

# Trash Racks for Principal Spillway Intakes

## What is a Trash Rack?

A trash rack is designed to provide protection against clogging of principal spillways under all flow conditions at a dam. In Nebraska, tree branches, logs, and corn stalks are the most common debris that can plug a spillway. A properly designed trash rack prevents large debris from entering a spillway that are too large to freely pass through, while at the same time, facilitating the passage of smaller trash. Trash racks will become plugged if the openings of the trash rack are too small to allow small debris, such as leaves and twigs, to pass. Trash racks are also important to prevent children and livestock from falling into spillways.

## Trash Rack Design

Trash racks are designed so that the average flow velocity through the trash racks does not exceed 2.5 feet per second for the full range of anticipated flow conditions. In addition, the openings of a trash rack should be about half the diameter of the spillway outlet pipe. This will assure large debris that could plug the pipe will be blocked and small debris will be allowed to pass through. For example, if the outlet pipe is 36 inches in diameter, the openings in the trash rack should be about 18 inches wide.

## Maintenance

Maintenance should include periodic checks of the trash rack for rusted and broken sections and repairing as needed. Trash racks should be checked frequently during and after storm events to ensure they are functioning properly and to remove accumulated debris. Extreme caution must be used when attempting to remove accumulated debris during periods of high flow. Keep your distance when removing debris so that you don't become trapped in flowing water when the flow increases after you remove the debris.

## How Do I Design a Trash Rack?

Fortunately, extensive research and years of experience has shown which trash racks work best in Nebraska. The following are examples of trash racks that have performed well over many years and have been approved for use in Nebraska. Standard drawings prepared by the Natural Resource Conservation Service (NRCS) for typical trash rack configurations are available at the end of this document.



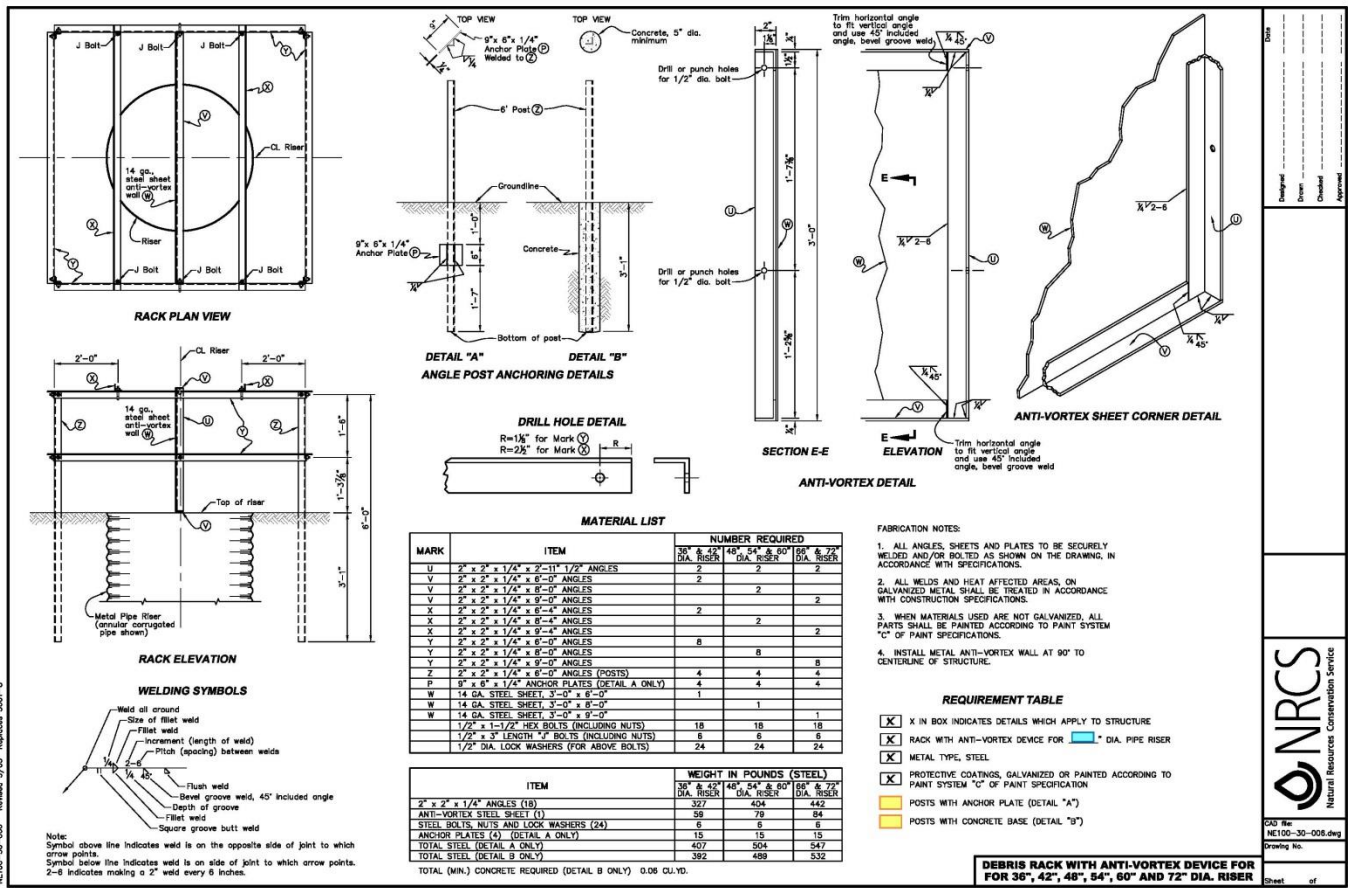
Example of an approved conical trash rack for vertical corrugated metal pipe risers.



Another example of an approved trash rack for corrugated metal pipe risers.



Example of approved trash rack for large reinforced concrete intake structure.



**MATERIAL LIST**

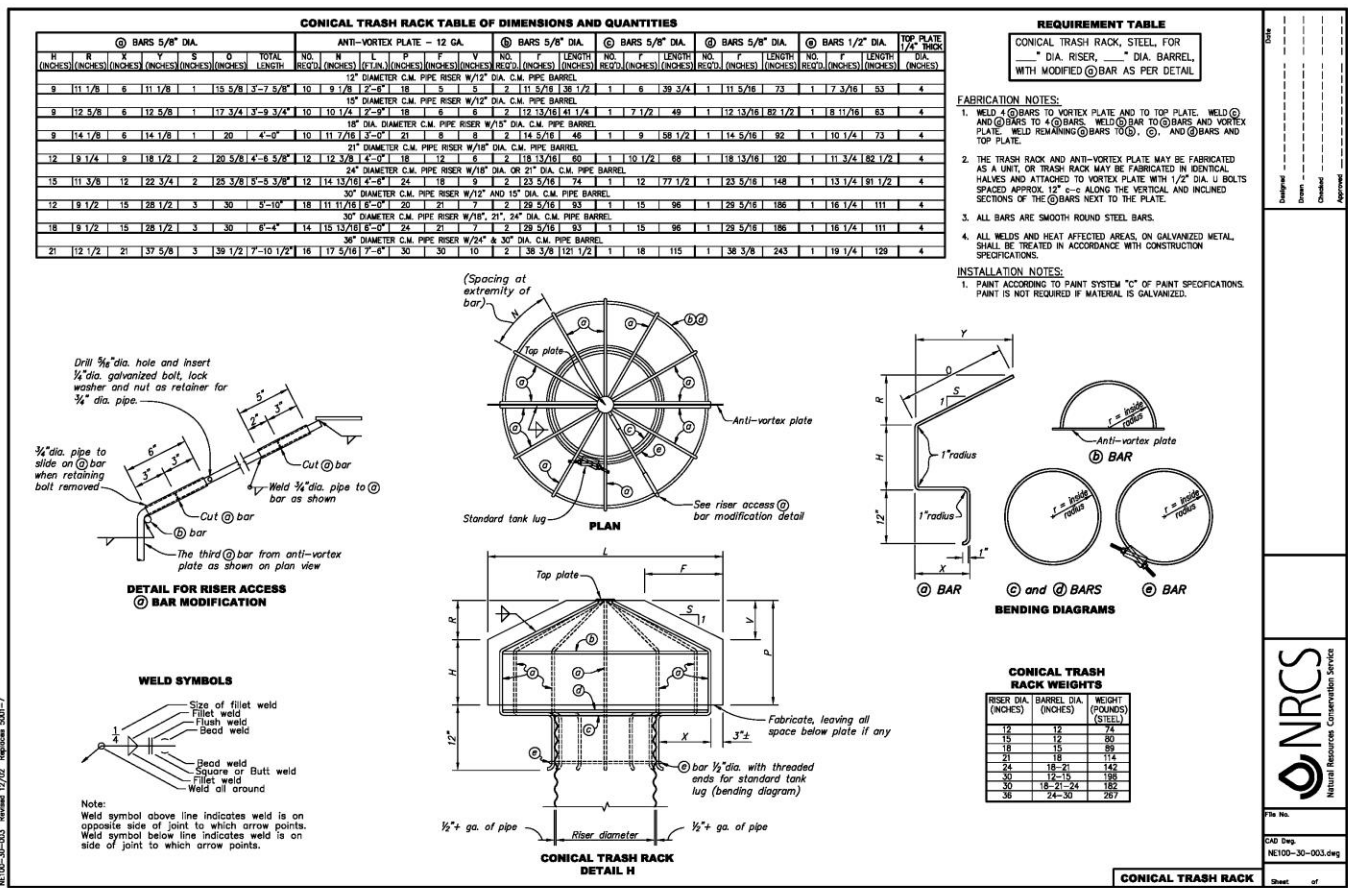
MARK	ITEM	NUMBER REQUIRED
U	2" x 2" x 1/4" x 7'-11" 1/2" ANGLES	2
V	2" x 2" x 1/4" x 6'-0" ANGLES	2
W	2" x 2" x 1/4" x 6'-0" ANGLES	2
X	2" x 2" x 1/4" x 6'-0" ANGLES	2
Y	2" x 2" x 1/4" x 6'-0" ANGLES	8
Z	2" x 2" x 1/4" x 6'-0" ANGLES (POSTS)	4
P	9" x 6" x 1/4" ANCHOR PLATES (DETAIL A ONLY)	4
W	14 GA. STEEL SHEET, 3'-0" x 6'-0"	1
W	14 GA. STEEL SHEET, 3'-0" x 6'-0"	1
W	14 GA. STEEL SHEET, 3'-0" x 6'-0"	1
W	1/2" x 3" LENGTH "F" BOLTS (INCLUDING NUTS)	18
W	1/2" x 3" LENGTH "F" BOLTS (INCLUDING NUTS)	6
W	1/2" DIA. LOCK WASHERS (FOR ABOVE BOLTS)	24

ITEM	WEIGHT IN POUNDS (STEEL)
2" x 2" x 1/4" ANGLES (18)	327
ANTI-VORTEX STEEL SHEET (1)	404
STEEL BOLTS, NUTS AND LOCK WASHERS (24)	59
ANCHOR PLATES (4) (DETAIL A ONLY)	6
TOTAL STEEL (DETAIL A ONLY)	407
TOTAL STEEL (DETAIL B ONLY)	499
TOTAL (MIN.) CONCRETE REQUIRED (DETAIL B ONLY) 0.08 CU. YD.	282

- FABRICATION NOTES:**
- ALL ANGLES, SHEETS AND PLATES TO BE SECURELY WELDED AND/OR BOLTED AS SHOWN ON THE DRAWING, IN ACCORDANCE WITH CONSTRUCTION SPECIFICATIONS.
  - ALL WELDS AND HEAT AFFECTED AREAS, ON GALVANIZED METAL SHALL BE TREATED IN ACCORDANCE WITH CONSTRUCTION SPECIFICATIONS.
  - WHEN MATERIALS USED ARE NOT GALVANIZED, ALL PARTS SHALL BE PAINTED ACCORDING TO PAINT SYSTEM "C" OF PAINT SPECIFICATIONS.
  - INSTALL METAL ANTI-VORTEX WALL AT 90° TO CENTERLINE OF STRUCTURE.
- REQUIREMENT TABLE**
- X IN BOX INDICATES DETAILS WHICH APPLY TO STRUCTURE
  - RACK WITH ANTI-VORTEX DEVICE FOR 36" DIA. PIPE RISER
  - METAL TYPE, STEEL
  - PROTECTIVE COATINGS, GALVANIZED OR PAINTED ACCORDING TO PAINT SYSTEM "C" OF PAINT SPECIFICATION
  - POSTS WITH ANCHOR PLATE (DETAIL "A")
  - POSTS WITH CONCRETE BASE (DETAIL "B")

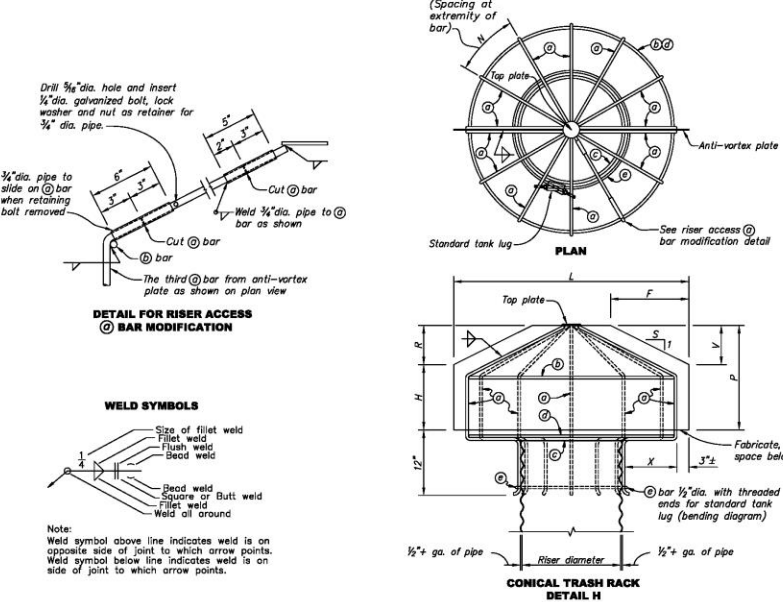
**DEBRIS RACK WITH ANTI-VORTEX DEVICE FOR 36", 42", 48", 54", 60" AND 72" DIA. RISER**



**CONICAL TRASH RACK TABLE OF DIMENSIONS AND QUANTITIES**

BARS 5/8" DIA.				ANTI-VORTEX PLATE - 12 GA.				BARS 5/8" DIA.				BARS 1/2" DIA.				TOP PLATE 1/4" THICK																		
N	R	X	Y	S	O	TOTAL LENGTH	NO.	N	L	P	F	NO.	F	LENGTH	NO.	F	LENGTH	NO.	F	LENGTH	NO.	F	LENGTH	NO.	F	LENGTH	NO.	F	LENGTH					
(INCHES)	(INCHES)	(INCHES)	(INCHES)	(INCHES)	(INCHES)	(INCHES)	REQ'D	(INCHES)	(INCHES)	(INCHES)	(INCHES)	REQ'D	(INCHES)	(INCHES)	REQ'D	(INCHES)	(INCHES)	REQ'D	(INCHES)	(INCHES)	REQ'D	(INCHES)	(INCHES)	REQ'D	(INCHES)	(INCHES)	REQ'D	(INCHES)	(INCHES)					
9	11 1/8	8	11 1/8	1	15 5/8	3'-7 5/8"	16	9	1/8	2	11 5/8	138 1/2	1	6	39 3/4	1	11 5/8	75	1	7 3/8	53	4												
9	12 5/8	8	12 5/8	1	17 3/4	3'-9 3/4"	10	10	1/4	2	12 5/8	174	1	7	49	1	12 13/16	83 1/2	1	8 1/8	63	4												
9	14 1/8	8	14 1/8	1	20	4'-0"	10	11 7/16	3'-0"	21	8	2	14 5/16	46	1	9	58 1/2	1	14 5/16	92	1	10 1/4	73	4										
12	19 1/4	9	18 1/2	2	20 5/8	4'-8 5/8"	12	12 3/8	4'-0"	18	12	1	18 1/2	66	1	10 1/2	68	1	18 13/16	120	1	11 3/4	82 1/2	4										
15	11 3/8	12	22 3/4	2	25 3/8	3'-5 3/8"	24	18	9	2	23 5/16	74	1	12	77 1/2	1	23 5/16	148	1	13 1/4	81 1/2	4												
12	19 1/2	15	28 1/2	3	30	5'-10"	18	11 11/16	5'-0"	20	21	7	29 5/16	83	1	15	96	1	29 5/16	186	1	16 1/4	111	4										
18	19 1/2	15	28 1/2	3	30	8'-4"	14	15 13/16	8'-0"	24	21	7	29 5/16	83	1	15	96	1	29 5/16	186	1	16 1/4	111	4										
21	12 1/2	21	37 5/8	3	39 1/2	7'-10 1/2"	16	17 5/16	7'-8"	30	30	10	2	38 3/8	121 1/2	1	18	115	1	38 3/8	243	1	19 1/4	129	4									

- REQUIREMENT TABLE**
- CONICAL TRASH RACK, STEEL, FOR " DIA. RISER, " DIA. BARREL, WITH MODIFIED @ BAR AS PER DETAIL
- FABRICATION NOTES:**
- WELD @ BARS TO VORTEX PLATE AND TO TOP PLATE. WELD @ BARS TO 4 @ BARS. WELD @ BAR TO @ BARS AND VORTEX PLATE. WELD REMAINING @ BARS TO @, @, AND @ BARS AND TOP PLATE.
  - THE TRASH RACK AND ANTI-VORTEX PLATE MAY BE FABRICATED AS A UNIT, OR TRASH RACK MAY BE FABRICATED IN IDENTICAL HALVES AND ATTACHED TO VORTEX PLATE WITH 1/2" DIA. U BOLTS SPACED APPROX. 12" c-c ALONG THE VERTICAL AND INCLUDED SECTIONS OF THE @ BARS NEXT TO THE PLATE.
  - ALL BARS ARE SMOOTH ROUND STEEL BARS.
  - ALL WELDS AND HEAT AFFECTED AREAS, ON GALVANIZED METAL, SHALL BE TREATED IN ACCORDANCE WITH CONSTRUCTION SPECIFICATIONS.
- INSTALLATION NOTES:**
- PAINT ACCORDING TO PAINT SYSTEM "C" OF PAINT SPECIFICATIONS. PAINT IS NOT REQUIRED IF MATERIAL IS GALVANIZED.



**CONICAL TRASH RACK WEIGHTS**

RISER DIA. (INCHES)	BARREL DIA. (INCHES)	WEIGHT (POUNDS) (STEEL)
12	12	44
15	12	80
18	15	89
21	18	114
24	18	142
30	12-15	138
30	18-21-24	162
36	24-30	297

**CONICAL TRASH RACK**