COACHELLA VALLEY WATER DISTRICT
GUIDELINE K-4
STORM DRAIN OUTLETS (LATERALS) DESIGN GUIDANCE

K-4.1 General Requirements

Where a storm drain outlet will discharge into a regional stormwater facility, CVWD requires the outlet to be designed to ensure the stability of the regional stormwater facilities and be consistent with approved hydraulic design reports. Guidance varies with the type of channel or facility (Table 8-1). For soft-bottom channels, such as the Whitewater River Stormwater Channel/ Coachella Valley Stormwater Channel (WWRSC/CVSC), Thousand Palms Stormwater Channel, or La Quinta Evacuation Channel, CVWD requires adequate protection to prevent potential bank and channel bed (scour) erosion. Storm drain outlets that discharge into concrete-bottomed channels (e.g. Palm Valley Stormwater Channel, West Magnesia Channel, etc.) should be consistent with the proposed or approved hydraulics report.

K-4.2 Recommended CVWD Outlet Design

Where a storm drain discharges into CVWD regional stormwater facilities, CVWD recommends slope protection consistent with guideline K-2 and channel bed protection consistent with the hydraulic characteristics and potential scour from the outlet. While there are a variety of alternatives for bed scour protection, CVWD generally recommends that the following features are incorporated in the design:

- A concrete cutoff wall extending below the maximum scour depth.
- Energy dissipation within the outlet system, prior to discharging to the facility.
- If the proposed outlet collects runoff from an adjacent development that is at a lower elevation than the design water surface elevation in the regional stormwater facility or if there is potential backflow from the regional stormwater system, a flap gate should be incorporated into the outlet system.
- Grading at the outlet to direct flows towards the center of the stormwater facility
- Angling of connections near confluences.

K-4.3 Alternative Scour Protection Designs

Thompson and Kilgore (2006), and other standard references, describe the hydraulic design of stilling basins, bed level dissipators, riprap basins and aprons and drop structures for outlet scour protection for culverts and channels. Alternative scour protection designs should be reviewed with the CVWD before proceeding with hydraulic design studies.

K-4.4 Hydraulic and Scour Studies

Thompson and Kilgore (2006) describe the hydraulic and scour analyses appropriate for energy dissipation from culverts and channels. Their approaches may require some modification to meet the particular conditions that occur in the stormwater facilities. Other publications that describe hydraulic and scour analyses for a variety of low head inflow structures include Breusers and Raudkivi (1991).

The general design condition for protection of the CVWD stormwater facilities is to assume the maximum outflow from the storm drain, both with and without flow in the stormwater facility and to provide appropriate protection to sections of the bank or bed that might erode under these design conditions, considering how flow will be directed once it leaves the outlet.

K-4.5 Design Drawing Submissions

The design plan set should indicate the extent of the works and show the keys or tie-ins or other features at the upstream and downstream ends of the protection, particularly where the revetment joins existing slope works or where the channel lining joins the slope protection.

The following specific information must be provided on the drawings submitted to the CVWD for review:

- Plans and profiles of the proposed storm drain outlets and connections that show slope, length, bearings, storm drain size, material type, etc. Elevations on the drawings must refer to the NAVD 1988 vertical datum and the drawing set will provide appropriate conversions covering the entire project area to NGVD 1929, if needed to compare as-built plans in NGVD 1929 datum
- Details of the outlet, headwall, wing wall, structural tie-in, energy dissipation system and the extent of outlet protection as dictated by the hydraulic analysis. CVWD standard details for outlet structures, provided below, shall be used unless a modification is necessary to meet the particular conditions that occur in the stormwater facility. Modifications to standard outlet details must be reviewed with the CVWD before proceeding.
- The inverts of the outlets shall be a minimum of 24” above the invert of the main channel. This can be 12” for concrete lined channels. Safety grates (storm drain outlet screens) are required for storm drain/lateral outlets greater than 16”.

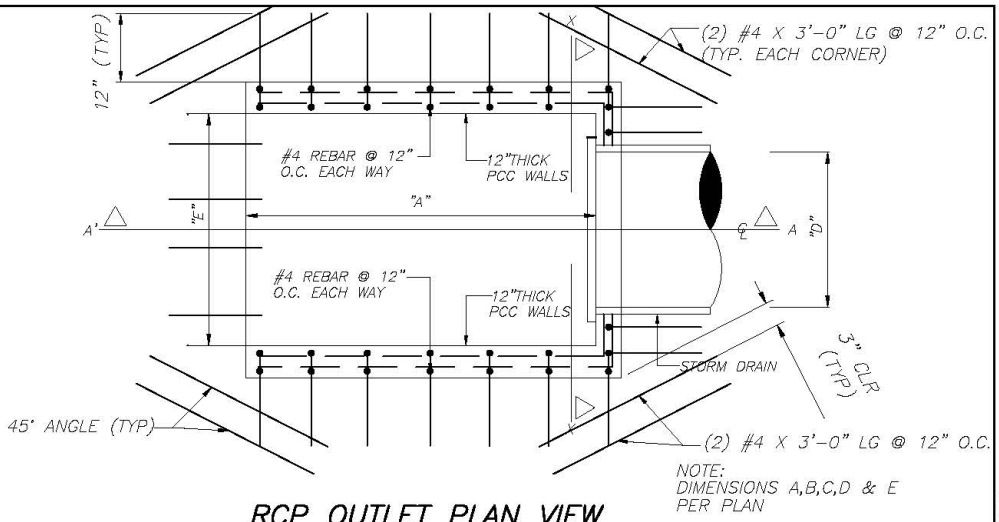
K-4.6 Submissions

The hydraulic design report describing the analyses for the particular storm drain will be submitted with the design drawings.

K-4.7 References

Breusers, h. And a. Raudkivi. 1991. Scouring. International association for Hydraulic Research Hydraulic Structures Design Manual: Hydraulic Design Considerations. A.A. Balkema, Rotterdam.

Thompson, P. And R. Kilgore. 2006. Hydraulic Design Of Energy Dissipators For Culverts And Channels. Hydraulic Engineering Circular No. 14 (3rd Edition). Federal Highways Administration. National Highway Institute.



RCP OUTLET PLAN VIEW

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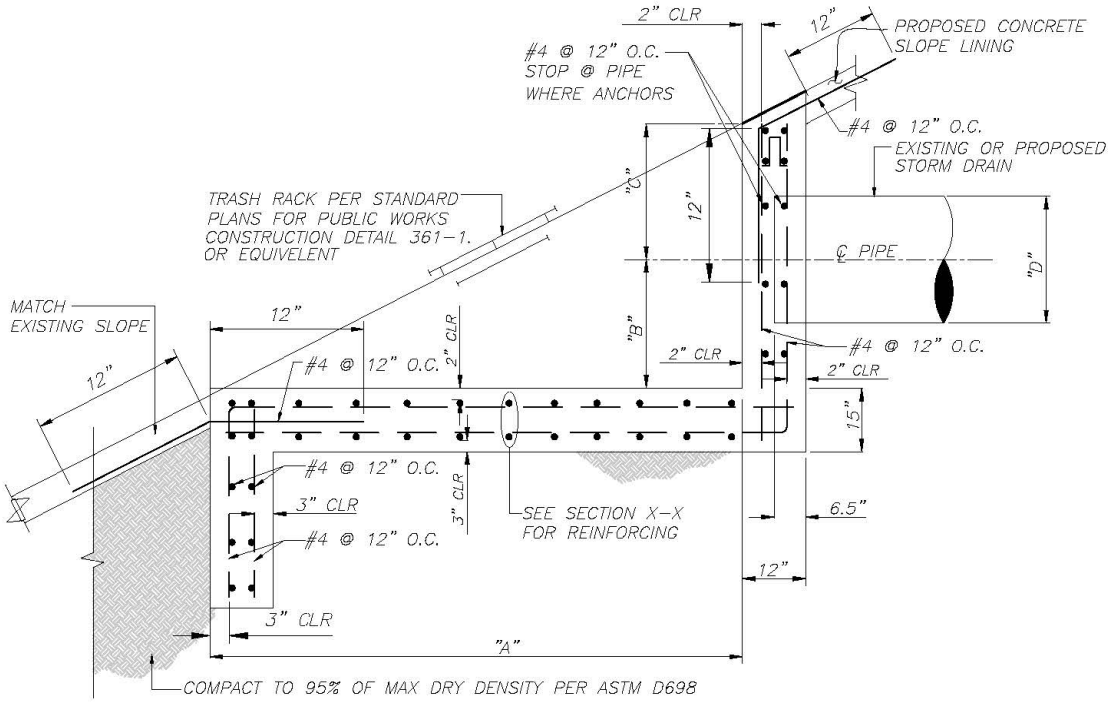

RCP OUTLET PLAN VIEW
SECTION A-A

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COACHELLA VALLEY WATER DISTRICT	
TYPICAL SLOPE PROTECTION DETAILS	
DECEMBER 2019	1 OF 4

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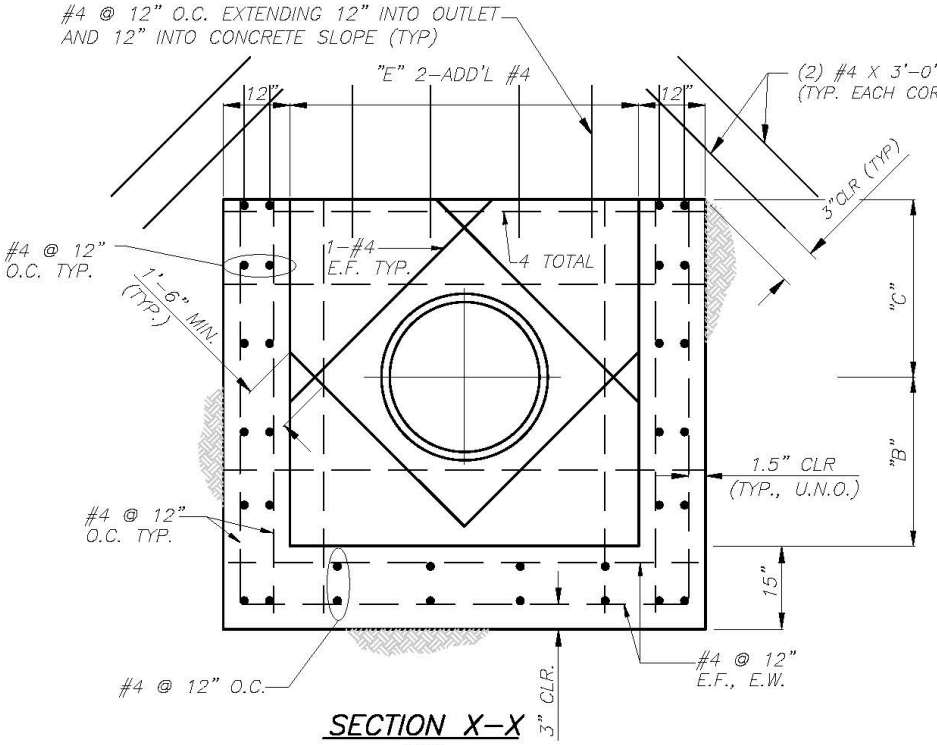

SECTION X-X

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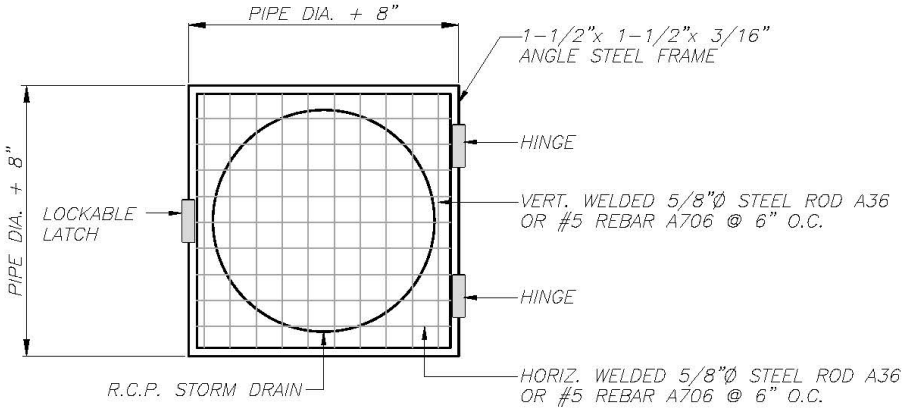
NOTE: HINGE & LATCH HASP SHALL BE SUPPLIED BY CONTRACTOR TO ENGINEER'S SATISFACTION



OUTLET DEBRIS SCREEN DETAIL
REQUIRED ON ALL OUTLETS EQUAL TO OR GREATER THAN 16"

COACHELLA VALLEY WATER DISTRICT	
TYPICAL SLOPE PROTECTION DETAILS	
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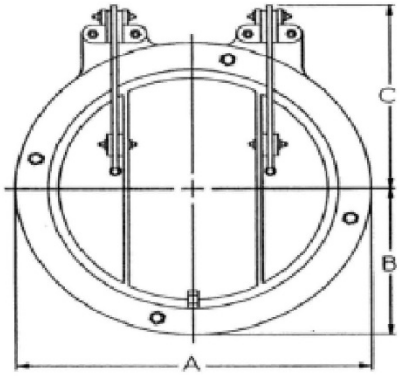

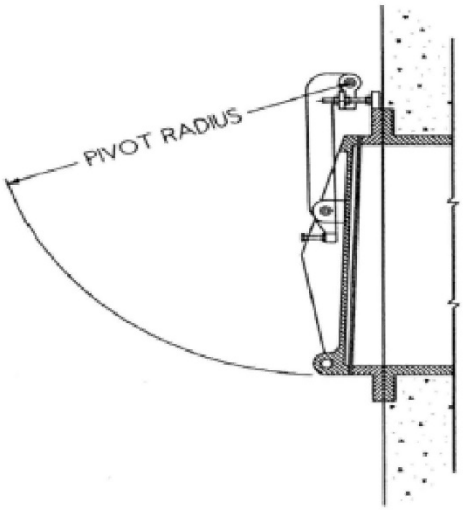

Opening Size Dia. (In.)	Dimensions (In.)			Pivot Radius (In.)
	A	B	C	
6	11.00	5.50	8.25	11.75
8	13.50	6.75	9.50	14.00
10	16.00	8.00	9.75	15.25
12	19.00	9.50	10.25	16.75
14	21.00	10.50	12.50	19.75
15	22.25	11.25	12.50	20.31
16	23.50	11.75	13.00	21.25
18	24.75	12.50	15.75	25.00
20	27.50	13.75	16.25	26.25
21	28.00	14.00	16.50	27.38
24	32.00	16.00	19.25	31.25
27	34.00	17.00	21.25	35.50

Opening Size Dia. (In.)	Dimensions (In.)			Pivot Radius (In.)
	A	B	C	
30	38.75	19.50	23.25	38.50
36	46.00	23.00	27.50	45.50
42	53.00	26.50	32.50	53.50
48	59.50	29.75	37.75	61.75
54	66.25	33.25	39.75	67.25
60	73.00	36.50	46.00	76.00
66	80.00	40.00	50.00	83.00
72	86.50	43.25	54.25	90.00
78	93.50	46.75	58.25	97.00
84	100.00	50.00	62.25	104.25
90	106.50	53.25	65.50	111.25
96	114.00	51.00	69.00	117.25

Model 50C Circular Flap Gate for Heads to 50 feet
Source: Hydro Gate (An example, not an endorsement)

COACHELLA VALLEY WATER DISTRICT

TYPICAL STORM DRAIN CIRCULAR FLAT GRATES

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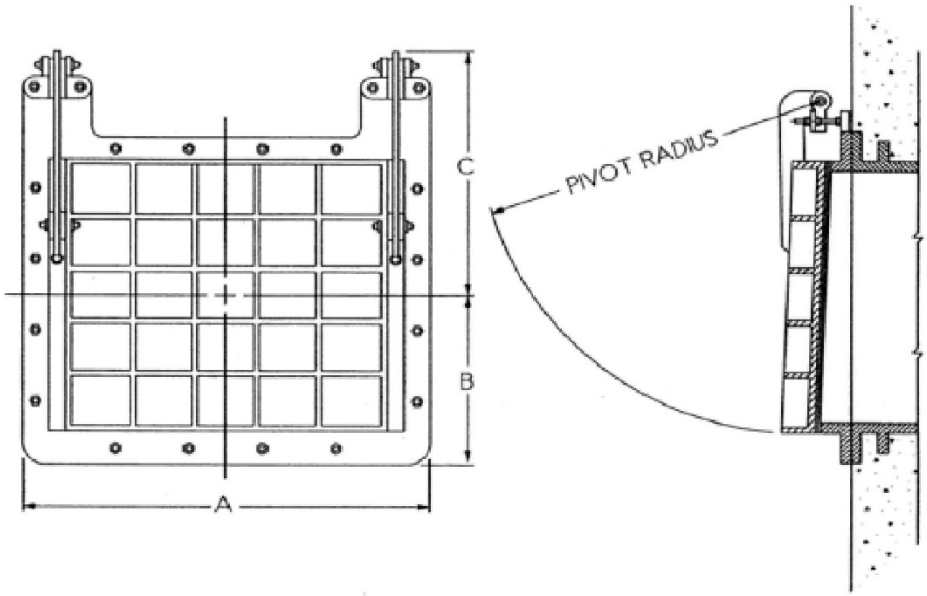

Opening Dia. (In.)	Dimensions (In.)			Pivot Radius (In.)
	A	B	C	
12 x 12	18.00	9.00	11.25	18.25
18 x 18	25.00	12.50	15.75	25.00
24 x 24	32.00	15.00	19.25	31.25
30 x 18	37.00	12.50	15.75	25.00
30 x 30	40.50	18.75	25.75	40.25
36 x 24	44.00	16.00	21.00	31.25
36 x 36	44.00	22.00	27.50	45.25
42 x 30	52.00	19.25	23.25	38.25
42 x 42	52.00	25.00	32.50	53.25
48 x 24	56.00	16.00	19.00	29.25
48 x 36	56.00	22.00	27.50	46.50
48 x 48	58.00	29.00	37.75	61.75
54 x 36	63.00	22.50	27.50	47.50
54 x 54	64.00	32.00	39.75	66.75
60 x 30	68.00	19.00	24.25	39.75

Opening Dia. (In.)	Dimensions (In.)			Pivot Radius (In.)
	A	B	C	
60 x 36	70.00	23.00	29.00	48.75
60 x 48	70.00	29.00	37.75	61.75
60 x 60	70.00	35.00	45.75	75.75
66 x 42	76.00	26.00	32.75	53.50
66 x 66	76.00	38.00	52.00	85.00
72 x 48	82.00	29.00	37.75	61.75
72 x 60	82.00	35.00	45.75	75.75
72 x 72	82.00	41.00	54.75	90.50
84 x 60	94.00	35.00	46.00	75.75
84 x 84	94.00	47.00	62.25	104.00
96 x 60	108.00	36.00	46.00	76.00
96 x 84	108.00	48.00	62.50	104.00
96 x 96	108.00	54.00	69.00	117.00
108 x 108	120.00	60.00	76.00	138.00
120 x 120	132.00	60.00	81.00	149.00

Model 50 Square and Rectangular Openings for Heads to 50 feet
Source: Hydro Gate (An example, not an endorsement)

COACHELLA VALLEY WATER DISTRICT

TYPICAL STORM DRAIN SQUARE AND RECTANGULAR FLAT GRATES

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