

Part II: Best Management Practices (BMPs)



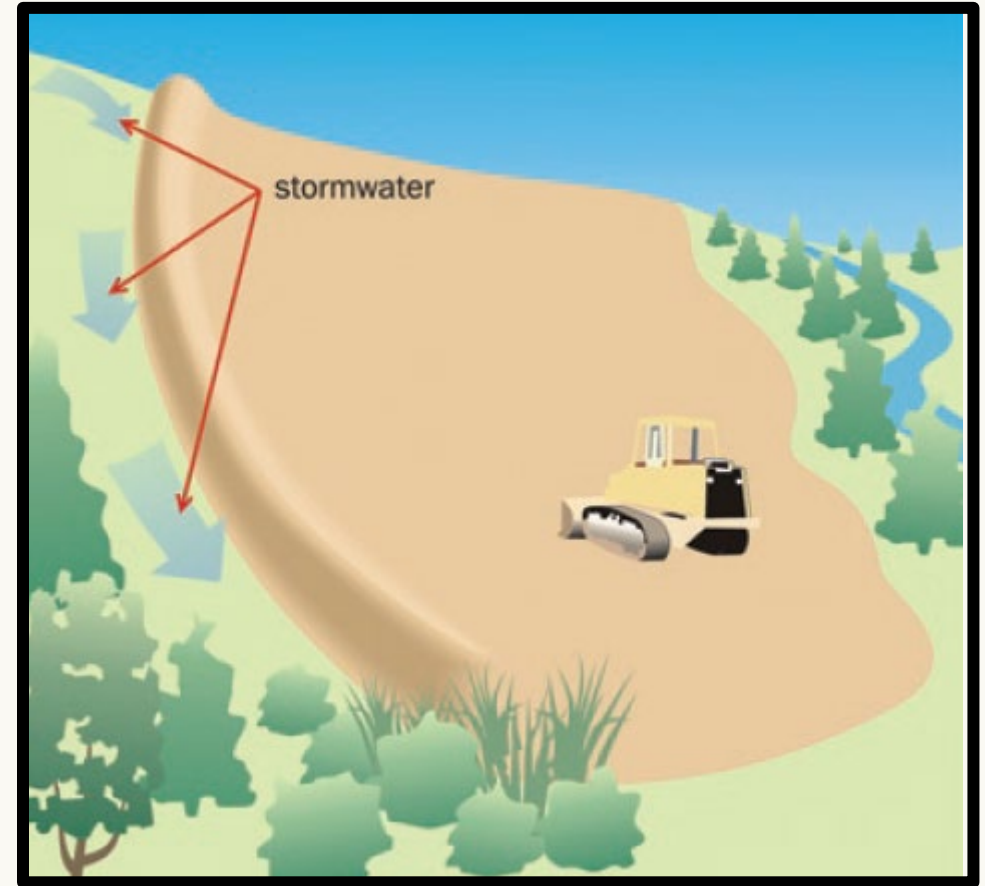
Best Management Practices (BMPs)

"Schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural practices to prevent or reduce the pollution of waters of the state and storm drain systems."

- ✓ **Design BMPs**
- ✓ **Procedural BMPs**
- ✓ **Physical BMPs**

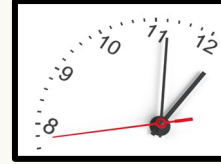
Design BMPs

- Minimize Disturbance
- Maximize existing topography/ land contours
- Minimize Slopes
- Account for onsite and offsite stormwater during construction.



Procedural BMPs

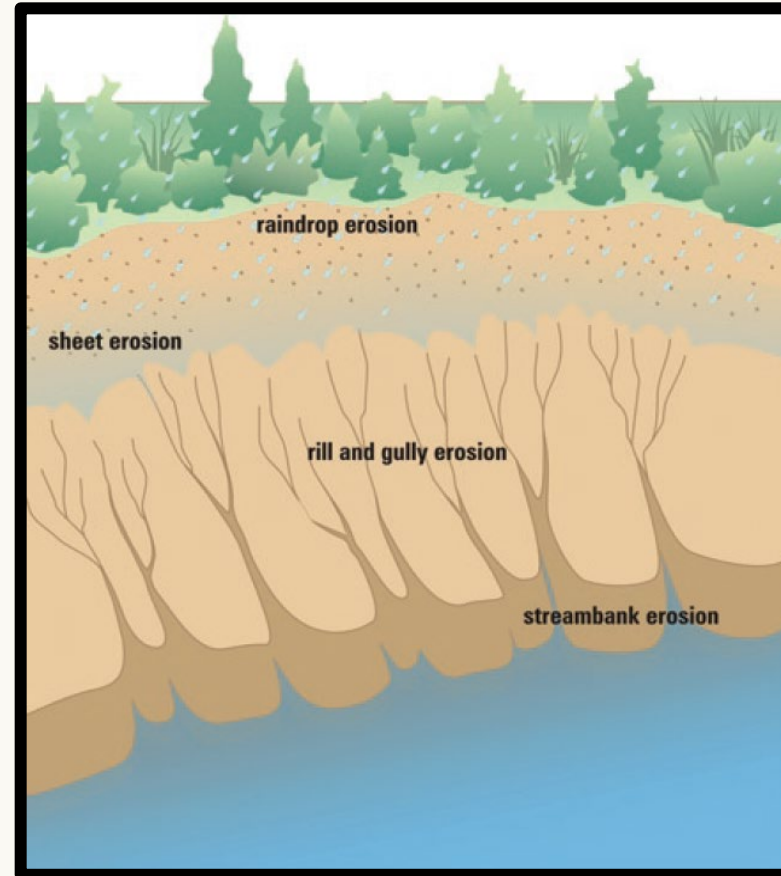
- Project phasing
- Timing major disturbance
- Integrate erosion control and schedules
- Preconstruction meeting
- Education and communication
- Common sense
- Materials on hand



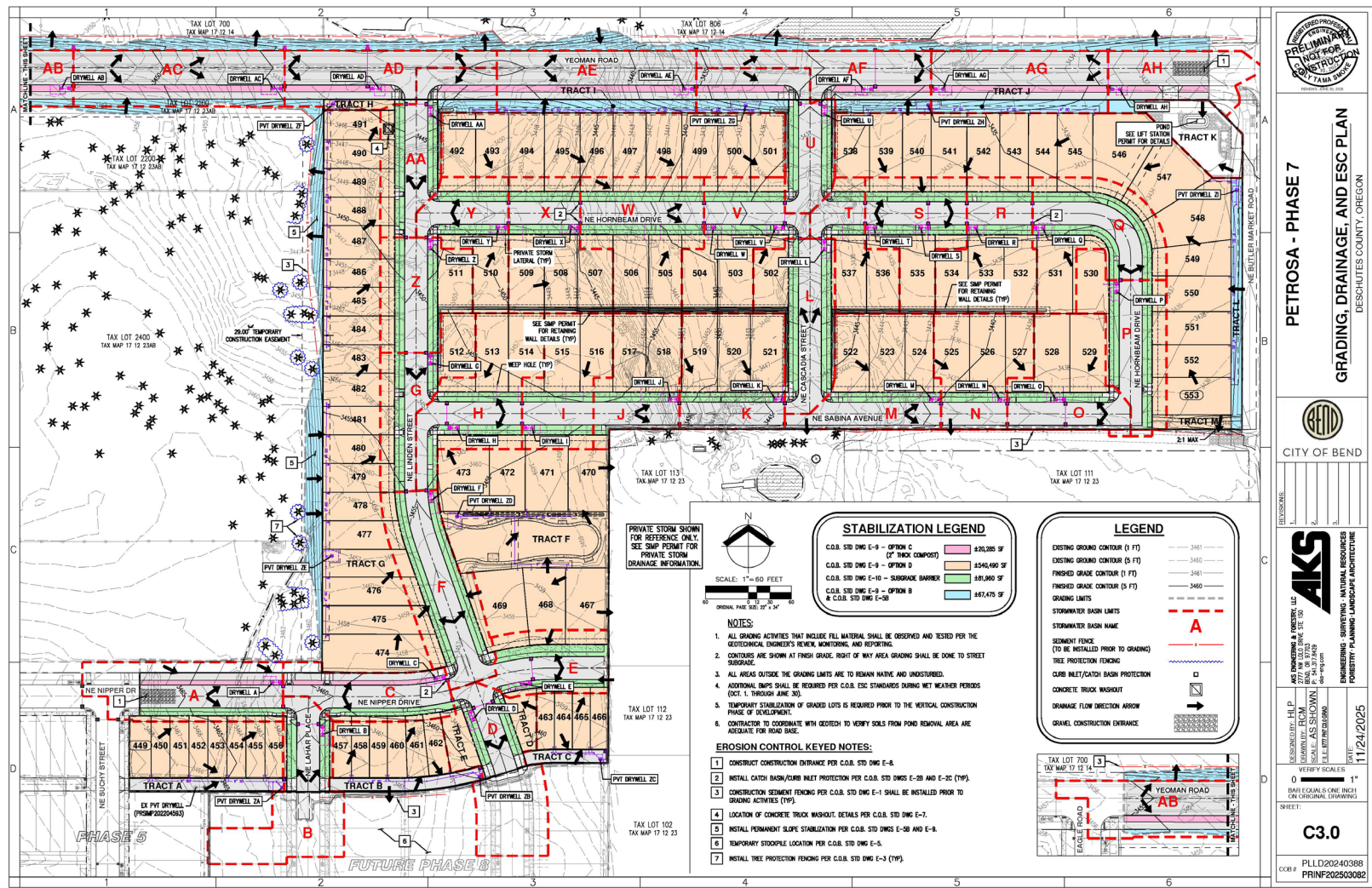
Physical BMPs

What do physical BMPs do?

- Intercept water
- Slow it down
- Spread it out
- Filter and settle



Erosion and Sediment Control Plan (ESCP)



Erosion and Sediment Control Plan (Residential)



Standard Erosion and Sediment Control Plan 1 – 4 Unit Development

Erosion Control Requirements & BMPs

1. Protect all downslope areas by providing perimeter control
2. Protect adjacent storm drains by installing inlet protection
3. Mitigate tracking of sediment onto paved surfaces by providing a rocked construction entrance
4. Minimize dust to the extent possible by providing dust control
5. Contain concrete waste for proper disposal by providing a concrete management facility
6. Protect trees and vegetation by installing tree protection fencing
7. Stabilize soil not actively being worked

General Housekeeping Requirements

1. This plan shall be available on site and updated as necessary.
2. Sweep sediment found offsite daily. Sediment ramps are not allowed for curb access.
3. Do not dump or wash material into a storm drain, dispose of trash in dumpster.
4. Keep portable toilets out of the street and sidewalk.
5. Inspect and maintain BMPs for the duration of the project.
6. Remove temporary BMPs once disturbed areas are stabilized.
7. Locate stockpiles within perimeter control for the project.
8. Clean spills promptly using dry cleanup methods.

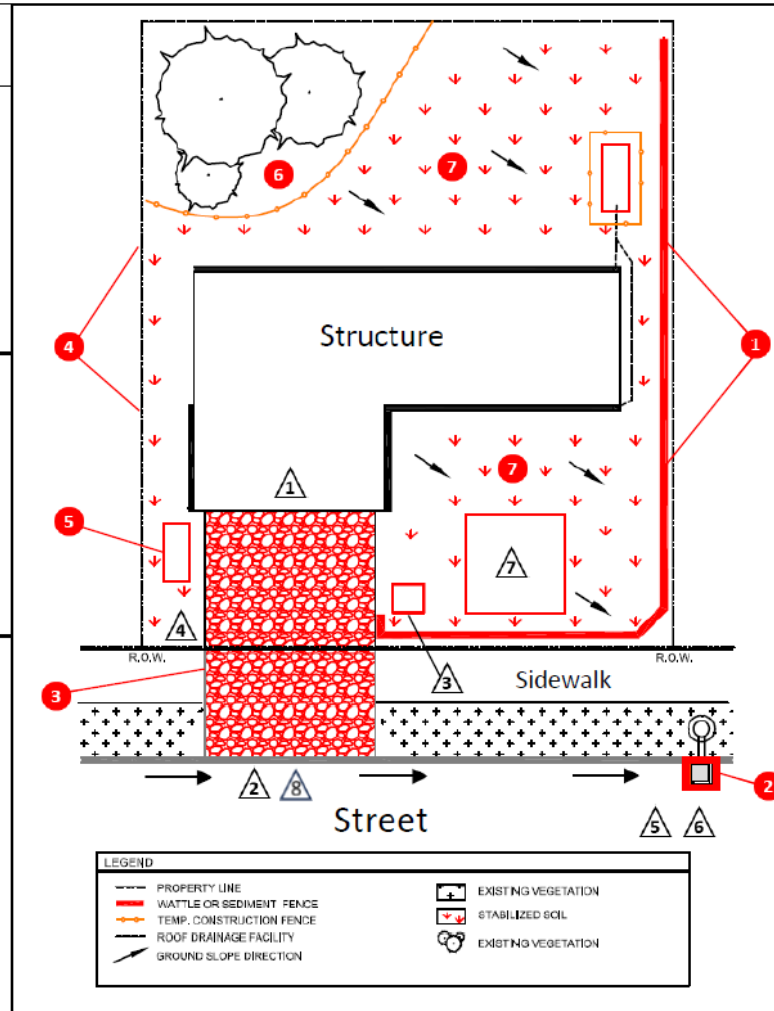
By signing this plan, I agree to meet each requirement and implement all necessary erosion, sediment and pollution control measures as outlined above to prevent erosion, sedimentation, and pollutants from leaving the site to the maximum extent practical. I understand that BMPs must be maintained, and they may need to change during construction to prevent erosion and prevent sediment, sediment laden water, and pollutants from leaving the site to the maximum extent practical. I understand that the City may inspect my project, and that failure to install or maintain adequate measures may result in re-inspection fees, fines, or other enforcement actions including a stop work order.

Tax Lot ID: _____

Site Address: _____

Name: _____

Signature: _____ Date: _____



Small Site Erosion Control Template

- Simplified plan to be used for small residential projects.

Preserve Existing Vegetation

Why lose it when you can use it?



Dust Control

Problem Areas:

- Active excavation
- Haul Routes/Traffic
- Loading Trucks
- Stockpile Management



Solutions:

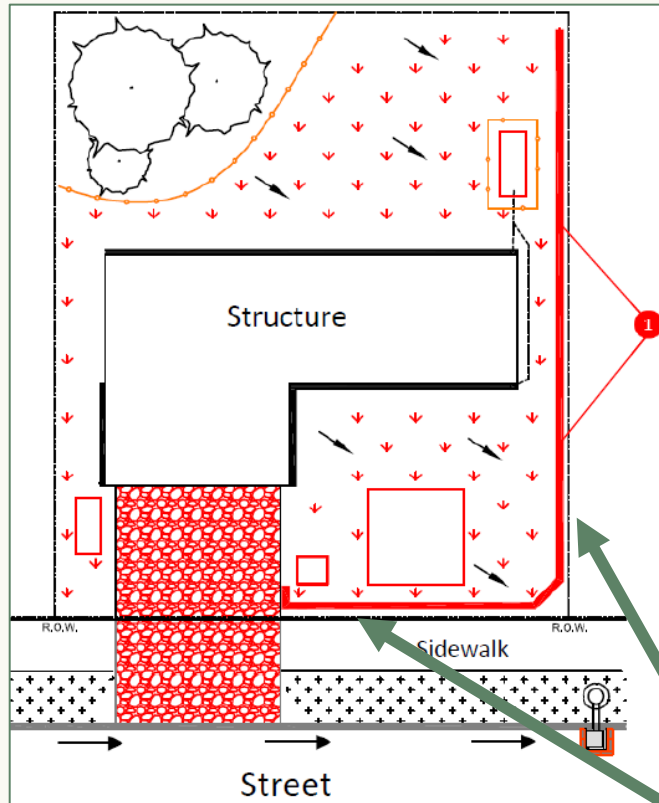
- Minimize disturbance
- Water
- Soil Stabilizer (with dye indicator).
- Stabilize unworked soil.



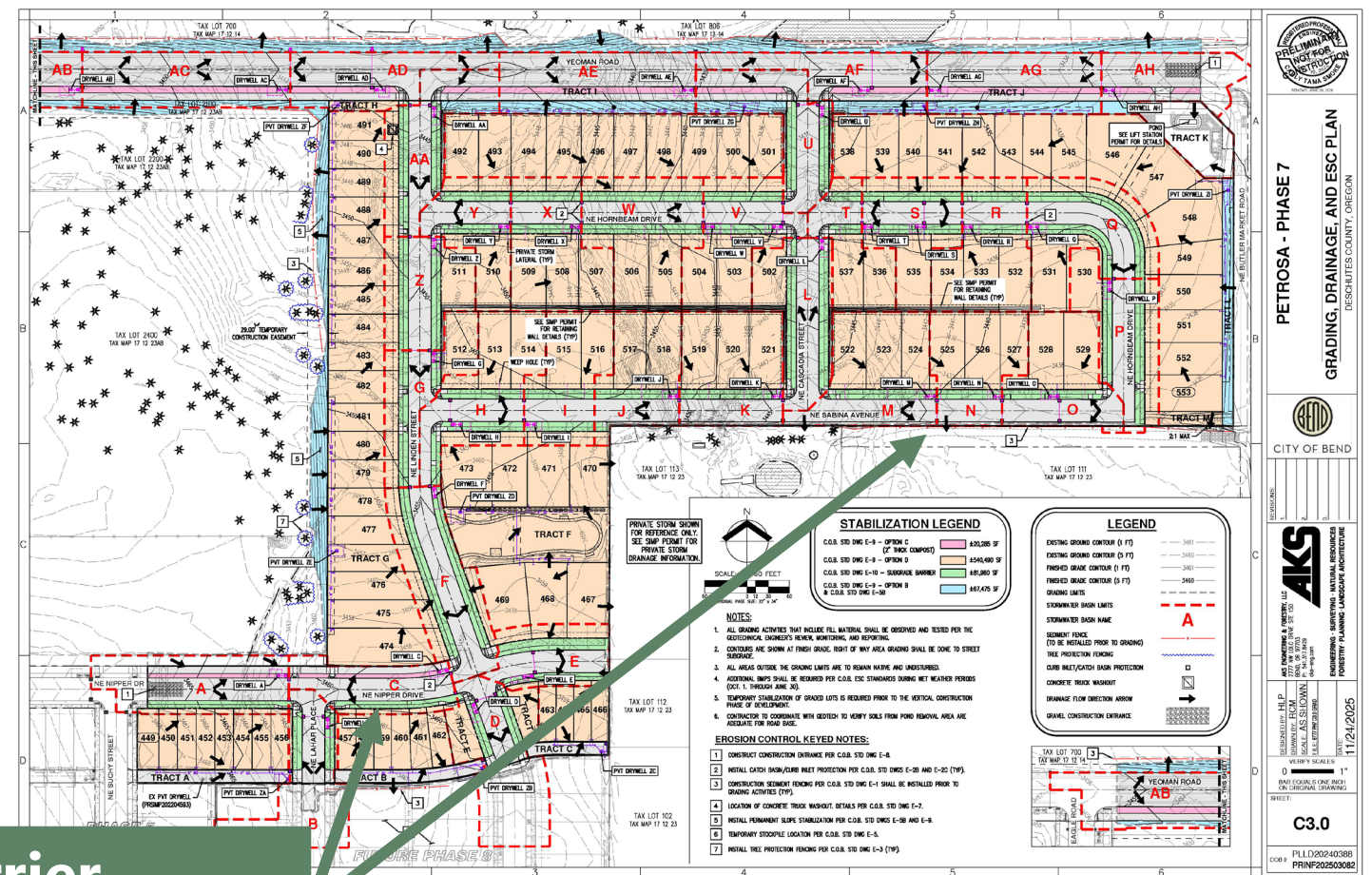


<https://bendoregon.gov/departments/public-works/water-services/protecting-our-water/erosion-control/>

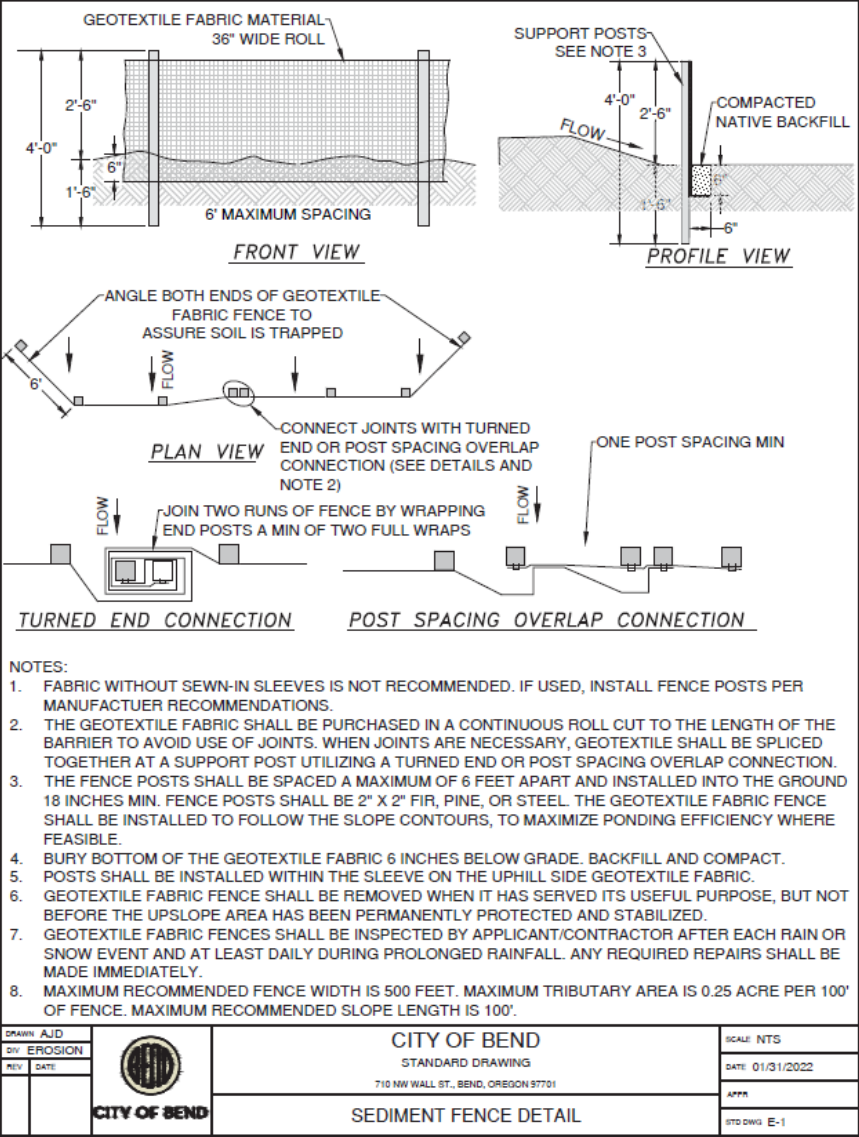
Perimeter Control



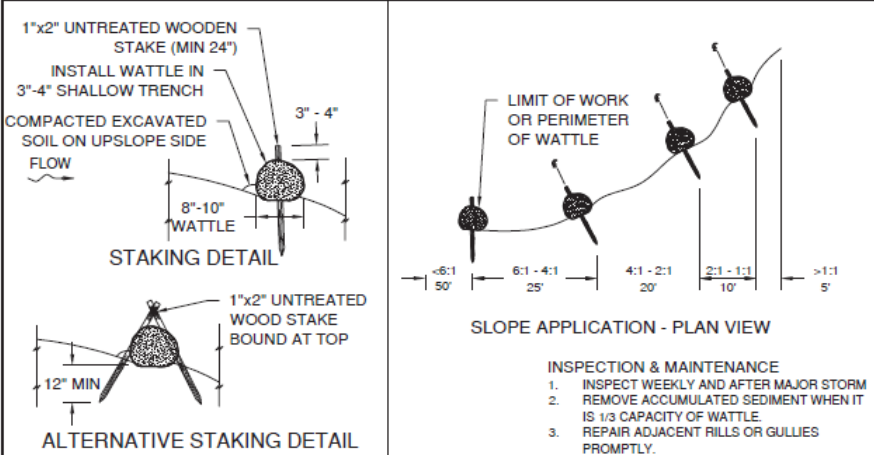
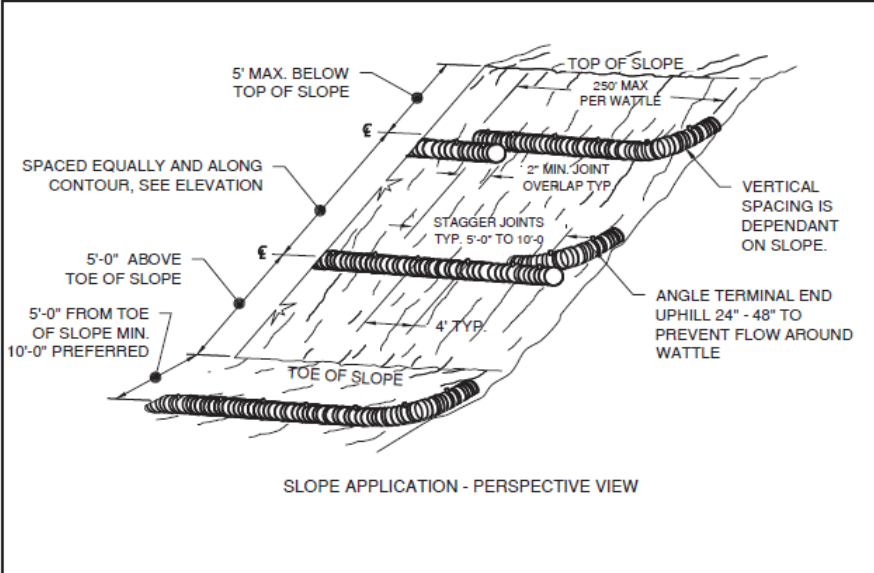
Sediment barrier downslope of the project



Perimeter Control – Sediment Fence



Perimeter Control – Straw Wattle



DESIGNED: CJH		CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE: NTS
DIV: EROSION			DATE: 11/01/2024
REV: DATE:			APP'D:
	CITY OF BEND	WATTLES	STD DWG: E-4



Perimeter Control – Berms

NOTES:

- DIRECT THE OUTLET SIDE OF THE ROCK/COMPOST FILTER BERMS ONTO A STABILIZED AREA, SUCH AS VEGETATION AND/OR ROCK.
- EMBED ROCK FILTER BERM A MIN. OF 4" INTO THE EXISTING GROUND/EMBANKMENT.
- USE ROCK FILTER BERM ON 2H:1V OR FLATTER SIDE SLOPES.
- PLACE FILTER BERMS ALONG OR ON THE GROUND CONTOUR WITH THE ENDS TURNED UP SLOPE.
- PRIOR TO INSTALLING A FILTER BERM IN A VEGETATED AREA, ENSURE THAT THE VEGETATION IS CUT TO A HEIGHT OF NO GREATER THAN 3" PRIOR TO INSTALLATION.
- COMPOST HAS NOT BEEN CHEMICALLY TREATED AND IS WEED-FREE, PLASTIC-FREE, DECOMPOSED, NON-WOODY PLANT MATERIAL; ANIMAL WASTE IS NOT ALLOWED.
- WHERE POSSIBLE, BERMS SHOULD BE PLACED AWAY FROM THE TOE OF THE SLOPE A MINIMUM OF 5 FEET TO ALLOW FOR ENERGY DISSIPATION AND STORAGE.

INSPECT & MAINTENANCE:

- INSPECT WEEKLY AND DAILY DURING STORM EVENTS.
- REMOVE SEDIMENT WHEN ACCUMULATION IS AT 1/3 THE CAPACITY.
- REPAIR ANY BREAKS OR EROSION OCCURRING IN THE BERM.

FILTER BERM DIMENSIONS AND SPACING BASED ON SLOPE				
SLOPE	BERM SPACING	BERM DIMENSIONS		
		HEIGHT	BOTTOM WIDTH	TOP WIDTH
>50:1	250 Ft	1 Ft	2 Ft (MIN)	1 Ft
50:1 - 10:1	125 Ft	1 Ft	2 Ft (MIN)	1 Ft
10:1 - 5:1	100 Ft	1 Ft	2 Ft (MIN)	1 Ft
3:1 - 2:1	50 Ft	1.30 Ft	2.6 Ft (MIN)	1 Ft
>2:1		1.50 Ft	3 Ft (MIN)	1 Ft

2' MIN

OUTLET SIDE

UNCONCENTRATED SHEET FLOW

TOE OF SLOPE

2' TYP

4" MIN SEE NOTE #2

SUBGRADE GEOTEXTILE

ROCK WITH MAX. SIZE, 6 INCHES

ROCK FILTER BERM

3' TYP

1' TYP

OUTLET SIDE

UNCONCENTRATED SHEET FLOW

1.5' TYP

COMPOST (SEE NOTE 6)

COMPOST FILTER BERM

DRAWN: CJH

DIV: EROSION

REV: DATE



CITY OF BEND

CITY OF BEND

STANDARD DRAWING

710 NW WALL ST., BEND, OREGON 97701

FILTER BERMS

SCALE: NTS

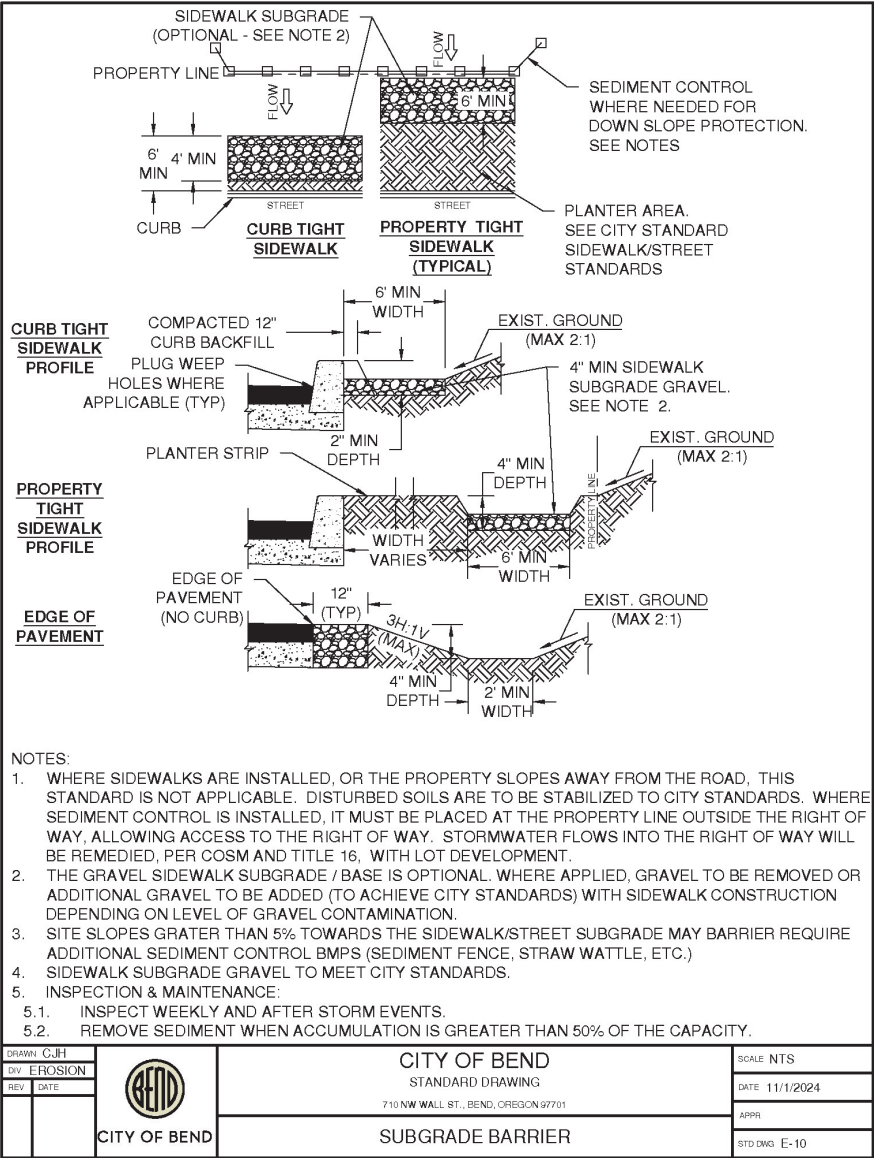
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APPR:

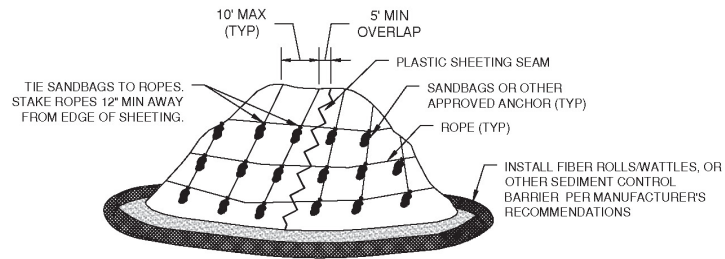
STD DWG: E-12



Perimeter Control - Subgrade

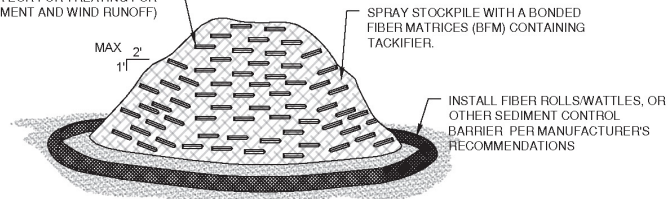


Perimeter Control - Stockpiles



TEMPORARY STOCKPILE STABILIZATION

TRACK WALK THE FULL EXTENT OF THE SLOPE. (OPTIONAL OR AS DIRECTED BY THE CITY OR EOR FOR TREATING FOR SEDIMENT AND WIND RUNOFF)



PERMANENT STOCKPILE STABILIZATION
NTS

NOTES:

TEMPORARY STOCKPIPE STABILIZATION:

1. INSTALL PLASTIC SHEETING VERTICALLY DOWN SLOPE.
2. INSTALL PLASTIC SHEETING SO EDGES OVERLAP AND ARE SHINGLED AWAY FROM PREVAILING WINDS.
3. PLASTIC SHEETING SHOULD ONLY BE UTILIZED AS REQUIRED BY THE CITY WHERE OTHER METHODS OF STOCKPILE STABILIZATION HAVE NOT PERFORMED.

INSPECTION AND MAINTENANCE:

1. INSPECT WEEKLY AND DAILY DURING STORM EVENTS
2. REPLACE TORN SHEETS AND REPAIR OPEN SEAMS.
3. COMPLETELY REMOVE ALL PLASTIC AND REPLACE WHEN IT BEGINS TO DETERIORATE.
4. COMPLETELY REMOVE PLASTIC WHEN IT IS NO LONGER NEEDED.
5. CHECK ANCHORING SYSTEMS AND REPAIR OR ADD ANCHORS.
6. VERIFY EFFECTIVE FUNCTION OF BMP AT TOE OF SLOPE.

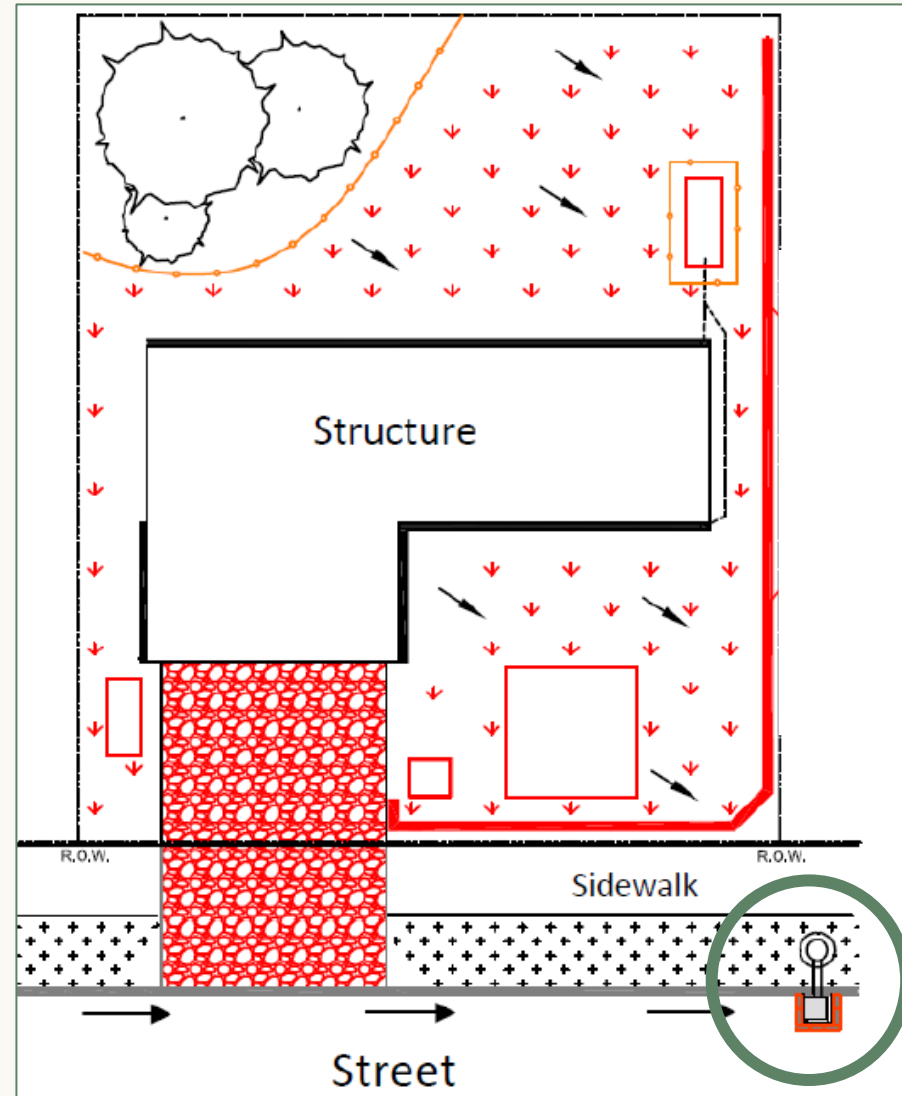
DRAWN: CJH DIV EROSION REV DATE			CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701		SCALE NTS
CITY OF BEND			STOCKPILE STABILIZATION		DATE 11/01/2024 APPR STD DWG E-5





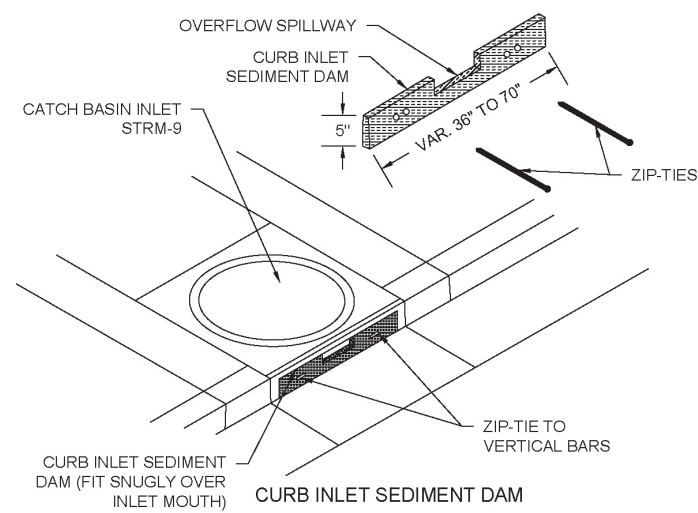
<https://bendoregon.gov/departments/public-works/water-services/protecting-our-water/erosion-control/>

Inlet Protection



Last line of defense!

Inlet Protection – Curb Inlet

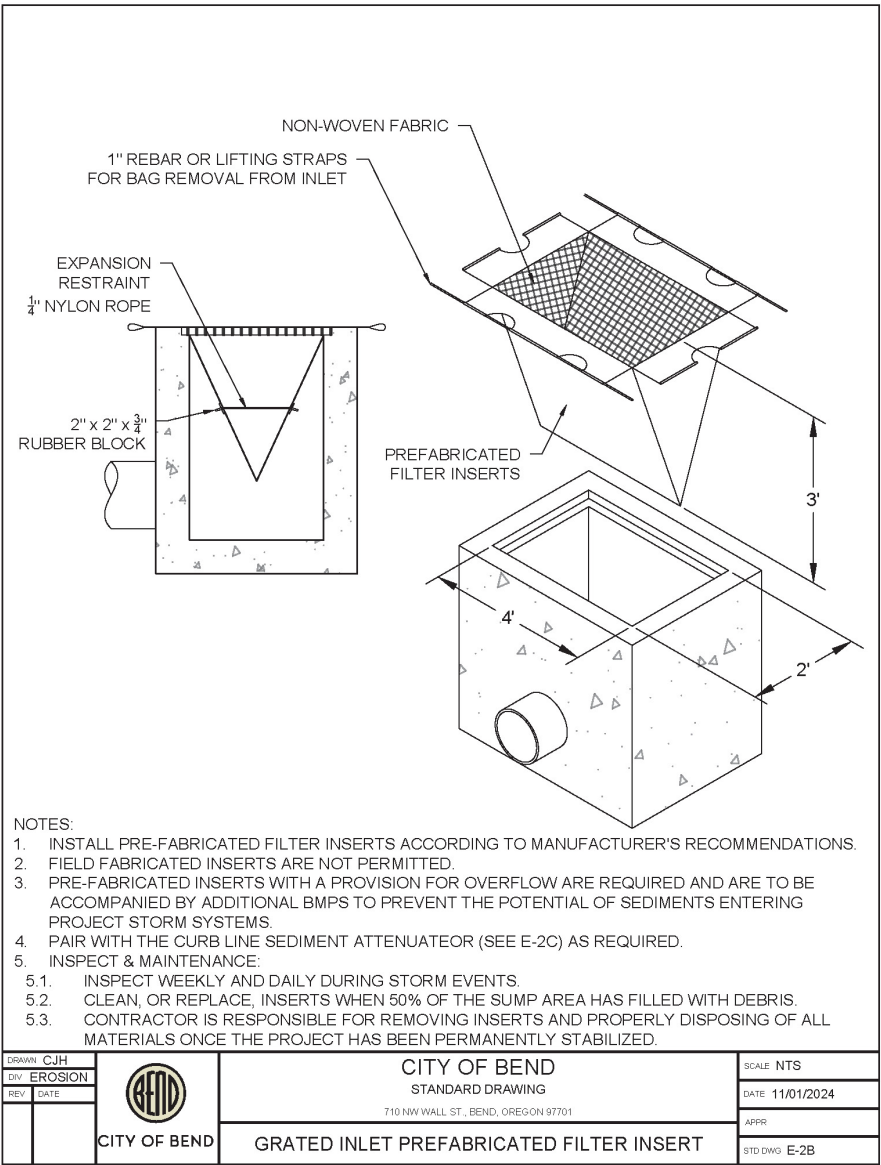


- NOTES:
- 1. INSTALL SEDIMENT DAM ACCORDING TO MANUFACTURE'S RECOMMENDATION. ENDS SHALL NOT EXTEND BEYOND THE MOUNT OF THE INLET.
 - 2. SEDIMENT DAMS ARE REQUIRED TO BE ACCOMPANIED BY ADDITIONAL BMPs TO PREVENT THE POTENTIAL OF SEDIMENTS ENTERING PROJECT STORM SYSTEMS.
 - 3. INSPECTION & MAINTENANCE:
 - 3.1. INSPECT DAMS WEEKLY AND DAILY DURING STORM EVENTS.
 - 3.2. CLEAN, OR REPLACE, DAMS WHEN DEBRIS HAS REACH A HEIGHT OF 2 INCHES.
 - 3.3. CONTRACTOR IS RESPONSIBLE FOR REMOVING DAMS AND PROPERLY DISPOSING OF ALL MATERIALS ONCE THE PROJECT HAS BEEN PERMANENTLY STABILIZED.

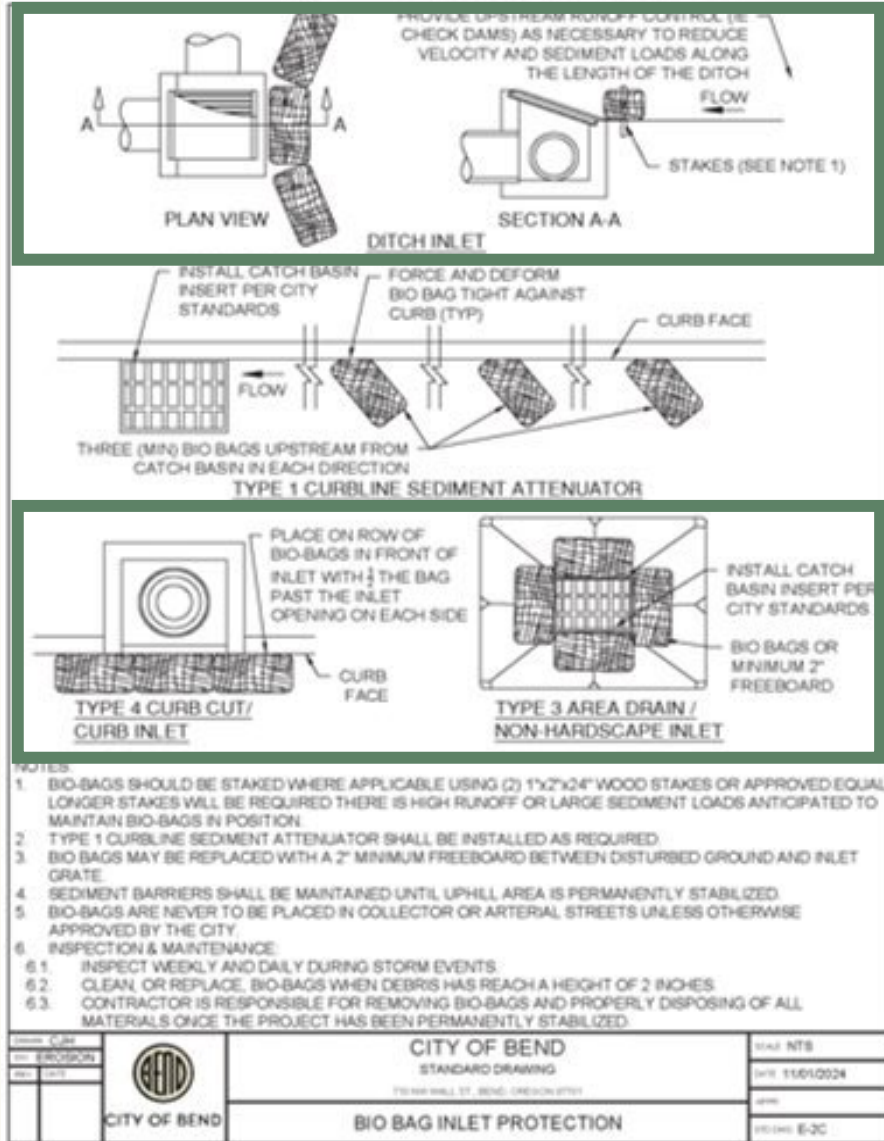
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DIV: EROSION				DATE: 11/01/2024	
REV	DATE			APPR:	
		CITY OF BEND		STD DWG: E-2A	
			CURB INLET PROTECTION		



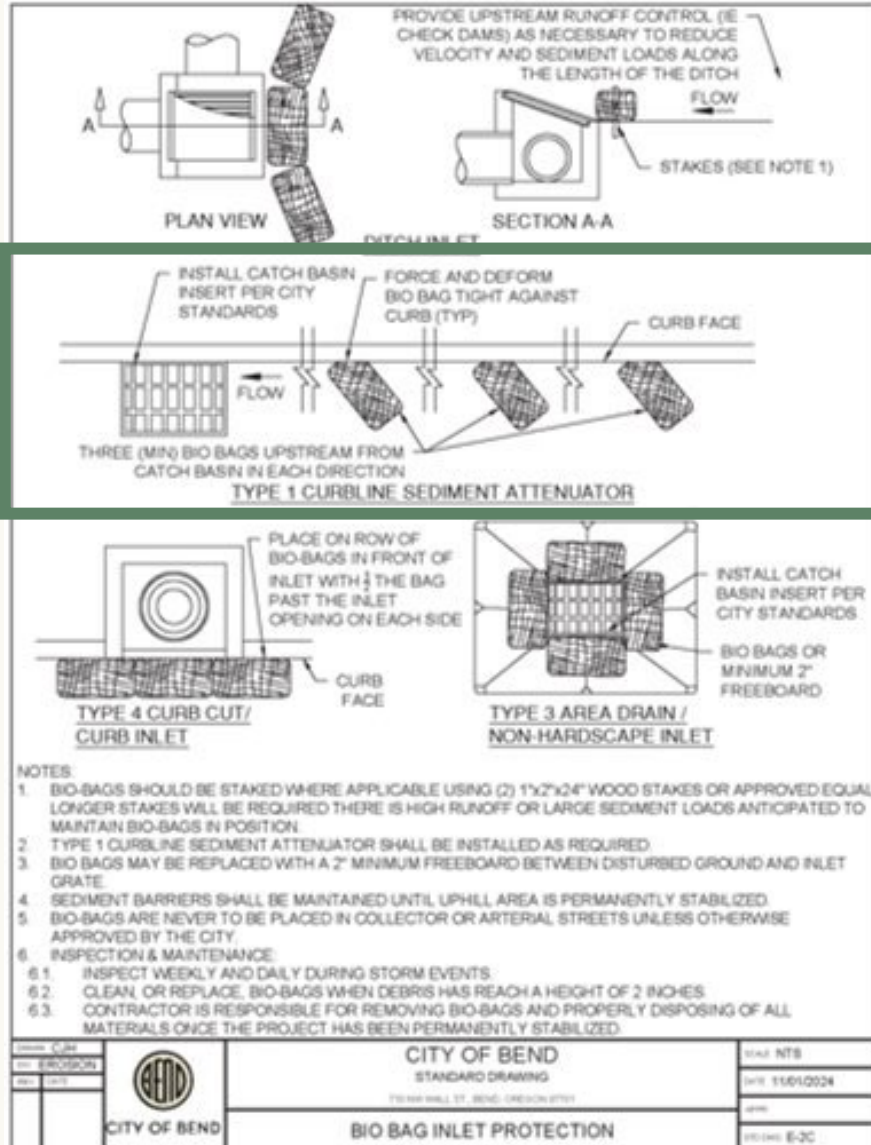
Inlet Protection – Grated Inlet



Inlet Protection – Area Drain & Ditch Inlet



Inlet Protection – Curbline Attenuator



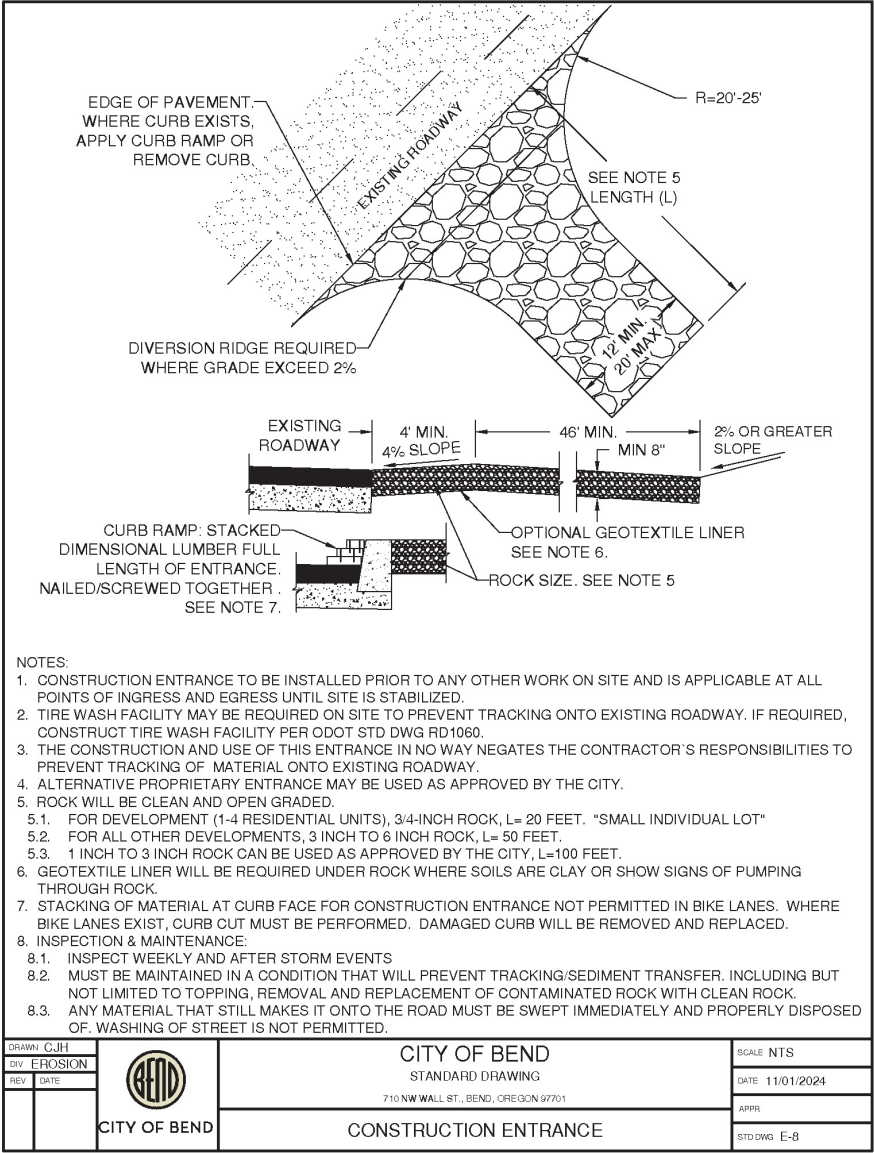
Inlet Protection – Curb Cut





<https://bendoregon.gov/departments/public-works/water-services/protecting-our-water/erosion-control/>

Construction Entrance - Rocked





[https://bendoregon.gov/departments/public-works/!\[\]\(c8d96c8885d3000a912c2582004aed63_img.jpg\)water-services/protecting-our-water/erosion-control/](https://bendoregon.gov/departments/public-works/water-services/protecting-our-water/erosion-control/)

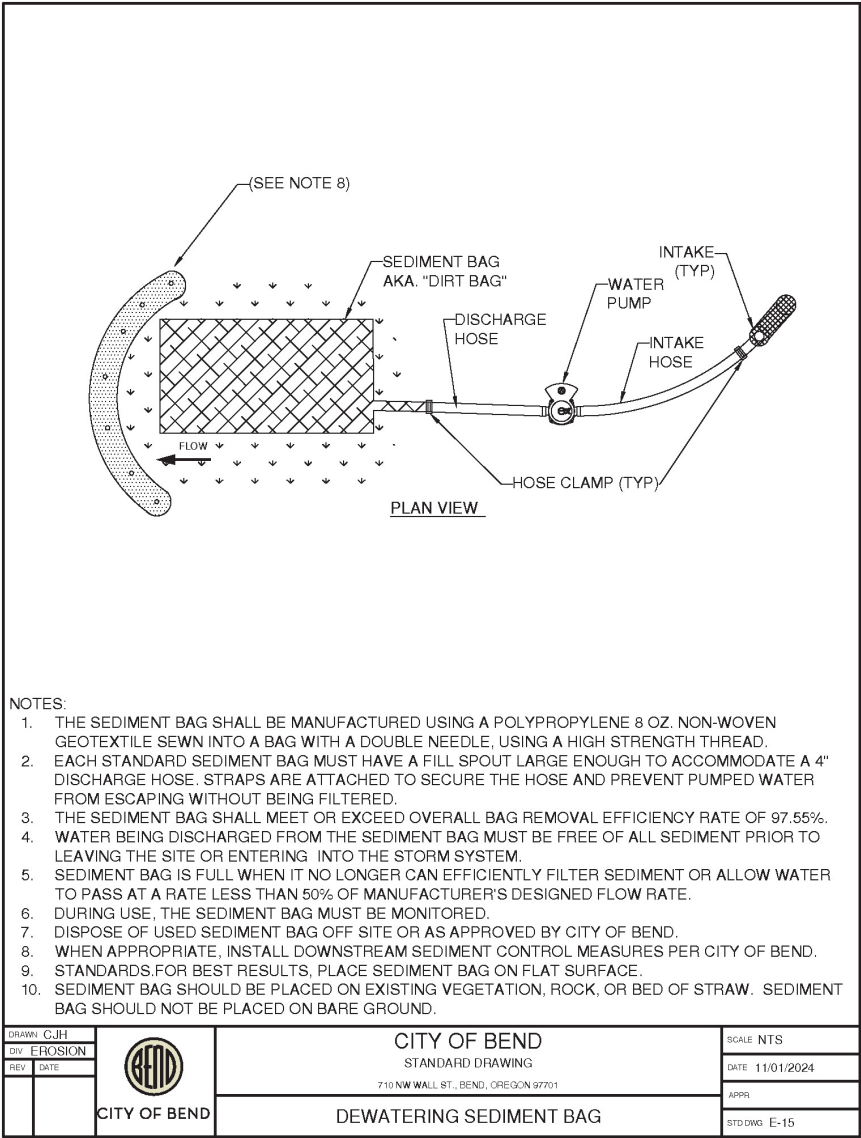
Construction Entrance – Alternative/Wheel Wash



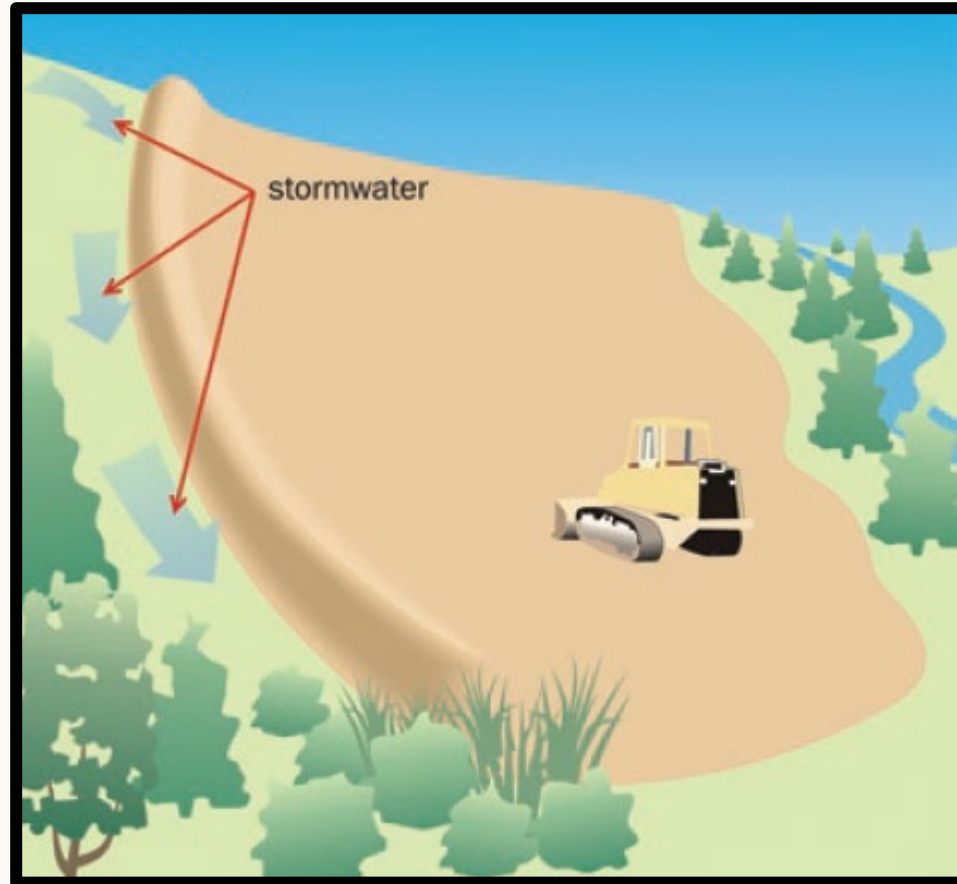
Road/Parking Stabilization



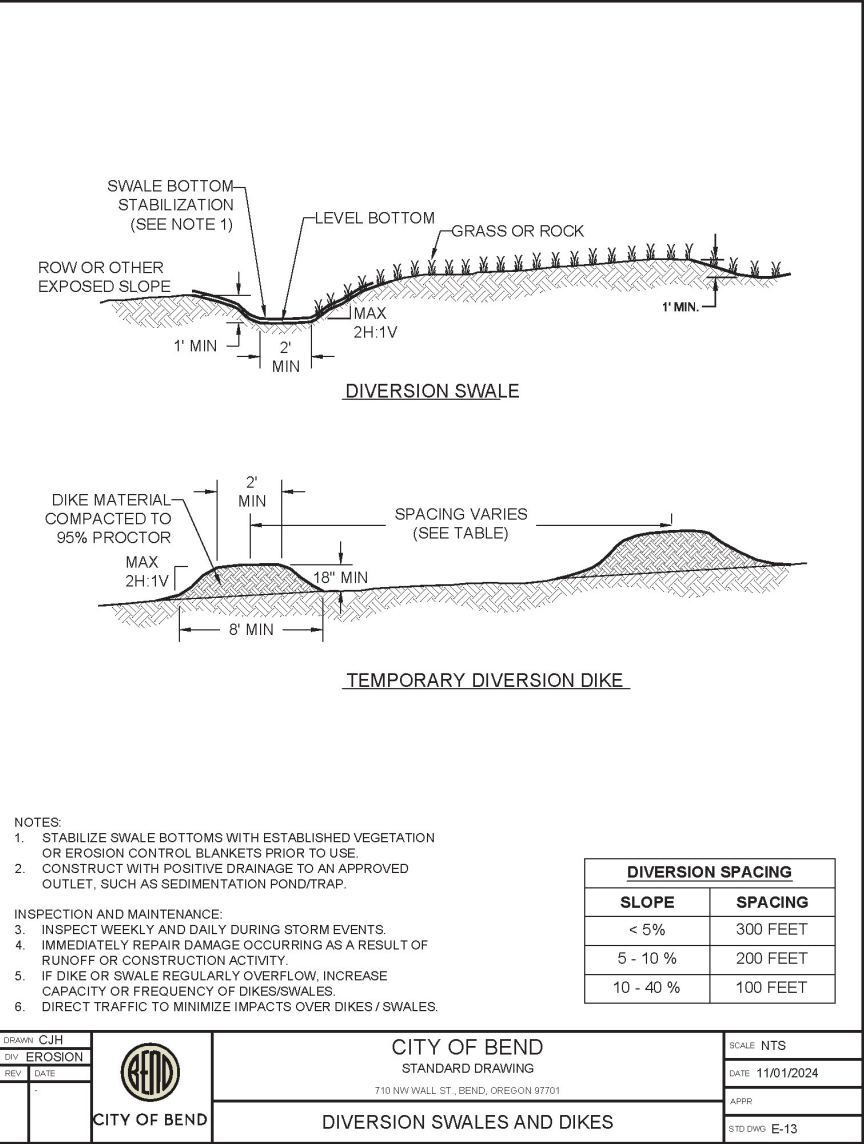
Dewatering – Sediment Bag



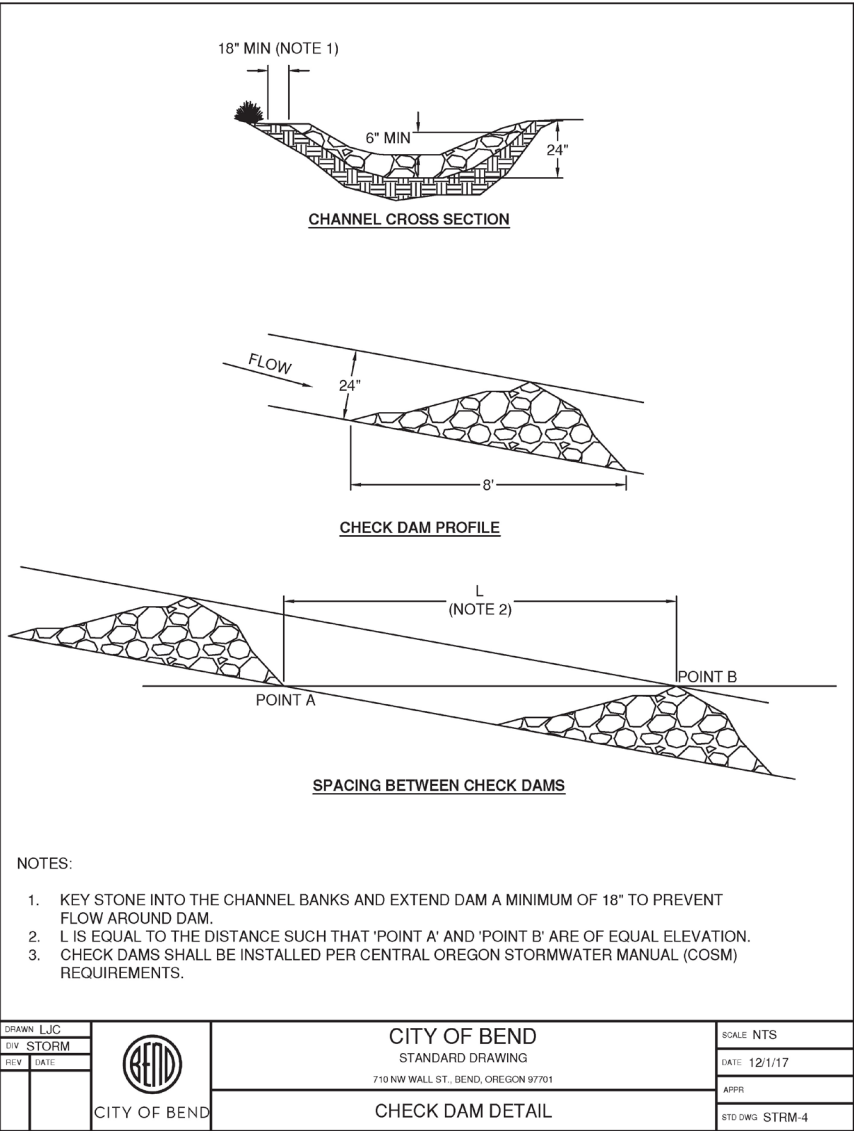
Runoff Control



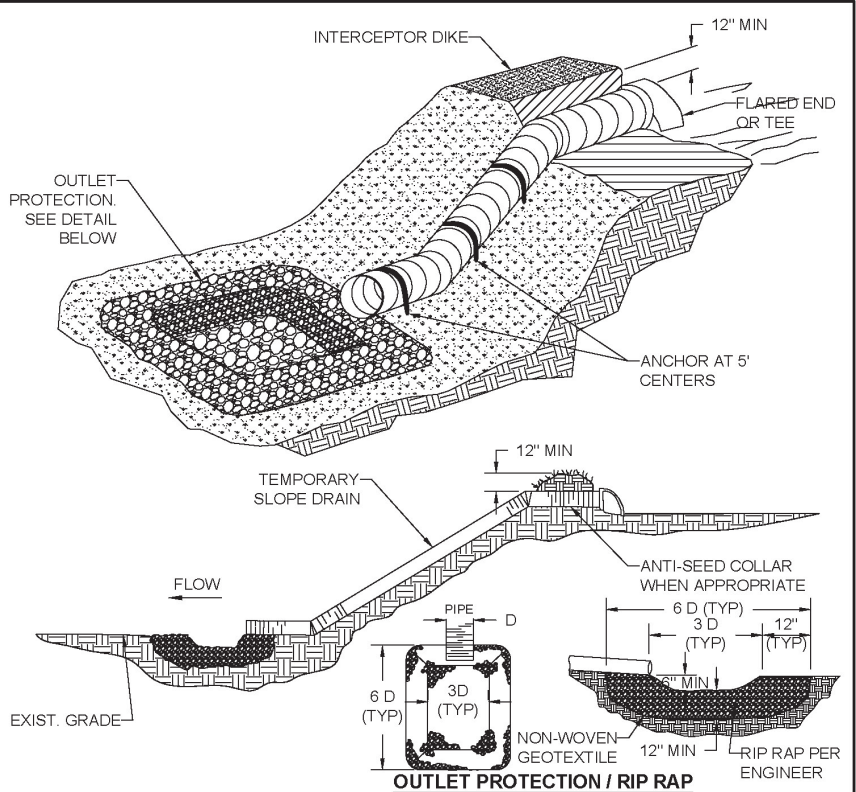
Runoff Control – Diversion Swales & Dikes



Runoff Control – Check Dam



Runoff Control – Pipe Slope Drain



GRADE RIPRAP SHALL BE THE CLASS AND SIZE OF ROCK ACCORDING TO THE FOLLOWING:					
CLASS 50	CLASS 100	CLASS 200	CLASS 700	CLASS 2000	
WEIGHT OF ROCK (LBS)					% (BY WEIGHT)
50-30	100-60	200-140	700-500	2000-1400	20
30-15	60-25	140-80	500-200	1400-700	30
15-2	25-2	80-8	200-20	700-40	40
2-0	2-0	8-0	20-0	40-0	10

- RIPRAP:**
- ROCK FOR RIPRAP SHALL BE ANGULAR IN SHAPE.
 - THICKNESS OF A SINGLE RAMP SHALL NOT BE LESS THAN 1/3 ITS LENGTH.
 - DESIGN BASED ON ODOT HYDRAULICS MANUAL AND COSM.
- RIPRAP INSTALLATION:**
- EXCAVATE BELOW FINISHED GRADE TO DEPTH & DIMENSION SHOWN ON APPROVED PLANS.
 - INSTALL WOVEN GEOTEXTILE FABRIC.
 - PLACE RIP RAP TO FINISHED GRADE.



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DIV: EROSION

REV: DATE



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STANDARD DRAWING

710 NW WALL ST., BEND, OREGON 97701

PIPE SLOPE DRAIN

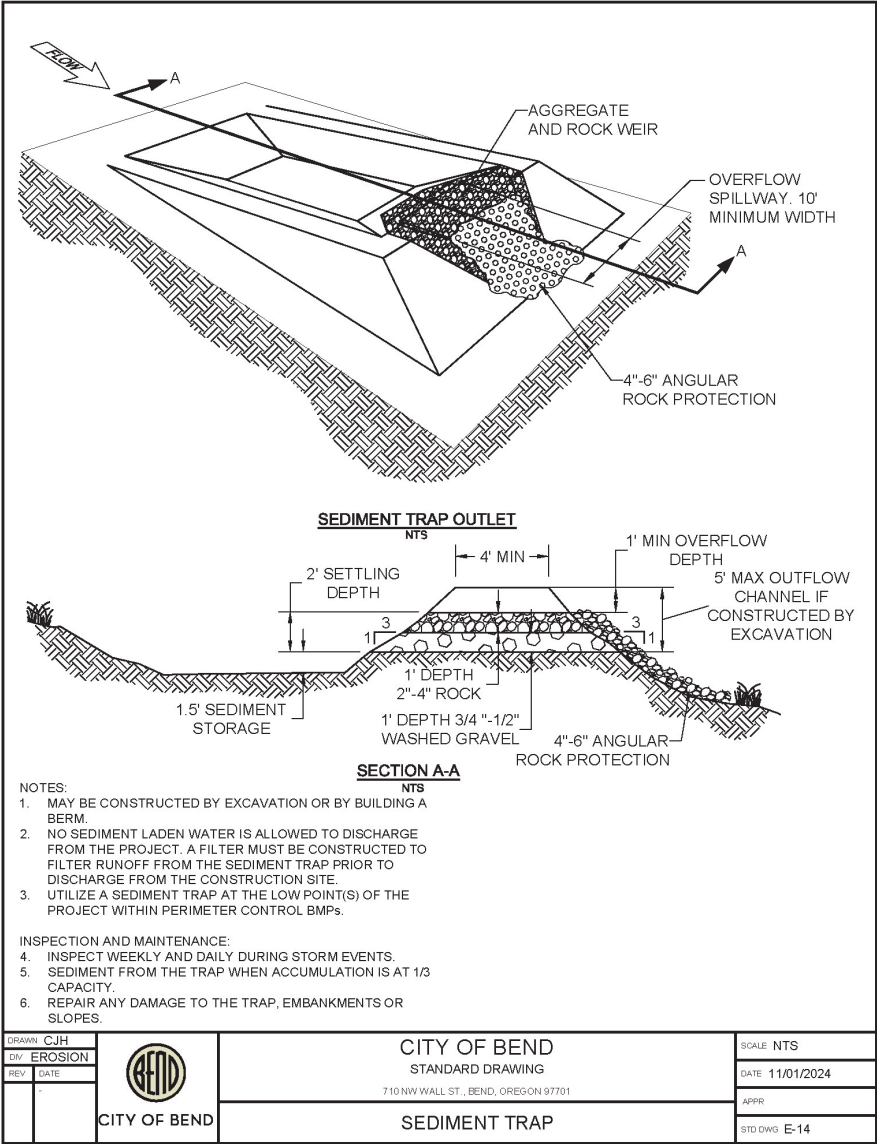
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DATE: 11/01/2024

APPR:

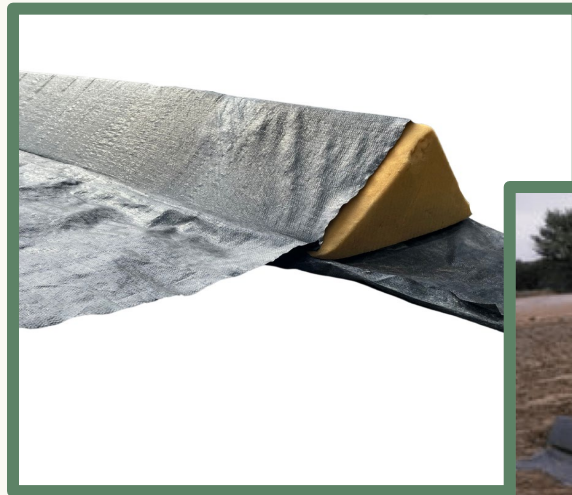
STD DWG: E-11

Runoff Control – Sediment Trap



Special Mention

- ❑ Filter socks/berms
- ❑ Spring Berms
- ❑ Triangle dikes



Stabilization – Temporary vs Permanent

Stabilization shall be achieved within 10 days of inactivity or project completion

Temporary Stabilization

- Earthwork **not at finished grade**
- Option Profiles A or B

Permanent Stabilization

- Earthwork **at finished grade** or project is deemed **inactive**
- Options Profiles A, B, C, D, and E
- Corresponding Requirements for project approval

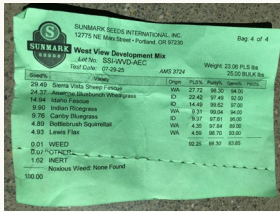
TEMPORARY STABILIZATION (EARTHWORK NOT AT FINISHED GRADE) SEE BEND STANDARDS AND SPECIFICATIONS II, CHAPTER 7.1.3 ↓ TEMPORARY STABILIZATION IS REQUIRED WITHIN 10 DAYS OF INACTIVITY OR AS APPROVED BY CITY ↓ ROUTINE PROJECT COMPLIANCE		TEMPORARY STABILIZATION OPTION PROFILES TEMPORARY STABILIZATION OPTION A BONDED FIBER MATRIX (BFM) SEED, FERTILIZER & TRACER SUBGRADE TEMPORARY STABILIZATION OPTION B ALTERNATIVE AS APPROVED BY THE CITY IN WRITING	
PERMANENT STABILIZATION (EARTHWORK AT FINISHED GRADE OR PROJECT IS DESIGNATED INACTIVE) SEE BEND STANDARDS AND SPECIFICATIONS II, CHAPTER 7.1.3 ↓ PERMANENT STABILIZATION IS REQUIRED WITHIN 10 DAYS OF PROJECT COMPLETION OR IF NO WORK OCCURS AT THE PROJECT SITE OVER A 30 DAY PERIOD ↓ FINAL PROJECT APPROVAL		PERMANENT STABILIZATION OPTION PROFILES PERMANENT STABILIZATION OPTION A BONDED FIBER MATRIX (BFM) SEED, FERTILIZER & TRACER SUBGRADE GERMINATION MUST ACHIEVE UNIFORM AERIAL PLANT COVERAGE OF >70% PERMANENT STABILIZATION OPTION B SEED, FERTILIZER & TRACER 100% COVER - 2" COMPOST BLANKET SUBGRADE NO GERMINATION OR AERIAL COVERAGE REQUIRED. PERMANENT STABILIZATION OPTION C 100% COVER SUBGRADE ALLOWED IN AREAS <5% SLOPE ONLY. COVER INCLUDES A 2 IN. THICK ROCK OR ORGANIC MULCH BLANKET. PERMANENT STABILIZATION OPTION D 100% SOIL STABILIZER COVER SUBGRADE ALLOWED IN AREAS OF RESIDENTIAL DEVELOPMENT WITH <5% SLOPE. WHERE FINAL LOT GRADE IS ACHIEVED BUT VERTICAL CONSTRUCTION IS TO OCCUR AS A SEPARATE PHASE. APPLIED AT MANUFACTURE'S RECOMMENDED RATE WITH AN EFFECTIVE PERIOD OF NO LESS THAN 6 MONTHS. PERMANENT STABILIZATION OPTION E ALTERNATIVE AS APPROVED BY THE CITY IN WRITING	
NOTES: A. WHEN A PROJECT IS DEEMED IN ACTIVE, WITH NO WORK OCCURRING OVER A 30 DAY PERMIT. THE PROJECT WILL BE REQUIRED TO BE PERMANENTLY STABILIZED. B. FOR PROJECTS WHERE SLOPES EXCEED 5%, SEE SLOPE / STOCKPILE STABILIZATION STANDARDS FOR ADDITIONAL DETAILS AND REQUIREMENTS. C. WHEN THE POTENTIAL EXISTS FOR SEDIMENT TO IMPACT ADJACENT PROPERTY OR PUBLIC AND PRIVATE STORM DRAINAGE SYSTEMS. ADDITIONAL BMPs MAY BE REQUIRED BY THE CITY TO ENSURE PROTECTION AND FULL STABILIZATION PRIOR TO FINAL APPROVAL.			
DRAWN: CJH DIV: EROSION REV: DATE  CITY OF BEND		CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 STABILIZATION REQUIREMENTS	
		SCALE: NTS DATE: 11/01/2024 APPR: STD. DWG: E-9	

Stabilization – Cover Options

Option A – Hydroseed

70% germination required

Seed



Bonded Fiber Matrix



Fertilizer



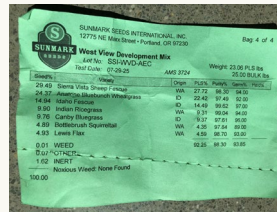
Application



Option B – Compost Blanket

No germination required

Seed



Compost



Fertilizer



Application



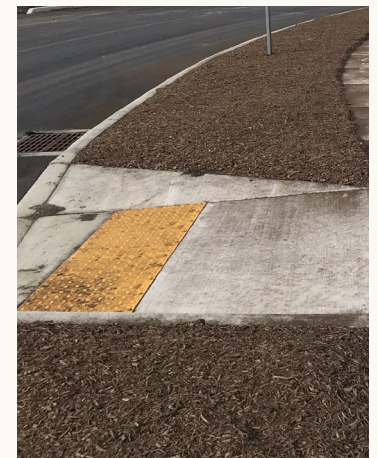
Option C – 100% Cover

Areas < 5% slope only

Rock mulch



Bark mulch



Compost



Wood Chips



Stabilization – Cover Options

Option D – 100% Soil Stabilizer Cover

**Additional sediment control measures required including the subgrade barrier (STD DWG E-10)*

Soil Stabilizer



Subgrade Barrier



Option E – Alternative as City Approved

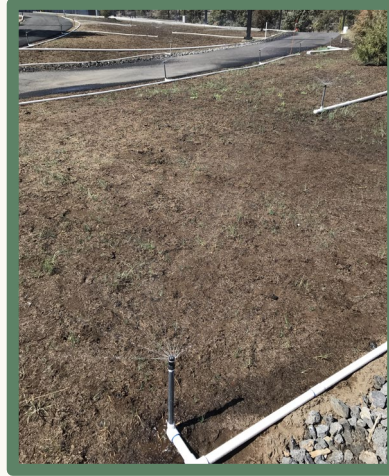
A combination of cover options and perimeter controls as approved by the City in writing. An approved landscaping plan is considered sufficient under Option E.

Stabilization – Special Considerations

Hydroseed with minimal seed germination



Temporary Irrigation



Alternative Cover



Deer trampling



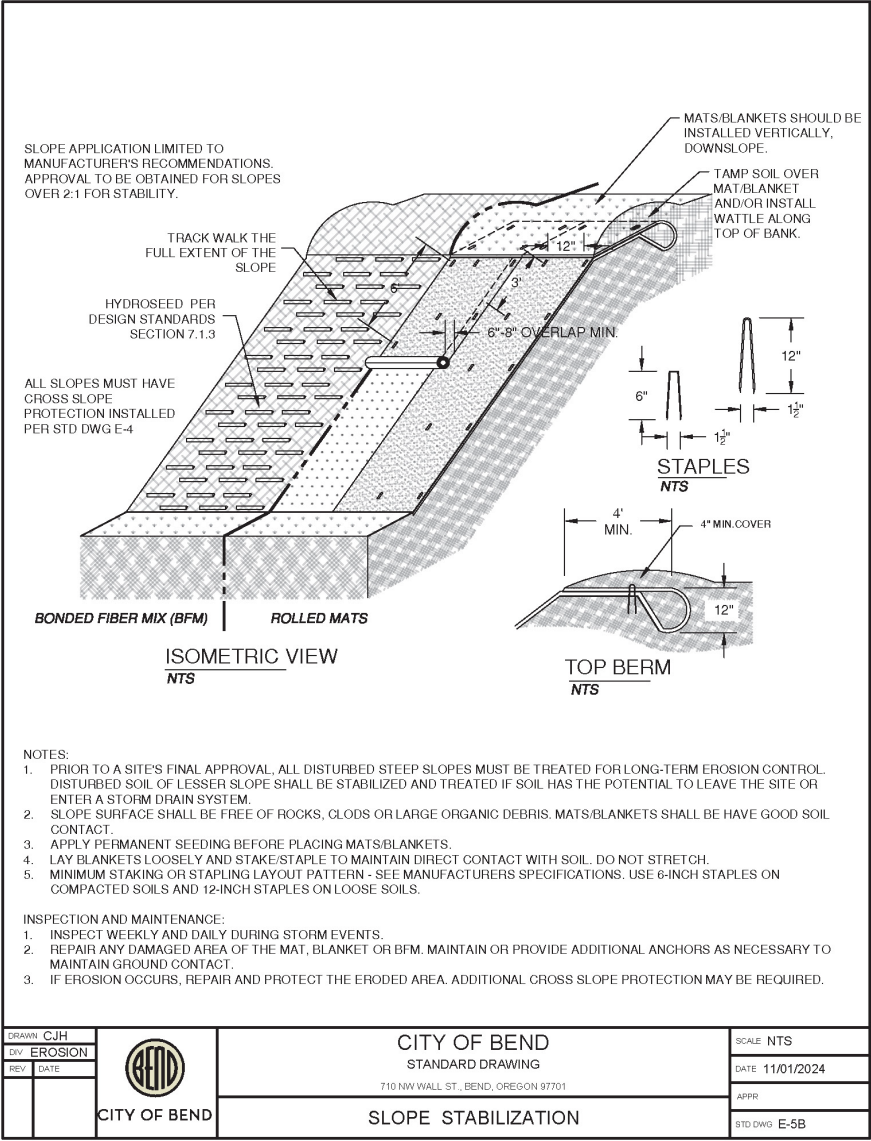
Low mulch coverage



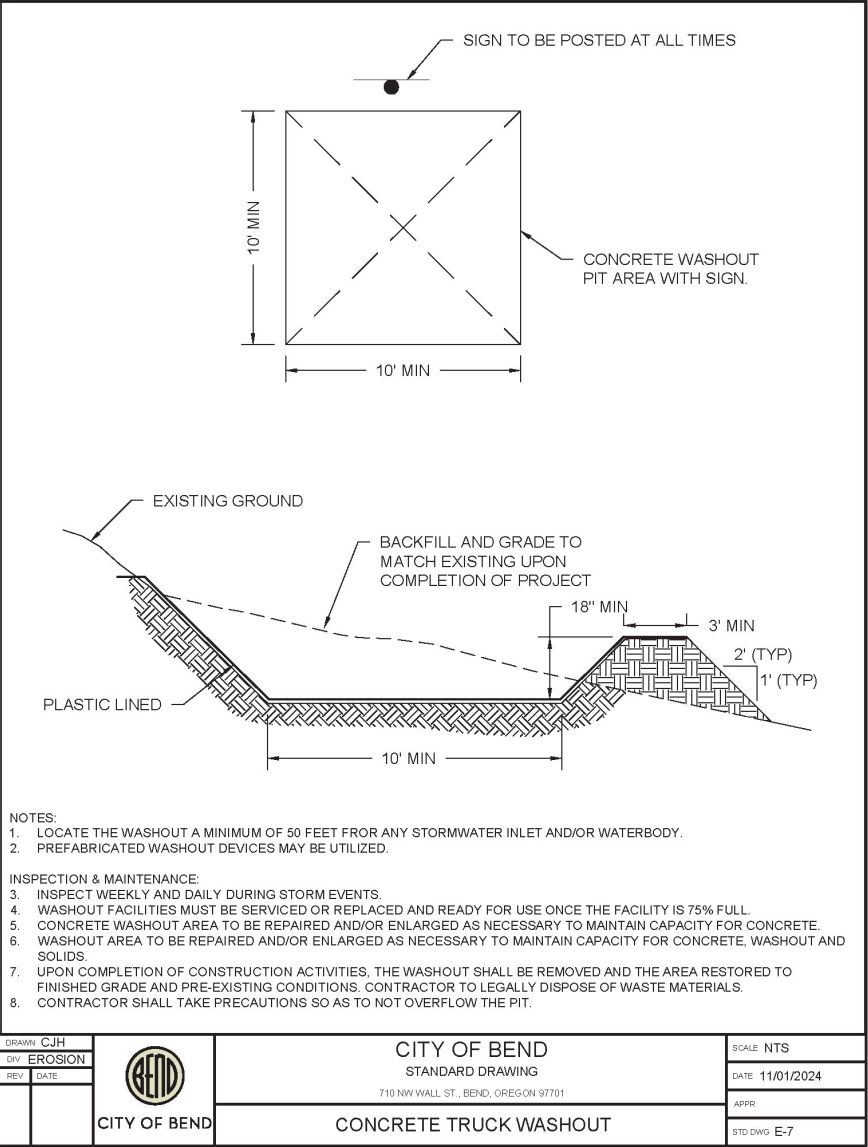
No irrigation... timing!



Stabilization - Slopes



Concrete Washout Area – Truck Washout





<https://bendoregon.gov/departments/public-works/water-services/protecting-our-water/erosion-control/>

Material Management





<https://bendoregon.gov/departments/public-works/water-services/protecting-our-water/erosion-control/>

Spill Prevention and Control

- ❖ Secondary Containment
- ❖ Saw Cutting



BMP Maintenance

Every BMP has maintenance!



Case Studies



Case Study: Steep Slopes

- Site Conditions:
 - 10 acres of disturbance
 - Steep slopes
 - Poor draining soils
- Problem:
 - BMPs not properly installed or maintained
 - Sediment laden runoff clogged new infrastructure which caused system failure



Case Study: Steep Slopes

BMP Installations and Maintenance



Was sediment fence the right tool in this application?



Which measure has been installed?



Is this straw wattle being maintained?



Does hydroseed permanently stabilize disturbance?

Case Study: Low Point(s)

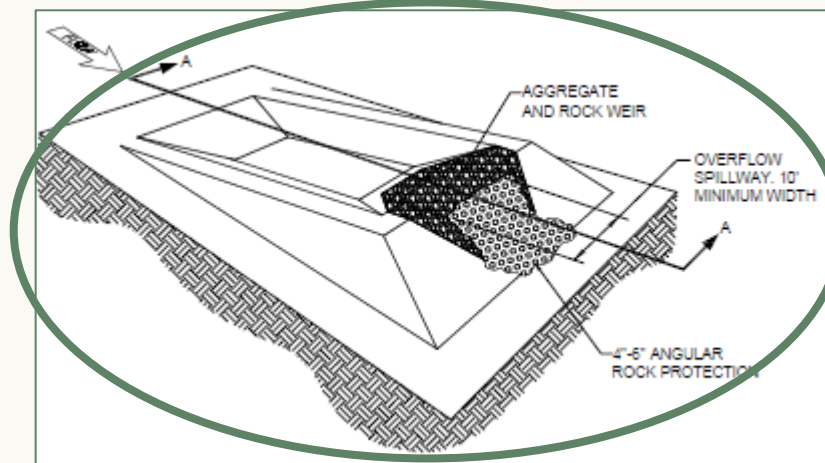
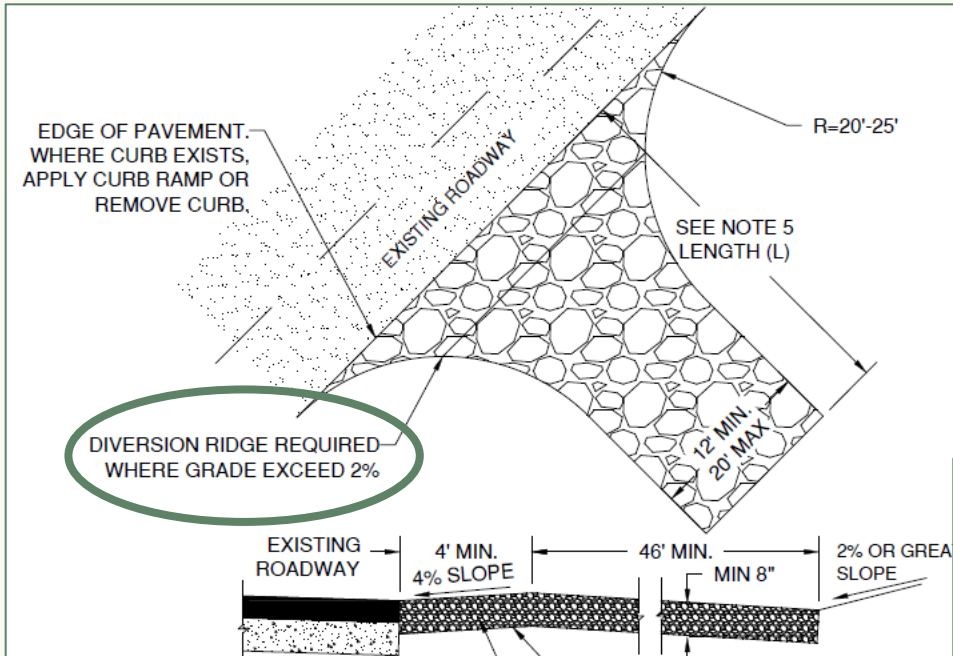
- Site Conditions:
 - 8 acres of disturbance
 - Single low point at the entrance
- Problem:
 - Only sediment fence and rocked entrance BMPs were noted on the plans



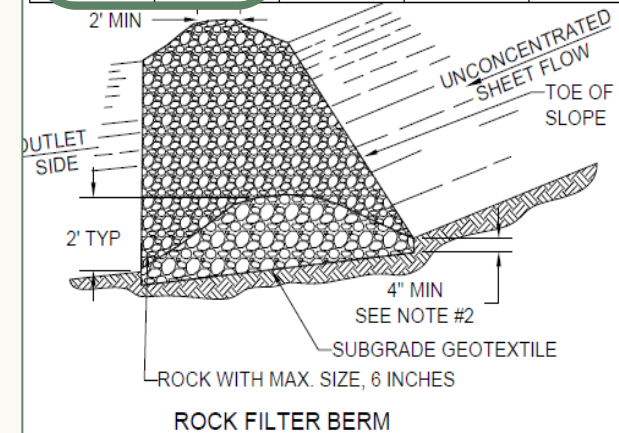
Case Study: Low Point(s)



What BMPs are missing from this photo of the low point?



FILTER BERM DIMENSIONS AND SPACING BASED ON SLOPE				
SLOPE	BERM SPACING	BERM DIMENSIONS		
		HEIGHT	BOTTOM WIDTH	TOP WIDTH
>50:1	250 Ft	1 Ft	2 Ft (MIN)	1 Ft
50:1 - 10:1	125 Ft	1 Ft	2 Ft (MIN)	1 Ft
10:1 - 5:1	100 Ft	1 Ft	2 Ft (MIN)	1 Ft
3:1 - 2:1	50 Ft	1.30 Ft	2.6 Ft (MIN)	1 Ft
>2:1		1.50 Ft	3 Ft (MIN)	1 Ft

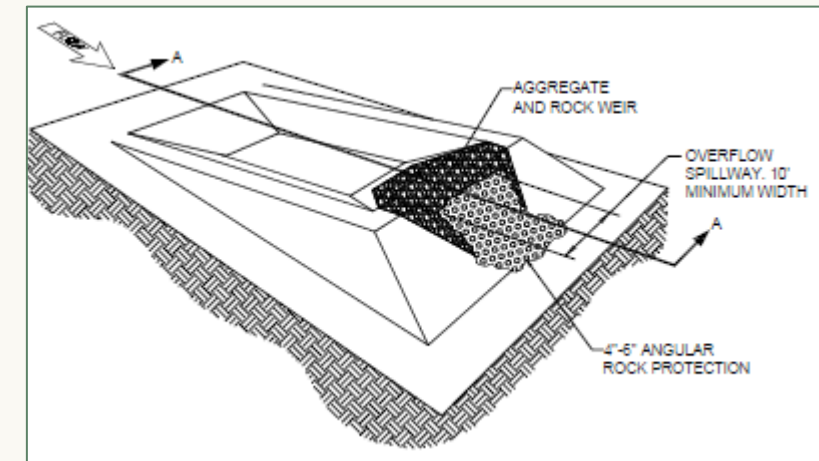
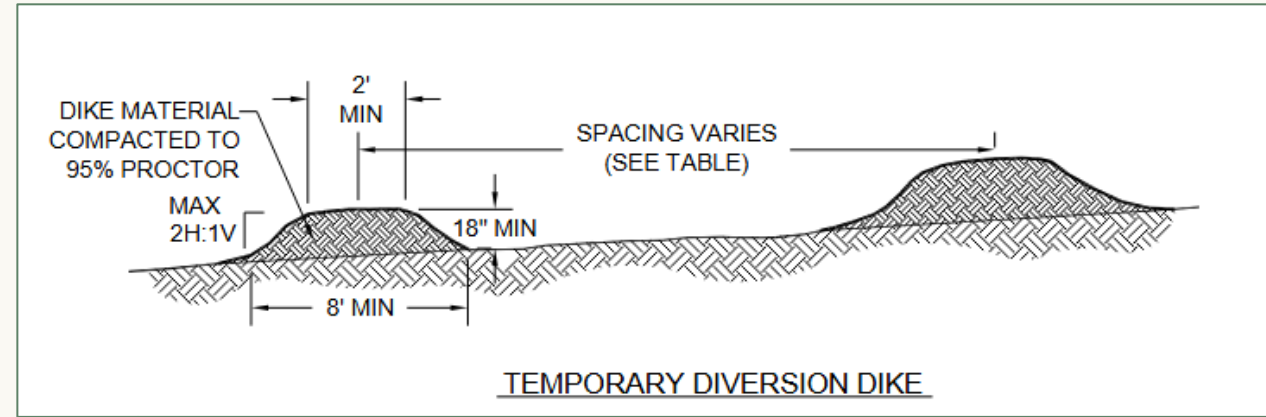


Case Study: Phased Construction/Seasonal Timing

- Site Conditions:
 - Large areas of disturbance (>25 acres)
- Problem:
 - Winter months: large runoff events and tracking of City streets
 - Summer months: several well documented dust complaints
 - Costly repairs and cleanup!



Case Study: Phased Construction/Seasonal Timing



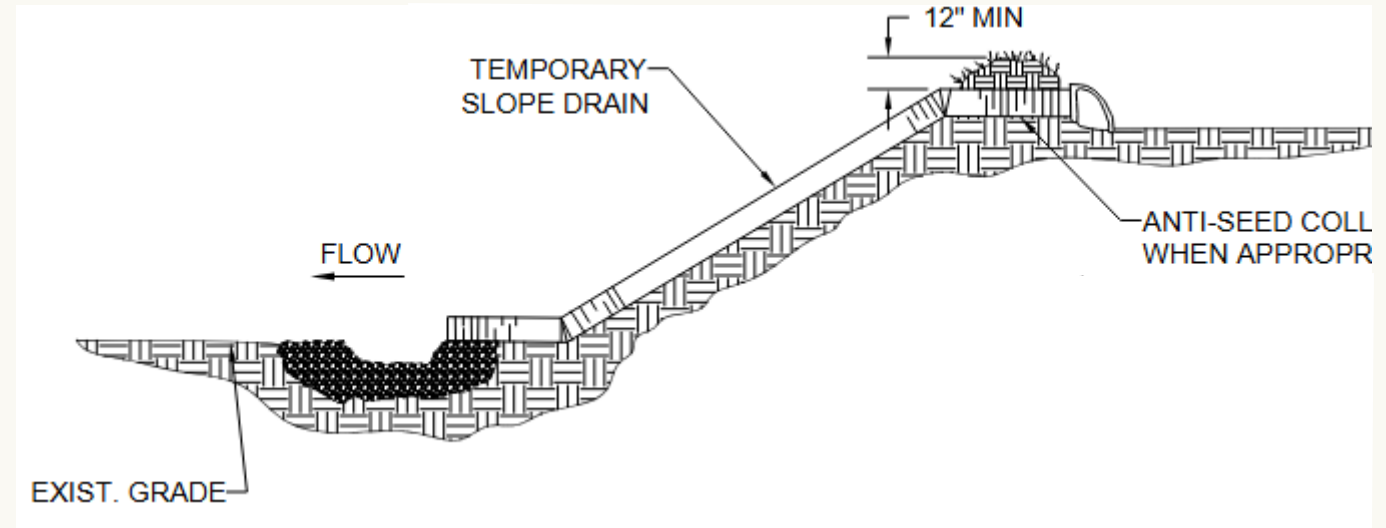
Case Study: Phased Construction/Seasonal Timing



*All disturbed areas
stabilized to control
runoff and dust.*



Case Study: Phased Construction/Seasonal Timing



Case Study: Snowmelt

- Site Conditions:
 - >35 acres of disturbance
 - New stormwater infrastructure
- Problem:
 - Rain on snow caused flashy runoff events
 - Freeze and thaw created challenging site conditions
 - Heavily trafficked areas located near entrances made for easy sediment trackout



Case Study: Snowmelt



What perimeter control BMP has been installed to keep sediment onsite?



The subgrade barrier BMP has proven to be an effective measure!



The construction entrance BMP has its limitations especially during the winter.



Stabilizing heavily trafficked areas leading up to the construction entrance

Case Study: Dust

- Site Conditions:
 - 30 acres of disturbance
 - Single water source
 - No dedicated water truck
 - Rock crushing operation
- Problem:
 - Several dust complaints and City inspections that documented a lack of dust control measures
- *Note: If the City's dust requirement can't be met then Oregon DEQ rules may apply which can require abatement and more stringent standards for measuring emissions.*



Case Study: Dust



*Active areas controlled
with water*

*Inactive areas
controlled by gravel*

Case Study: Dust

*Pre-wetted
material
entering the
crusher*



*Dedicated water
source and
controls*

Thank You!



Quiz

Complete the short quiz using the link below
or Q code:

<https://forms.cloud.microsoft/r/vmjSPP5FUU>

City of Bend Erosion Control
Training Quiz



Contact Us



Questions may be directed to stormwater@bendoregon.gov or 541-317-3010

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Accommodation Information for People with Disabilities & Language Assistance Services

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