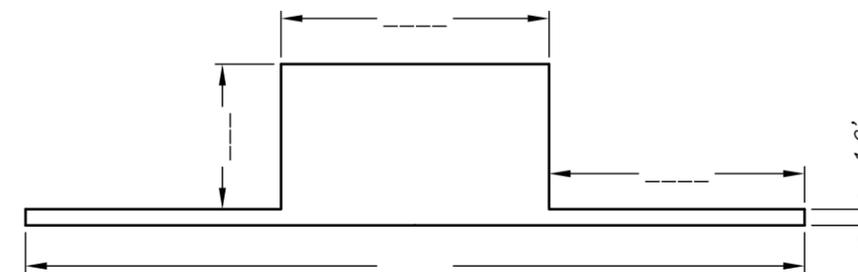
UPSTREAM RIPRAP:  $\{\frac{\pi}{2}[(\frac{W}{2}+4)^2 - (\frac{W}{2})^2] + 8B\}/27$  (CuYd)

DOWNSTREAM RIPRAP:  $(W+4Rh)(RL)/27$  (CuYd)

UPSTREAM GEOTEXTILE:  $\{\frac{\pi}{2}[(\frac{W}{2}+4)^2 - (\frac{W}{2})^2] + 10B + \pi(\frac{W}{2}+4)\}/9$  (SqYd)\*

DOWNSTREAM GEOTEXTILE:  $(RL+1)(W+4.47Rh+2)/9$  (SqYd)\*

\*Geotextile formulas for covered surfaces only



**CONCRETE DIMENSIONS SUMMARY**

**STEEL SCHEDULE (All #4 bars)**

Mark	Type	B	C	Quantity	Length	Total Length	Quantity Formulas	Length Formulas
1	20	2'-4"					$W + 2$	$C \text{ Leg} = \frac{W}{2} + B + 1'$
2	Str.	-	-		2'-4"		$2[\text{RoundUp}(S - .25')]$	Given
3	Str.	-	-	10			Given	$\frac{W}{2} + S + 1.42'$
4	Str.	-	-				$\text{RoundUp}(\frac{W}{2} + B + 0.5')$	$W + 1.0'$
Total Length								lin. ft.
Weight = Total Length x 0.668 lb/lin. ft.								lb.

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