CITY OF Grand Junction COLORADO

Purchasing Division

ADDENDUM NO. 2

DATE: **July 23, 2018**
FROM: **City of Grand Junction Purchasing Division**
TO: **All Offerors**
RE: **Las Colonias Business Park Phase 2 IFB-4547-18-DH**

Offerors responding to the above referenced solicitation are hereby instructed that the requirements have been clarified, modified, superseded and supplemented as to this date as hereinafter described.

Please make note of the following clarifications:

1. **Composite Utility Plan Set** – Scale shown in title block is incorrect. Refer to scale on plan sheet adjacent to north arrow. Note 11x17 scale 1"=60', 22x34 scale 1"=30'.
2. **Construction Storm Water Management Plan** – See attached.
3. **Reinforcing Steel** – See Special Provision (SP-12) and revised Standard Plan M-412-1 attached to Addendum No .2.
4. **Bid Schedule (Addendum No.2)** - See attached. Contractor shall utilize the attached updated/revised Bid Schedule when submitting their bid response.
5. **Pond Liner Ventilation System** – A line item for the vent system to be installed below the pond liner has been added to the bid schedule (Addendum No. 2). Details and specifications for this line item will be issued in Addendum No. 3.
6. **SP-9 SECTION 712 MISCELLANEOUS shall include the following:**

   Qualification Requirements – The PVC Geomembrane Installer shall have installed a minimum of 1,000,000 square feet of PVC geomembrane and be an IAGI member.

PLANS:

- **Sheets 126 and 127 – Lake and Pond Geomembrane Detail.**
  1. **Both drawings reference "Engineer Approved Fill" above the liner and below the Cobble and Engineer Approve Onsite Rock Material. Clarify what type of material is to be used.** See Special Prevision (SP-11) attached to Addendum No. 2.
  2. **Can a quantity and Line Item be added to the bid form to identify the Engineer Approved Fill for a pay item?** A line item for Import Structure Backfill (Engineer Approved - Above Pond Liner) (1' Thick) has been added to the bid schedule (Addendum No. 2).

3. **Both drawings reference ¼" Pit Fines (on slope) and ¾" or 1 ½" Gravel (on pond bottom). Can a quantity and Line Item be added to the bid form to identify these items for a pay item?** A line item for Structure Backfill (Below Pond Liner) (4" Thick) has been added to the bid schedule (Addendum No. 2).

- **Sheets 169 to 182 – Landscape Plan.**
  1. **Line Items 60 (Topsoil) and 61 (Clean Fill) appear to be consistent with Line Items 116 to 119 (Landscape Areas) for ONSITE work. There appears to be areas OFFSITE, completed in Phase One that receive Seeding and Mulching. Can you verify that the Seeding and Mulching quantities are correct?** The seeding and mulching quantities have been verified by the Landscape Architect. Quantities for Phase 2 Bid Schedule include landscape and irrigation work to be completed in Phase 1 Site work. Soil Preparation was included in the Phase 1 bid for landscape areas.

BIDFORM:

1. **Line Item 105 – Preformed Thermoplastic Pavement Marking. Clarify what this line item is for. It appears that Line Items 106-109 have identified with more definition what these items are.** Preformed Thermoplastic Pavement Marking Line Items have been revised in the bid schedule (Addendum No. 2).
2. **Line Item 165 - Boat Ramp A/Preconstruction Services. Clarify what you are looking for with this Line Item.** This is a heading only, not a line item. The revision has been made in the bid schedule (Addendum No. 2).
3. **Line Item 197 – 2" Schedule 80 PVC. Can you verify that 14,810 lf is the correct quantity? Considering that multiple conduits could be in the same trench, can a line item and quantity be added for trenching and backfilling?** The quantity for both 2" and 4" Schedule 80 PVC have been revised in the bid schedule (Addendum No. 2). A line item for Trench, Lump Sum (Approximately 10,000 LF) has also been added to the bid schedule (Addendum No. 2). Note the 2" and 4" conduit for sight lighting and electrical may be in trench alone at times, combined with one another or included in the projects joint trench with Xcel, Century Link, Charter and Broadband. The Contractors means and methods will dictate the amount of conduit per trench in certain runs.

Water:

1. Line item #19- 6" Gate valves….I only see 17 on the plans, bid shows 18.
   Bid per Bid Schedule (Addendum No. 2).
2. Line item #27- 8" 45ell….I see 8 on the plans, bid shows 6.
   Line item has been revised. See Bid Schedule (Addendum No. 2).
3. Also I see a few vertical changes in the 8" water line (page 9,11,14), do these need 45's or 22's and if so what item # are we to bid them in? Four additional 22.5 and 8 45-degree bends were added to the bid schedule (Addendum No.2) to address conflicts.
4. Plans show 1- 8" 11ell (page 12)….no item #.
   Line item has been added. See Bid Schedule (Addendum No. 2).

5. Line item #31- 8” cap….no 8” caps on plans, only 6”. Quantity correct 8.
   Line item has been revised. See Bid Schedule (Addendum No. 2).
6. Item #49- ADS inlets…..ADS/me only see 22 on the plans, bid shows 25.
   Bid per Bid Schedule (Addendum No. 2).
7. Some of the storm drain pipe quantities don’t match from plans to bid-
   Item #3- 6” PVC 450ft…..I only see 142ft actually called out on the plans. I assume the rest for the Area Inlet piping?
   Correct.
8. Item #10- 12” PVC 63ft…..I only see 31ft (page 26).
   See Plan View. Two 12” Pipes parallel to one another.
9. Item #11- 18” PVC 21ft…..I see 220ft (page 25,26).
   Line item has been revised. See Bid Schedule (Addendum No. 2).
10. Item #18- 18” ADS 1,300ft….I only see 974ft.
    Line item has been revised. See Bid Schedule (Addendum No. 2).
11. Item #17- Yard hydrants….do you have a detail for the yard hydrant assy? Spec for the hydrant….any particular manu or features needed? Lead free?
    Wordford Freeze Less Yard Hydrant model W-34
12. Item #33- Fire hydrants…..there are 3 runs of 20ft plus, do you require joint restraints in that case?
    Yes
13. Item #40- 1” Backflow….do you have a detail for the backflow assy? Is it similar to GJ detail W-15?
    Correct.

-- End Addendum No. 2 --

The original solicitation for the project noted above is amended as noted.

All other conditions of subject remain the same.

Respectfully,

Duane Hoff Jr., Senior Buyer
City of Grand Junction, Colorado

Bid Schedule: Las Colonias Business Park Phase 2
Addendum No. 2

Contractor: _____

Item No.	CDOT, City Ref.	Description	Quantity	Units	Unit Price	Total Price
1	104.4	Cap top half of sewer in concrete per City Standard Detail GU-04	4.	EA	$ _____	$ _____
2	108.2	6" Water Pipe (C-900 PVC)	500.	LF	$ _____	$ _____
3	108.2	6" Storm Drain (C-900 PVC)	450.	LF	$ _____	$ _____
4	108.2	8" Water Pipe (C-900 PVC)	2,900.	LF	$ _____	$ _____
5	108.2	12" Water Pipe (C-900 PVC)	600.	LF	$ _____	$ _____
6	108.2	4" Sewer Service Pipe (SDR 35)	220.	LF	$ _____	$ _____
7	108.2	6" Sewer Service Pipe (SDR 35)	600.	LF	$ _____	$ _____
8	108.2	8" Gravity Sewer Pipe (SDR 35)	1,300.	LF	$ _____	$ _____
9	108.2	12" Storm Drain Pipe	650.	LF	$ _____	$ _____
10	108.2	12" Storm Drain Pipe (C-900 PVC)	63.	LF	$ _____	$ _____
11	108.2	18" Storm Drain Pipe (C-900 PVC)	220.	LF	$ _____	$ _____
12	108.2	18" Storm Drain Pipe	1,000.	LF	$ _____	$ _____
13	108.2	21" Storm Drain Pipe	415.	LF	$ _____	$ _____
14	108.2	24" Storm Drain Pipe	300.	LF	$ _____	$ _____
15	108.2	36" Storm Drain Pipe	675.	LF	$ _____	$ _____
16	108.3	1' Water Pipe (Schedule 40 PVC)	600.	LF	$ _____	$ _____
17	108.3	1" Water Yard Hydrant	10.	EA	$ _____	$ _____
18	108.2	Import Trench Backfill	550.	CY	$ _____	$ _____
19	108.3	6" Gate Valve	18.	EA	$ _____	$ _____
20	108.3	8" Gate Valve	3.	EA	$ _____	$ _____
21	108.3	12" Gate Valve	2.	EA	$ _____	$ _____
22	108.3	8" x 6" Tee	12.	EA	$ _____	$ _____
23	108.3	12" x 6" Tee	4.	EA	$ _____	$ _____
24	108.3	12" x 8" Tee	1.	EA	$ _____	$ _____
25	108.3	8", 90° Elbow	1.	EA	$ _____	$ _____
26	108.3	8", 22.5° Elbow	8.	EA	$ _____	$ _____
27	108.3	8", 45° Elbow	16.	EA	$ _____	$ _____
28	108.3	8", 11.25° Elbow	1.	EA	$ _____	$ _____
29	108.3	12", 22.5° Elbow	3.	EA	$ _____	$ _____
30	108.3	12", 45° Elbow	2.	EA	$ _____	$ _____
31	108.3	8" x 6" Reducer	2.	EA	$ _____	$ _____
32	108.3	6" End Cap/Plug	8.	EA	$ _____	$ _____
33	108.3	8" x 8" Tee	2.	EA	$ _____	$ _____
34	108.3	Fire Hydrant	10.	EA	$ _____	$ _____
35	108.3	12" x 8" Reducer	1.	EA	$ _____	$ _____
36	108.3	4" Sewer Service Tap	8.	EA	$ _____	$ _____
37	108.3	Sanitary Sewer Cleanout (2-way) to include appurtenances per City Standard Detail SS - 07.	8.	EA	$ _____	$ _____
38	108.3	1" Tapping Saddle	2.	EA	$ _____	$ _____
39	108.3	1" Corporation Stop	2.	EA	$ _____	$ _____
40	108.3	1" Tee	10.	EA	$ _____	$ _____
41	108.3	1" Backflow Prevention Device	2.	EA	$ _____	$ _____
42	108.4	2" Water Service Line (HDPE)	300.	LF	$ _____	$ _____

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Item No.	CDOT, City Ref.	Description	Quantity	Units	Unit Price	Total Price
43	108.4	2" Water Service Assembly	9.	EA	$ _____	$ _____
44	108.5	Sanitary Sewer Basic Manhole (48" I.D.)	10.	EA	$ _____	$ _____
45	108.5	Manhole Barrel Section (D>5')(48" I.D.)	30.	VLF	$ _____	$ _____
46	108.5	Storm Sewer Basic Manhole (48" I.D.)	4.	EA	$ _____	$ _____
47	108.5	Connect to Existing Manhole (8" Pipe)	1.	EA	$ _____	$ _____
48	108.5	Storm Sewer Flared End Section (36" I.D.)	3.	EA	$ _____	$ _____
49	108.5	Pour in Place Storm Drain Box. Box L2 on the plan set.	1.	EA	$ _____	$ _____
50	108.5	ADS Inlets or engineer approved equal	25.	EA	$ _____	$ _____
51	108.5	Storm Sewer Flared End Section (24" I.D.) (Directly in front of outlets structure pond 3)	1.	EA	$ _____	$ _____
52	108.6	Double Storm Drain Inlet (Vertical Curb)	3.	EA	$ _____	$ _____
53	108.6	Triple Large Storm Drain Area Inlet	1.	EA	$ _____	$ _____
54	108.6	Storm Sewer Basic Manhole (72" ID)	4.	EA	$ _____	$ _____
55	108.6	Special Small Storm Drain Area Inlet (see plan details)	10.	EA	$ _____	$ _____
56	108.6	Outlet Structure - See "Water Quality Outlet Structure Pond 3" to include all appurtenances (complete in place).	1.	EA	$ _____	$ _____
57	108.6	Single Storm Drain Inlet (Vertical Curb)	10.	EA	$ _____	$ _____
58	108.6	Large Area Inlet	7.	EA	$ _____	$ _____
59	108.7	Granular Stabilization Material (Type B)	1,500.	TON	$ _____	$ _____
60	203	Excavation and Embankment - See SP - 4.	47,800.	CY	$ _____	$ _____
61	206	Import Structure Backfill (Engineer Approved - Above Pond Liner) (1' Thick) See Special Previsions (SP-11) in Addendum No. 2.	12,000.	SY	$ _____	$ _____
62	206	Structure Backfill (Below Pond Liner) (4" Thick)	12,000.	SY	$ _____	$ _____
63	207	Topsoil (6" Thick) (all areas subject to plantings)	60,500.	SY	$ _____	$ _____
64	207	Import Fill Material - Clean fill 12" Thick at all areas with ground cover not paved	60,500.	SY	$ _____	$ _____
65	208	Erosion Control (Complete in Place)	Lump	SUM	- - -	$ _____
66	208	Stabilized Construction Entrance	2.	EA	$ _____	$ _____
67	209	Dust Abatement	270.	DAYS	$ _____	$ _____
68	210	Reset Structures - Reset SSMH C1	1.	EA	$ _____	$ _____
69	304	Aggregate - River Cobble 1" -3" (6" Thick) to include approved fill below. (Butterfly Lake)	7,800.	SY		
70	304	Subgrade Stabilization - Aggregate Base Course (Class 3) (12" Thick)	4,000.	SY	$ _____	$ _____
71	304	Aggregate Base Course (Class 6) (13" Thick)	12,250.	SY	$ _____	$ _____
72	306	Reconditioning (12" Deep)	16,000.	SY	$ _____	$ _____
73	304	Pond Aggregate (Generated on site) to be placed over engineer approved backfill. See Sp - 4.	4,200.	SY	$ _____	$ _____
74	401	Hot Mix Asphalt (5" thick) (Grading SX 75, Binder Grade 64-22)	3,400.	TON	$ _____	$ _____
75	420	Geosynthetics - Mirafi RS580i or approved equal	4,000.	SY	$ _____	$ _____

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Item No.	CDOT, City Ref.	Description	Quantity	Units	Unit Price	Total Price
76	420	Geotextile Fabric (Non-Woven) Underlayment at Pond Liner.	108,000.	SF	$ _____	$ _____
77	504	Concrete Wall (Class D) per M and S Standard M-601-20 (Wall Design Height 5'). Work shall include approximately 720 lbs. Reinforcing Steel (Epoxy Coated), Structural Concrete Coating (Exterior of wall), 38 cy Structural Backfill (Class 1) and any necessary appurtenances to complete work. Includes water spill adjustment flat bar. Refer to Plan Sheets for detail. (waterfall wall)	20.	CY	$ _____	$ _____
78	504	Concrete Wall (Class D) per M and S Standard M-601-20 (Wall Design Height 3'). Work shall include approximately 12,650 lbs. Reinforcing Steel (Epoxy Coated), Structural Concrete Coating (Exterior of wall), 540 cy Structural Backfill (Class 1) and any necessary appurtenances to complete work. Refer to Plan Sheets for detail. (pond perimeter walls, upper/lower waterfall trough walls, and check dam wall)	286.	CY	$ _____	$ _____
79	504	Concrete Wall (Class D) per M and S Standard M-601-20 (Wall Design Height 3'). Work shall include approximately 15,100 lbs. Reinforcing Steel (Epoxy Coated), Structural Concrete Coating (Exterior of wall), 640 cy Structural Backfill (Class 1) and any necessary appurtenances to complete work. Refer to Plan Sheets for detail. (lake perimeter wall)	350.	CY	$ _____	$ _____
80	506	Riprap (d50=12" to include geogrid)	120.	SY	$ _____	$ _____
81	607	Steel Hand Rail (adjacent to HVOHP pole remaining in place)	40.	LF	$ _____	$ _____
82	607	6' Black Vinyl Coated Chain Link Fencing to include gates and appurtenances.	1,845.	LF	$ _____	$ _____
83	608	Concrete Pavement (Roundabout and in and around Trash enclosure) (10" Thick) to include 6" of Class 6 Aggregate Base Course.	1,800.	SY	$ _____	$ _____
84	608	Concrete Curb and Spill Gutter (1.5' Wide) to include 6" of Class 6 Aggregate Base Course.	1,345.	LF	$ _____	$ _____
85	608	Concrete Median Edger (1.5' wide) to include 4" of Class 6 Aggregate Base Course)	410.	LF	$ _____	$ _____
86	608	Concrete Truck Apron (Roundabout) (10" Thick) to include 6" of Class 6 Aggregate Base Course.	300.	SY	$ _____	$ _____
87	608	Concrete Slope Pave (6" Thick) to include 6" of Class 6 Aggregate Base Course.	25.	SY	$ _____	$ _____

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Item No.	CDOT, City Ref.	Description	Quantity	Units	Unit Price	Total Price
88	608	Concrete Terrace Edger to include 6" of Class 6 Aggregate Base Course. See Plan Details at both ends of Butterfly Bridge.	710.	LF	$ _____	$ _____
89	608	Concrete Art Pedestals (See Detail)	8.	EA	$ _____	$ _____
90	608	Concrete Curb (6" Wide, 14" High) to include 6" of Class 6 Aggregate Base Course.	1,925.	LF	$ _____	$ _____
91	608	Concrete Curb and Gutter (2' Wide) to include 6" of Class 6 Aggregate Base	3,600.	LF	$ _____	$ _____
92	608	Concrete Drive Over Curb and Gutter (2.5' Wide) to include 6" of Class 6 Aggregate Base Course.	705.	LF	$ _____	$ _____
93	608	Concrete Sidewalk (6" Thick) to include 6" of Class 6 Aggregate Base Course.	14,230.	SY	$ _____	$ _____
94	608	Concrete Pavement (Parking) (8" Thick) to include 6" of Class 6 Aggregate Base Course.	2,250.	SY	$ _____	$ _____
95	608	Concrete Drainage Pan (3' Wide) to include 6" of Class 6 Aggregate Base Course.	270.	LF	$ _____	$ _____
96	608	Concrete Drainage Pan (6' Wide) to include 6" of Class 6 Aggregate Base Course.	600.	LF	$ _____	$ _____
97	608	Concrete Corner Fillet to include 6" of Class 6 Aggregate Base Course.	42.	SY	$ _____	$ _____
98	608	Concrete Curb Ramp to include 6" of Class 6 Aggregate Base Course.	180.	SY	$ _____	$ _____
99	608	Concrete Sidewalk (Pond Edger) (Spanish Gold) (6" Thick) to include 6" of Class 6 Aggregate Base Course.	660.	SY	$ _____	$ _____
100	608	Detectable Warning (Cast Iron, Wet Set) (2'x2)	50.	EA	$ _____	$ _____
101	613	2" Schedule 80 PVC (Century Link)	2,200.	LF	$ _____	$ _____
102	613	4" Schedule 80 PVC (Century Link)	2,200.	LF	$ _____	$ _____
103	613	6" Schedule 80 PVC (City Broadband)	2,200.	LF	$ _____	$ _____
104	613	Joint Trench	3,000.	LF	$ _____	$ _____
105	613	Large Splice Box (Quasite) (3' - 2 5/8" x 2'-2")	12.	EA	$ _____	$ _____
106	620	Sanitary Facility	1.	EA	$ _____	$ _____
107	625	Construction Surveying	Lump	SUM	- - -	$ _____
108	626	Mobilization	Lump	SUM	- - -	$ _____
109	627	Preformed Thermoplastic Pavement Marking (Handicap Symbol)	8.	EA	$ _____	$ _____
110	627	Preformed Thermoplastic Pavement Marking (X-walk) (2' x 10' TYP.)	30.	EA	$ _____	$ _____
111	627	Preformed Thermoplastic Pavement Marking (8" White Dotted Line, 2' Segment, 3' Gap)	100.	LF	$ _____	$ _____
112	627	Preformed Thermoplastic Pavement Marking (4" White Solid)	20,000.	LF	$ _____	$ _____
113	630	Traffic Control (Complete In Place)	Lump	SUM	- - -	$ _____
114	630	Traffic Control Plan	Lump	SUM	- - -	$ _____
115	712	Geomembrane (40 Mil) - See SP - 9.	108,000.	SQ. FT.	$ _____	$ _____

Bid Schedule: Las Colonias Business Park Phase 2
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Item No.	CDOT, City Ref.	Description	Quantity	Units	Unit Price	Total Price
116	712	Batten Bar (complete in place) (irrigation ponds and butterfly lake) See Sp - 10 for details.	3,000.	LF	$ _____	$ _____
117	712	Pond Liner Ventilation System.	Lump	SUM	- - -	$ _____
118	712	Plaza Area Surface Treatment (pour in place EPDM) (Engineer Approved)	1,250.	SY	$ _____	$ _____
119		**LANDSCAPE**				
120		Lawn, Hydroseeded, Fine Grade	345,620.	SF	$ _____	$ _____
121		Native Grass, Hydroseeded, Fine Grade	27,036.	SF	$ _____	$ _____
122		Shrub Bed - Wood mulch, No fabric	91,259.	SF	$ _____	$ _____
123		Shrub Bed - Decomposed Granite, No fabric	69,651.	SF	$ _____	$ _____
124		Pea Gravel	772.	SF	$ _____	$ _____
125		Concrete Edger	4,325.	LF	$ _____	$ _____
126		2" Canopy Trees	69.	EA	$ _____	$ _____
127		1-1/2" Ornamental Trees	17.	EA	$ _____	$ _____
128		6 ft Evergreen Trees	21.	EA	$ _____	$ _____
129		5 Gallon Deciduous Shrubs	814.	EA	$ _____	$ _____
130		1 Gallon Deciduous Shrubs	112.	EA	$ _____	$ _____
131		5 Gallon Evergreen Shrubs	248.	EA	$ _____	$ _____
132		1 Gallon Perennials	545.	EA	$ _____	$ _____
133		Boulders, 5'X3'	33.	EA	$ _____	$ _____
134		Boulders, 3'X2'	17.	EA	$ _____	$ _____
135		**IRRIGATION**				
136		4" Conduit Sleeves, includes trenching, backfill & compaction	920.	LF	$ _____	$ _____
137		6" Conduit Sleeves, includes trenching, backfill & compaction	30.	LF	$ _____	$ _____
138		2 Wire Irrigation Control Wire	4,560.	LF	$ _____	$ _____
139		Rainbird FD-101TURF decoder	71.	EA	$ _____	$ _____
140		LSP-1 Surge Protector	17.	EA	$ _____	$ _____
141		tap into existing irrigation system	1.	LS	$ _____	$ _____
142		6" C900 DR 18 PVC Mainline, including Trenching, Filling, and thrust blocking	4,560.	LF	$ _____	$ _____
143		4" Isolation Valve (at tap)	2.	EA	$ _____	$ _____
144		Flow Sensor	2.	EA	$ _____	$ _____
145		4" Master Valve	2.	EA	$ _____	$ _____
146		4" Pressure Reducing Valve	2.	EA	$ _____	$ _____
147		6" Isolation Valve	7.	EA	$ _____	$ _____
148		Drain Valve, 2" Mueller	1.	EA	$ _____	$ _____
149		1-1/2" Automatic Control Valve Assembly	28.	EA	$ _____	$ _____
150		2" Automatic Control Valve Assembly	43.	EA	$ _____	$ _____
151		Future Valve Location assembly	12.	EA	$ _____	$ _____
152		1401 Bubbler Heads, on riser, swing pipe	3,170.	EA	$ _____	$ _____
153		1804 Pop-up heads, spray nozzle	248.	LF	$ _____	$ _____
154		1804 Pop-up heads, R-VAN nozzle	100.	EA	$ _____	$ _____
155		5004 Gear Drive head, swing joint assembly	272.	EA	$ _____	$ _____

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Item No.	CDOT, City Ref.	Description	Quantity	Units	Unit Price	Total Price
156		6504 Gear Drive head, swing joint assembly	171.	EA	$ _____	$ _____
157		Quick Coupler Valve	18.	EA	$ _____	$ _____
158		1" Poly Lateral for bubbler	13,930.	EA	$ _____	$ _____
159		1" Class 160 PVC Lateral Piping Including Trenching and Filling	11,360.	LF	$ _____	$ _____
160		1-1/2" Class 160 PVC Lateral Piping Including Trenching and Filling	8,310.	LF	$ _____	$ _____
161		2" Class 160 PVC Lateral Piping Including Trenching and Filling	3,640.	LF	$ _____	$ _____
162		2-1/2" Class 160 PVC Lateral Piping Including Trenching and Filling	810.	LF	$ _____	$ _____
163		Rainbird LDI (Large Decoder Interface)	1.	EA	$ _____	$ _____
164		Irrigation Controller Ground Plate and Grounding Rod Assembly	1.	EA	$ _____	$ _____
165		2 HP Otterbine Floating Fountain with anchor block	1.	EA	$ _____	$ _____
166		10 HP Recirculation Munro Pump and Slide Rail Assembly	1.	EA	$ _____	$ _____
167		60" manhole sump w/ 36" hatch	1.	EA	$ _____	$ _____
168		**Boat Ramp**				
169	**A**	**Preconstruction Services**				
170	1	Mobilization, General Conditions & Best Management Practices	Lump	SUM	- - -	$ _____
171	**B**	**Erosion Control and Care of Water**				
172	4	General Staging Area BMPs	Lump	SUM	- - -	$ _____
173	5	Care of Water (COW) Practices	Lump	SUM	- - -	$ _____
174	**C**	**BOAT RAMP CONSTRUCTION AND SITE IMPROVEMENTS**				
175	6	Clear and grub site	40,000.	SF	$ _____	$ _____
176	7	Unclassified Bank Excavation	2,675.	CY	$ _____	$ _____
177	8	Placement and Rough Grading of Excavated Material On Site	400.	CY	$ _____	$ _____
178	9	Stockpile Excavated Alluvium Nearby	2,635.	CY	$ _____	$ _____
179	10	Scarify and Recompact Subgrade (Depicted Parking Area & Under Concrete)	27,000.	SF	$ _____	$ _____
180	11	Furnish and Rough Grade Suitable Subgrade Base Course per Geotechnical Specifications	447.	TONS	$ _____	$ _____
181	12	Furnish and Compact 8" min. of CDOT Class-6 Road Base (Depicted Parking Area and Turn Around)	990.	TONS	$ _____	$ _____
182	13	Furnish and Install 6" Concrete Sidewalk, Including Curb and Gutter	37.	CY	$ _____	$ _____
183	14	Furnish and Install Cedar Log Parking Delineation	660.	LF	$ _____	$ _____
184	15	Furnish and Install #3 Rebar for Cedar Log Installation	132.	LF	$ _____	$ _____
185	16	98% Compacted Subgrade on Undisturbed Alluvium (Boat Ramp)	4,000.	SF	$ _____	$ _____
186	17	Furnish and Compact 6" CDOT Class-6 Road Base (Boat Ramp)	124.	TONS	$ _____	$ _____

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Item No.	CDOT, City Ref.	Description	Quantity	Units	Unit Price	Total Price
187	18	Reinforced Concrete Cast in Place and Texture Boat Ramp (8" Thick Slab)	79.	CY	$ _____	$ _____
188	19	Furnish and Install 3" Minus Ramp Shoulder (8" depth)	11.	CY	$ _____	$ _____
189	20	Furnish and Install 12" Minus Ramp Shoulder (18" depth)	25.	CY	$ _____	$ _____
190	21	Furnish and Install Boulder for Ramp Toe and Terraced Landing	49.	TONS	$ _____	$ _____
191	22	Place Boulder for Ramp Toe and Terraced Landing	200.	TONS	$ _____	$ _____
192	23	Furnish and Install Non-woven Filter Fabric	715.	SY	$ _____	$ _____
193	24	Furnish and Install 1-2mm Sand (8" depth)	63.	CY	$ _____	$ _____
194	25	Furnish and Install 5/8" Rounded Gravel (8" depth)	32.	CY	$ _____	$ _____
195	26	Furnish and Install 1" Rounded Gravel (8" depth)	28.	CY	$ _____	$ _____
196	27	Furnish and Install Boat Staging Tie-offs	4.	EA	$ _____	$ _____
197	28	Topsoil, Seeding, and Planting	Lump	SUM	- - -	$ _____
198	29	Furnish and Install Erosion Control Blankets	328.	SY	$ _____	$ _____
199	30	Irrigation	Lump	SUM	- - -	$ _____
200		**Composite Utility Schedules**				
201		2" Schedule 80 PVC	13,000.	LF	$ _____	$ _____
202		4" Schedule 80 PVC	600.	LF	$ _____	$ _____
203		Type One Pull Box	144.	EA	$ _____	$ _____
204		Wiring	Lump	SUM	- - -	$ _____
205		Light Standard and Luminaire (Pedestrian)	90.	EA	$ _____	$ _____
206		Light Standard and Luminaire (Street)	12.	EA	$ _____	$ _____
207		Light Standard Foundation (Pedestrian)	90.	EA	$ _____	$ _____
208		Light Standard Foundation (Street)	12.	EA	$ _____	$ _____
209		Light Standard and Luminaire (Waterfall)	3.	EA	$ _____	$ _____
210		Nema 3R Enclosure (Waterfall Controls)	1.	EA	$ _____	$ _____
211		Nema Disconnect Panels	3.	EA	$ _____	$ _____
212		Lighting Control Center PWR Pedestal (Special)	3.	EA	$ _____	$ _____
213		RV/Food Truck Pedestals	10.	EA	$ _____	$ _____
214		Trench - Site Lighting and Electrical will require approximately 10,000 Linear Feet of Trencing.	Lump	SUM	- - -	$ _____
MCR		Minor Contract Revisions	- - -	- - -	- - -	$ 300,000.00

Bid Amount: **$** _____

Bid Amount:

_____ **dollars**

SP- 11 SECTION 206 – EXCAVATION AND BACKFILL FOR STRUCTURES

Section 206 of the Standard Specifications is hereby revised for this project as follows:

Subsections 206.02 General, shall include the following:

Structure backfill shall be composed of non-organic mineral aggregates and soil from excavations, borrow pits, or other sources off site. Imported Structure Backfill shall be material meeting the requirements of Section 103.16. Crusher fines are a suitable substitute.

206.07 Basis of Payment.

Add the following:

Payment for work shall be made under Import Structure Backfill (Engineer Approved – Above Pond Liner) (1' Thick) and will be measured by square yard of placed and compacted material per plan.

Pay Item	**Pay Unit**
Import Structure Backfill (Engineer Approved-Above Pond Liner) (1' Thick)	SY

SP- 12 SECTION 602 – REINFORCING STEEL

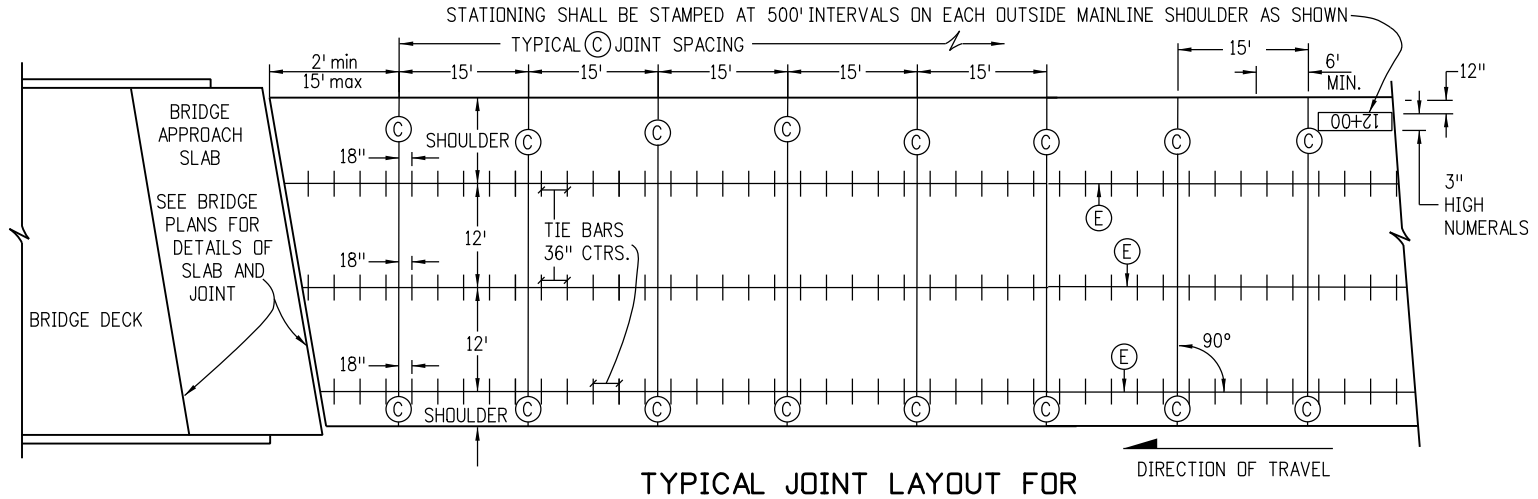
Section 602 of the Standard Specifications is hereby revised for this project as follows:

Section 602, shall include the following:

Concrete curb and gutter adjacent to concrete pavement shall include epoxy coated tie bars, 30" in length, 30" O.C.

Concrete pavement (PCCP) shall include reinforcing steel and dowels per revised Standard Plan (Jan. 2018) M-412-1.

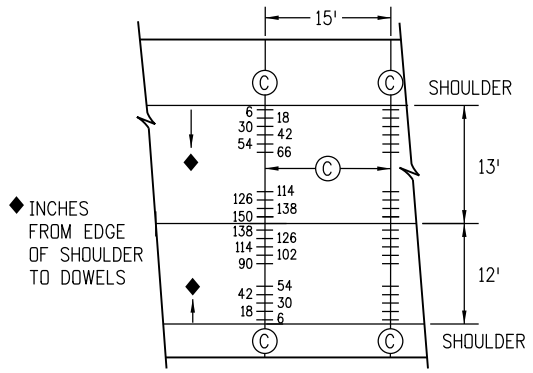
Reinforcing steel and dowel bars will ***not*** be measured and paid for separately, but shall be considered incidental to concrete.



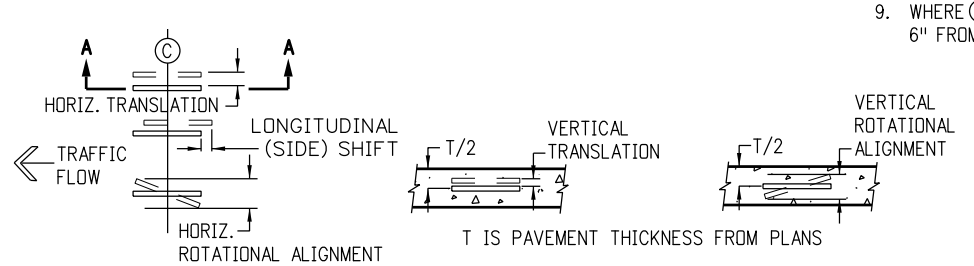
TYPICAL JOINT LAYOUT FOR CONCRETE ROADWAY WITH CONCRETE SHOULDERS

GENERAL NOTES

1. THIS STANDARD PLAN DOES NOT APPLY TO THIN CONCRETE OVERLAYS (WHITETOPPING).
2. TRANSVERSE CONSTRUCTION JOINTS SHALL BE LOCATED AT A Ⓒ JOINT.
3. THIS JOINT LAYOUT SHALL BE USED AS A STANDARD OF THE JOINT LAYOUT FOR THE PROJECT. IF THE CONTRACTOR PROPOSES VARIATIONS FROM THIS STANDARD OR THE PROJECT HAS UNUSUAL OR IRREGULAR CONDITIONS NOT COVERED HEREIN, THE CONTRACTOR SHALL PREPARE A PAVEMENT JOINT LAYOUT FOR APPROVAL BY THE ENGINEER. SLABS 13 FT. IN WIDTH SHALL BE CONSTRUCTED ONLY WHERE DESIGNATED ON THE PLANS.
4. ON MULTILANE DIVIDED HIGHWAYS, THE MULTILANE DIRECTIONAL PAVEMENT AND BOTH SHOULDERS SHALL BE PLACED WITH Ⓔ LONGITUDINAL SAWED CONTRACTION JOINTS.
5. ON MULTILANE DIVIDED HIGHWAYS SEPARATED BY A CONCRETE BARRIER, A Ⓓ JOINT SHALL BE CONSTRUCTED AT ONE OF THE BARRIER FACES.
6. Ⓓ JOINTS SHALL BE CONSTRUCTED BETWEEN THE TWO OPPOSING DIRECTIONS OF TRAVEL ON A MULTILANE UNDIVIDED HIGHWAY WHEN ALL OF THE FOLLOWING APPLY:
   A. PAVEMENT IS CONTINUOUS ACROSS BOTH DIRECTIONS OF TRAVEL.
   B. THERE IS NO MEDIAN BARRIER.
   C. THE WIDTH OF THE PAVEMENT IN ONE DIRECTION IS GREATER THAN 80 FEET.
7. ON VARIABLE WIDTH SLABS, THE 2 FT. OR 4 FT. END OF SLAB WIDTH DIMENSION MAY VARY ±6 INCHES.
8. Ⓛ JOINTS ARE TO BE USED WHEN A TRAFFIC LANE IS ADDED SEPARATELY, OR FOR TAPERS, OR FOR SPEED CHANGE LANES. ALTERNATIVE LONGITUDINAL JOINT LOCATIONS AT SPEED CHANGE LANES MAY BE USED IF APPROVED.
9. WHERE Ⓒ JOINTS ARE SHOWN IN THE SHOULDER, THE DOWEL BARS WILL BE PLACED ON 12" CENTERS STARTING 6" FROM THE ROADWAY Ⓔ JOINT.



DOWEL BAR DETAIL FOR Ⓒ JOINT WITH 13 FT. AND 12 FT. WIDE SLABS

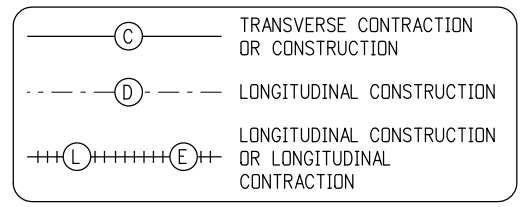


PLAN VIEW
SHOWING HORIZ. TRANSLATION, LONGITUDINAL (SIDE) SHIFT AND HORIZ. ROTATIONAL ALIGNMENT

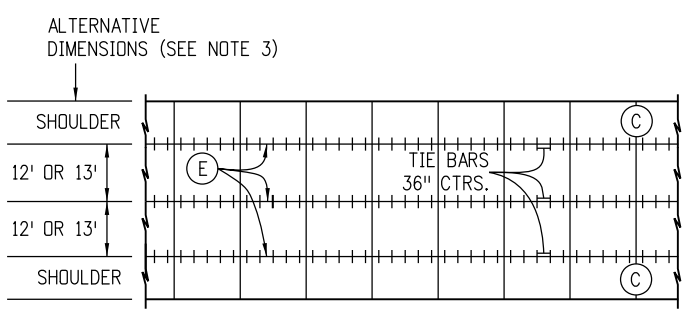
SECTION A-A
SHOWING VERTICAL TRANSLATION TOLERANCE

SECTION A-A
SHOWING VERTICAL ROTATIONAL ALIGNMENT

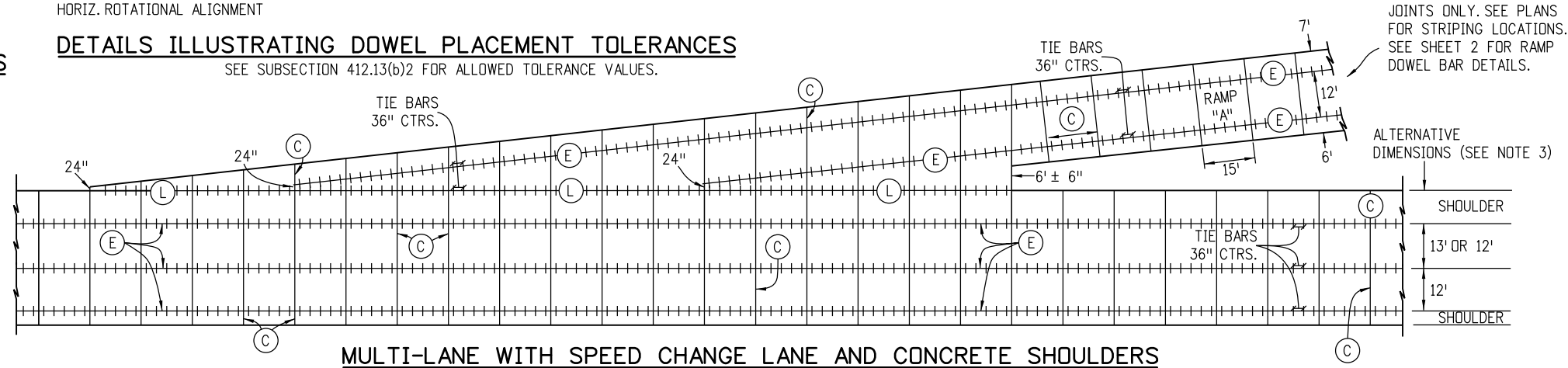
JOINT LEGEND
(SEE SHEET 5 FOR JOINT DETAILS)



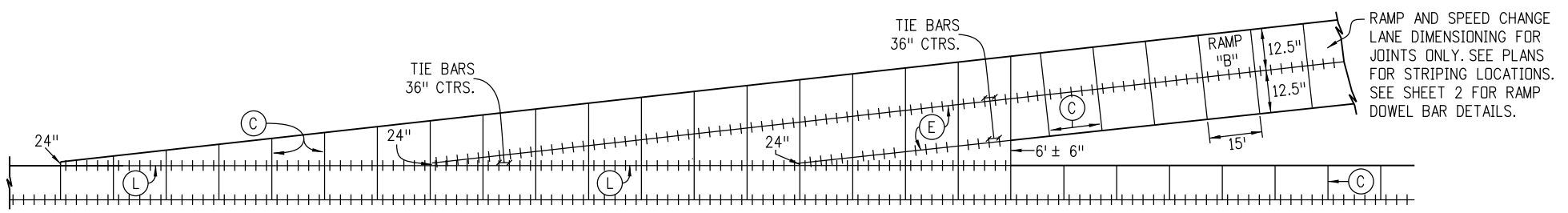
DETAILS ILLUSTRATING DOWEL PLACEMENT TOLERANCES
SEE SUBSECTION 412.13(b)2 FOR ALLOWED TOLERANCE VALUES.



RURAL TWO-LANE



MULTI-LANE WITH SPEED CHANGE LANE AND CONCRETE SHOULDERS



OPTIONAL LONGITUDINAL JOINT IN CENTER FOR SINGLE LANE SPEED CHANGE LANE

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 01/18/18 Initials: LTA	(R-X)	07/24/12	Changed Tie Bar spacing from 30" to 36".
Full Path: www.coloradodot.info/business/designsupport	(R-X)	01/18/18	Changed all (DC) and (T) joints to (C) joints. Reduced all 14 foot slabs to 13 feet.
Drawing File Name: 412010105.dgn	(R-X)		
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CONCRETE PAVEMENT JOINTS

Issued By: Project Development Branch on July 4, 2012

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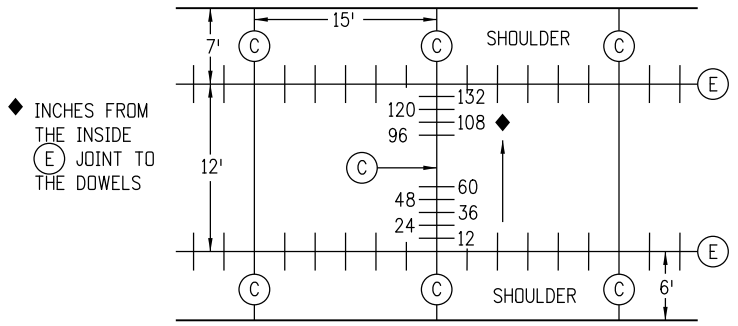
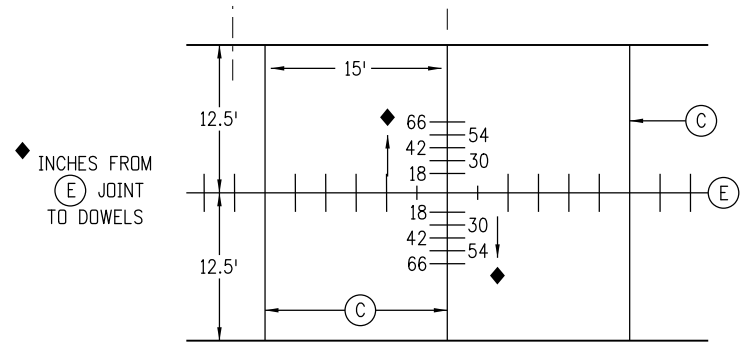
M-412-1
Sheet No. 1 of 5



RAMP "A" DOWEL BAR DETAIL
FOR C JOINT WITH A 12 FT. LANE

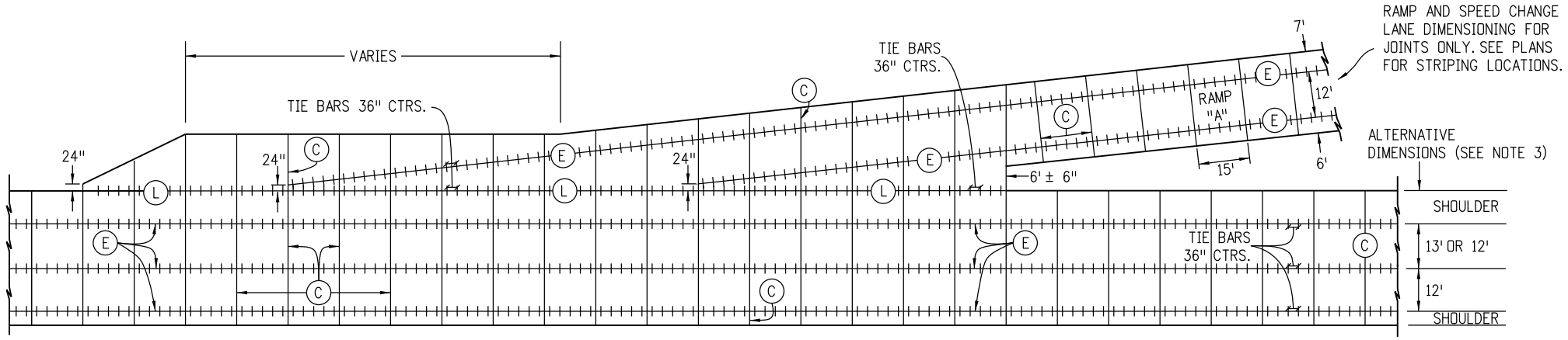


RAMP "B" DOWEL BAR DETAIL FOR C JOINT
WITH CENTER LONGITUDINAL SPLIT LANE

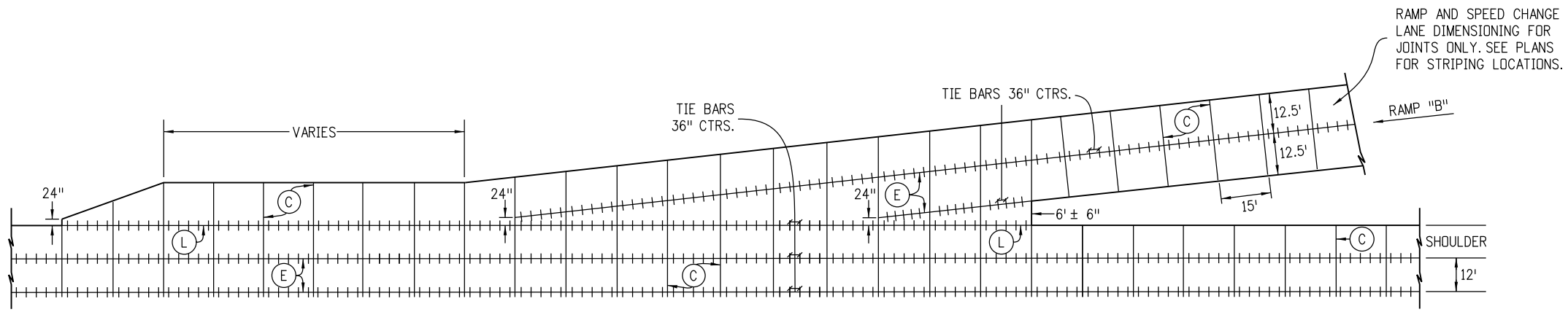
JOINT LEGEND

(SEE SHEET 5 FOR JOINT DETAILS)

- (C) TRANSVERSE CONTRACTION OR CONSTRUCTION
- (D) LONGITUDINAL CONSTRUCTION
- (L) (E) LONGITUDINAL CONSTRUCTION OR LONGITUDINAL CONTRACTION



MULTI-LANE WITH ACCELERATION AND DECELERATION LANES AND CONCRETE SHOULDERS



OPTIONAL LONGITUDINAL JOINT IN CENTER FOR SINGLE LANE ACCELERATION AND DECELERATION LANE

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 01/18/18 Initials: LTA	(R-X)	07/24/12	Changed Tie Bar spacing from 30" to 36".
Full Path: www.coloradodot.info/business/designsupport	(R-X)	01/18/18	Changed all (DC) and (T) joints to (C) joints. Reduced all 14 foot slabs to 13 feet.
Drawing File Name: 412010205.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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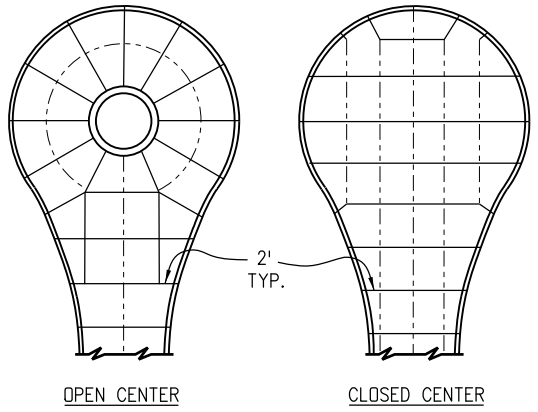


CUL-DE-SAC

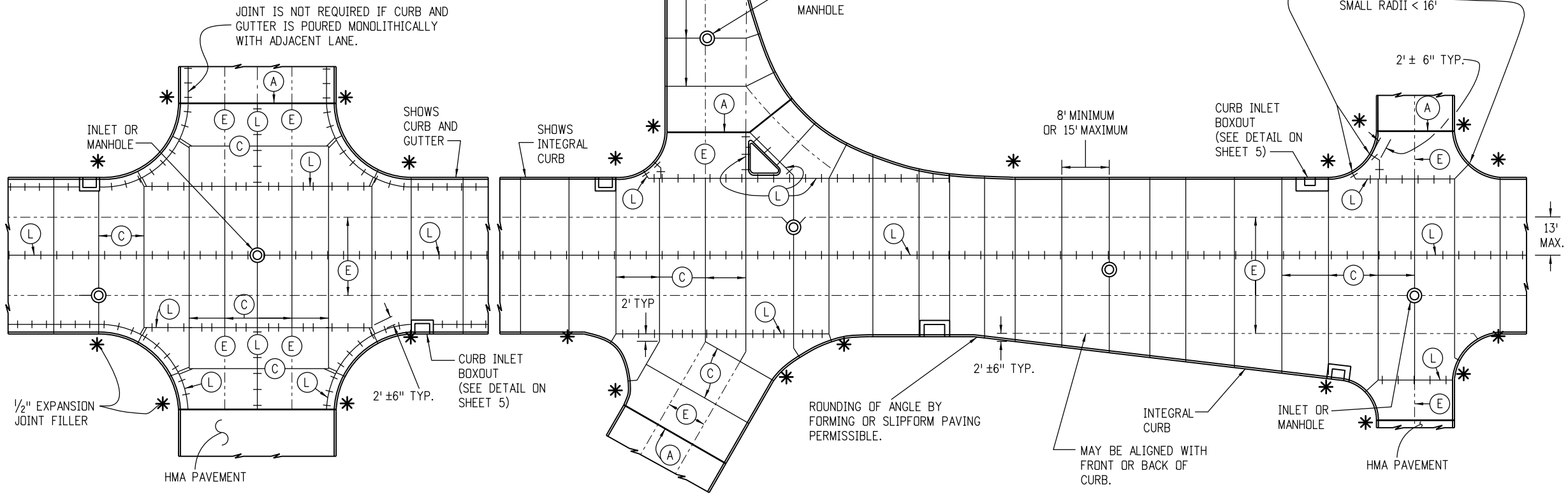
JOINT LEGEND

(SEE SHEET 5 FOR JOINT DETAILS)

- (A) EXPANSION
- (C) TRANSVERSE CONTRACTION OR CONSTRUCTION
- (D) LONGITUDINAL CONSTRUCTION
- (E) LONGITUDINAL CONTRACTION
- (L) LONGITUDINAL CONSTRUCTION

NOTES

1. LONGITUDINAL JOINTS SHALL BE PLACED ADJACENT TO LANE MARKINGS WHEN POSSIBLE, AND HAVE A MAXIMUM SPACING OF 13 FT. (15 FT. IS PERMITTED WITH MONOLITHIC CURB AND GUTTER).
2. CONSTRUCT TRANSVERSE JOINTS PERPENDICULAR TO THE CENTERLINE OF PAVEMENT AND EXTEND THROUGH THE CURB OR CURB AND GUTTER.
3. * PLACE ½ IN. MIN. EXPANSION JOINT FILLER IN TOP 6 IN. OF CURB JOINT AT INTERSECTION RETURN RADIUS POINTS.
4. THE CONTRACTOR SHALL, UNLESS OTHERWISE SHOWN ON THE PLANS, SELECT AND USE A BOND BREAKER AT INLETS, MANHOLES AND SIMILAR SIZE STRUCTURES. SMALLER STRUCTURES SUCH AS VALVE AND MONUMENT BOXES SHALL NOT REQUIRE A BOND BREAKER.
5. WHERE A LONGITUDINAL JOINT PASSES LESS THAN 1 FT. FROM A CAST-IN-PAVEMENT MANHOLE OR SIMILAR SIZE STRUCTURE, A TYPICAL 2 FT. RADIAL JOINT, AS SHOWN IN THE DETAILS, SHALL BE USED.
6. TRANSVERSE JOINTS SHALL EITHER INTERSECT THE CENTER OF CIRCULAR MANHOLES AND INLETS OR BE AT LEAST 4 FT. AWAY FROM THE EDGE OF CIRCULAR MANHOLES. SEE CURB INLET BOXOUT DETAIL ON SHEET 5.
7. TRANSVERSE CONSTRUCTION JOINTS SHALL BE LOCATED AT A (C) JOINT.
6. THE ENGINEERS SHALL HAVE AN OPTION TO USE INDIVIDUAL DOWELS IN THE (C) JOINT ON SHORT RUN (2' ± 6") TO CURB RADIUS RETURNS.



TYPICAL CURBED PAVEMENT JOINT LAYOUT

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 01/18/18 Initials: LTA	(R-X)	01/18/18	Changed all (DC) and (T) joints to (C) joints. Reduced all 14 foot slabs to 13 feet.
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Drawing File Name: 412010305.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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Sheet No. 3 of 5

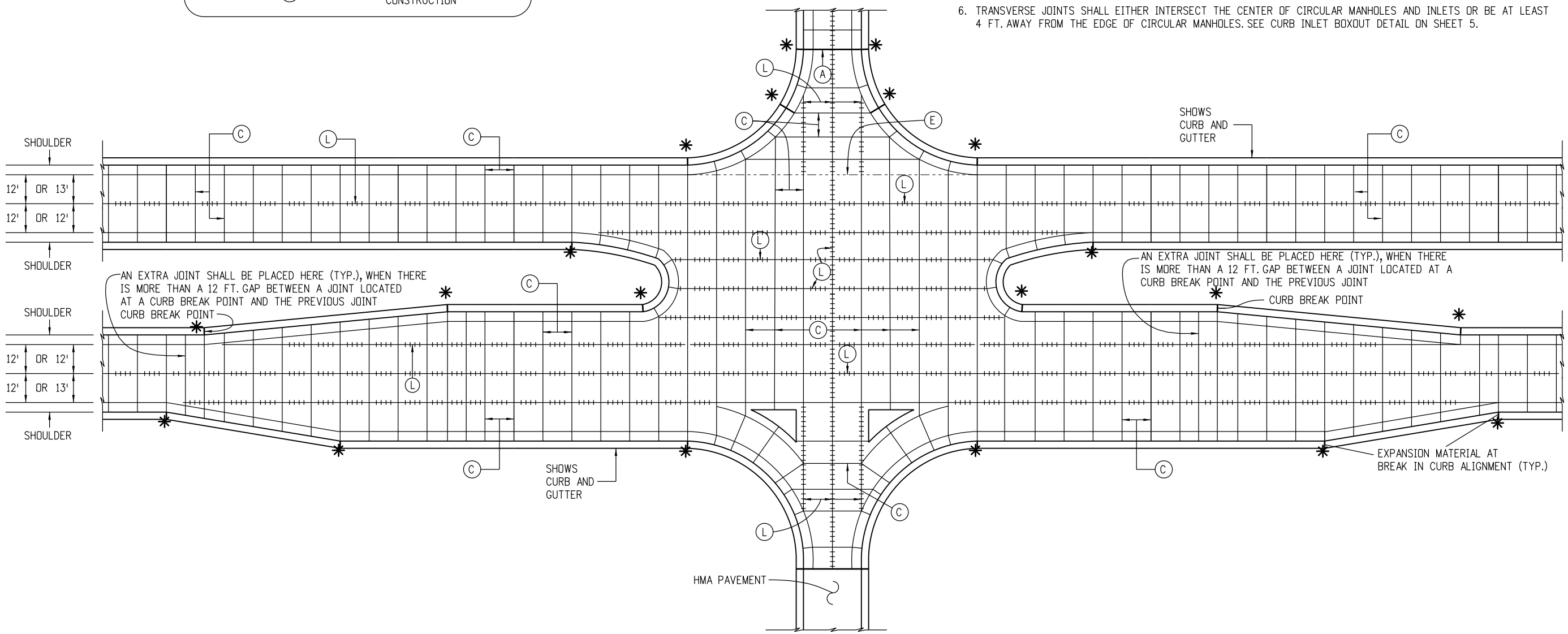
JOINT LEGEND

(SEE SHEET 5 FOR JOINT DETAILS)

- (A) EXPANSION
- (C) TRANSVERSE CONTRACTION OR CONSTRUCTION
- (D) LONGITUDINAL CONSTRUCTION
- (E) LONGITUDINAL CONTRACTION
- (L) LONGITUDINAL CONSTRUCTION

NOTES

1. LONGITUDINAL JOINTS SHALL BE PLACED ADJACENT TO LANE MARKINGS WHEN POSSIBLE, AND HAVE A MAXIMUM SPACING OF 13 FT. (15 FT. IS PERMITTED WITH MONOLITHIC CURB AND GUTTER).
2. CONSTRUCT TRANSVERSE JOINTS PERPENDICULAR TO THE CENTERLINE OF PAVEMENT AND EXTEND THROUGH THE CURB OR CURB AND GUTTER.
3. * PLACE ½ IN. MIN. EXPANSION JOINT FILLER IN TOP 6 IN. OF CURB JOINT AT INTERSECTION RETURN RADIUS POINTS.
4. THE CONTRACTOR SHALL, UNLESS OTHERWISE SHOWN ON THE PLANS, SELECT AND USE A BOND BREAKER AT INLETS, MANHOLES AND SIMILAR SIZE STRUCTURES. SMALLER STRUCTURES SUCH AS VALVE AND MONUMENT BOXES DO NOT REQUIRE A BOND BREAKER.
5. WHERE A LONGITUDINAL JOINT WOULD PASS LESS THAN 1 FT. FROM A CAST-IN-PAVEMENT MANHOLE OR SIMILAR SIZE STRUCTURE, A TYPICAL 2 FT. RADIAL JOINT, AS SHOWN IN THE DETAILS, SHALL BE USED.
6. TRANSVERSE JOINTS SHALL EITHER INTERSECT THE CENTER OF CIRCULAR MANHOLES AND INLETS OR BE AT LEAST 4 FT. AWAY FROM THE EDGE OF CIRCULAR MANHOLES. SEE CURB INLET BOXOUT DETAIL ON SHEET 5.



MULTI-LANE INTERSECTION WITH SPEED CHANGE LANE AND CONCRETE SHOULDERS

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 01/18/18 Initials: LTA	R-X	01/18/18	Changed all (DC) and (T) joints to (C) joints. Reduced all 14 foot slabs to 13 feet.
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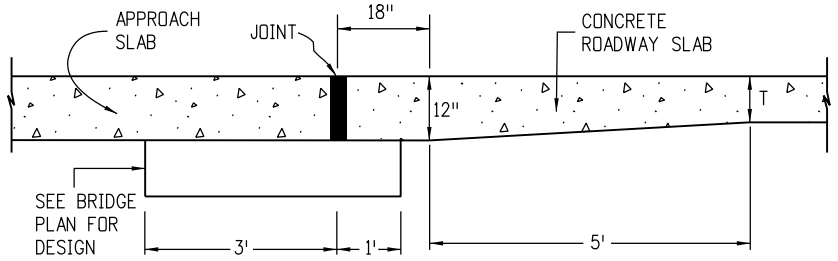
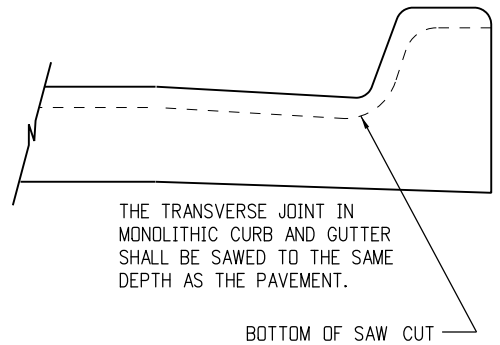


BRIDGE APPROACH



NOTE

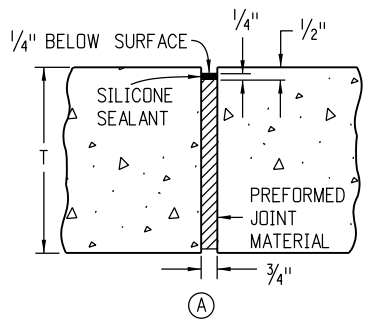
PAVEMENT THICKNESS (T), SHALL BE AS SHOWN ON THE PLANS.

PAVEMENT THICKNESS (T)	DOWEL BAR DIAMETER
7 IN. ≤ T ≤ 8 IN.	1 IN.
8 IN. ≤ T ≤ 10 IN.	1.25 IN.
10 IN. < T ≤ 15 IN.	1.50 IN.

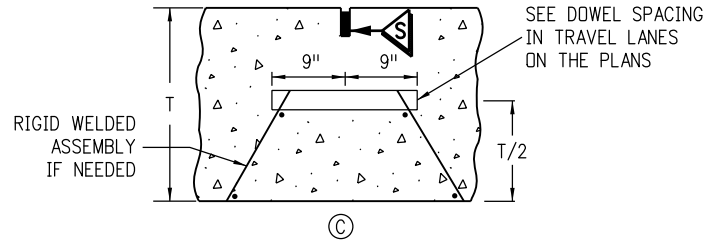
REINFORCING SIZE TABLE

TIE BAR SIZE IS NO. 5 WHEN PAVEMENT IS PLACED ON UNBOUND BASES.

TIE BAR IS NO. 6 WHEN PAVEMENT IS PLACED ON LIME TREATED SOIL, ASPHALT OR CEMENT TREATED, MILLED ASPHALT, OR RECYCLED ASPHALT BASES.

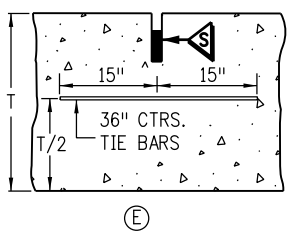


EXPANSION JOINT



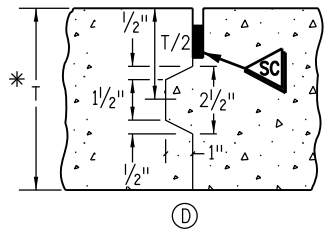
DOWELED TRANSVERSE CONSTRUCTION OR CONTRACTION JOINT

(TRANSVERSE WEAKENED PLANE JOINT)



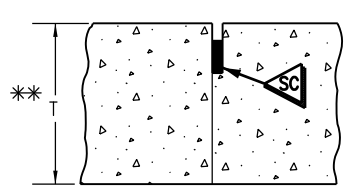
LONGITUDINAL CONTRACTION JOINT

(LONGITUDINAL WEAKENED PLANE JOINT)



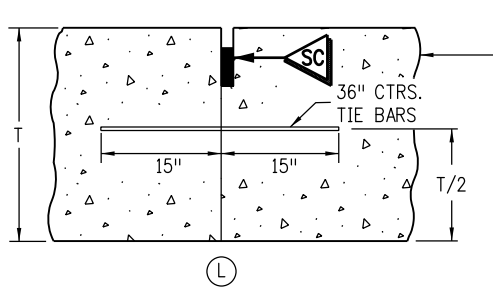
LONGITUDINAL CONSTRUCTION JOINT

* USE ONLY IF T ≥ 8 IN.
FORM ONLY FEMALE KEYWAY



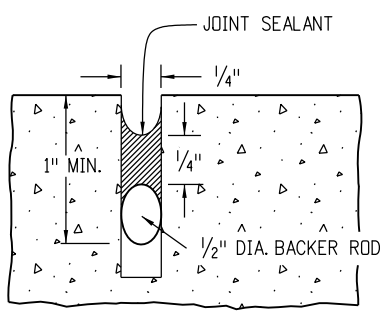
LONGITUDINAL CONSTRUCTION JOINT

** USE ONLY IF T < 8 IN.

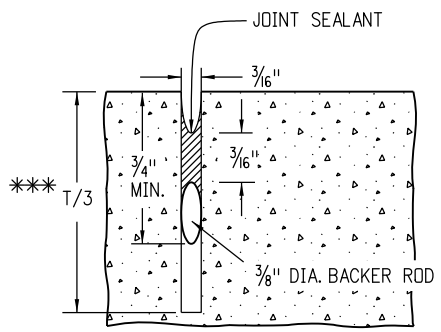


A KEYWAY IS ALLOWED TO FACILITATE USE OF BENT TIE BARS OR APPROVED TWO PIECE CONNECTORS

LONGITUDINAL CONSTRUCTION JOINT

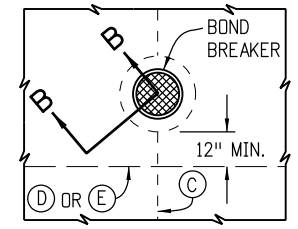


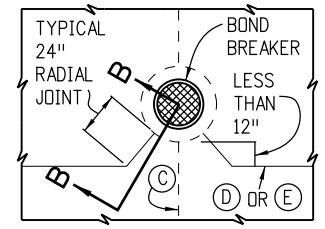
SEAL AT CONSTRUCTION JOINT SC



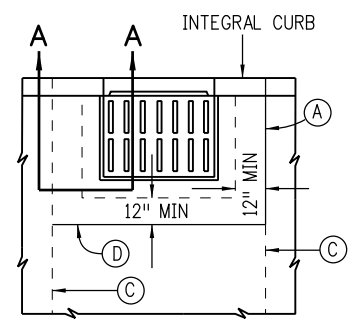
SAWED JOINT S

*** USE T/4 WHEN T < 8 IN.



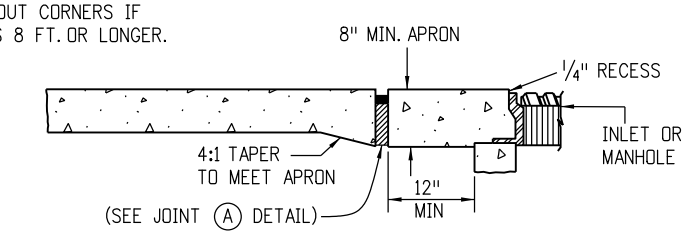


INLET OR MANHOLE CAST IN PAVEMENT

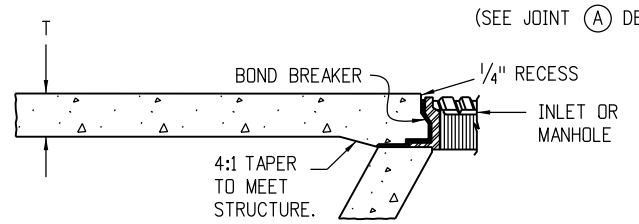


INSTALL TRANSVERSE JOINT AT BOTH BOXOUT CORNERS IF BOXOUT IS 8 FT. OR LONGER.

CURB INLET BOXOUT



SECTION A-A



SECTION B-B

BOND BREAKER SHALL BE COMPOSED OF PLASTIC SHEET, BUILDING PAPER OR OTHER APPROVED MATERIAL THAT PREVENTS BONDING.

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 01/18/18 Initials: LTA	R-X	07/24/12	Changed Tie Bar spacing from 30" to 36".
Full Path: www.coloradodot.info/business/designsupport	R-X		Modified the Reinforcing Size Table.
Drawing File Name: 412010505.dgn	R-X	01/18/18	Changed all DC and T joints to C joints.
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	R-X		

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Division of Project Support JBK/LTA

CONCRETE PAVEMENT JOINTS

Issued By: Project Development Branch on July 4, 2012

STANDARD PLAN NO.
M-412-1
Sheet No. 5 of 5

Construction Stormwater Management Plan

For

Las Colonias Business Park Phase 2

This CSWMP for Las Colonias Business Park Phase 2 is formatted and presented consistent with Mesa County SWMM and State of Colorado SWMP criteria. There are no exceptions to State required inclusions in the plan. The following CSWMP is organized and presented as follows:

Section 1: Site Description

Section 2: Site Map

Section 3: Stormwater Management Controls

Section 4: Final Stabilization

Section 5: Inspection and Maintenance Procedures

Appendix A: Site Map with BMP design details

Appendix B: Site Aerial Photo of Preexisting Vegetative Cover

Appendix C: CDPHE Section 9 Dewatering exemption letter

Appendix D: Inspection Report Example

Appendix E: Contractor Spill Prevention and Control Plan (SPCP) (To be included)

This CSWMP was prepared by The City of Grand Junction for The City of Grand Junction in accordance with good engineering, hydrologic, and pollution control practices. This CSWMP has been developed per the Colorado Discharge Permit System (CDPS) General Permit for Stormwater Discharges Associated with Construction Activity. It was also developed to meet City of Grand Junction, Mesa County and 5-2-1 Drainage Authority standards.

This CSWMP will be treated as a living document where erosion and sediment control measures can/will be amended and may be completely replaced with other "Best Management Practices" (BMPs) in an effort to prevent pollution or degradation to state waters.

When a change is made to this CSWMP, the CSWMP Administrator or qualified designee will note the change in both the inspection report as well as initial and date the CSWMP Site Map to reflect current site conditions.

This CSWMP and the CSWMP Site Map must be amended immediately by the CSWMP Administrator or qualified designee when the following occurs:

1. A change occurs requiring new or revised control measures.
2. Control measures are proven ineffective in controlling pollutants in stormwater runoff.
3. Control measures are no longer necessary.
4. Corrective measures are made onsite that result in changes.

When a control measure is proven ineffective, the permit is in noncompliance at that time. The permit will remain noncompliant until the ineffective control measure has been corrected.

CSWMP Administrator

Name	Title	Company	Phone	Email
1.				

Qualified Stormwater Personnel

Name	Title	Company	Phone	Email
1.				
2.				
3.				

1. Site Description

a) The nature of the construction activity at the site. The description should include the physical location and address or cross streets, type of project, a summary of the grading activities, installation of utilities, paving, excavation, landscaping, and the final disposition of the property.

The Las Colonias Business Park Phase 2 project has a total disturbance of 23.02 acres. The project is located south of Winters Avenue, southeast of the Riverside Parkway and north of the Colorado River. See Appendix B for an aerial view of the project.
Land disturbing activities at the site may consist of site grading, excavation, cuts and fills, material stockpiling, and other practices common in commercial development. Construction activities may include, but are not limited to, material import/export, concrete and asphalt placement, underground utility installation, building construction and landscaping.

b) The proposed sequence for major activities. Describe the sequence of events involved in the construction project, such as grading, excavation, final landscaping, etc.

1) Installation of site access and perimeter sediment controls.
2) Installation of temporary, interior erosion controls.
3) Site grading.
4) Concrete and Asphalt placement.
5) Underground utility installation.
6) Construction of Buildings and Restrooms.
7) Construction of permanent stormwater BMPs.
8) Revision of temporary stormwater BMPs to accommodate final landscaping.
9) Sodding and final landscaping.
10) Removal of temporary BMPs and final cleaning of permanent BMPs.

c) Estimates of the total area of the site, and the area and location expected to be disturbed by clearing, excavation, grading, or other construction activities.

Entire lot: 23.02 acres. Area to be disturbed: 23.02 acres.

d) A summary of any existing data used in the development of the site construction plans or SWMP that describe the soil or existing potential for soil erosion.

The site appears to contain a considerable amount of imported pit run fill of varying depths. NRCS reports mention that native soils on the project may consist of a wide range of alluvial soils deposited from changes in the river channel over the years, to include a sandy, silt clay. Groundwater and worn river gravel layers are likely to be encountered in excavations.
The loose, porous, open nature of the soil insures the ready penetration of water and can be subject to erosion.

e) A description of the existing vegetation at the site and an estimate of the percent vegetative ground cover.

Existing Vegetation on the site consists of various semi-desert shrubs and grasses such as sagebrush, rabbit brush and other plants. The undeveloped site has approximately 5% vegetative cover. See Appendix B for an aerial photo of existing

vegetation.

f) The location and description of all potential pollution sources, including ground surface disturbing activities, vehicle fueling, storage of fertilizers or chemicals, etc.

Sediment from ground disturbance will be the primary potential pollutant. Other potential sources are:

a. Concrete washout activities.
b. Equipment fueling and maintenance operations.
c. Building material soluble, paints, solvents, grout, mortar, stucco and adhesives.

g) The location and description of any anticipated allowable sources of non-stormwater discharge at the site, e.g., uncontaminated springs, landscape irrigation return flow, construction dewatering, and concrete washout.

The following are ALLOWABLE non-stormwater discharges and will be identified both in the CSWMP and on the CSWMP Site Map.

a. Concrete Washout. Discharges to the ground of concrete washout water associated with the washing of concrete tools and concrete mixer chutes. This will be in a clearly marked, contained area, current on the CSWMP Site Map. Discharges of concrete washout water must not leave the site as surface runoff or reach receiving waters as defined by the CDPHE permit.

   The bottom of the CWA will be above ground water. If not, it will be lined with an impermeable synthetic liner that is designed to control seepage.

   A portable washout container is optional.

b. Uncontaminated springs. There are no springs identified on-site.
c. Landscape irrigation return flow. To Be Determined.
d. Emergency firefighting activities. To Be Determined.

e. Construction Dewatering. CDPHE Section 9 Exemption letter, dated 7/11/2018. See Appendix C.

   Ground water is expected to be encountered during excavation for deep utilities and site ponds. When necessary to dewater the Contractor will be required to excavate a settlement pond(s) adjacent to the work to discharge to.

   The intent is to capture the water and allow to percolate. Within 30 days of construction of the pond(s) it shall be backfilled to comply with an exemption from the Authority of Solid Waste, section 9, Temporary Discharge to Impoundment. Impoundment locations shall fall in green space areas outside of building footprints, roadways, etc.

h) The name of the receiving water (s) and the size, type and location of any outfall(s). If the stormwater discharge is to a municipal separate storm sewer system, the name of that system, the location of the storm sewer discharge, and the ultimate receiving water(s).

Stormwater is conveyed through double 3' x 6' Reinforced Concrete Box Culverts at Winters Avenue, enters a 24" RCP water quality detention pond built during Phase 1, through two 36" RCPs crossing the Riverfront Trail and leaving site through an existing 36" RCP outfall that drains to the Colorado River. See Appendix A.

2. Site Map

The SWMP must include a site map showing the entire area and identifying the following components:
a) Construction site boundaries;
The site map clearly identifies the boundaries of the property. Please see Appendix A.
b) All areas of ground surface disturbance;
Ground surface disturbance will occur on the entire property. Please see Appendix A.
c) Areas of cut and fill;
Site survey cut and fill information will be available as needed. Site contours are properly labeled. Please see Appendix A.
d) Areas used for storage of building materials, equipment, soil, or waste;
The contractor will determine a staging area prior to construction. The contractor will make the requisite changes to the CSWMP Site Map (Appendix A) before storing materials on the site.
e) Locations of dedicated asphalt or concrete batch plants;
There will be no dedicated asphalt or concrete batch plants on this project.
f) Locations of all structural BMPs;
Please see the CSWMP Site Map for specific locations of each individual structural BMP designated on the project as well as installation drawings of the BMPs selected. Please see Appendix A.
g) Locations of non-structural BMPs as applicable; and
Please see the CSWMP Site Map for specific locations of each individual non-structural BMP designated on the project as well as installation drawings of the BMPs selected. Please see Appendix A.
h) Locations of springs, streams, wetlands and other surface waters.
The project's south property line flanks the north banks of the Colorado River. Please See Appendix B.

3. Stormwater Management Controls

The SWMP must include a description of all stormwater management controls that will be implemented as part of the construction activity to control pollutants in stormwater discharges. The appropriateness and priorities of stormwater management controls in the SWMP shall reflect the potential pollutant sources identified at the facility. The description of the stormwater management controls shall address the following, at a minimum:

a) SWMP Administrator- The SWMP shall identify a specific individual(s), position, or title who is responsible for developing, implementing, maintaining, and revising the SWMP. The activities and responsibilities of the administrator shall address all aspects of the facility's SWMP.

The CSWMP Administrator will be selected prior to the commencement of site activities. The CSWMP Administrator is responsible for developing, maintaining, implementing, and revising the CSWMP. Remember that the CSWMP administrator is the contact for all on-site CSWMP-related issues and is the person responsible for its accuracy, completeness, and implementation. The CSWMP Administrator will be a person with sufficient authority to adequately manage and direct day-to-day stormwater quality management activities at the site.

b) Identification of Potential Pollution Sources- All potential pollutant sources, including materials and activities, at a site must be evaluated for the potential to contribute pollutants to stormwater discharges. The SWMP shall identify and describe those sources determined to have the potential to contribute pollutants to stormwater discharges, and the sources must be controlled through BMP selection and implementation, as required in paragraph (c) below. At a minimum each of the following sources and activities shall be evaluated for the potential to contribute pollutants to stormwater discharges, and identified in the SWMP if found to have such potential:

1) all disturbed and stored soils;

Disturbed soils that produce dust and stockpiles from excavations with sheet flow potential are pollutant concerns. BMPs may include surface roughening, moisture conditioning via water truck, tarped transport vehicles, construction phasing, earth dikes, "green" dust surfactants, material export, high wind shutdown, seed and mulch or other means necessary to control erosion and sediment transport.

2) vehicle tracking of sediments;

Vehicles tracking sediments are a potential pollutant source. BMPs to mitigate off-site vehicle tracking include angular aggregate tracking pads at construction access points, operator awareness, exit surveys and street sweeping.

3) management of contaminated soils;

This project has the potential to contaminate soils with fuels, oils, grease or other fluids that may be on site. The contractor will clean up the contaminated soils as part of their Spill Prevention and Control Plan (SPCP). Appendix E.

4) loading and unloading operations;

This project has the potential for spills during material delivery while loading or unloading. The contractor will clean up in accordance with the contractor's Spill Prevention and Control Plan (SPCP), Appendix E.

5) outdoor storage activities (building materials, fertilizers, chemicals, etc.

Outdoor storage of building materials, fertilizers, chemicals, or other potentially soluble material have the potential to contaminate stormwater from spills or leaks. No outdoor storage is proposed, however, if needs arise, the storage area will have secondary containment in the form of earth dikes, silt fence, negative grade, etc. with the designated location clearly marked on the CSWMP Site Map.

6) vehicle and equipment maintenance and fueling;

Vehicular fueling and equipment maintenance has the potential to contribute fuel, oils, and other fluids to the ground. Construction equipment shall be routinely checked and all fluid spills will be cleaned up as part of the contractor's Spill Prevention and Control Plan (SPCP) in Appendix E.

7) significant dust or particulate generating processes;

Any haul road or stockpile left unattended for any length of time has the potential to generate significant dust. BMPs to control dust include surface roughening, moisture conditioning via water truck, construction phasing, earth dikes, "green" dust surfactants, tarped transport vehicles, high wind project shutdown, travel on paved surfaces, excess material export, seed and mulch or other means necessary.

8) routine maintenance activities involving fertilizers, pesticides, detergents, fuels, solvents, oils, etc.;

There is a potential for a spill during routine maintenance activities. In the event of a spill, the contractor will clean up the spill immediately as part of their Spill Prevention and Control Plan (SPCP) in Appendix E.

9) On-site waste management practices (waste piles, liquid wastes, dumpsters, etc.);

On-site waste maybe generated during all phases of construction. Potential pollutants include concrete wash water, asphalt debris, worker trash, off site wind-blown debris, building construction materials to include paint, solvents, mortar, grout, masonry, stucco, punctured bags of dry mix chemicals or additives, wood debris, drywall debris, roofing materials, nails, etc.

Control measures include good housekeeping procedures, removing waste before containers are full, secondary containment on all mixing operations and familiarity with the locations and contents of the contractor's Spill Prevention and Control Plan (SPCP) in Appendix E.

10) concrete truck/equipment washing, including concrete truck chute and associated fixtures and equipment;

Concrete waste and concrete wash water are potential pollutants that will be generated on-site. Discharges to the ground of concrete washout water associated with the washing of concrete tools and concrete mixer chutes is allowed in a dedicated Concrete Washout Area (CWA), clearly marked both in the field and on the CSWMP Site Map.

The bottom of the CWA will be above ground water. If not, it will be lined with an impermeable synthetic liner that is designed to control seepage.

All washout activities shall be conducted within a contained area.

A portable washout container is optional.

11) dedicated asphalt and concrete batch plants;

No asphalt or concrete batch plants will be built.

12) non-industrial waste sources such as worker trash and portable toilets;

Worker trash and portable toilets have pollutant potential.
The contractor shall provide waste receptacles on the job site and portable toilets that are routinely serviced as well as staked down to prevent tipping during high winds.

13) other areas or procedures where potential spills can occur.

No other areas have been identified at this time.

c) Best Management Practices. The SWMP shall identify and describe appropriate BMPs, including, but not limited to, those required by paragraphs 1 through 8 below, that will be implemented at the facility to reduce the potential of the sources identified in part b, above, to contribute pollutants to stormwater discharges. The SWMP shall clearly describe the installation and implementation specifications for each BMP identified in the SWMP to ensure proper implementation, operation, and maintenance of the BMP.

1. Structural Practices for Erosion Control. The SWMP shall clearly describe and locate all structural practices implemented at the site to minimize erosion and sediment transport. Practices may include, but are not limited to: straw bales, wattles/sediment control logs, silt fences, earth dikes, drainage swales, sediment traps, subsurface drains, pipe slope drains, inlet protection, outlet protection, gabions, and temporary or permanent sediment basins.

1. Stabilized Construction Entrance (3).
See CSWMP Site Map, page 115 for locations, page 113 for installation and maintenance details.
2. Culvert Outlet Trap with Anchored Straw Bale Barrier (4).
See CSWMP Site Map, page 115 for locations, page 113 for installation and maintenance details.
3. Erosion Log Toe of Slope Protection.
a. Joining Erosion Logs.
See CSWMP Site Map, page 115 for locations, page 114 for installation and maintenance details.
4. (Type II) Storm Drain Inlet Protection (20)
See CSWMP Site Map, page 115 for locations, page 114 for installation and maintenance details.
5. Other Structural "Best Management Practices" that are to be implemented to minimize erosion and control sediment transport are:
- Concrete Washout Area (CWA). This area shall be clearly marked. The bottom of the CWA will be above ground water. If not, it will be lined with an impermeable synthetic liner that is designed to control seepage. See fact sheet for CWA installation and maintenance procedures in Appendix A. A portable facility is

an option.

- Other structural BMP erosion and sediment control measures to be utilized on-site may include Silt Fence, Rock Socks and Earth Dikes/Drainage Swales. See fact sheets for installation and maintenance procedures in Appendix A.

2) Non-Structural Practices for Erosion and Sediment Control. The SWMP shall clearly describe and locate, as applicable, all non-structural practices implemented at the site to minimize erosion and sediment transport. Description must include interim and permanent stabilization practices, and site-specific scheduling for implementation of the practices. The SWMP should include practices to ensure that existing vegetation is preserved where possible. Non-structural practices may include, but are not limited to: temporary vegetation, permanent vegetation, mulching, geotextiles, sod stabilization, slope roughening, vegetative buffer strips, protection of trees, and preservation of mature vegetation.

Non-Structural BMP sequencing:

1. Efforts will be made to maintain pre-existing vegetation within 50 feet of the Colorado River.
2. Minimize the disturbance of existing vegetation, when possible.
3. Condition soils to mitigate dust.
4. Roughen slopes, where possible, to minimize erosion.
5. Temporary vegetation may follow the construction of the building pads and installation of underground irrigation.
6. Permanent vegetation. Refer to Site Landscape Plan.

3) Phased BMP Implementation The SWMP shall clearly describe the relationship between the phases of construction, and the implementation and maintenance of both structural and non-structural stormwater management controls. The SWMP must identify the stormwater management controls to be implemented during the project phases, which can include, but are not limited to, clearing and grubbing; road construction; utility and infrastructure installation; vertical construction; final grading; and final stabilization.

1. Installation of vehicle tracking pad and perimeter sediment controls.
2. Installation of Construction Staging Area.
3. Rough Grade Site Profile.
4. Slope Roughening of slopes 3:1 or greater.
5. Install Concrete Washout.
6. Utility Installation.
7. Installation of off-site storm inlet protection.
8. Installation of curb, gutter and sidewalks.
9. Paving.
10. Remove temporary interior structural BMPs to accommodate final grading.
11. Replacement of temporary interior structural BMPs after final grading, as needed.
12. Final Stabilization.
13. BMP removal.

4) Materials Handling and Spill Prevention. The SWMP shall clearly describe and locate all practices implemented at the site to minimize impacts from procedures or significant materials that could contribute pollutants to runoff. Such procedures or significant materials could include: exposed storage of building materials; paints and solvents; fertilizers or chemicals; waste material; and equipment maintenance or fueling procedures. Areas or procedures where potential spills can occur must have spill prevention and response procedures identified in the SWMP.

Potential pollutants may include but are not limited to, contaminated soils from

fueling or equipment maintenance operations, building material mixing operations, fertilizers or chemicals that carry the potential to be in violation of the federal Clean Water Act and the Colorado Water Quality Control Act.

Please refer to contractor's Spill Prevention and Control Plan (SPCP) in Appendix E.

The contractor shall immediately contact the CDPHE (1-877-518-5608) to report spills that may result in a non-permitted discharge of pollutants to State waters.

Consistent with the requirements of the CDPHE permit, all pollutants other than sediment will be secondary contained and properly protected from the elements at all times.

5) Dedicated Concrete or Asphalt Batch Plants. The SWMP shall clearly describe and locate all practices implemented at the site to control stormwater pollution from dedicated concrete batch plants or dedicated asphalt batch plants covered by this certification.

No concrete or asphalt batch plants will be implemented on this project.

6) Vehicle Tracking Control. The SWMP shall clearly describe and locate all practices implemented at the site to control potential sediment discharges from vehicle tracking. Practices must be implemented for all areas of potential vehicle tracking, and can include: minimizing site access; street sweeping or scraping; tracking pads; graveled parking areas; requiring that vehicles stay on paved areas on-site; wash racks; contractor education; and/or sediment control BMPs, etc.

Vehicles tracking sediments are a potential pollutant source. BMPs to mitigate off-site vehicle tracking include angular aggregate tracking pads at construction access points, operator awareness, exit surveys and street sweeping.

Please refer to the CSWMP Site Map, Appendix A, for project tracking control locations. In the event changes are needed, both the CSWMP and the CSWMP Site Map will be amended to reflect current conditions.

7) Waste Management and Disposal, Including Concrete Washout. The SWMP shall clearly describe and locate the practices implemented at the site to control stormwater pollution from all construction site wastes (liquid and solid), including concrete washout activities. The practices used for concrete washout must ensure that these activities do not result in the contribution of pollutants associated with the washing activity to stormwater runoff. The SWMP shall clearly describe and locate the practices to be used that will ensure that no washout water from concrete washout activities is discharged from the site as surface runoff or to surface waters.

On-site waste maybe generated during all phases of construction. Potential pollutants include concrete wash water, asphalt debris, worker trash, off site wind-blown debris, building construction materials to include paint, solvents, mortar, grout, masonry, stucco, punctured bags of dry mix chemicals or additives, wood debris, drywall debris, roofing materials, nails, etc.

Concrete waste and concrete wash water are potential pollutants that will be generated on-site. Discharges to the ground of concrete washout water associated with the washing of concrete tools and concrete mixer chutes is allowed in a dedicated Concrete Washout Area (CWA), which is to be clearly

marked both in the field and on the CSWMP Site Map.

All washout activities will be conducted within a contained area.

Concrete Washout Area (CWA). The bottom of the CWA will be above ground water. If not, it will be lined with an impermeable synthetic liner that is designed to control seepage.

A portable washout is an option.

The CWA location will be kept current on the CSWMP Site Map and clearly marked.

8) Groundwater and Stormwater Dewatering. The SWMP shall clearly describe and locate the practices implemented at the site to control stormwater pollution from the dewatering of groundwater or stormwater from excavations, wells, etc. Part I.D.3.d of the permit authorizes the conditional discharge of construction dewatering to the ground. For any construction dewatering of groundwater not authorized under a separate CDPS discharge permit, the SWMP shall clearly describe and locate the practices to be used that will ensure that no groundwater from construction dewatering is discharged from the site as surface runoff or to surface waters.

Construction Dewatering. CDPHE Section 9 Exemption, dated 7/11/2018.

Ground water is expected to be encountered during excavation for deep utilities and site ponds. When necessary to dewater the Contractor will be required to excavate a settlement pond(s) adjacent to the work to discharge to.

The intent is to capture the water and allow to percolate. Within 30 days of construction of the pond(s) it shall be backfilled to comply with an exemption from the Authority of Solid Waste, section 9, Temporary Discharge to Impoundment. Impoundment locations shall fall in green space areas outside of building footprints, road ways, etc.

See Appendix C.

4. Final Stabilization and Long-term Stormwater Management

a) The SWMP shall clearly describe the practices used to achieve final stabilization of all disturbed areas at the site, and any planned practices to control pollutants in stormwater discharges that will occur after construction operations have been completed at the site. b) Final stabilization practices for obtaining a vegetative cover should include, as appropriate: seed mix selection and application methods; soil preparation and amendments; soil stabilization practices (e.g. crimed straw, hydro mulch or rolled erosion control products); and appropriate sediment control BMPs as needed until final stabilization is achieved; etc.

Control measures will be selected for areas of the project not covered by pavement, concrete, or structures. Temporary BMP's will remain in place if required in the Landscape Plan. Sediment and erosion control BMPs that were installed for construction may have to be removed with new BMPs installed to protect the landscaped areas until 70% revegetation is achieved. This includes but is not limited to, mulching, sod stabilization and the protection of trees.

Per the permit requirements, these BMPs also need to be located on the map, and you may find it helpful to develop a second map rather than try and fit it on the construction BMP map.

c) Final stabilization is reached when all ground surface disturbing activities at the site have been completed, and uniform vegetative cover has been established within an individual plant density of at least 70 percent of pre-disturbance levels, or equivalent permanent, physical erosion reduction methods have been employed.

Existing vegetation covers around 5% of the native, semi-desert brush and grasses on site. Remedial measures have occurred on this site in the past and the majority of the site has been replaced with imported pit run of varying thickness. See Appendix B.

Final Stabilization is considered complete with the following:

1. All ground disturbing activities are complete.
2. Appropriate sediment control measures are in place.
3. Seed mix, soil preparation and soil stabilization methods have been applied.
4. At least 70% of the site has a uniform vegetative cover.
5. Temporary control measures can be removed once final stabilization has been determined by the CSWMP Administrator.

5. Inspection and Maintenance Procedures

a) The SWMP shall clearly describe the inspection and maintenance procedures implemented at the site to maintain all erosion and sediment control practices and other protective practices identified in the SWMP, in good and effective operation condition.

During construction, the CSWMP Administrator or designee, shall make periodic inspections of:

a. The site perimeter.
b. All disturbed areas.
c. Haul routes.
d. Material and Waste Storage Areas.
e. Locations with potential to discharge off-site.
f. Vehicle exits.

Site inspections will start within 7 calendar days of the commencement of construction activities on site.

Inspections will occur a minimum of every 14 days or within 24 hours of any measured precipitation event of ¼" or more on record with the National Oceanic and Atmospheric Administration (NOAA).

Please refer to the CDPHE permit for longer periods of site inactivity.

When a control measure is proven ineffective, the permit is in noncompliance at that time. The contractor will remain noncompliant until the ineffective control measure has been corrected.

Please see the example of a field inspection report form in Appendix D.

If other inspection reports are used, they will follow the guidelines of the CDPHE permit.

Please see the CSWMP Site Map (Appendix A).

1. Stabilized Construction Entrance (3).
See CSWMP Site Map, page 115 for locations, page 113 for installation and maintenance details.
2. Culvert Outlet Trap with Anchored Straw Bale Barrier (4).
See CSWMP Site Map, page 115 for locations, page 113 for installation and maintenance details.
3. Erosion Log Toe of Slope Protection.
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See CSWMP Site Map, page 115 for locations, page 114 for installation and maintenance details.
4. (Type II) Storm Drain Inlet Protection (20)
See CSWMP Site Map, page 115 for locations, page 114 for installation and maintenance details.
5. Other Structural "Best Management Practices" that are to be implemented to minimize erosion and control sediment transport are:

- Concrete Washout Area (CWA). This area shall be clearly marked. The bottom of the CWA will be above ground water. If not, it will be lined with an impermeable synthetic liner that is designed to control seepage. See fact sheet for CWA installation and maintenance procedures in Appendix A.

- Other structural BMP erosion and sediment control measures to be utilized on-site may include Silt Fence, Rock Socks and Earth Dikes/Drainage Swales. See fact sheets for installation and maintenance procedures in Appendix A.

Appendix A

EROSION CONTROL MEASURES

Contractor to update the SWMP according to specific construction phasing and stormwater management practices for current construction activity when warranted.

Site Description

1. The site has a total disturbance area of 23.02 acres with the majority of disturbance being caused by the development of Phase 2 of the Las Colonias Business Park.
2. Stormwater leaves the site through double 3' x 6' Reinforced Concrete Box Culverts, a 24" RCP built from the Water Quality Pond during Phase 1, two 36" RCP's crossing the riverfront path just ahead of the pedestrian bridge and another 36" RCP in the same area where they all drain directly to the Colorado River.
3. Proposed utilities for this project include: storm drain, sanitary sewer, potable water, gas, electricity, telephone, cable television, and broadband infrastucture.

EROSION CONTROL MEASURES

Performance Standards

The general requirements for erosion control work shall be as follows:

1. Any grading shall be conducted in such a manner so as to effectively reduce accelerated soil erosion and resulting sedimentation.
2. All grading shall be designed, constructed and completed in such a manner so that exposed area of any disturbed land shall be limited to the shortest time period.
3. Sediment caused by accelerated soil erosion shall be removed from runoff water before leaving the site.
4. The contractor shall try to minimize the amount of disturbance necessary for the construction project by preserving established vegetation to act as a BMP.

During Construction (Temporary Measures)

1. Anchored Straw Bales (ASB): The use of hay bales is proposed as a culvert outlet trap at the junction of the outlet of the tripple 3x7 and double 3x6 RCBC's to stop any sediment produced from stormwater runoff from continueing to the new temporary drain channel as shown on the construction drawings. Hay bales will also be used further as a sediment trap where the new temporary channel ties to the existing channel downstream of the culvert outlet trap.
2. Erosion Logs: The use of erosion logs is proposed at the toe of cut and fill slopes and other areas where sediment from upstream flows may spill to existing drainage ways. Other locations are shown on the plan. Installation shall be in accordance with the detail as shown on the plans.
3. Inlet Protection: The use of inlet protection is proposed at all inlets to trap sediment before entering the storm drain system.

After Construction (Permanent Measures)

1. Rip-Rap: The use of rip-rap per construction drawings is proposed for around the outlet of several pipes as noted and shown.

1. Reseeding: the majority of the site will be seeded with grass or other plantings as shown in the landscape plans. All disturbed areas will be seeded if otherwise not proposed to be paved.

Maintenance

1. The contractor or his designated representative shall make routine checks on all erosion control measures to determine if repairs or sediment removal is necessary.
2. After each rainfall or moderate snow melt, erosion control measures are to be checked. If repairs are needed, they shall be completed immediately.
3. Silt and sediment shall be removed when they reach a height of one-half of the barrier (erosion log or anchored straw bale).
4. When temporary measures are to be removed, any silt and sediment deposits shall be removed and spread evenly in fill areas.

General Notes

1. The SWMP establishes the minimum acceptable requirements for stormwater pollution prevention on site. The Contractor may supplement these requirements as appropriate for specific construction activites. Any changes to the practices shown on this plan must be reviewed by Project Inspector/Engineer prior to implementation.
2. At all times during construction, erosion and sediment control shall be maintained by the contractor or his designated representative.
3. Erosion control systems shall be installed as grading progresses.
4. The Contractor shall provide and maintain a portable concrete washout facilty.
5. Details shown are schematic only. Adjust as necessary to fit field conditions.
6. Erosion bales shall be placed to avoid runoff flowing between, around or under bales. Bales shall be anchored with 2" x 2" x 4' wooden stakes or #4 reinforcing bars, two per bale (see details for further instructions).
7. Negative impacts to downstream areas (or receiving waters) caused by the slope grading to be monitored and corrected by the contractor.
8. Construction traffic entrances shall be cleaned on a continual basis during slope grading.
9. A copy of the SWMP and construction plans shall be maintained on site at all times.

DESCRIPTION	DATE
REVISION △	
REVISION △	
REVISION △	
REVISION △	

DRAWN BY JCS DATE 2018
DESIGNED BY JCS DATE 2018
CHECKED BY TCP DATE 2018
APPROVED BY TCP DATE 2018

SCALES: PLAN HORIZONTAL 1" = 50'

CITY OF Grand Junction COLORADO

PUBLIC WORKS
ENGINEERING DIVISION

LAS COLONIAS BUSINESS PARK PHASE 2
STORM WATER MANAGEMENT NOTES

112

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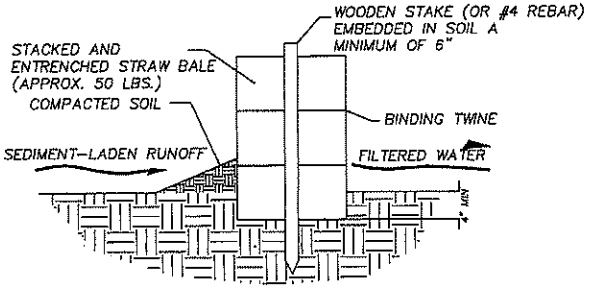
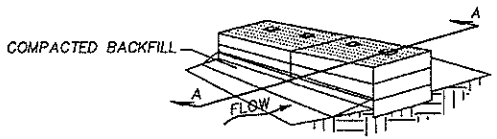
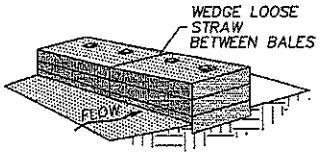


SECTION A–A



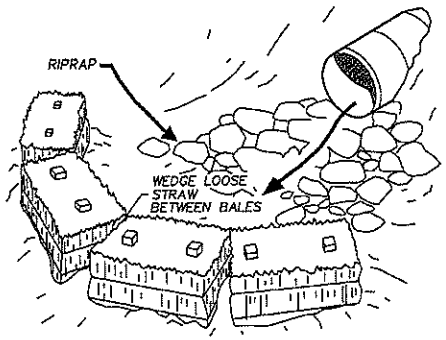
STEP 3. PLACE COMPACTED BACKFILL AGAINST THE UPSTREAM FACE.



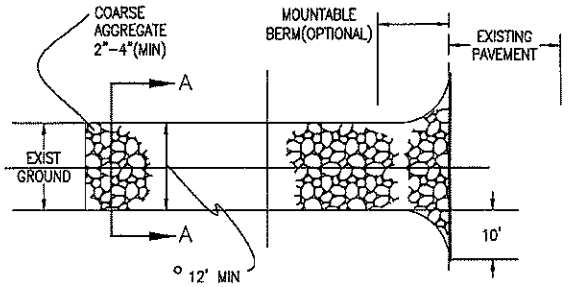
STEP 2. PLACE BALE IN TRENCH, STAKE IN PLACE

STEP 1. EXCAVATE TRENCH FOR BALES

BALE INSTALLATION PROCEDURE

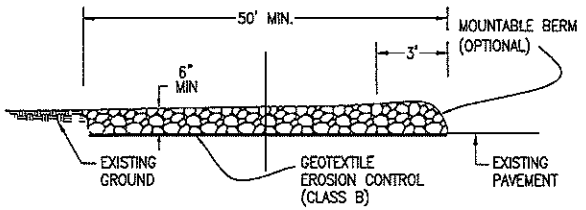


CULVERT OUTLET TRAP
n.t.s.
ANCHORED STRAW BALE (A.S.B.)

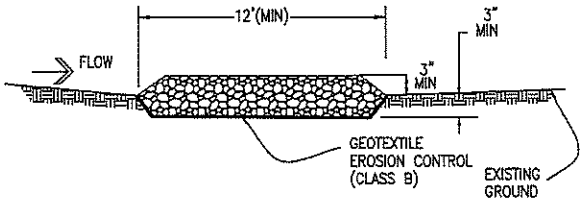


° MUST EXTEND FULL WIDTH OF INGRESS AND EGRESS OPERATION.

PLAN VIEW



SIDE ELEVATION



SECTION A–A

STABILIZED CONSTRUCTION ENTRANCE

DESCRIPTION	DATE
REVISION 1	
REVISION 2	
REVISION 3	
REVISION 4	

DRAWN BY JCS DATE 2018
DESIGNED BY JCS DATE 2018
CHECKED BY TCP DATE 2018
APPROVED BY TCP DATE 2018
SCALES: PLAN

CITY OF Grand Junction COLORADO

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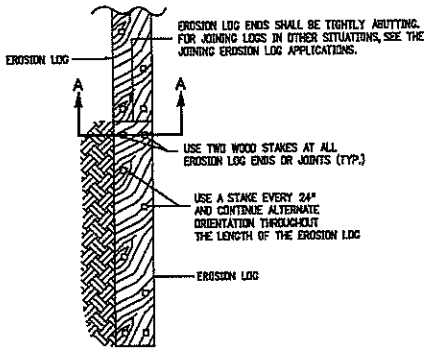
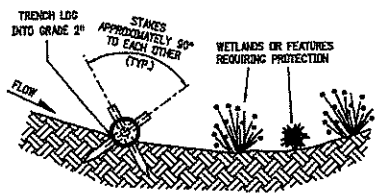
ENGINEERING DIVISION

LAS COLONIAS BUSINESS PARK PHASE 2
STORM WATER MANAGEMENT DETAILS

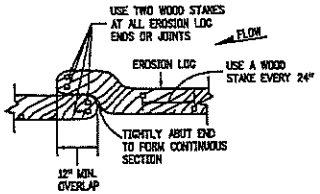


PLAN VIEW

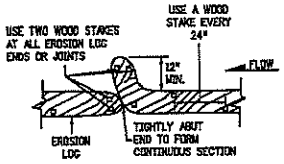


SECTION A-A

TYPICAL STAKE INSTALLATION

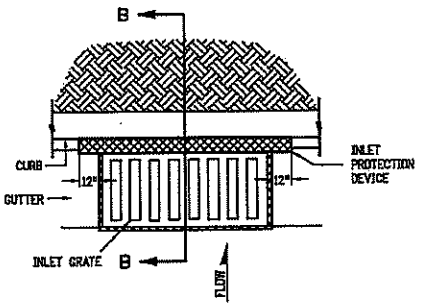


OVERLAP JOINING DETAIL

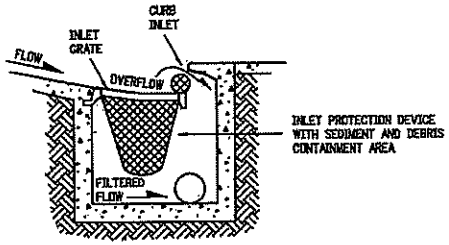


J-HOOK JOINING DETAIL

JOINING EROSION LOG APPLICATIONS



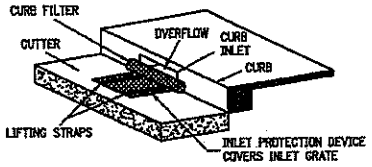
PLAN VIEW



SECTION B-B

OPTION A

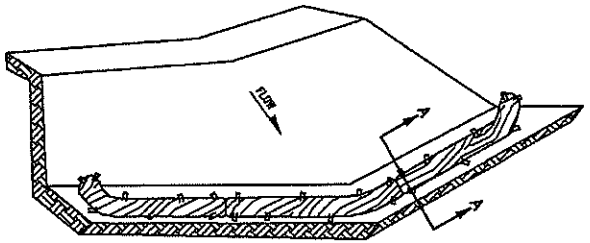
STORM DRAIN INLET PROTECTION (TYPE II)



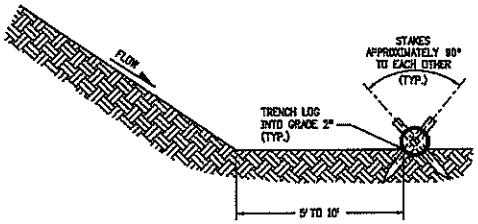
ISOMETRIC VIEW

OPTION B

STORM DRAIN INLET PROTECTION (TYPE II)



ISOMETRIC VIEW



SECTION A-A

NOTES:

1. EROSION LOGS USED AT TOE OF SLOPE SHALL BE PLACED 5 TO 10 FEET BEYOND TOE OF SLOPE TO PROVIDE STORAGE CAPACITY.
2. EROSION LOGS SHALL BE PLACED ON THE CONTOUR WITH ENDS FLARED UP SLOPE.
3. SEE SHEET 2 OF 11 FOR JOINING LOGS DETAIL.

EROSION LOGS PAY ITEMS	
NUMBER	DESCRIPTION
208-00012	TYPE 1 (9")
208-00002	TYPE 1 (12")
208-00013	TYPE 1 (20")
208-00007	TYPE 2 (8")
208-00008	TYPE 2 (12")
208-00009	TYPE 2 (18")

EROSION LOG TOE OF SLOPE PROTECTION

DESCRIPTION	DATE
REVISION 4	
REVISION 3	
REVISION 2	
REVISION 1	

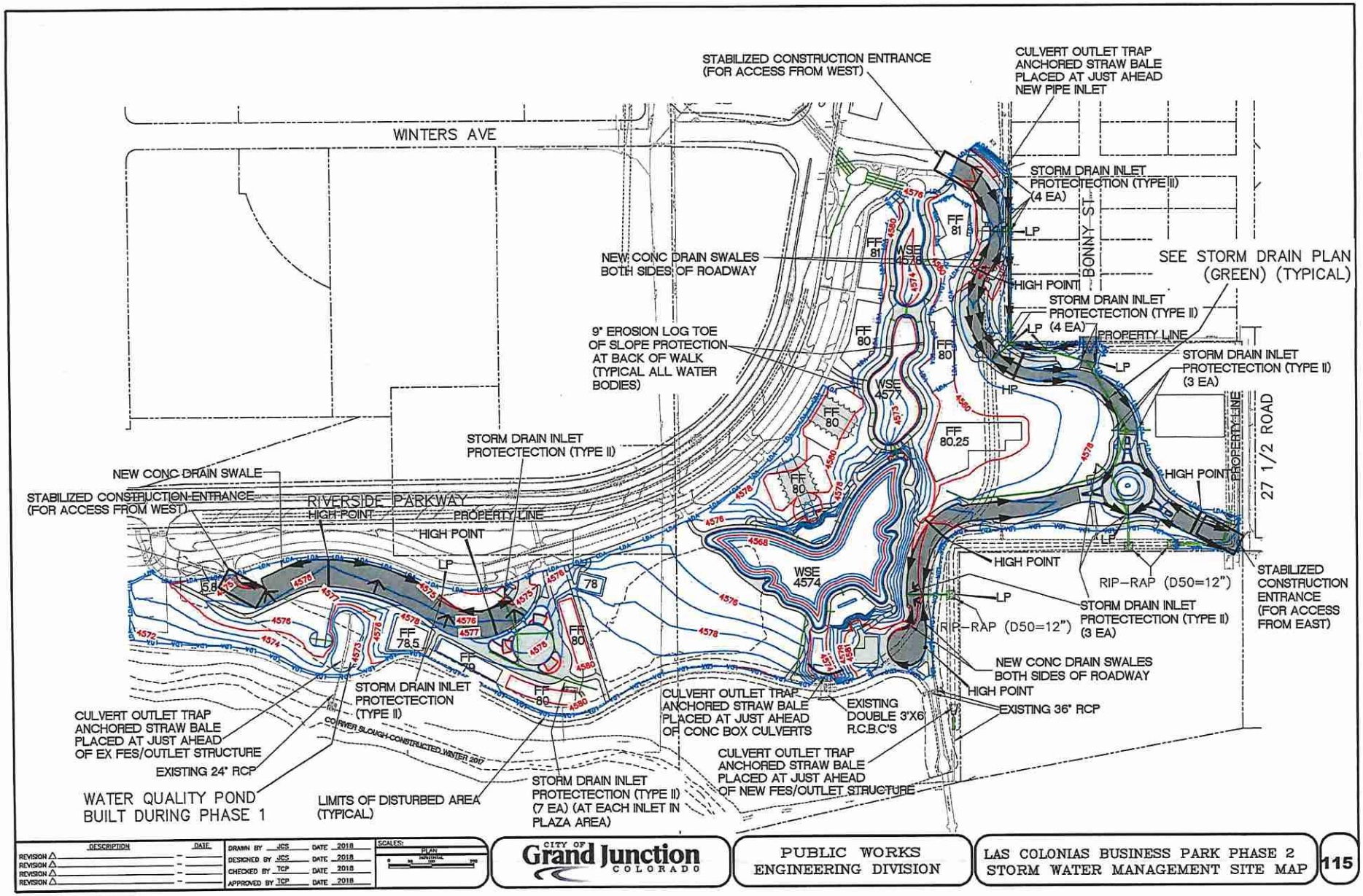
DRAWN BY JCS DATE 2018
DESIGNED BY JCS DATE 2018
CHECKED BY TCP DATE 2018
APPROVED BY TCP DATE 2018

SCALE: PLAN

CITY OF Grand Junction COLORADO

PUBLIC WORKS
ENGINEERING DIVISION

LAS COLONIAS BUSINESS PARK PHASE 2
STORM WATER MANAGEMENT DETAILS



DESCRIPTION	DATE
REVISION	
REVISION	
REVISION	
REVISION	

DRAWN BY JCS DATE 2018
DESIGNED BY JCS DATE 2018
CHECKED BY TCP DATE 2018
APPROVED BY TCP DATE 2018

SCALES: PLAN (HORIZONTAL) 1in = 50ft

CITY OF Grand Junction COLORADO

PUBLIC WORKS
ENGINEERING DIVISION

LAS COLONIAS BUSINESS PARK PHASE 2
STORM WATER MANAGEMENT SITE MAP

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Earth Dikes and Drainage Swales (ED/DS) EC-10

Description

Earth dikes and drainage swales are temporary storm conveyance channels constructed either to divert runoff around slopes or to convey runoff to additional sediment control BMPs prior to discharge of runoff from a site. Drainage swales may be lined or unlined, but if an unlined swale is used, it must be well compacted and capable of resisting erosive velocities.

Photograph ED/DS-1. Example of an earth dike used to divert flows at a construction site. Photo courtesy of CDOT.

Appropriate Uses

Earth dikes and drainage swales are typically used to control the flow path of runoff at a construction site by diverting runoff around areas prone to erosion, such as steep slopes. Earth dikes and drainage swales may also be constructed as temporary conveyance features. This will direct runoff to additional sediment control treatment BMPs, such as sediment traps or basins.

Design and Installation

When earth dikes are used to divert water for slope protection, the earth dike typically consists of a horizontal ridge of soil placed perpendicular to the slope and angled slightly to provide drainage along the contour. The dike is used in conjunction with a swale or a small channel upslope of the berm to convey the diverted water. Temporary diversion dikes can be constructed by excavation of a V-shaped trench or ditch and placement of the fill on the downslope side of the cut. There are two types of placement for temporary slope diversion dikes:

- A dike located at the top of a slope to divert upland runoff away from the disturbed area and convey it in a temporary or permanent channel.
- A diversion dike located at the base or mid-slope of a disturbed area to intercept runoff and reduce the effective slope length.

Depending on the project, either an earth dike or drainage swale may be more appropriate. If there is a need for cut on the project, then an excavated drainage swale may be better suited. When the project is primarily fill, then a conveyance constructed using a berm may be the better option.

All dikes or swales receiving runoff from a disturbed area should direct stormwater to a sediment control BMP such as a sediment trap or basin.

Earth Dikes and Drainage Swales	
Functions	
Erosion Control	Yes
Sediment Control	Moderate
Site/Material Management	No

EC-10 Earth Dikes and Drainage Swales (ED/DS)

Unlined dikes or swales should only be used for intercepting sheet flow runoff and are not intended for diversion of concentrated flows.

Details with notes are provided for several design variations, including:

ED-1. Unlined Earth Dike formed by Berm

DS-1. Unlined Excavated Swale

DS-2. Unlined Swale Formed by Cut and Fill

DS-3. ECB-lined Swale

DS-4. Synthetic-lined Swale

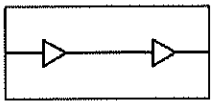
DS-5. Riprap-lined Swale

The details also include guidance on permissible velocities for cohesive channels if unlined approaches will be used.

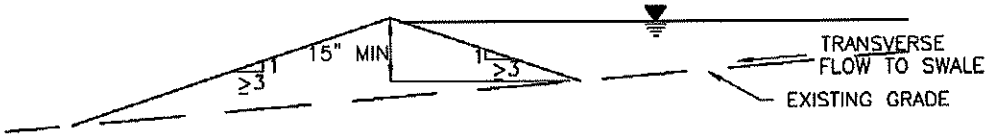
Maintenance and Removal

Inspect earth dikes for stability, compaction, and signs of erosion and repair. Inspect side slopes for erosion and damage to erosion control fabric. Stabilize slopes and repair fabric as necessary. If there is reoccurring extensive damage, consider installing rock check dams or lining the channel with riprap.

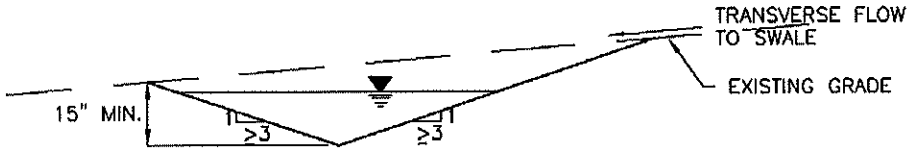
If drainage swales are not permanent, remove dikes and fill channels when the upstream area is stabilized. Stabilize the fill or disturbed area immediately following removal by revegetation or other permanent stabilization method approved by the local jurisdiction.



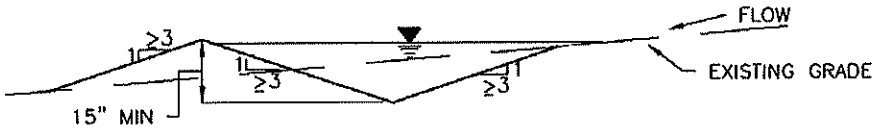
ED/DS



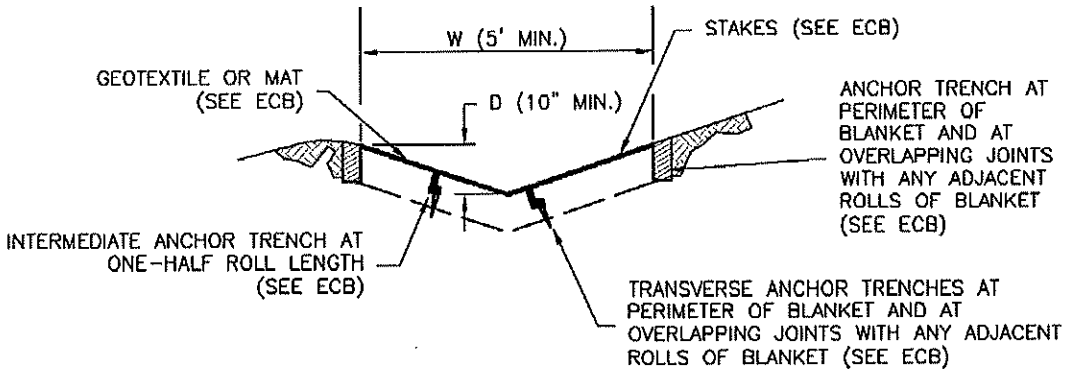
ED-1. COMPACTED UNLINED EARTH DIKE FORMED BY BERM



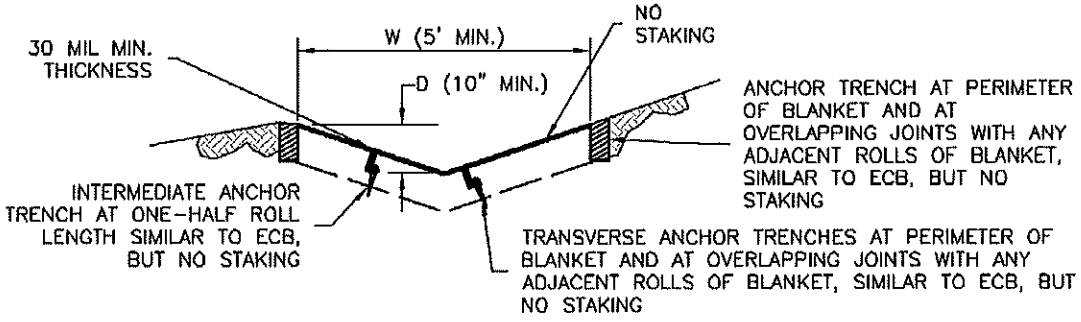
DS-1. COMPACTED UNLINED EXCACATED SWALE



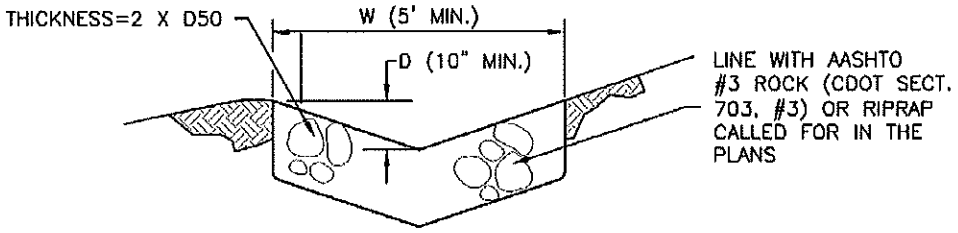
DS-2. COMPACTED UNLINED SWALE FORMED BY CUT AND FILL



DS-3. ECB LINED SWALE (CUT AND FILL OR BERM)



DS-4. SYNTHETIC LINED SWALE



DS-5. RIPRAP LINED SWALE

EARTH DIKE AND DRAINAGE SWALE INSTALLATION NOTES

1. SEE SITE PLAN FOR:
   - LOCATION OF DIVERSION SWALE
   - TYPE OF SWALE (UNLINED, COMPACTED AND/OR LINED).
   - LENGTH OF EACH SWALE.
   - DEPTH, D, AND WIDTH, W DIMENSIONS.
   - FOR ECB/TRM LINED DITCH, SEE ECB DETAIL.
   - FOR RIPRAP LINED DITCH, SIZE OF RIPRAP, D50.

2. SEE DRAINAGE PLANS FOR DETAILS OF PERMANENT CONVEYANCE FACILITIES AND/OR DIVERSION SWALES EXCEEDING 2-YEAR FLOW RATE OR 10 CFS.

3. EARTH DIKES AND SWALES INDICATED ON SWMP PLAN SHALL BE INSTALLED PRIOR TO LAND-DISTURBING ACTIVITIES IN PROXIMITY.

4. EMBANKMENT IS TO BE COMPACTED TO 90% OF MAXIMUM DENSITY AND WITHIN 2% OF OPTIMUM MOISTURE CONTENT ACCORDING TO ASTM D698.

5. SWALES ARE TO DRAIN TO A SEDIMENT CONTROL BMP.

6. FOR LINED DITCHES, INSTALLATION OF ECB/TRM SHALL CONFORM TO THE REQUIREMENTS OF THE ECB DETAIL.

7. WHEN CONSTRUCTION TRAFFIC MUST CROSS A DIVERSION SWALE, INSTALL A TEMPORARY CULVERT WITH A MINIMUM DIAMETER OF 12 INCHES.

Check Dams (CD) EC-12

Description

Check dams are temporary grade control structures placed in drainage channels to limit the erosivity of stormwater by reducing flow velocity. Check dams are typically constructed from rock, gravel bags, sand bags, or sometimes, proprietary devices. Reinforced check dams are typically constructed from rock and wire gabion. Although the primary function of check dams is to reduce the velocity of concentrated flows, a secondary benefit is sediment trapping upstream of the structure.

Photograph CD-1. Rock check dams in a roadside ditch. Photo courtesy of WWE.

Appropriate Uses

Use as a grade control for temporary drainage ditches or swales until final soil stabilization measures are established upstream and downstream. Check dams can be used on mild or moderately steep slopes. Check dams may be used under the following conditions:

- As temporary grade control facilities along waterways until final stabilization is established.
- Along permanent swales that need protection prior to installation of a non-erodible lining.
- Along temporary channels, ditches or swales that need protection where construction of a non-erodible lining is not practicable.
- Reinforced check dams should be used in areas subject to high flow velocities.

Design and Installation

Place check dams at regularly spaced intervals along the drainage swale or ditch. Check dams heights should allow for pools to develop upstream of each check dam, extending to the downstream toe of the check dam immediately upstream.

When rock is used for the check dam, place rock mechanically or by hand. Do not dump rocks into the drainage channel. Where multiple check dams are used, the top of the lower dam should be at the same elevation as the toe of the upper dam.

When reinforced check dams are used, install erosion control fabric under and around the check dam to prevent erosion on the upstream and downstream sides. Each section of the dam should be keyed in to reduce the potential for washout or undermining. A rock apron upstream and downstream of the dam may be necessary to further control erosion.

Check Dams	
Functions	
Erosion Control	Yes
Sediment Control	Moderate
Site/Material Management	No

Design details with notes are provided for the following types of check dams:

- Rock Check Dams (CD-1)
- Reinforced Check Dams (CD-2)

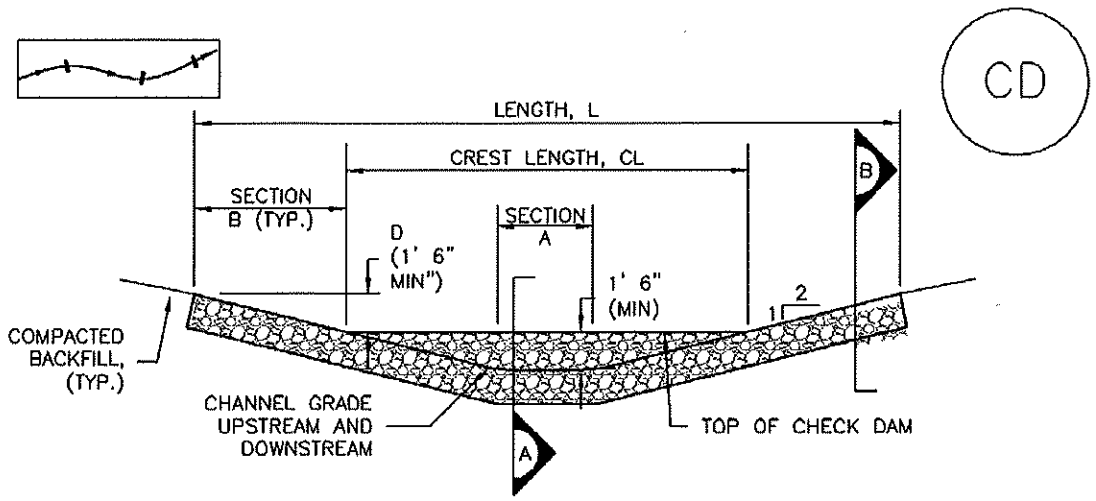
Sediment control logs may also be used as check dams; however, silt fence is not appropriate for use as a check dam. Many jurisdictions also prohibit or discourage use of straw bales for this purpose.

Maintenance and Removal

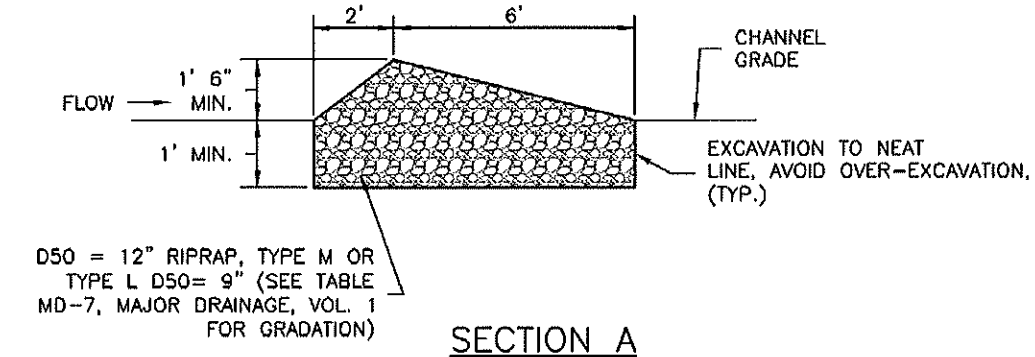
Replace missing rocks causing voids in the check dam. If gravel bags or sandbags are used, replace or repair torn or displaced bags.

Remove accumulated sediment, as needed to maintain BMP effectiveness, typically before the sediment depth upstream of the check dam is within ½ of the crest height. Remove accumulated sediment prior to mulching, seeding, or chemical soil stabilization. Removed sediment can be incorporated into the earthwork with approval from the Project Engineer, or disposed of at an alternate location in accordance with the standard specifications.

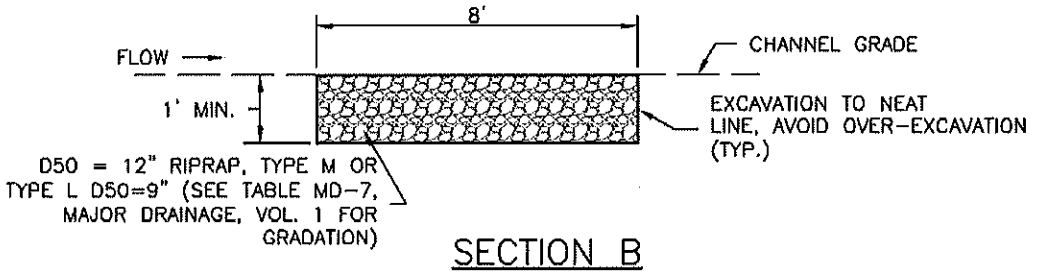
Check dams constructed in permanent swales should be removed when perennial grasses have become established, or immediately prior to installation of a non-erodible lining. All of the rock and accumulated sediment should be removed, and the area seeded and mulched, or otherwise stabilized.



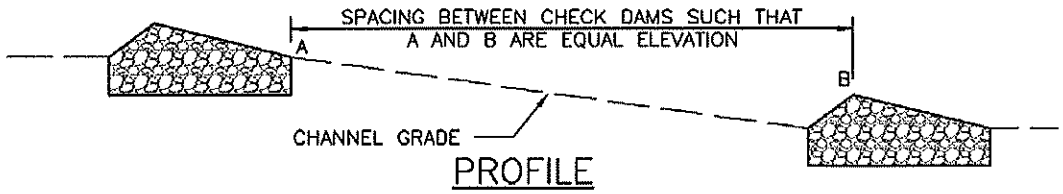
CHECK DAM ELEVATION VIEW



SECTION A



SECTION B



PROFILE

CD-1. CHECK DAM

CHECK DAM INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   -LOCATION OF CHECK DAMS.
   -CHECK DAM TYPE (CHECK DAM OR REINFORCED CHECK DAM).
   -LENGTH (L), CREST LENGTH (CL), AND DEPTH (D).

2. CHECK DAMS INDICATED ON INITIAL SWMP SHALL BE INSTALLED AFTER CONSTRUCTION FENCE, BUT PRIOR TO ANY UPSTREAM LAND DISTURBING ACTIVITIES.

3. RIPRAP UTILIZED FOR CHECK DAMS SHOULD BE OF APPROPRIATE SIZE FOR THE APPLICATION. TYPICAL TYPES OF RIPRAP USED FOR CHECK DAMS ARE TYPE M (D50 12") OR TYPE L (D50 9").

4. RIPRAP PAD SHALL BE TRENCHED INTO THE GROUND A MINIMUM OF 1'.

5. THE ENDS OF THE CHECK DAM SHALL BE A MINIMUM OF 1' 6" HIGHER THAN THE CENTER OF THE CHECK DAM.

CHECK DAM MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

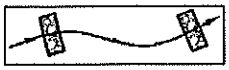
4. SEDIMENT ACCUMULATED UPSTREAM OF THE CHECK DAMS SHALL BE REMOVED WHEN THE SEDIMENT DEPTH IS WITHIN ½ OF THE HEIGHT OF THE CREST.

5. CHECK DAMS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

6. WHEN CHECK DAMS ARE REMOVED, EXCAVATIONS SHALL BE FILLED WITH SUITABLE COMPACTED BACKFILL. DISTURBED AREA SHALL BE SEEDED AND MULCHED AND COVERED WITH GEOTEXTILE OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.



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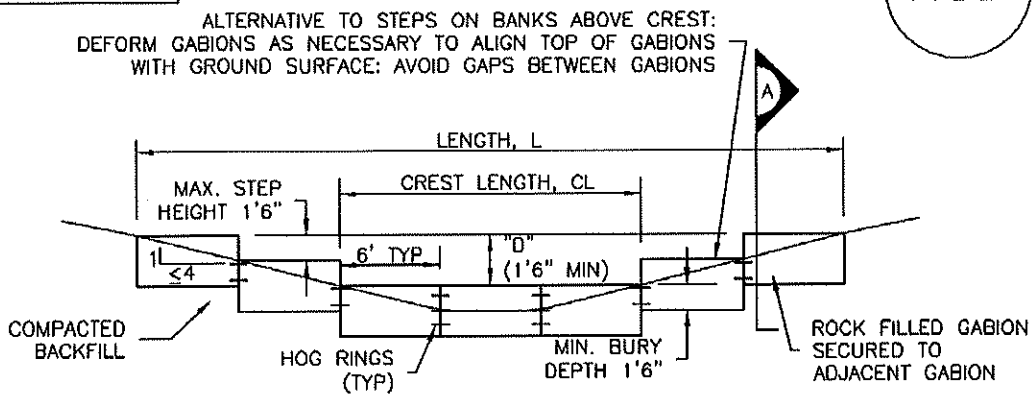
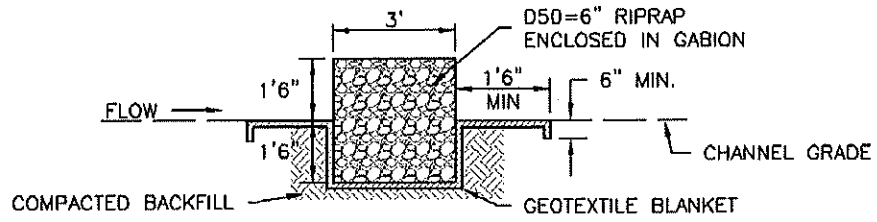


REINFORCED CHECK DAM ELEVATION VIEW



SECTION A

REINFORCED CHECK DAM INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   -LOCATIONS OF CHECK DAMS.
   -CHECK DAM TYPE (CHECK DAM OR REINFORCED CHECK DAM).
   -LENGTH (L), CREST LENGTH (CL), AND DEPTH (D).

2. CHECK DAMS INDICATED ON THE SWMP SHALL BE INSTALLED PRIOR TO AN UPSTREAM LAND-DISTURBING ACTIVITIES.

3. REINFORCED CHECK DAMS, GABIONS SHALL HAVE GALVANIZED TWISTED WIRE NETTING WITH A MAXIMUM OPENING DIMENSION OF 4½" AND A MINIMUM WIRE THICKNESS OF 0.10". WIRE "HOG RINGS" AT 4" SPACING OR OTHER APPROVED MEANS SHALL BE USED AT ALL GABION SEAMS AND TO SECURE THE GABION TO THE ADJACENT SECTION.

4. THE CHECK DAM SHALL BE TRENCHED INTO THE GROUND A MINIMUM OF 1' 6".

5. GEOTEXTILE BLANKET SHALL BE PLACED IN THE REINFORCED CHECK DAM TRENCH EXTENDING A MINIMUM OF 1' 6" ON BOTH THE UPSTREAM AND DOWNSTREAM SIDES OF THE REINFORCED CHECK DAM.

CD-2. REINFORCED CHECK DAM

REINFORCED CHECK DAM MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SEDIMENT ACCUMULATED UPSTREAM OF REINFORCED CHECK DAMS SHALL BE REMOVED AS NEEDED TO MAINTAIN THE EFFECTIVENESS OF BMP, TYPICALLY WHEN THE UPSTREAM SEDIMENT DEPTH IS WITHIN ½ THE HEIGHT OF THE CREST.

5. REPAIR OR REPLACE REINFORCED CHECK DAMS WHEN THERE ARE SIGNS OF DAMAGE SUCH AS HOLES IN THE GABION OR UNDERCUTTING.

6. REINFORCED CHECK DAMS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

7. WHEN REINFORCED CHECK DAMS ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED, AND COVERED WITH A GEOTEXTILE BLANKET, OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAIL ADAPTED FROM DOUGLAS COUNTY, COLORADO AND CITY OF AURORA, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Wind Erosion/Dust Control (DC) EC-14

Description

Wind erosion and dust control BMPs help to keep soil particles from entering the air as a result of land disturbing construction activities. These BMPs include a variety of practices generally focused on either graded disturbed areas or construction roadways. For graded areas, practices such as seeding and mulching, use of soil binders, site watering, or other practices that provide prompt surface cover should be used. For construction roadways, road watering and stabilized surfaces should be considered.

Photograph DC-1. Water truck used for dust suppression. Photo courtesy of Douglas County.

Appropriate Uses

Dust control measures should be used on any site where dust poses a problem to air quality. Dust control is important to control for the health of construction workers and surrounding waterbodies.

Design and Installation

The following construction BMPs can be used for dust control:

- An irrigation/sprinkler system can be used to wet the top layer of disturbed soil to help keep dry soil particles from becoming airborne.
- Seeding and mulching can be used to stabilize disturbed surfaces and reduce dust emissions.
- Protecting existing vegetation can help to slow wind velocities across the ground surface, thereby limiting the likelihood of soil particles to become airborne.
- Spray-on soil binders form a bond between soil particles keeping them grounded. Chemical treatments may require additional permitting requirements. Potential impacts to surrounding waterways and habitat must be considered prior to use.
- Placing rock on construction roadways and entrances will help keep dust to a minimum across the construction site.
- Wind fences can be installed on site to reduce wind speeds. Install fences perpendicular to the prevailing wind direction for maximum effectiveness.

Wind Erosion Control/ Dust Control	
Functions	
Erosion Control	Yes
Sediment Control	No
Site/Material Management	Moderate

Maintenance and Removal

When using an irrigation/sprinkler control system to aid in dust control, be careful not to overwater. Overwatering will cause construction vehicles to track mud off-site.

Concrete Washout Area (CWA) MM-1

Description

Concrete waste management involves designating and properly managing a specific area of the construction site as a concrete washout area. A concrete washout area can be created using one of several approaches designed to receive wash water from washing of tools and concrete mixer chutes, liquid concrete waste from dump trucks, mobile batch mixers, or pump trucks. Three basic approaches are available: excavation of a pit in the ground, use of an above ground storage area, or use of prefabricated haul-away concrete washout containers. Surface discharges of concrete washout water from construction sites are prohibited.

Photograph CWA-1. Example of concrete washout area. Note gravel tracking pad for access and sign.

Appropriate Uses

Concrete washout areas must be designated on all sites that will generate concrete wash water or liquid concrete waste from onsite concrete mixing or concrete delivery.

Because pH is a pollutant of concern for washout activities, when unlined pits are used for concrete washout, the soil must have adequate buffering capacity to result in protection of state groundwater standards; otherwise, a liner/containment must be used. The following management practices are recommended to prevent an impact from unlined pits to groundwater:

- The use of the washout site should be temporary (less than 1 year), and
- The washout site should be not be located in an area where shallow groundwater may be present, such as near natural drainages, springs, or wetlands.

Design and Installation

Concrete washout activities must be conducted in a manner that does not contribute pollutants to surface waters or stormwater runoff. Concrete washout areas may be lined or unlined excavated pits in the ground, commercially manufactured prefabricated washout containers, or aboveground holding areas constructed of berms, sandbags or straw bales with a plastic liner.

Although unlined washout areas may be used, lined pits may be required to protect groundwater under certain conditions.

Do not locate an unlined washout area within 400 feet of any natural drainage pathway or waterbody or within 1,000 feet of any wells or drinking water sources. Even for lined concrete washouts, it is advisable to locate the facility away from waterbodies and drainage paths. If site constraints make these

Concrete Washout Area	
Functions	
Erosion Control	No
Sediment Control	No
Site/Material Management	Yes

setbacks infeasible or if highly permeable soils exist in the area, then the pit must be installed with an impermeable liner (16 mil minimum thickness) or surface storage alternatives using prefabricated concrete washout devices or a lined aboveground storage area should be used.

Design details with notes are provided in Detail CWA-1 for pits and CWA-2 for aboveground storage areas. Pre-fabricated concrete washout container information can be obtained from vendors.

Maintenance and Removal

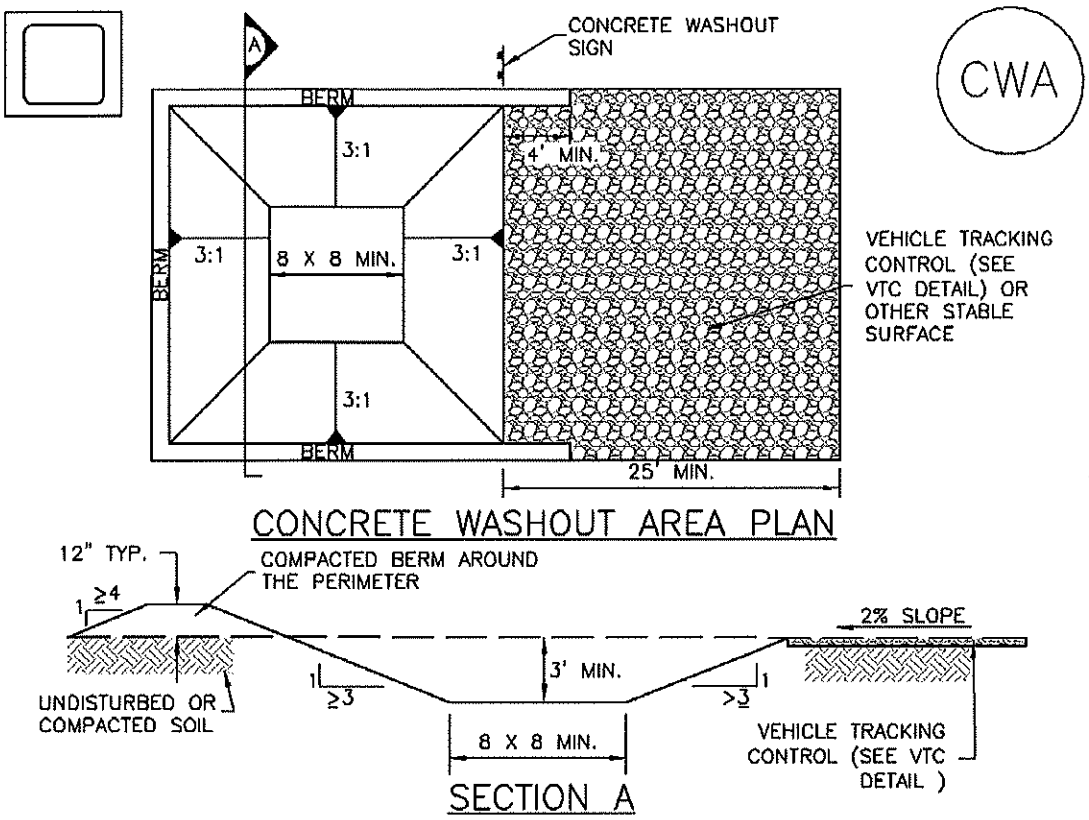
A key consideration for concrete washout areas is to ensure that adequate signage is in place identifying the location of the washout area. Part of inspecting and maintaining washout areas is ensuring that adequate signage is provided and in good repair and that the washout area is being used, as opposed to washout in non-designated areas of the site.

Remove concrete waste in the washout area, as needed to maintain BMP function (typically when filled to about two-thirds of its capacity). Collect concrete waste and deliver offsite to a designated disposal location.

Upon termination of use of the washout site, accumulated solid waste, including concrete waste and any contaminated soils, must be removed from the site to prevent on-site disposal of solid waste. If the wash water is allowed to evaporate and the concrete hardens, it may be recycled.

Photograph CWA-2. Prefabricated concrete washout. Photo courtesy of CDOT.

Photograph CWA-3. Earthen concrete washout. Photo courtesy of CDOT.



CWA–1. CONCRETE WASHOUT AREA

CWA INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –CWA INSTALLATION LOCATION.

2. DO NOT LOCATE AN UNLINED CWA WITHIN 400' OF ANY NATURAL DRAINAGE PATHWAY OR WATERBODY. DO NOT LOCATE WITHIN 1,000' OF ANY WELLS OR DRINKING WATER SOURCES. IF SITE CONSTRAINTS MAKE THIS INFEASIBLE, OR IF HIGHLY PERMEABLE SOILS EXIST ON SITE, THE CWA MUST BE INSTALLED WITH AN IMPERMEABLE LINER (16 MIL MIN. THICKNESS) OR SURFACE STORAGE ALTERNATIVES USING PREFABRICATED CONCRETE WASHOUT DEVICES OR A LINED ABOVE GROUND STORAGE ARE SHOULD BE USED.

3. THE CWA SHALL BE INSTALLED PRIOR TO CONCRETE PLACEMENT ON SITE.

4. CWA SHALL INCLUDE A FLAT SUBSURFACE PIT THAT IS AT LEAST 8' BY 8' SLOPES LEADING OUT OF THE SUBSURFACE PIT SHALL BE 3:1 OR FLATTER. THE PIT SHALL BE AT LEAST 3' DEEP.

5. BERM SURROUNDING SIDES AND BACK OF THE CWA SHALL HAVE MINIMUM HEIGHT OF 1'.

6. VEHICLE TRACKING PAD SHALL BE SLOPED 2% TOWARDS THE CWA.

7. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE CWA, AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CWA TO OPERATORS OF CONCRETE TRUCKS AND PUMP RIGS.

8. USE EXCAVATED MATERIAL FOR PERIMETER BERM CONSTRUCTION.

MM-1 Concrete Washout Area (CWA)

CWA MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. THE CWA SHALL BE REPAIRED, CLEANED, OR ENLARGED AS NECESSARY TO MAINTAIN CAPACITY FOR CONCRETE WASTE. CONCRETE MATERIALS, ACCUMULATED IN PIT, SHALL BE REMOVED ONCE THE MATERIALS HAVE REACHED A DEPTH OF 2'.

5. CONCRETE WASHOUT WATER, WASTED PIECES OF CONCRETE AND ALL OTHER DEBRIS IN THE SUBSURFACE PIT SHALL BE TRANSPORTED FROM THE JOB SITE IN A WATER-TIGHT CONTAINER AND DISPOSED OF PROPERLY.

6. THE CWA SHALL REMAIN IN PLACE UNTIL ALL CONCRETE FOR THE PROJECT IS PLACED.

7. WHEN THE CWA IS REMOVED, COVER THE DISTURBED AREA WITH TOP SOIL, SEED AND MULCH OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

(DETAIL ADAPTED FROM DOUGLAS COUNTY, COLORADO AND THE CITY OF PARKER, COLORADO, NOT AVAILABLE IN AUTOCAD).

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Stockpile Management (SP) MM-2

Description

Stockpile management includes measures to minimize erosion and sediment transport from soil stockpiles.

Appropriate Uses

Stockpile management should be used when soils or other erodible materials are stored at the construction site. Special attention should be given to stockpiles in close proximity to natural or manmade storm systems.

Photograph SP-1. A topsoil stockpile that has been partially revegetated and is protected by silt fence perimeter control.

Design and Installation

Locate stockpiles away from all drainage system components including storm sewer inlets. Where practical, choose stockpile locations that that will remain undisturbed for the longest period of time as the phases of construction progress. Place sediment control BMPs around the perimeter of the stockpile, such as sediment control logs, rock socks, silt fence, straw bales and sand bags. See Detail SP-1 for guidance on proper establishment of perimeter controls around a stockpile. For stockpiles in active use, provide a stabilized designated access point on the upgradient side of the stockpile.

Stabilize the stockpile surface with surface roughening, temporary seeding and mulching, erosion control blankets, or soil binders. Soils stockpiled for an extended period (typically for more than 60 days) should be seeded and mulched with a temporary grass cover once the stockpile is placed (typically within 14 days). Use of mulch only or a soil binder is acceptable if the stockpile will be in place for a more limited time period (typically 30-60 days). Timeframes for stabilization of stockpiles noted in this fact sheet are "typical" guidelines. Check permit requirements for specific federal, state, and/or local requirements that may be more prescriptive.

Stockpiles should not be placed in streets or paved areas unless no other practical alternative exists. See the Stabilized Staging Area Fact Sheet for guidance when staging in roadways is unavoidable due to space or right-of-way constraints. For paved areas, rock socks must be used for perimeter control and all inlets with the potential to receive sediment from the stockpile (even from vehicle tracking) must be protected.

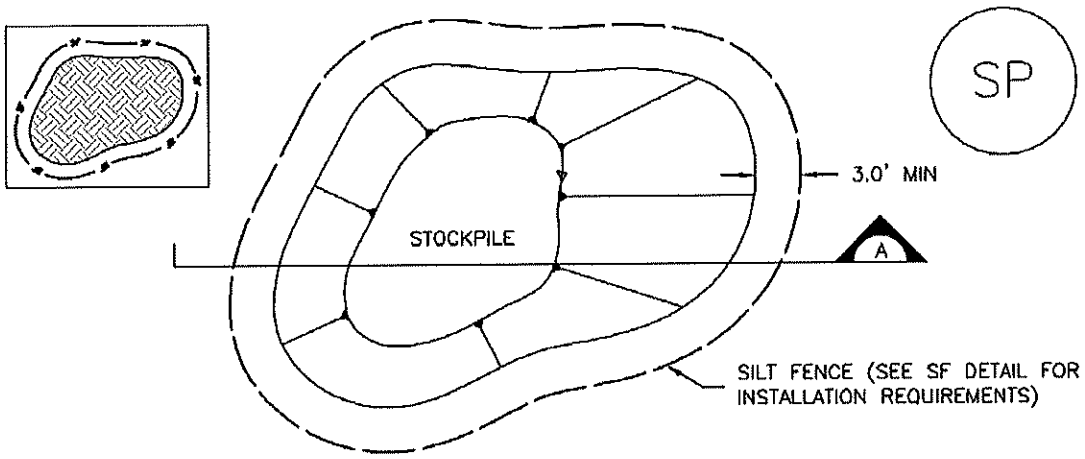
Maintenance and Removal

Inspect perimeter controls and inlet protection in accordance with their respective BMP Fact Sheets. Where seeding, mulch and/or soil binders are used, reseeding or reapplication of soil binder may be necessary.

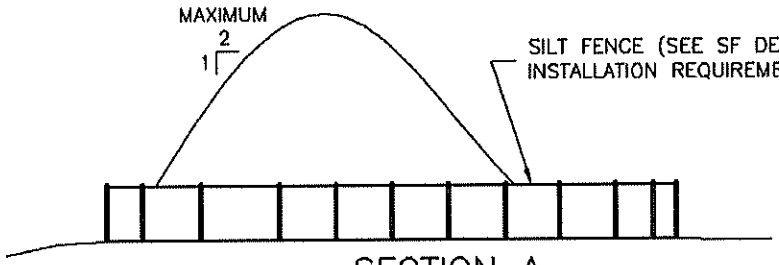
When temporary removal of a perimeter BMP is necessary to access a stockpile, ensure BMPs are reinstalled in accordance with their respective design detail section.

Stockpile Management	
Functions	
Erosion Control	Yes
Sediment Control	Yes
Site/Material Management	Yes

When the stockpile is no longer needed, properly dispose of excess materials and revegetate or otherwise stabilize the ground surface where the stockpile was located.



STOCKPILE PROTECTION PLAN



SECTION A

SP–1. STOCKPILE PROTECTION

STOCKPILE PROTECTION INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION OF STOCKPILES.
   –TYPE OF STOCKPILE PROTECTION.

2. INSTALL PERIMETER CONTROLS IN ACCORDANCE WITH THEIR RESPECTIVE DESIGN DETAILS. SILT FENCE IS SHOWN IN THE STOCKPILE PROTECTION DETAILS; HOWEVER, OTHER TYPES OF PERIMETER CONTROLS INCLUDING SEDIMENT CONTROL LOGS OR ROCK SOCKS MAY BE SUITABLE IN SOME CIRCUMSTANCES. CONSIDERATIONS FOR DETERMINING THE APPROPRIATE TYPE OF PERIMETER CONTROL FOR A STOCKPILE INCLUDE WHETHER THE STOCKPILE IS LOCATED ON A PERVIOUS OR IMPERVIOUS SURFACE, THE RELATIVE HEIGHTS OF THE PERIMETER CONTROL AND STOCKPILE, THE ABILITY OF THE PERIMETER CONTROL TO CONTAIN THE STOCKPILE WITHOUT FAILING IN THE EVENT THAT MATERIAL FROM THE STOCKPILE SHIFTS OR SLUMPS AGAINST THE PERIMETER, AND OTHER FACTORS.

3. STABILIZE THE STOCKPILE SURFACE WITH SURFACE ROUGHENING, TEMPORARY SEEDING AND MULCHING, EROSION CONTROL BLANKETS, OR SOIL BINDERS. SOILS STOCKPILED FOR AN EXTENDED PERIOD (TYPICALLY FOR MORE THAN 60 DAYS) SHOULD BE SEEDED AND MULCHED WITH A TEMPORARY GRASS COVER ONCE THE STOCKPILE IS PLACED (TYPICALLY WITHIN 14 DAYS). USE OF MULCH ONLY OR A SOIL BINDER IS ACCEPTABLE IF THE STOCKPILE WILL BE IN PLACE FOR A MORE LIMITED TIME PERIOD (TYPICALLY 30–60 DAYS).

4. FOR TEMPORARY STOCKPILES ON THE INTERIOR PORTION OF A CONSTRUCTION SITE, WHERE OTHER DOWNGRADIENT CONTROLS, INCLUDING PERIMETER CONTROL, ARE IN PLACE, STOCKPILE PERIMETER CONTROLS MAY NOT BE REQUIRED.

STOCKPILE PROTECTION MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

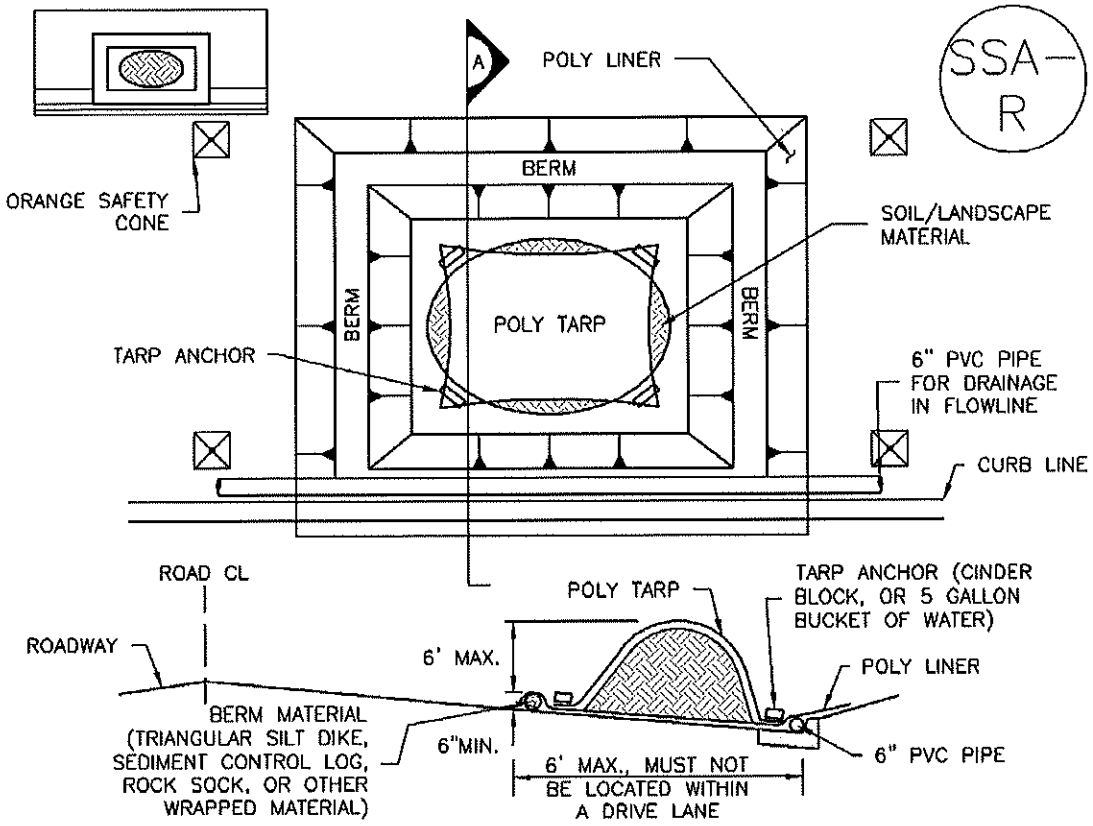
STOCKPILE PROTECTION MAINTENANCE NOTES

4. IF PERIMETER PROTECTION MUST BE MOVED TO ACCESS SOIL STOCKPILE, REPLACE PERIMETER CONTROLS BY THE END OF THE WORKDAY.

5. STOCKPILE PERIMETER CONTROLS CAN BE REMOVED ONCE ALL THE MATERIAL FROM THE STOCKPILE HAS BEEN USED.

(DETAILS ADAPTED FROM PARKER, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.



SP-2. MATERIALS STAGING IN ROADWAY

MATERIALS STAGING IN ROADWAYS INSTALLATION NOTES

1. SEE PLAN VIEW FOR
   -LOCATION OF MATERIAL STAGING AREA(S).
   -CONTRACTOR MAY ADJUST LOCATION AND SIZE OF STAGING AREA WITH APPROVAL FROM THE LOCAL JURISDICTION.

2. FEATURE MUST BE INSTALLED PRIOR TO EXCAVATION, EARTHWORK OR DELIVERY OF MATERIALS.

3. MATERIALS MUST BE STATIONED ON THE POLY LINER. ANY INCIDENTAL MATERIALS DEPOSITED ON PAVED SECTION OR ALONG CURB LINE MUST BE CLEANED UP PROMPTLY.

4. POLY LINER AND TARP COVER SHOULD BE OF SIGNIFICANT THICKNESS TO PREVENT DAMAGE OR LOSS OF INTEGRITY.

5. SAND BAGS MAY BE SUBSTITUTED TO ANCHOR THE COVER TARP OR PROVIDE BERMING UNDER THE BASE LINER.

6. FEATURE IS NOT INTENDED FOR USE WITH WET MATERIAL THAT WILL BE DRAINING AND/OR SPREADING OUT ON THE POLY LINER OR FOR DEMOLITION MATERIALS.

7. THIS FEATURE CAN BE USED FOR:
   -UTILITY REPAIRS.
   -WHEN OTHER STAGING LOCATIONS AND OPTIONS ARE LIMITED.
   -OTHER LIMITED APPLICATION AND SHORT DURATION STAGING.

MATERIALS STAGING IN ROADWAY MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. INSPECT PVC PIPE ALONG CURB LINE FOR CLOGGING AND DEBRIS. REMOVE OBSTRUCTIONS PROMPTLY.

5. CLEAN MATERIAL FROM PAVED SURFACES BY SWEEPING OR VACUUMING.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

(DETAILS ADAPTED FROM AURORA, COLORADO)

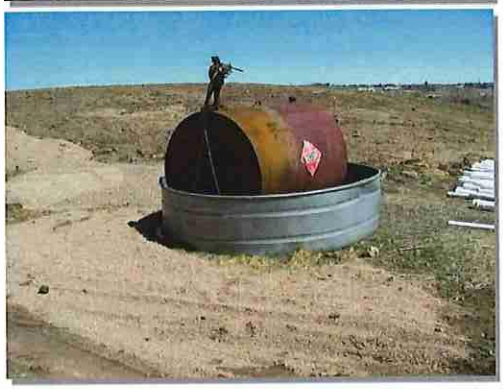
Good Housekeeping Practices (GH) MM-3

Description

Implement construction site good housekeeping practices to prevent pollution associated with solid, liquid and hazardous construction-related materials and wastes. Stormwater Management Plans (SWMPs) should clearly specify BMPs including these good housekeeping practices:

- Provide for waste management.
- Establish proper building material staging areas.
- Designate paint and concrete washout areas.
- Establish proper equipment/vehicle fueling and maintenance practices.
- Control equipment/vehicle washing and allowable non-stormwater discharges.
- Develop a spill prevention and response plan.

Acknowledgement: This Fact Sheet is based directly on EPA guidance provided in *Developing Your Stormwater Pollution Prevent Plan* (EPA 2007).



Photographs GH-1 and GH-2. Proper materials storage and secondary containment for fuel tanks are important good housekeeping practices. Photos courtesy of CDOT and City of Aurora.

Appropriate Uses

Good housekeeping practices are necessary at all construction sites.

Design and Installation

The following principles and actions should be addressed in SWMPs:

- **Provide for Waste Management.** Implement management procedures and practices to prevent or reduce the exposure and transport of pollutants in stormwater from solid, liquid and sanitary wastes that will be generated at the site. Practices such as trash disposal, recycling, proper material handling, and cleanup measures can reduce the potential for stormwater runoff to pick up construction site wastes and discharge them to surface waters. Implement a comprehensive set of waste-management practices for hazardous or toxic materials, such as paints, solvents, petroleum products, pesticides, wood preservatives, acids, roofing tar, and other materials. Practices should include storage, handling, inventory, and cleanup procedures, in case of spills. Specific practices that should be considered include:

  Solid or Construction Waste

  - Designate trash and bulk waste-collection areas on-site.

Good Housekeeping	
Functions	
Erosion Control	No
Sediment Control	No
Site/Material Management	Yes

- Recycle materials whenever possible (e.g., paper, wood, concrete, oil).
- Segregate and provide proper disposal options for hazardous material wastes.
- Clean up litter and debris from the construction site daily.
- Locate waste-collection areas away from streets, gutters, watercourses, and storm drains. Waste-collection areas (dumpsters, and such) are often best located near construction site entrances to minimize traffic on disturbed soils. Consider secondary containment around waste collection areas to minimize the likelihood of contaminated discharges.
- Empty waste containers before they are full and overflowing.

Sanitary and Septic Waste

- Provide convenient, well-maintained, and properly located toilet facilities on-site.
- Locate toilet facilities away from storm drain inlets and waterways to prevent accidental spills and contamination of stormwater.
- Maintain clean restroom facilities and empty portable toilets regularly.
- Where possible, provide secondary containment pans under portable toilets.
- Provide tie-downs or stake-downs for portable toilets.
- Educate employees, subcontractors, and suppliers on locations of facilities.
- Treat or dispose of sanitary and septic waste in accordance with state or local regulations. Do not discharge or bury wastewater at the construction site.
- Inspect facilities for leaks. If found, repair or replace immediately.
- Special care is necessary during maintenance (pump out) to ensure that waste and/or biocide are not spilled on the ground.

Hazardous Materials and Wastes

- Develop and implement employee and subcontractor education, as needed, on hazardous and toxic waste handling, storage, disposal, and cleanup.
- Designate hazardous waste-collection areas on-site.
- Place all hazardous and toxic material wastes in secondary containment.

Photograph GH-3. Locate portable toilet facilities on level surfaces away from waterways and storm drains. Photo courtesy of WWE.

- Hazardous waste containers should be inspected to ensure that all containers are labeled properly and that no leaks are present.

- **Establish Proper Building Material Handling and Staging Areas.** The SWMP should include comprehensive handling and management procedures for building materials, especially those that are hazardous or toxic. Paints, solvents, pesticides, fuels and oils, other hazardous materials or building materials that have the potential to contaminate stormwater should be stored indoors or under cover whenever possible or in areas with secondary containment. Secondary containment measures prevent a spill from spreading across the site and may include dikes, berms, curbing, or other containment methods. Secondary containment techniques should also ensure the protection of groundwater. Designate staging areas for activities such as fueling vehicles, mixing paints, plaster, mortar, and other potential pollutants. Designated staging areas enable easier monitoring of the use of materials and clean up of spills. Training employees and subcontractors is essential to the success of this pollution prevention principle. Consider the following specific materials handling and staging practices:

  - Train employees and subcontractors in proper handling and storage practices.

  - Clearly designate site areas for staging and storage with signs and on construction drawings. Staging areas should be located in areas central to the construction site. Segment the staging area into sub-areas designated for vehicles, equipment, or stockpiles. Construction entrances and exits should be clearly marked so that delivery vehicles enter/exit through stabilized areas with vehicle tracking controls (See Vehicle Tracking Control Fact Sheet).

  - Provide storage in accordance with Spill Protection, Control and Countermeasures (SPCC) requirements and plans and provide cover and impermeable perimeter control, as necessary, for hazardous materials and contaminated soils that must be stored on site.

  - Ensure that storage containers are regularly inspected for leaks, corrosion, support or foundation failure, or other signs of deterioration and tested for soundness.

  - Reuse and recycle construction materials when possible.

- **Designate Concrete Washout Areas.** Concrete contractors should be encouraged to use the washout facilities at their own plants or dispatch facilities when feasible; however, concrete washout commonly occurs on construction sites. If it is necessary to provide for concrete washout areas on-site, designate specific washout areas and design facilities to handle anticipated washout water. Washout areas should also be provided for paint and stucco operations. Because washout areas can be a source of pollutants from leaks or spills, care must be taken with regard to their placement and proper use. See the Concrete Washout Area Fact Sheet for detailed guidance.

  Both self-constructed and prefabricated washout containers can fill up quickly when concrete, paint, and stucco work are occurring on large portions of the site. Be sure to check for evidence that contractors are using the washout areas and not dumping materials onto the ground or into drainage facilities. If the washout areas are not being used regularly, consider posting additional signage, relocating the facilities to more convenient locations, or providing training to workers and contractors.

  When concrete, paint, or stucco is part of the construction process, consider these practices which will help prevent contamination of stormwater. Include the locations of these areas and the maintenance and inspection procedures in the SWMP.

- Do not washout concrete trucks or equipment into storm drains, streets, gutters, uncontained areas, or streams. Only use designated washout areas.
- Establish washout areas and advertise their locations with signs. Ensure that signage remains in good repair.
- Provide adequate containment for the amount of wash water that will be used.
- Inspect washout structures daily to detect leaks or tears and to identify when materials need to be removed.
- Dispose of materials properly. The preferred method is to allow the water to evaporate and to recycle the hardened concrete. Full service companies may provide dewatering services and should dispose of wastewater properly. Concrete wash water can be highly polluted. It should not be discharged to any surface water, storm sewer system, or allowed to infiltrate into the ground in the vicinity of waterbodies. Washwater should not be discharged to a sanitary sewer system without first receiving written permission from the system operator.

- **Establish Proper Equipment/Vehicle Fueling and Maintenance Practices.** Create a clearly designated on-site fueling and maintenance area that is clean and dry. The on-site fueling area should have a spill kit, and staff should know how to use it. If possible, conduct vehicle fueling and maintenance activities in a covered area. Consider the following practices to help prevent the discharge of pollutants to stormwater from equipment/vehicle fueling and maintenance. Include the locations of designated fueling and maintenance areas and inspection and maintenance procedures in the SWMP.
  - Train employees and subcontractors in proper fueling procedures (stay with vehicles during fueling, proper use of pumps, emergency shutoff valves, etc.).
  - Inspect on-site vehicles and equipment regularly for leaks, equipment damage, and other service problems.
  - Clearly designate vehicle/equipment service areas away from drainage facilities and watercourses to prevent stormwater run-on and runoff.
  - Use drip pans, drip cloths, or absorbent pads when replacing spent fluids.
  - Collect all spent fluids, store in appropriate labeled containers in the proper storage areas, and recycle fluids whenever possible.
- **Control Equipment/Vehicle Washing and Allowable Non-Stormwater Discharges.** Implement practices to prevent contamination of surface and groundwater from equipment and vehicle wash water. Representative practices include:
  - Educate employees and subcontractors on proper washing procedures.
  - Use off-site washing facilities, when available.
  - Clearly mark the washing areas and inform workers that all washing must occur in this area.
  - Contain wash water and treat it using BMPs. Infiltrate washwater when possible, but maintain separation from drainage paths and waterbodies.

- Use high-pressure water spray at vehicle washing facilities without detergents. Water alone can remove most dirt adequately.
- Do not conduct other activities, such as vehicle repairs, in the wash area.
- Include the location of the washing facilities and the inspection and maintenance procedures in the SWMP.

- **Develop a Spill Prevention and Response Plan.** Spill prevention and response procedures must be identified in the SWMP. Representative procedures include identifying ways to reduce the chance of spills, stop the source of spills, contain and clean up spills, dispose of materials contaminated by spills, and train personnel responsible for spill prevention and response. The plan should also specify material handling procedures and storage requirements and ensure that clear and concise spill cleanup procedures are provided and posted for areas in which spills may potentially occur. When developing a spill prevention plan, include the following:
  - Note the locations of chemical storage areas, storm drains, tributary drainage areas, surface waterbodies on or near the site, and measures to stop spills from leaving the site.
  - Provide proper handling and safety procedures for each type of waste. Keep Material Safety Data Sheets (MSDSs) for chemical used on site with the SWMP.
  - Establish an education program for employees and subcontractors on the potential hazards to humans and the environment from spills and leaks.
  - Specify how to notify appropriate authorities, such as police and fire departments, hospitals, or municipal sewage treatment facilities to request assistance. Emergency procedures and contact numbers should be provided in the SWMP and posted at storage locations.
  - Describe the procedures, equipment and materials for immediate cleanup of spills and proper disposal.
  - Identify personnel responsible for implementing the plan in the event of a spill. Update the spill prevention plan and clean up materials as changes occur to the types of chemicals stored and used at the facility.

Spill Prevention, Control, and Countermeasure (SPCC) Plan

Construction sites may be subject to 40 CFR Part 112 regulations that require the preparation and implementation of a SPCC Plan to prevent oil spills from aboveground and underground storage tanks. The facility is subject to this rule if it is a non-transportation-related facility that:

- Has a total storage capacity greater than 1,320 gallons or a completely buried storage capacity greater than 42,000 gallons.
- Could reasonably be expected to discharge oil in quantities that may be harmful to navigable waters of the United States and adjoining shorelines.

Furthermore, if the facility is subject to 40 CFR Part 112, the SWMP should reference the SPCC Plan. To find out more about SPCC Plans, see EPA's website on SPPC at www.epa.gov/oilspill/spcc.htm.

Reporting Oil Spills

In the event of an oil spill, contact the National Response Center toll free at 1-800-424- 8802 for assistance, or for more details, visit their website: www.nrc.uscg.mil.

Maintenance and Removal

Effective implementation of good housekeeping practices is dependent on clear designation of personnel responsible for supervising and implementing good housekeeping programs, such as site cleanup and disposal of trash and debris, hazardous material management and disposal, vehicle and equipment maintenance, and other practices. Emergency response "drills" may aid in emergency preparedness.

Checklists may be helpful in good housekeeping efforts.

Staging and storage areas require permanent stabilization when the areas are no longer being used for construction-related activities.

Construction-related materials, debris and waste must be removed from the construction site once construction is complete.

Design Details

See the following Fact Sheets for related Design Details:

MM-1 Concrete Washout Area

MM-2 Stockpile Management

SM-4 Vehicle Tracking Control

Design details are not necessary for other good housekeeping practices; however, be sure to designate where specific practices will occur on the appropriate construction drawings.

Silt Fence (SF) SC-1

Description

A silt fence is a woven geotextile fabric attached to wooden posts and trenched into the ground. It is designed as a sediment barrier to intercept sheet flow runoff from disturbed areas.

Photograph SF-1. Silt fence creates a sediment barrier, forcing sheet flow runoff to evaporate or infiltrate.

Appropriate Uses

A silt fence can be used where runoff is conveyed from a disturbed area as sheet flow. Silt fence is not designed to receive concentrated flow or to be used as a filter fabric. Typical uses include:

- Down slope of a disturbed area to accept sheet flow.
- Along the perimeter of a receiving water such as a stream, pond or wetland.
- At the perimeter of a construction site.

Design and Installation

Silt fence should be installed along the contour of slopes so that it intercepts sheet flow. The maximum recommended tributary drainage area per 100 lineal feet of silt fence, installed along the contour, is approximately 0.25 acres with a disturbed slope length of up to 150 feet and a tributary slope gradient no steeper than 3:1. Longer and steeper slopes require additional measures. This recommendation only applies to silt fence installed along the contour. Silt fence installed for other uses, such as perimeter control, should be installed in a way that will not produce concentrated flows. For example, a "J-hook" installation may be appropriate to force runoff to pond and evaporate or infiltrate in multiple areas rather than concentrate and cause erosive conditions parallel to the silt fence.

See Detail SF-1 for proper silt fence installation, which involves proper trenching, staking, securing the fabric to the stakes, and backfilling the silt fence. Properly installed silt fence should not be easily pulled out by hand and there should be no gaps between the ground and the fabric.

Silt fence must meet the minimum allowable strength requirements, depth of installation requirement, and other specifications in the design details. Improper installation of silt fence is a common reason for silt fence failure; however, when properly installed and used for the appropriate purposes, it can be highly effective.

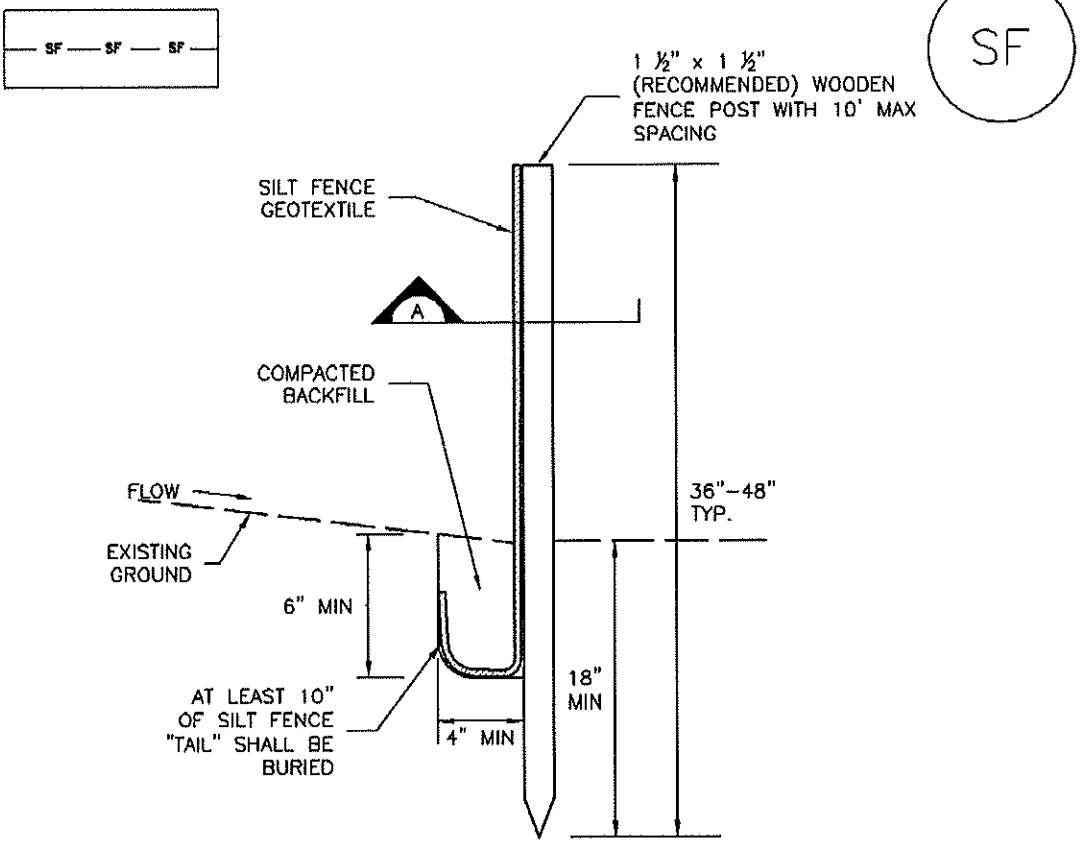
Silt Fence	
Functions	
Erosion Control	No
Sediment Control	Yes
Site/Material Management	No

Maintenance and Removal

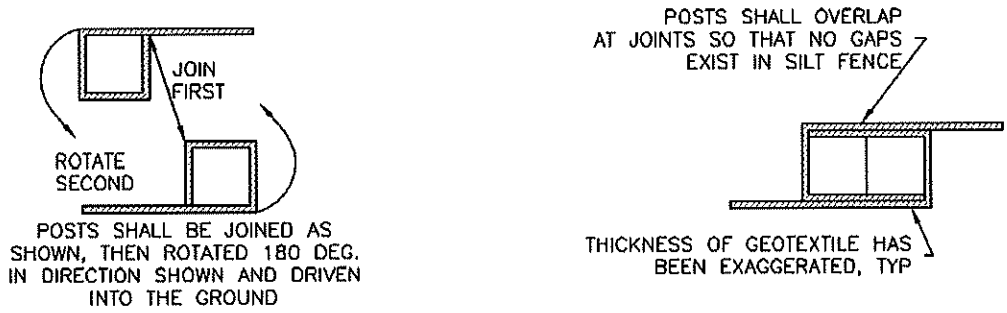
Inspection of silt fence includes observing the material for tears or holes and checking for slumping fence and undercut areas bypassing flows. Repair of silt fence typically involves replacing the damaged section with a new section. Sediment accumulated behind silt fence should be removed, as needed to maintain BMP effectiveness, typically before it reaches a depth of 6 inches.

Silt fence may be removed when the upstream area has reached final stabilization.

Photograph SF-2. When silt fence is not installed along the contour, a "J-hook" installation may be appropriate to ensure that the BMP does not create concentrated flow parallel to the silt fence. Photo courtesy of Tom Gore.



SILT FENCE



SECTION A

SF–1. SILT FENCE

SILT FENCE INSTALLATION NOTES

1. SILT FENCE MUST BE PLACED AWAY FROM THE TOE OF THE SLOPE TO ALLOW FOR WATER PONDING. SILT FENCE AT THE TOE OF A SLOPE SHOULD BE INSTALLED IN A FLAT LOCATION AT LEAST SEVERAL FEET (2–5 FT) FROM THE TOE OF THE SLOPE TO ALLOW ROOM FOR PONDING AND DEPOSITION.

2. A UNIFORM 6" X 4" ANCHOR TRENCH SHALL BE EXCAVATED USING TRENCHER OR SILT FENCE INSTALLATION DEVICE. NO ROAD GRADERS, BACKHOES, OR SIMILAR EQUIPMENT SHALL BE USED.

3. COMPACT ANCHOR TRENCH BY HAND WITH A "JUMPING JACK" OR BY WHEEL ROLLING. COMPACTION SHALL BE SUCH THAT SILT FENCE RESISTS BEING PULLED OUT OF ANCHOR TRENCH BY HAND.

4. SILT FENCE SHALL BE PULLED TIGHT AS IT IS ANCHORED TO THE STAKES. THERE SHOULD BE NO NOTICEABLE SAG BETWEEN STAKES AFTER IT HAS BEEN ANCHORED TO THE STAKES.

5. SILT FENCE FABRIC SHALL BE ANCHORED TO THE STAKES USING 1" HEAVY DUTY STAPLES OR NAILS WITH 1" HEADS. STAPLES AND NAILS SHOULD BE PLACED 3" ALONG THE FABRIC DOWN THE STAKE.

6. AT THE END OF A RUN OF SILT FENCE ALONG A CONTOUR, THE SILT FENCE SHOULD BE TURNED PERPENDICULAR TO THE CONTOUR TO CREATE A "J–HOOK." THE "J–HOOK" EXTENDING PERPENDICULAR TO THE CONTOUR SHOULD BE OF SUFFICIENT LENGTH TO KEEP RUNOFF FROM FLOWING AROUND THE END OF THE SILT FENCE (TYPICALLY 10' – 20').

7. SILT FENCE SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.

SILT FENCE MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SEDIMENT ACCUMULATED UPSTREAM OF THE SILT FENCE SHALL BE REMOVED AS NEEDED TO MAINTAIN THE FUNCTIONALITY OF THE BMP, TYPICALLY WHEN DEPTH OF ACCUMULATED SEDIMENTS IS APPROXIMATELY 6".

5. REPAIR OR REPLACE SILT FENCE WHEN THERE ARE SIGNS OF WEAR, SUCH AS SAGGING, TEARING, OR COLLAPSE.

6. SILT FENCE IS TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION, OR IS REPLACED BY AN EQUIVALENT PERIMETER SEDIMENT CONTROL BMP.

7. WHEN SILT FENCE IS REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAIL ADAPTED FROM TOWN OF PARKER, COLORADO AND CITY OF AURORA, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Rock Sock (RS) SC-5

Description

A rock sock is constructed of gravel that has been wrapped by wire mesh or a geotextile to form an elongated cylindrical filter. Rock socks are typically used either as a perimeter control or as part of inlet protection. When placed at angles in the curb line, rock socks are typically referred to as curb socks. Rock socks are intended to trap sediment from stormwater runoff that flows onto roadways as a result of construction activities.

Photograph RS-1. Rock socks placed at regular intervals in a curb line can help reduce sediment loading to storm sewer inlets. Rock socks can also be used as perimeter controls.

Appropriate Uses

Rock socks can be used at the perimeter of a disturbed area to control localized sediment loading. A benefit of rock socks as opposed to other perimeter controls is that they do not have to be trenched or staked into the ground; therefore, they are often used on roadway construction projects where paved surfaces are present.

Use rock socks in inlet protection applications when the construction of a roadway is substantially complete and the roadway has been directly connected to a receiving storm system.

Design and Installation

When rock socks are used as perimeter controls, the maximum recommended tributary drainage area per 100 lineal feet of rock socks is approximately 0.25 acres with disturbed slope length of up to 150 feet and a tributary slope gradient no steeper than 3:1. A rock sock design detail and notes are provided in Detail RS-1. Also see the Inlet Protection Fact Sheet for design and installation guidance when rock socks are used for inlet protection and in the curb line.

When placed in the gutter adjacent to a curb, rock socks should protrude no more than two feet from the curb in order for traffic to pass safely. If located in a high traffic area, place construction markers to alert drivers and street maintenance workers of their presence.

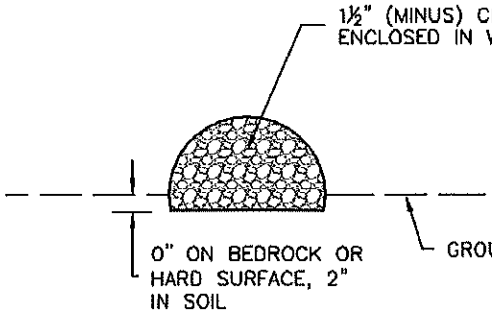
Maintenance and Removal

Rock socks are susceptible to displacement and breaking due to vehicle traffic. Inspect rock socks for damage and repair or replace as necessary. Remove sediment by sweeping or vacuuming as needed to maintain the functionality of the BMP, typically when sediment has accumulated behind the rock sock to one-half of the sock's height.

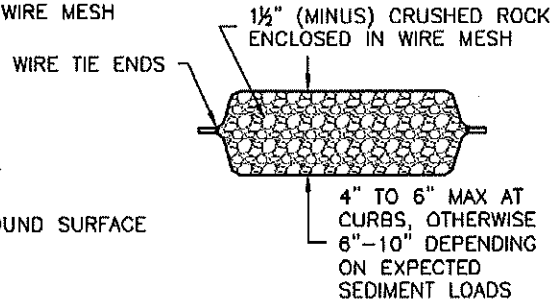
Once upstream stabilization is complete, rock socks and accumulated sediment should be removed and properly disposed.

Rock Sock	
Functions	
Erosion Control	No
Sediment Control	Yes
Site/Material Management	No

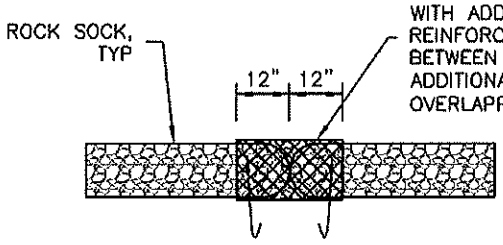
RS



ROCK SOCK SECTION



ROCK SOCK PLAN



ROCK SOCK JOINTING

ANY GAP AT JOINT SHALL BE FILLED WITH AN ADEQUATE AMOUNT OF 1½" (MINUS) CRUSHED ROCK AND WRAPPED WITH ADDITIONAL WIRE MESH SECURED TO ENDS OF ROCK REINFORCED SOCK. AS AN ALTERNATIVE TO FILLING JOINTS BETWEEN ADJOINING ROCK SOCKS WITH CRUSHED ROCK AND ADDITIONAL WIRE WRAPPING, ROCK SOCKS CAN BE OVERLAPPED (TYPICALLY 12–INCH OVERLAP) TO AVOID GAPS.

GRADATION TABLE	
SIEVE SIZE	MASS PERCENT PASSING SQUARE MESH SIEVES
	NO. 4
2"	100
1½"	90 – 100
1"	20 – 55
¾"	0 – 15
⅜"	0 – 5
MATCHES SPECIFICATIONS FOR NO. 4 COARSE AGGREGATE FOR CONCRETE PER AASHTO M43. ALL ROCK SHALL BE FRACTURED FACE, ALL SIDES.	

ROCK SOCK INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION(S) OF ROCK SOCKS.

2. CRUSHED ROCK SHALL BE 1½" (MINUS) IN SIZE WITH A FRACTURED FACE (ALL SIDES) AND SHALL COMPLY WITH GRADATION SHOWN ON THIS SHEET (1½" MINUS).

3. WIRE MESH SHALL BE FABRICATED OF 10 GAGE POULTRY MESH, OR EQUIVALENT, WITH A MAXIMUM OPENING OF ½", RECOMMENDED MINIMUM ROLL WIDTH OF 48"

4. WIRE MESH SHALL BE SECURED USING "HOG RINGS" OR WIRE TIES AT 6" CENTERS ALONG ALL JOINTS AND AT 2" CENTERS ON ENDS OF SOCKS.

5. SOME MUNICIPALITIES MAY ALLOW THE USE OF FILTER FABRIC AS AN ALTERNATIVE TO WIRE MESH FOR THE ROCK ENCLOSURE.

RS–1. ROCK SOCK PERIMETER CONTROL

ROCK SOCK MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. ROCK SOCKS SHALL BE REPLACED IF THEY BECOME HEAVILY SOILED, OR DAMAGED BEYOND REPAIR.

5. SEDIMENT ACCUMULATED UPSTREAM OF ROCK SOCKS SHALL BE REMOVED AS NEEDED TO MAINTAIN FUNCTIONALITY OF THE BMP, TYPICALLY WHEN DEPTH OF ACCUMULATED SEDIMENTS IS APPROXIMATELY ½ OF THE HEIGHT OF THE ROCK SOCK.

6. ROCK SOCKS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

7. WHEN ROCK SOCKS ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAIL ADAPTED FROM TOWN OF PARKER, COLORADO AND CITY OF AURORA, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

NOTE: THE DETAILS INCLUDED WITH THIS FACT SHEET SHOW COMMONLY USED, CONVENTIONAL METHODS OF ROCK SOCK INSTALLATION IN THE DENVER METROPOLITAN AREA. THERE ARE MANY OTHER SIMILAR PROPRIETARY PRODUCTS ON THE MARKET. UDFCD NEITHER NDORSES NOR DISCOURAGES USE OF PROPRIETARY PROTECTION PRODUCTS; HOWEVER, IN THE EVENT PROPRIETARY METHODS ARE USED, THE APPROPRIATE DETAIL FROM THE MANUFACTURER MUST BE INCLUDED IN THE SWMP AND THE BMP MUST BE INSTALLED AND MAINTAINED AS SHOWN IN THE MANUFACTURER'S DETAILS.

Construction Phasing/Sequencing (CP) SM-1

Description

Effective construction site management to minimize erosion and sediment transport includes attention to construction phasing, scheduling, and sequencing of land disturbing activities. On most construction projects, erosion and sediment controls will need to be adjusted as the project progresses and should be documented in the SWMP.

Photograph CP-1. Construction phasing to avoid disturbing the entire area at one time. Photo courtesy of WWE.

Construction phasing refers to disturbing only part of a site at a time to limit the potential for erosion from dormant parts of a site. Grading activities and construction are completed and soils are effectively stabilized on one part of a site before grading and construction begins on another portion of the site.

Construction sequencing or scheduling refers to a specified work schedule that coordinates the timing of land disturbing activities and the installation of erosion and sediment control practices.

Appropriate Uses

All construction projects can benefit from upfront planning to phase and sequence construction activities to minimize the extent and duration of disturbance. Larger projects and linear construction projects may benefit most from construction sequencing or phasing, but even small projects can benefit from construction sequencing that minimizes the duration of disturbance.

Typically, erosion and sediment controls needed at a site will change as a site progresses through the major phases of construction. Erosion and sediment control practices corresponding to each phase of construction must be documented in the SWMP.

Design and Installation

BMPs appropriate to the major phases of development should be identified on construction drawings. In some cases, it will be necessary to provide several drawings showing construction-phase BMPs placed according to stages of development (e.g., clearing and grading, utility installation, active construction, final stabilization). Some municipalities in the Denver area set maximum sizes for disturbed area associated with phases of a construction project. Additionally, requirements for phased construction drawings vary among local governments within the UDFCD boundary. Some local governments require separate erosion and sediment control drawings for initial BMPs, interim conditions (in active construction), and final stabilization.

Construction Scheduling	
Functions	
Erosion Control	Moderate
Sediment Control	Moderate
Site/Material Management	Yes

Typical construction phasing BMPs include:

- Limit the amount of disturbed area at any given time on a site to the extent practical. For example, a 100-acre subdivision might be constructed in five phases of 20 acres each.
- If there is carryover of stockpiled material from one phase to the next, position carryover material in a location easily accessible for the pending phase that will not require disturbance of stabilized areas to access the stockpile. Particularly with regard to efforts to balance cut and fill at a site, careful planning for location of stockpiles is important.

Typical construction sequencing BMPs include:

- Sequence construction activities to minimize duration of soil disturbance and exposure. For example, when multiple utilities will occupy the same trench, schedule installation so that the trench does not have to be closed and opened multiple times.
- Schedule site stabilization activities (e.g., landscaping, seeding and mulching, installation of erosion control blankets) as soon as feasible following grading.
- Install initial erosion and sediment control practices before construction begins. Promptly install additional BMPs for inlet protection, stabilization, etc., as construction activities are completed.

Table CP-1 provides typical sequencing of construction activities and associated BMPs.

Maintenance and Removal

When the construction schedule is altered, erosion and sediment control measures in the SWMP and construction drawings should be appropriately adjusted to reflect actual "on the ground" conditions at the construction site. Be aware that changes in construction schedules can have significant implications for site stabilization, particularly with regard to establishment of vegetative cover.

Table CP-1. Typical Phased BMP Installation for Construction Projects

Project Phase	BMPs
Pre-disturbance, Site Access	▪ Install sediment controls downgradient of access point (on paved streets this may consist of inlet protection). ▪ Establish vehicle tracking control at entrances to paved streets. Fence as needed. ▪ Use construction fencing to define the boundaries of the project and limit access to areas of the site that are not to be disturbed. **Note: it may be necessary to protect inlets in the general vicinity of the site, even if not downgradient, if there is a possibility that sediment tracked from the site could contribute to the inlets.**
Site Clearing and Grubbing	▪ Install perimeter controls as needed on downgradient perimeter of site (silt fence, wattles, etc). ▪ Limit disturbance to those areas planned for disturbance and protect undisturbed areas within the site (construction fence, flagging, etc). ▪ Preserve vegetative buffer at site perimeter. ▪ Create stabilized staging area. ▪ Locate portable toilets on flat surfaces away from drainage paths. Stake in areas susceptible to high winds. ▪ Construct concrete washout area and provide signage. ▪ Establish waste disposal areas. ▪ Install sediment basins. ▪ Create dirt perimeter berms and/or brush barriers during grubbing and clearing. ▪ Separate and stockpile topsoil, leave roughened and/or cover. ▪ Protect stockpiles with perimeter control BMPs. Stockpiles should be located away from drainage paths and should be accessed from the upgradient side so that perimeter controls can remain in place on the downgradient side. Use erosion control blankets, temporary seeding, and/or mulch for stockpiles that will be inactive for an extended period. ▪ Leave disturbed area of site in a roughened condition to limit erosion. Consider temporary revegetation for areas of the site that have been disturbed but that will be inactive for an extended period. ▪ Water to minimize dust but not to the point that watering creates runoff.

Project Phase	BMPs
Utility And Infrastructure Installation	**In Addition to the Above BMPs:** ▪ Close trench as soon as possible (generally at the end of the day). ▪ Use rough-cut street control or apply road base for streets that will not be promptly paved. ▪ Provide inlet protection as streets are paved and inlets are constructed. ▪ Protect and repair BMPs, as necessary. ▪ Perform street sweeping as needed.
Building Construction	**In Addition to the Above BMPs:** ▪ Implement materials management and good housekeeping practices for home building activities. ▪ Use perimeter controls for temporary stockpiles from foundation excavations. ▪ For lots adjacent to streets, lot-line perimeter controls may be necessary at the back of curb.
Final Grading	**In Addition to the Above BMPs:** ▪ Remove excess or waste materials. ▪ Remove stored materials.
Final Stabilization	**In Addition to the Above BMPs:** ▪ Seed and mulch/tackify. ▪ Seed and install blankets on steep slopes. ▪ Remove all temporary BMPs when site has reached final stabilization.

Protection of Existing Vegetation (PV) SM-2

Description

Protection of existing vegetation on a construction site can be accomplished through installation of a construction fence around the area requiring protection. In cases where upgradient areas are disturbed, it may also be necessary to install perimeter controls to minimize sediment loading to sensitive areas such as wetlands. Existing vegetation may be designated for protection to maintain a stable surface cover as part of construction phasing, or vegetation may be protected in areas designated to remain in natural condition under post-development conditions (e.g., wetlands, mature trees, riparian areas, open space).

Photograph PV-1. Protection of existing vegetation and a sensitive area. Photo courtesy of CDOT.

Appropriate Uses

Existing vegetation should be preserved for the maximum practical duration on a construction site through the use of effective construction phasing. Preserving vegetation helps to minimize erosion and can reduce revegetation costs following construction.

Protection of wetland areas is required under the Clean Water Act, unless a permit has been obtained from the U.S. Army Corps of Engineers (USACE) allowing impacts in limited areas.

If trees are to be protected as part of post-development landscaping, care must be taken to avoid several types of damage, some of which may not be apparent at the time of injury. Potential sources of injury include soil compaction during grading or due to construction traffic, direct equipment-related injury such as bark removal, branch breakage, surface grading and trenching, and soil cut and fill. In order to minimize injuries that may lead to immediate or later death of the tree, tree protection zones should be developed during site design, implemented at the beginning of a construction project, as well as continued during active construction.

Design and Installation

General

Once an area has been designated as a preservation area, there should be no construction activity allowed within a set distance of the area. Clearly mark the area with construction fencing. Do not allow stockpiles, equipment, trailers or parking within the protected area. Guidelines to protect various types of existing vegetation follow.

Protection of Existing Vegetation	
Functions	
Erosion Control	Yes
Sediment Control	Moderate
Site/Material Management	Yes

Surface Cover During Phased Construction

Install construction fencing or other perimeter controls around areas to be protected from clearing and grading as part of construction phasing.

Maintaining surface cover on steep slopes for the maximum practical duration during construction is recommended.

Open Space Preservation

Where natural open space areas will be preserved as part of a development, it is important to install construction fencing around these areas to protect them from compaction. This is particularly important when areas with soils with high infiltration rates are preserved as part of LID designs. Preserved open space areas should not be used for staging and equipment storage.

Wetlands and Riparian Areas

Install a construction fence around the perimeter of the wetland or riparian (streamside vegetation) area to prevent access by equipment. In areas downgradient of disturbed areas, install a perimeter control such as silt fence, sediment control logs, or similar measure to minimize sediment loading to the wetland.

Tree Protection[1]

- Before beginning construction operations, establish a tree protection zone around trees to be preserved by installing construction fences. Allow enough space from the trunk to protect the root zone from soil compaction and mechanical damage, and the branches from mechanical damage (see Table PV-1). If low branches will be kept, place the fence outside of the drip line. Where this is not possible, place fencing as far away from the trunk as possible. In order to maintain a healthy tree, be aware that about 60 percent of the tree's root zone extends beyond the drip line.

Table PV-1
Guidelines for Determining the Tree Protection Zone
(Source: Matheny and Clark, 1998; as cited in GreenCO and WWE 2008)

	Distance from Trunk (ft) per inch of DBH		
Species Tolerance to Damage	*Young*	*Mature*	*Over mature*
Good	0.5'	0.75'	1.0'
Moderate	0.75'	1.0'	1.25'
Poor	1.0'	1.25'	1.5'
Notes: DBH = diameter at breast height (4.5 ft above grade); Young = <20% of life expectancy; Mature = 20%-80% of life expectancy; Over mature =>80% of life expectancy			

- Most tree roots grow within the top 12 to 18 inches of soil. Grade changes within the tree protection zone should be avoided where possible because seemingly minor grade changes can either smother

[1] Tree Protection guidelines adapted from GreenCO and WWE (2008). *Green Industry Best Management Practices (BMPs) for the Conservation and Protection of Water Resources in Colorado: Moving Toward Sustainability, Third Release.* See www.greenco.org for more detailed guidance on tree preservation.

roots (in fill situations) or damage roots (in cut situations). Consider small walls where needed to avoid grade changes in the tree protection zone.

- Place and maintain a layer of mulch 4 to 6-inch thick from the tree trunk to the fencing, keeping a 6-inch space between the mulch and the trunk. Mulch helps to preserve moisture and decrease soil compaction if construction traffic is unavoidable. When planting operations are completed, the mulch may be reused throughout planting areas.

- Limit access, if needed at all, and appoint one route as the main entrance and exit to the tree protection zone. Within the tree protection zone, do not allow any equipment to be stored, chemicals to be dumped, or construction activities to take place except fine grading, irrigation system installation, and planting operations. These activities should be conducted in consultation with a landscaping professional, following Green Industry BMPs.

- Be aware that soil compaction can cause extreme damage to tree health that may appear gradually over a period of years. Soil compaction is easier to prevent than repair.

Maintenance and Removal

Repair or replace damaged or displaced fencing or other protective barriers around the vegetated area.

If damage occurs to a tree, consult an arborist for guidance on how to care for the tree. If a tree in a designated preservation area is damaged beyond repair, remove and replace with a 2-inch diameter tree of the same or similar species.

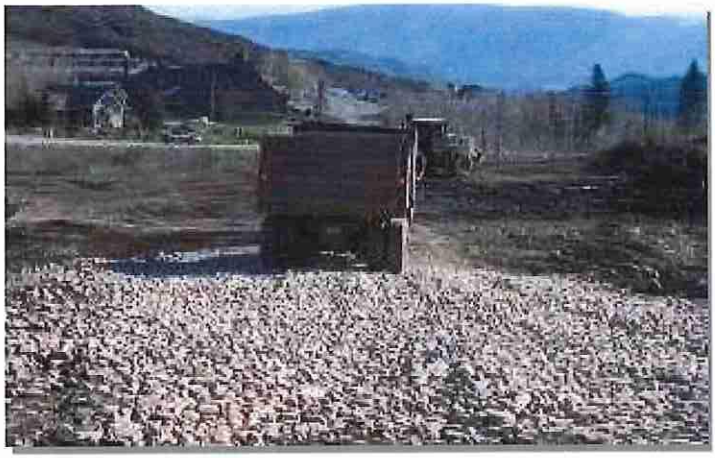
Construction equipment must not enter a wetland area, except as permitted by the U.S. Army Corps of Engineers (USACE). Inadvertent placement of fill in a wetland is a 404 permit violation and will require notification of the USACE.

If damage to vegetation occurs in a protected area, reseed the area with the same or similar species, following the recommendations in the USDCM *Revegetation* chapter.

Vehicle Tracking Control (VTC) SM-4

Description

Vehicle tracking controls provide stabilized construction site access where vehicles exit the site onto paved public roads. An effective vehicle tracking control helps remove sediment (mud or dirt) from vehicles, reducing tracking onto the paved surface.



Photograph VTC-1. A vehicle tracking control pad constructed with properly sized rock reduces off-site sediment tracking.

Appropriate Uses

Implement a stabilized construction entrance or vehicle tracking control where frequent heavy vehicle traffic exits the construction site onto a paved roadway. An effective vehicle tracking control is particularly important during the following conditions:

- Wet weather periods when mud is easily tracked off site.
- During dry weather periods where dust is a concern.
- When poorly drained, clayey soils are present on site.

Although wheel washes are not required in designs of vehicle tracking controls, they may be needed at particularly muddy sites.

Design and Installation

Construct the vehicle tracking control on a level surface. Where feasible, grade the tracking control towards the construction site to reduce off-site runoff. Place signage, as needed, to direct construction vehicles to the designated exit through the vehicle tracking control. There are several different types of stabilized construction entrances including:

VTC-1. Aggregate Vehicle Tracking Control. This is a coarse-aggregate surfaced pad underlain by a geotextile. This is the most common vehicle tracking control, and when properly maintained can be effective at removing sediment from vehicle tires.

VTC-2. Vehicle Tracking Control with Construction Mat or Turf Reinforcement Mat. This type of control may be appropriate for site access at very small construction sites with low traffic volume over vegetated areas. Although this application does not typically remove sediment from vehicles, it helps protect existing vegetation and provides a stabilized entrance.

Vehicle Tracking Control	
Functions	
Erosion Control	Moderate
Sediment Control	Yes
Site/Material Management	Yes

VTC-3. Stabilized Construction Entrance/Exit with Wheel Wash. This is an aggregate pad, similar to VTC-1, but includes equipment for tire washing. The wheel wash equipment may be as simple as hand-held power washing equipment to more advance proprietary systems. When a wheel wash is provided, it is important to direct wash water to a sediment trap prior to discharge from the site.

Vehicle tracking controls are sometimes installed in combination with a sediment trap to treat runoff.

Maintenance and Removal

Inspect the area for degradation and replace aggregate or material used for a stabilized entrance/exit as needed. If the area becomes clogged and ponds water, remove and dispose of excess sediment or replace material with a fresh layer of aggregate as necessary.

With aggregate vehicle tracking controls, ensure rock and debris from this area do not enter the public right-of-way.

Remove sediment that is tracked onto the public right of way daily or more frequently as needed. Excess sediment in the roadway indicates that the stabilized construction entrance needs maintenance.

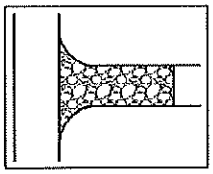
Ensure that drainage ditches at the entrance/exit area remain clear.

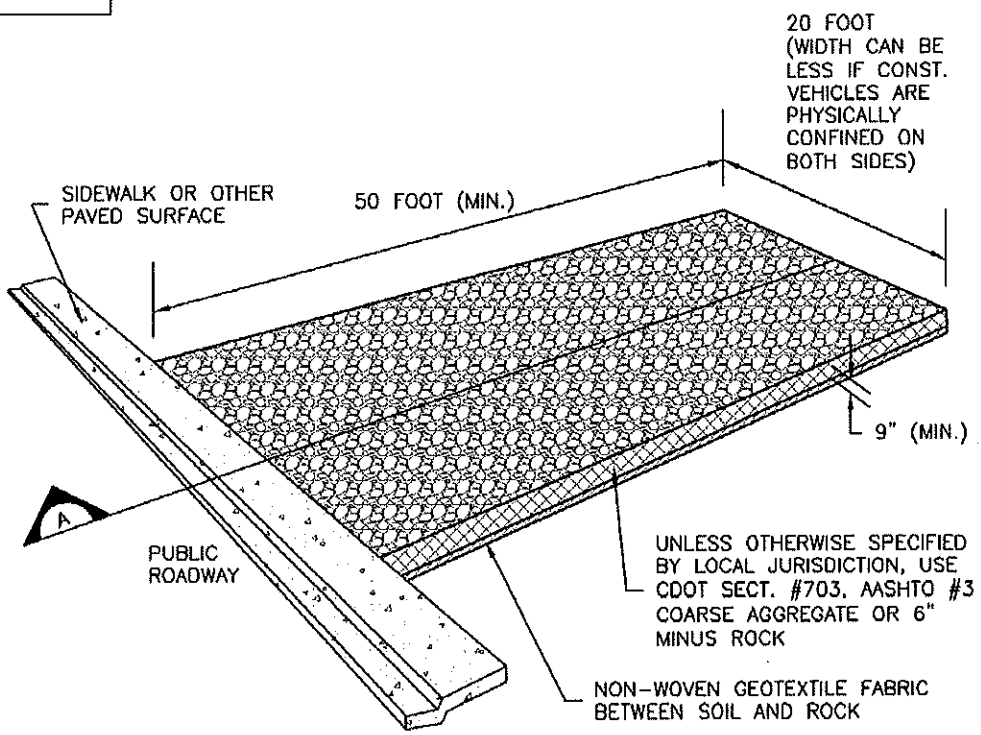
Photograph VTC-2. A vehicle tracking control pad with wheel wash facility. Photo courtesy of Tom Gore.

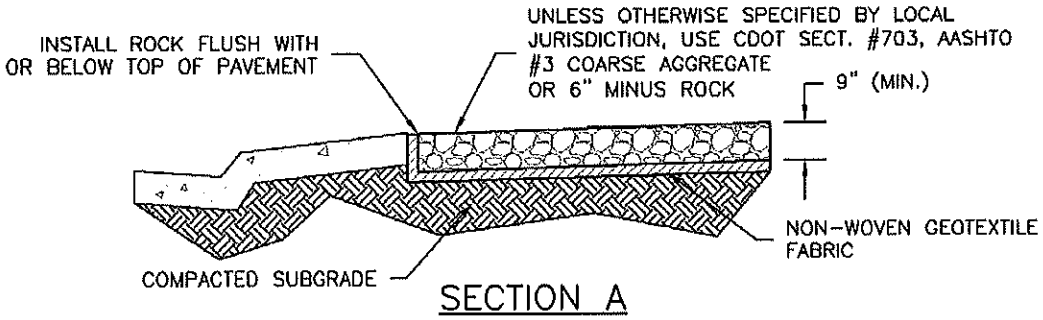
A stabilized entrance should be removed only when there is no longer the potential for vehicle tracking to occur. This is typically after the site has been stabilized.

When wheel wash equipment is used, be sure that the wash water is discharged to a sediment trap prior to discharge. Also inspect channels conveying the water from the wash area to the sediment trap and stabilize areas that may be eroding.

When a construction entrance/exit is removed, excess sediment from the aggregate should be removed and disposed of appropriately. The entrance should be promptly stabilized with a permanent surface following removal, typically by paving.

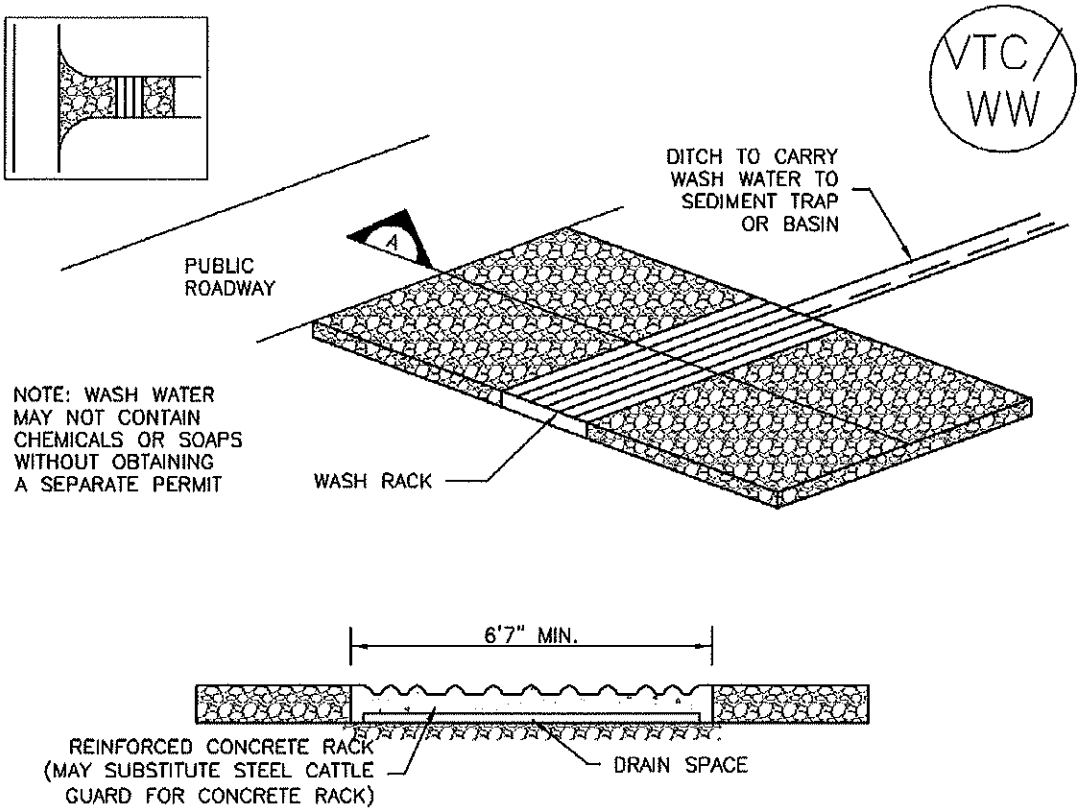




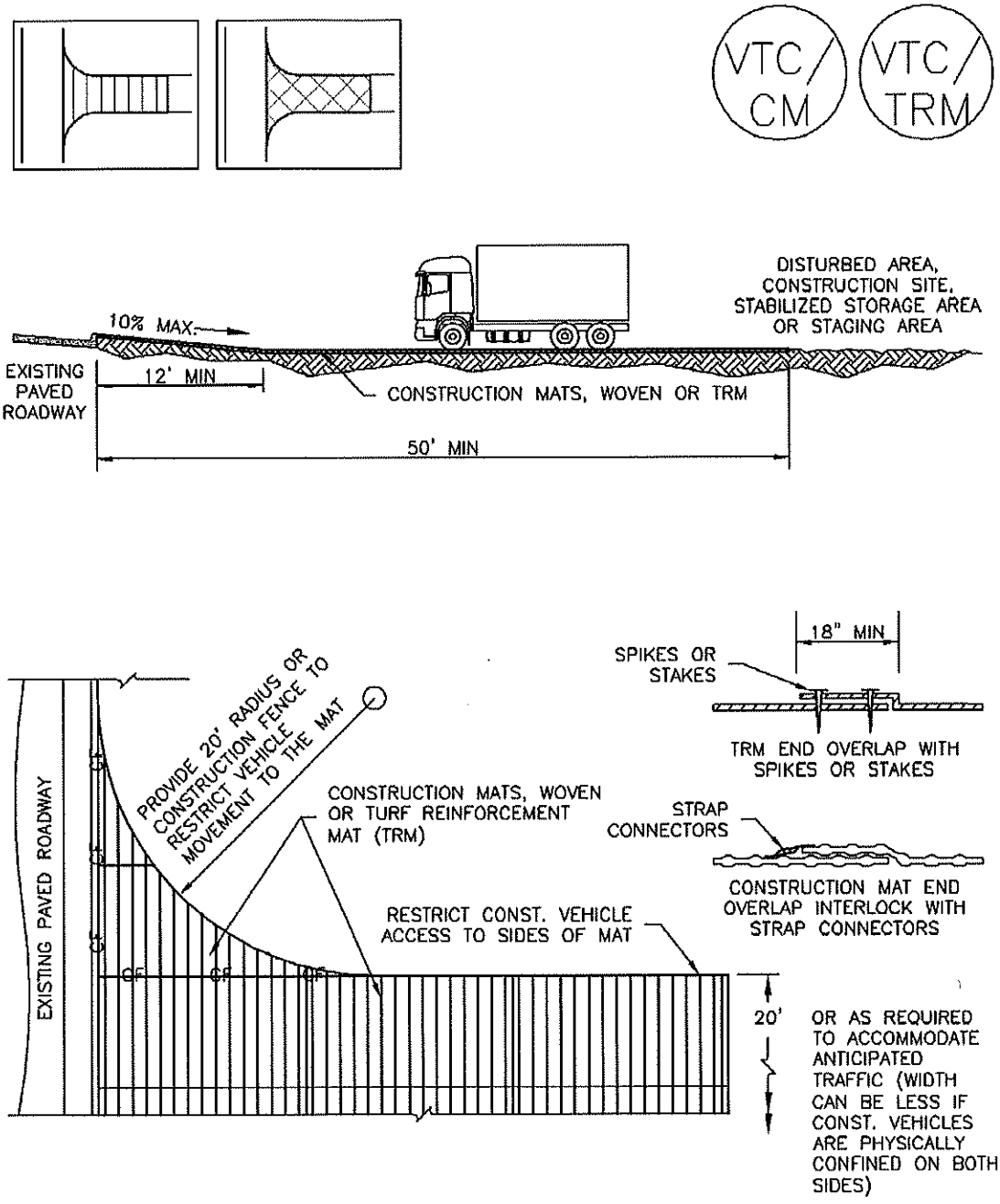


SECTION A

VTC-1. AGGREGATE VEHICLE TRACKING CONTROL



VTC–2. AGGREGATE VEHICLE TRACKING CONTROL WITH WASH RACK



VTC–3. VEHICLE TRACKING CONTROL W/ CONSTRUCTION MAT OR TURF REINFORCEMENT MAT (TRM)

STABILIZED CONSTRUCTION ENTRANCE/EXIT INSTALLATION NOTES

1. SEE PLAN VIEW FOR
   -LOCATION OF CONSTRUCTION ENTRANCE(S)/EXIT(S).
   -TYPE OF CONSTRUCTION ENTRANCE(S)/EXITS(S) (WITH/WITHOUT WHEEL WASH, CONSTRUCTION MAT OR TRM).

2. CONSTRUCTION MAT OR TRM STABILIZED CONSTRUCTION ENTRANCES ARE ONLY TO BE USED ON SHORT DURATION PROJECTS (TYPICALLY RANGING FROM A WEEK TO A MONTH) WHERE THERE WILL BE LIMITED VEHICULAR ACCESS.

3. A STABILIZED CONSTRUCTION ENTRANCE/EXIT SHALL BE LOCATED AT ALL ACCESS POINTS WHERE VEHICLES ACCESS THE CONSTRUCTION SITE FROM PAVED RIGHT-OF-WAYS.

4. STABILIZED CONSTRUCTION ENTRANCE/EXIT SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.

5. A NON-WOVEN GEOTEXTILE FABRIC SHALL BE PLACED UNDER THE STABILIZED CONSTRUCTION ENTRANCE/EXIT PRIOR TO THE PLACEMENT OF ROCK.

6. UNLESS OTHERWISE SPECIFIED BY LOCAL JURISDICTION, ROCK SHALL CONSIST OF DOT SECT. #703, AASHTO #3 COARSE AGGREGATE OR 6" (MINUS) ROCK.

STABILIZED CONSTRUCTION ENTRANCE/EXIT MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. ROCK SHALL BE REAPPLIED OR REGRADED AS NECESSARY TO THE STABILIZED ENTRANCE/EXIT TO MAINTAIN A CONSISTENT DEPTH.

5. SEDIMENT TRACKED ONTO PAVED ROADS IS TO BE REMOVED THROUGHOUT THE DAY AND AT THE END OF THE DAY BY SHOVELING OR SWEEPING. SEDIMENT MAY NOT BE WASHED DOWN STORM SEWER DRAINS.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

(DETAILS ADAPTED FROM CITY OF BROOMFIELD, COLORADO, NOT AVAILABLE IN AUTOCAD)

Stabilized Staging Area (SSA) SM-6

Description

A stabilized staging area is a clearly designated area where construction equipment and vehicles, stockpiles, waste bins, and other construction-related materials are stored. The contractor office trailer may also be located in this area. Depending on the size of the construction site, more than one staging area may be necessary.

Photograph SSA-1. Example of a staging area with a gravel surface to prevent mud tracking and reduce runoff. Photo courtesy of Douglas County.

Appropriate Uses

Most construction sites will require a staging area, which should be clearly designated in SWMP drawings. The layout of the staging area may vary depending on the type of construction activity. Staging areas located in roadways due to space constraints require special measures to avoid materials being washed into storm inlets.

Design and Installation

Stabilized staging areas should be completed prior to other construction activities beginning on the site. Major components of a stabilized staging area include:

- Appropriate space to contain storage and provide for loading/unloading operations, as well as parking if necessary.
- A stabilized surface, either paved or covered, with 3-inch diameter aggregate or larger.
- Perimeter controls such as silt fence, sediment control logs, or other measures.
- Construction fencing to prevent unauthorized access to construction materials.
- Provisions for Good Housekeeping practices related to materials storage and disposal, as described in the Good Housekeeping BMP Fact Sheet.
- A stabilized construction entrance/exit, as described in the Vehicle Tracking Control BMP Fact Sheet, to accommodate traffic associated with material delivery and waste disposal vehicles.

Over-sizing the stabilized staging area may result in disturbance of existing vegetation in excess of that required for the project. This increases costs, as well as requirements for long-term stabilization following the construction period. When designing the stabilized staging area, minimize the area of disturbance to the extent practical.

Stabilized Staging Area	
Functions	
Erosion Control	Yes
Sediment Control	Moderate
Site/Material	Yes

Minimizing Long-Term Stabilization Requirements

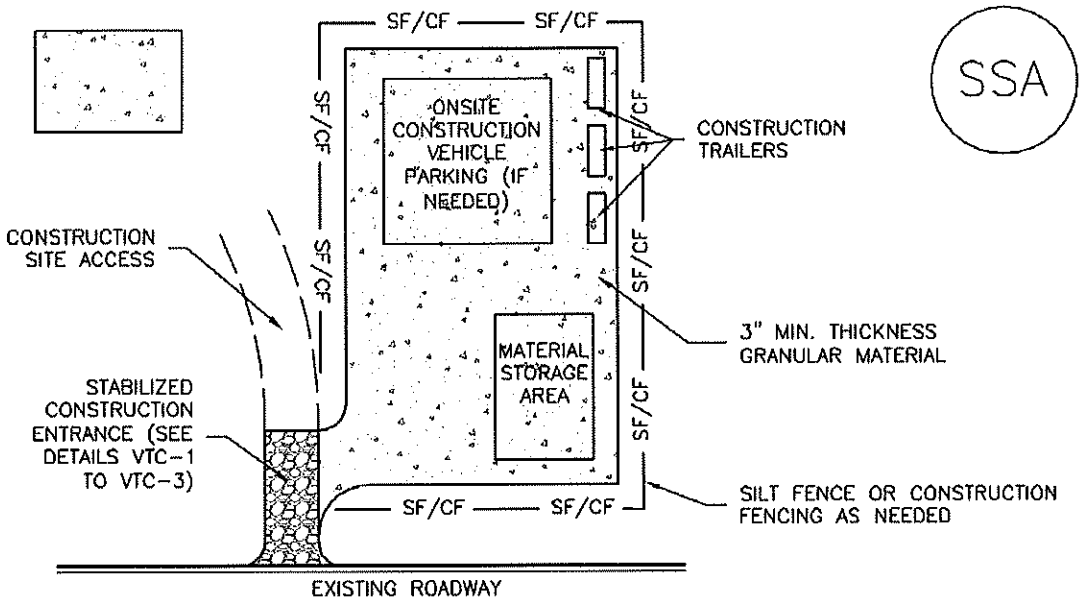
- Utilize off-site parking and restrict vehicle access to the site.
- Use construction mats in lieu of rock when staging is provided in an area that will not be disturbed otherwise.
- Consider use of a bermed contained area for materials and equipment that do not require a stabilized surface.
- Consider phasing of staging areas to avoid disturbance in an area that will not be otherwise disturbed.

See Detail SSA-1 for a typical stabilized staging area and SSA-2 for a stabilized staging area when materials staging in roadways is required.

Maintenance and Removal

Maintenance of stabilized staging areas includes maintaining a stable surface cover of gravel, repairing perimeter controls, and following good housekeeping practices.

When construction is complete, debris, unused stockpiles and materials should be recycled or properly disposed. In some cases, this will require disposal of contaminated soil from equipment leaks in an appropriate landfill. Staging areas should then be permanently stabilized with vegetation or other surface cover planned for the development.



SSA-1. STABILIZED STAGING AREA

STABILIZED STAGING AREA INSTALLATION NOTES

1. SEE PLAN VIEW FOR
   -LOCATION OF STAGING AREA(S).
   -CONTRACTOR MAY ADJUST LOCATION AND SIZE OF STAGING AREA WITH APPROVAL FROM THE LOCAL JURISDICTION.

2. STABILIZED STAGING AREA SHOULD BE APPROPRIATE FOR THE NEEDS OF THE SITE. OVERSIZING RESULTS IN A LARGER AREA TO STABILIZE FOLLOWING CONSTRUCTION.

3. STAGING AREA SHALL BE STABILIZED PRIOR TO OTHER OPERATIONS ON THE SITE.

4. THE STABILIZED STAGING AREA SHALL CONSIST OF A MINIMUM 3" THICK GRANULAR MATERIAL.

5. UNLESS OTHERWISE SPECIFIED BY LOCAL JURISDICTION, ROCK SHALL CONSIST OF DOT SECT. #703, AASHTO #3 COARSE AGGREGATE OR 6" (MINUS) ROCK.

6. ADDITIONAL PERIMETER BMPs MAY BE REQUIRED INCLUDING BUT NOT LIMITED TO SILT FENCE AND CONSTRUCTION FENCING.

STABILIZED STAGING AREA MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. ROCK SHALL BE REAPPLIED OR REGRADED AS NECESSARY IF RUTTING OCCURS OR UNDERLYING SUBGRADE BECOMES EXPOSED.

STABILIZED STAGING AREA MAINTENANCE NOTES

5. STABILIZED STAGING AREA SHALL BE ENLARGED IF NECESSARY TO CONTAIN PARKING, STORAGE, AND UNLOADING/LOADING OPERATIONS.

6. THE STABILIZED STAGING AREA SHALL BE REMOVED AT THE END OF CONSTRUCTION. THE GRANULAR MATERIAL SHALL BE REMOVED OR, IF APPROVED BY THE LOCAL JURISDICTION, USED ON SITE, AND THE AREA COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY LOCAL JURISDICTION.

NOTE: MANY MUNICIPALITIES PROHIBIT THE USE OF RECYCLED CONCRETE AS GRANULAR MATERIAL FOR STABILIZED STAGING AREAS DUE TO DIFFICULTIES WITH RE-ESTABLISHMENT OF VEGETATION IN AREAS WHERE RECYCLED CONCRETE WAS PLACED.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO, NOT AVAILABLE IN AUTOCAD)

Street Sweeping and Vacuuming (SS) SM-7

Description

Street sweeping and vacuuming remove sediment that has been tracked onto roadways to reduce sediment transport into storm drain systems or a surface waterway.

Photograph SS-1. A street sweeper removes sediment and potential pollutants along the curb line at a construction site. Photo courtesy of Tom Gore.

Appropriate Uses

Use this practice at construction sites where vehicles may track sediment offsite onto paved roadways.

Design and Installation

Street sweeping or vacuuming should be conducted when there is noticeable sediment accumulation on roadways adjacent to the construction site. Typically, this will be concentrated at the entrance/exit to the construction site. Well-maintained stabilized construction entrances, vehicle tracking controls and tire wash facilities can help reduce the necessary frequency of street sweeping and vacuuming.

On smaller construction sites, street sweeping can be conducted manually using a shovel and broom. Never wash accumulated sediment on roadways into storm drains.

Maintenance and Removal

- Inspect paved roads around the perimeter of the construction site on a daily basis and more frequently, as needed. Remove accumulated sediment, as needed.
- Following street sweeping, check inlet protection that may have been displaced during street sweeping.
- Inspect area to be swept for materials that may be hazardous prior to beginning sweeping operations.

Street Sweeping/ Vacuuming	
Functions	
Erosion Control	No
Sediment Control	Yes
Site/Material Management	Yes

Stabilized Staging Area (SSA) SM-6

Description

A stabilized staging area is a clearly designated area where construction equipment and vehicles, stockpiles, waste bins, and other construction-related materials are stored. The contractor office trailer may also be located in this area. Depending on the size of the construction site, more than one staging area may be necessary.

Photograph SSA-1. Example of a staging area with a gravel surface to prevent mud tracking and reduce runoff. Photo courtesy of Douglas County.

Appropriate Uses

Most construction sites will require a staging area, which should be clearly designated in SWMP drawings. The layout of the staging area may vary depending on the type of construction activity. Staging areas located in roadways due to space constraints require special measures to avoid materials being washed into storm inlets.

Design and Installation

Stabilized staging areas should be completed prior to other construction activities beginning on the site. Major components of a stabilized staging area include:

- Appropriate space to contain storage and provide for loading/unloading operations, as well as parking if necessary.
- A stabilized surface, either paved or covered, with 3-inch diameter aggregate or larger.
- Perimeter controls such as silt fence, sediment control logs, or other measures.
- Construction fencing to prevent unauthorized access to construction materials.
- Provisions for Good Housekeeping practices related to materials storage and disposal, as described in the Good Housekeeping BMP Fact Sheet.
- A stabilized construction entrance/exit, as described in the Vehicle Tracking Control BMP Fact Sheet, to accommodate traffic associated with material delivery and waste disposal vehicles.

Over-sizing the stabilized staging area may result in disturbance of existing vegetation in excess of that required for the project. This increases costs, as well as requirements for long-term stabilization following the construction period. When designing the stabilized staging area, minimize the area of disturbance to the extent practical.

Stabilized Staging Area	
Functions	
Erosion Control	Yes
Sediment Control	Moderate
Site/Material	Yes

Minimizing Long-Term Stabilization Requirements

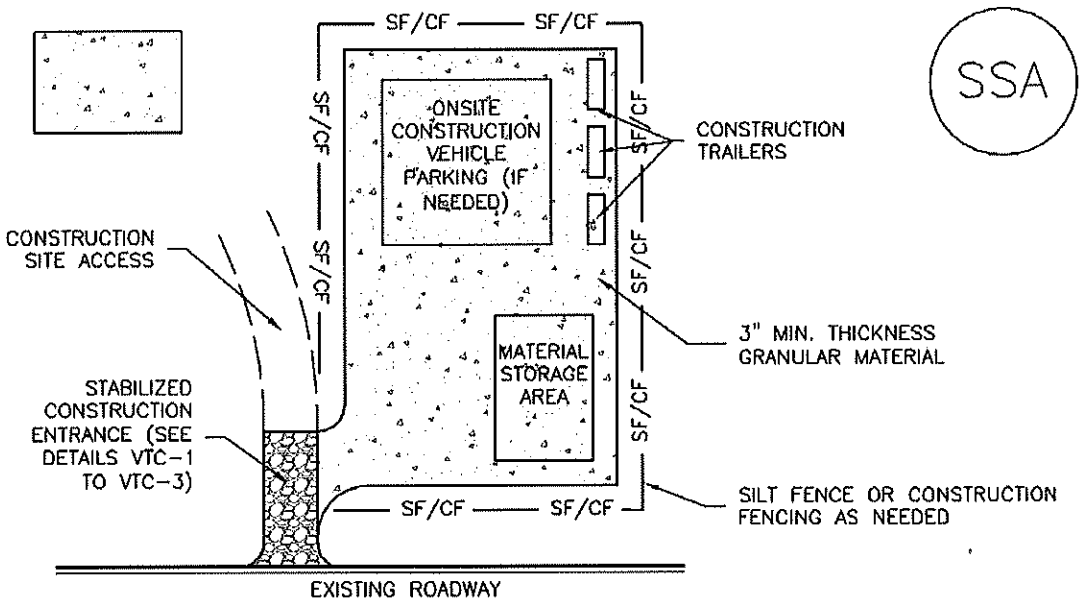
- Utilize off-site parking and restrict vehicle access to the site.
- Use construction mats in lieu of rock when staging is provided in an area that will not be disturbed otherwise.
- Consider use of a bermed contained area for materials and equipment that do not require a stabilized surface.
- Consider phasing of staging areas to avoid disturbance in an area that will not be otherwise disturbed.

See Detail SSA-1 for a typical stabilized staging area and SSA-2 for a stabilized staging area when materials staging in roadways is required.

Maintenance and Removal

Maintenance of stabilized staging areas includes maintaining a stable surface cover of gravel, repairing perimeter controls, and following good housekeeping practices.

When construction is complete, debris, unused stockpiles and materials should be recycled or properly disposed. In some cases, this will require disposal of contaminated soil from equipment leaks in an appropriate landfill. Staging areas should then be permanently stabilized with vegetation or other surface cover planned for the development.



SSA-1. STABILIZED STAGING AREA

STABILIZED STAGING AREA INSTALLATION NOTES

1. SEE PLAN VIEW FOR
   -LOCATION OF STAGING AREA(S).
   -CONTRACTOR MAY ADJUST LOCATION AND SIZE OF STAGING AREA WITH APPROVAL FROM THE LOCAL JURISDICTION.

2. STABILIZED STAGING AREA SHOULD BE APPROPRIATE FOR THE NEEDS OF THE SITE. OVERSIZING RESULTS IN A LARGER AREA TO STABILIZE FOLLOWING CONSTRUCTION.

3. STAGING AREA SHALL BE STABILIZED PRIOR TO OTHER OPERATIONS ON THE SITE.

4. THE STABILIZED STAGING AREA SHALL CONSIST OF A MINIMUM 3" THICK GRANULAR MATERIAL.

5. UNLESS OTHERWISE SPECIFIED BY LOCAL JURISDICTION, ROCK SHALL CONSIST OF DOT SECT. #703, AASHTO #3 COARSE AGGREGATE OR 6" (MINUS) ROCK.

6. ADDITIONAL PERIMETER BMPs MAY BE REQUIRED INCLUDING BUT NOT LIMITED TO SILT FENCE AND CONSTRUCTION FENCING.

STABILIZED STAGING AREA MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

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3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. ROCK SHALL BE REAPPLIED OR REGRADED AS NECESSARY IF RUTTING OCCURS OR UNDERLYING SUBGRADE BECOMES EXPOSED.

STABILIZED STAGING AREA MAINTENANCE NOTES

5. STABILIZED STAGING AREA SHALL BE ENLARGED IF NECESSARY TO CONTAIN PARKING, STORAGE, AND UNLOADING/LOADING OPERATIONS.

6. THE STABILIZED STAGING AREA SHALL BE REMOVED AT THE END OF CONSTRUCTION. THE GRANULAR MATERIAL SHALL BE REMOVED OR, IF APPROVED BY THE LOCAL JURISDICTION, USED ON SITE, AND THE AREA COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY LOCAL JURISDICTION.

NOTE: MANY MUNICIPALITIES PROHIBIT THE USE OF RECYCLED CONCRETE AS GRANULAR MATERIAL FOR STABILIZED STAGING AREAS DUE TO DIFFICULTIES WITH RE-ESTABLISHMENT OF VEGETATION IN AREAS WHERE RECYCLED CONCRETE WAS PLACED.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO, NOT AVAILABLE IN AUTOCAD)

Surface Roughening (SR) EC-1

Description

Surface roughening is an erosion control practice that involves tracking, scarifying, imprinting, or tilling a disturbed area to provide temporary stabilization of disturbed areas. Surface roughening creates variations in the soil surface that help to minimize wind and water erosion. Depending on the technique used, surface roughening may also help establish conditions favorable to establishment of vegetation.

Photograph SR-1. Surface roughening via imprinting for temporary stabilization.

Appropriate Uses

Surface roughening can be used to provide temporary stabilization of disturbed areas, such as when revegetation cannot be immediately established due to seasonal planting limitations. Surface roughening is not a stand-alone BMP, and should be used in conjunction with other erosion and sediment controls.

Surface roughening is often implemented in conjunction with grading and is typically performed using heavy construction equipment to track the surface. Be aware that tracking with heavy equipment will also compact soils, which is not desirable in areas that will be revegetated. Scarifying, tilling, or ripping are better surface roughening techniques in locations where revegetation is planned. Roughening is not effective in very sandy soils and cannot be effectively performed in rocky soil.

Design and Installation

Typical design details for surfacing roughening on steep and mild slopes are provided in Details SR-1 and SR-2, respectively.

Surface roughening should be performed either after final grading or to temporarily stabilize an area during active construction that may be inactive for a short time period. Surface roughening should create depressions 2 to 6 inches deep and approximately 6 inches apart. The surface of exposed soil can be roughened by a number of techniques and equipment. Horizontal grooves (running parallel to the contours of the land) can be made using tracks from equipment treads, stair-step grading, ripping, or tilling.

Fill slopes can be constructed with a roughened surface. Cut slopes that have been smooth graded can be roughened as a subsequent operation. Roughening should follow along the contours of the slope. The tracks left by truck mounted equipment working perpendicular to the contour can leave acceptable horizontal depressions; however, the equipment will also compact the soil.

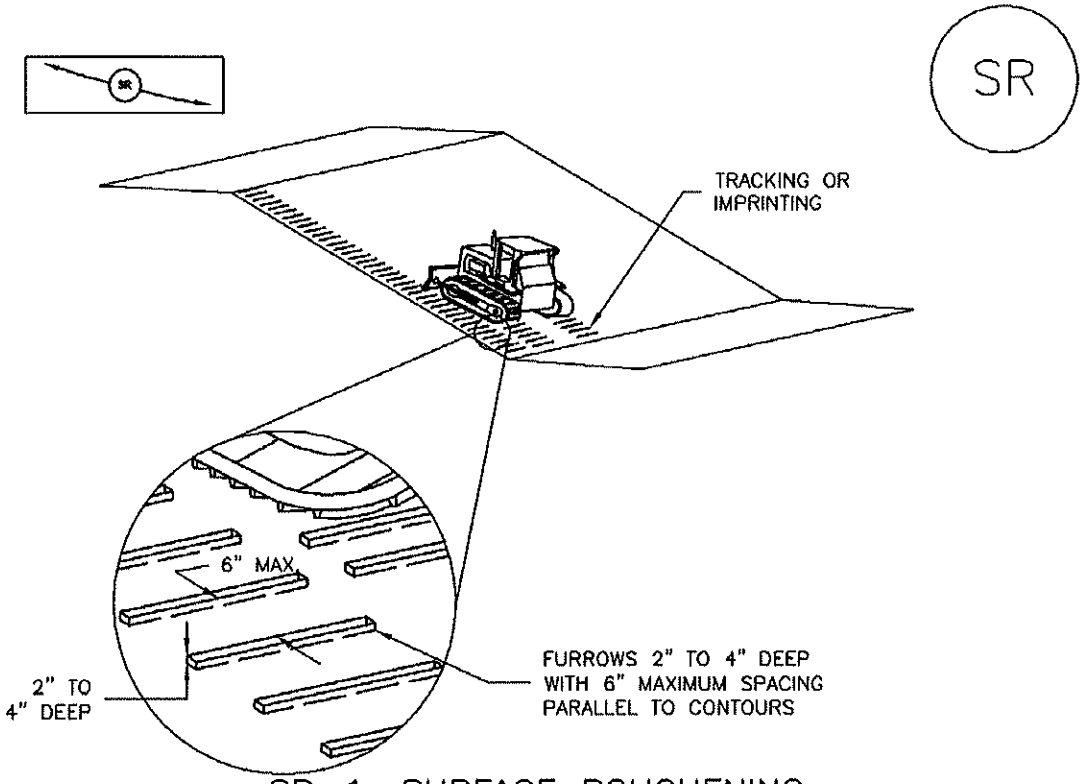
Surface Roughening	
Functions	
Erosion Control	Yes
Sediment Control	No
Site/Material Management	No

Maintenance and Removal

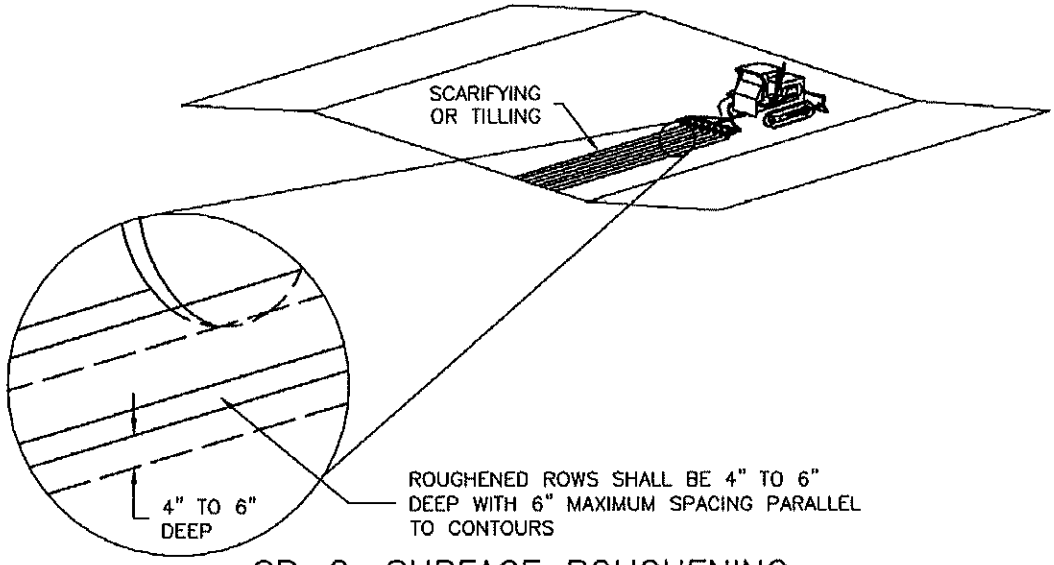
Care should be taken not to drive vehicles or equipment over areas that have been surface roughened. Tire tracks will smooth the roughened surface and may cause runoff to collect into rills and gullies.

Because surface roughening is only a temporary control, additional treatments may be necessary to maintain the soil surface in a roughened condition.

Areas should be inspected for signs of erosion. Surface roughening is a temporary measure, and will not provide long-term erosion control.



SR–1. SURFACE ROUGHENING
FOR STEEP SLOPES (3:1 OR STEEPER)



SR–2. SURFACE ROUGHENING
FOR LOW SLOPES (LESS THAN 3:1)

SURFACE ROUGHENING INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   -LOCATION(S) OF SURFACE ROUGHENING.

2. SURFACE ROUGHENING SHALL BE PROVIDED PROMPTLY AFTER COMPLETION OF FINISHED GRADING (FOR AREAS NOT RECEIVING TOPSOIL) OR PRIOR TO TOPSOIL PLACEMENT OR ANY FORECASTED RAIN EVENT.

3. AREAS WHERE BUILDING FOUNDATIONS, PAVEMENT, OR SOD WILL BE PLACED WITHOUT DELAY IN THE CONSTRUCTION SEQUENCE, SURFACE ROUGHENING IS NOT REQUIRED.

4. DISTURBED SURFACES SHALL BE ROUGHENED USING RIPPING OR TILLING EQUIPMENT ON THE CONTOUR OR TRACKING UP AND DOWN A SLOPE USING EQUIPMENT TREADS.

5. A FARMING DISK SHALL NOT BE USED FOR SURFACE ROUGHENING.

SURFACE ROUGHENING MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACE UPON DISCOVERY OF THE FAILURE.

4. VEHICLES AND EQUIPMENT SHALL NOT BE DRIVEN OVER AREAS THAT HAVE BEEN SURFACE ROUGHENED.

5. IN NON-TURF GRASS FINISHED AREAS, SEEDING AND MULCHING SHALL TAKE PLACE DIRECTLY OVER SURFACE ROUGHENED AREAS WITHOUT FIRST SMOOTHING OUT THE SURFACE.

6. IN AREAS NOT SEEDED AND MULCHED AFTER SURFACE ROUGHENING, SURFACES SHALL BE RE-ROUGHENED AS NECESSARY TO MAINTAIN GROOVE DEPTH AND SMOOTH OVER RILL EROSION.

(DETAILS ADAPTED FROM TOWN OF PARKER, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Appendix B

City of Grand Junction

N

0 0.1 0.2 mi

Printed: 7/19/2018

1 inch = 376 feet

CITY OF Grand Junction COLORADO GEOGRAPHIC INFORMATION SYSTEM

Appendix C

COLORADO
Department of Public
Health & Environment

Dedicated to protecting and improving the health and environment of the people of Colorado

Electronic submittal
jerodt@gjcity.org

July 11, 2018

Mr. Jerod Timothy
City of Grand Junction Public Works
250 North 5th St.
Grand Junction, CO 81501

RE: Request for Section 9 Exemption
Determination: Approved
Las Colonias Business Park Phase 2
SW / MES GEN / 1.1

Dear Mr. Timothy:

The Hazardous Materials and Waste Management Division of the Colorado Department of Public Health and Environment - Hazardous Materials and Waste Management Division (Division) - Solid Waste and Materials Management Program (SW Program) received the following documents:

- "Memo of Understanding - Section 9 Exemption" (Request) dated July 2, 2018, submitted by the City of Grand Junction (City) by Jerod Timothy (Project Manager)
- Drawing 2 - Las Colonias Business Park Phase 2 Project Overview, prepared by the City of Grand Junction Public Works Engineering Division (2018) received in an email from Jerod Timothy on July 2, 2018.

The Request was reviewed to evaluate compliance with the Solid Wastes Disposal Sites and Facilities Act, CRS 30-20-100.5 *et. seq.* (the Act), the Regulations Pertaining to Solid Waste Sites and Facilities, 6 CCR 1007-2, Part 1 (the Regulations).

The City is planning to construct several small shallow impoundments/ponds during construction of Phase 2 at Las Colonias Business Park for purposes of temporary storage of potentially impacted groundwater from dewatering of excavations and utility trenches. The waste water will be allowed to percolate back into the subsurface and the remaining pond bottom will be covered with clean soil following construction. The Department of Energy Legacy Management (DOE) and the UMTRA staff in the Remediation Program of the Division have direct oversight for the environmental covenant. They both approved Phase 1/1A in February 2018 which included relocation and percolation of potentially impacted groundwater on-site. Mr. Edward Roemer approved Phase 2 via email July 3, 2018.

The SW Program has determined that the impoundments/percolation ponds as explained in the Request qualify for exemption from the Regulations Section 9.1.2 A(15) as impoundments used for temporary storage of solid waste. The percolation ponds requested exemption from the Regulations as currently planned is **approved.**

Sincerely,

Robert J Peterson

Robert J. Peterson
Environmental Protection Specialist
Solid Waste Program Permitting Unit
Hazardous Materials and Waste Management Division

Ec: M. Cosby, UMTRA
W. Frazier, DOE
E. Roemer, DOE
M. Griffin, WQCD

Appendix D

Stormwater Inspection Report

Name of Project: Las Colonias Business Park Phase 2	Inspector:	Date of Inspection:
Permit #:	Comments:	
Type of Inspection:	14-Day 30-Day Post-Storm	
Have the maintenance needs identified during the last inspection been addressed?		

BMPs	Need Maintenance?	Date Maintenance Completed	Comments
Stabilized Construction Entrance			
Erosion Logs			
Inlet Protection			
Outlet Protection			
Drainage Swales			
Concrete Washout			
Secondary Containment of liquid waste			

Spills	
Materials	

Handling	
General Housekeeping	

Is the site in compliance with the SWMP?

I verify that, to the best of my knowledge and belief, all corrective action and maintenance items identified during the inspection are complete, and the site is currently in compliance with the permit.

Signature of Inspector _____

Appendix E

Contractor Spill Prevention and Control Plan

(to be included)