LINN COUNTY

EROSION AND SEDIMENT CONTROL MANUAL

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1 INTRODUCTION

This Erosion and Sediment Control (ESC) Manual provides technical guidance for the design, installation, inspection, and maintenance of temporary and permanent erosion prevention and sediment control measures. The manual is intended for use by site designers, developers, contractors, and inspectors during all activities where there will be disturbed earth for projects located within the MS4 Stormwater Management Areas identified in Appendix A. These include clearing and grubbing, excavation, fill, construction, and any other activities that contribute to erosion and the movement of sediments. This manual is also intended to provide an educational resource to the public.

It is the intent of this manual to describe proactive practices designed to prevent erosion and the release of sediments and other pollutants generated at a site of ground disturbance. Site planning and good site control are the best practices that can be used to prevent discharges. This manual is organized to emphasize measures preventing erosion and controlling stormwater runoff, as opposed to practices designed to strictly control sediment.

1.1 PURPOSE

This ESC Manual was developed for the sole purpose of providing erosion prevention and sediment control Best Management Practices (BMPs). The contents of this manual should not be interpreted as necessarily representing the policies or recommendations of other referenced agencies or organizations. The mention of trade names, products, or companies does not constitute an endorsement.

It is intended this manual and alternative methods acceptable for use in other jurisdictions will be reviewed on a regular basis, with the Manual updated as needed.

1.2 ACRONYMS

AOS	Apparent Opening Size
BMP	Best Management Practice
CFR	Code of Federal Regulations
DEQ	Department of Environmental Quality
DSL	Division of State Lands
DMA	Designated Management Agency
ECRM	Erosion Control and Revegetation Mats
EPA	Environmental Protection Agency
EPCM	Erosion and Pollution Control Manager
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Control Plan
HDPE	High Density Polyethylene Pipe
LCC	Linn County Code
NPDES	National Pollutant Discharge Elimination System
MS4	Municipal Separate Storm Sewer Systems
OAR	Oregon Administrative Rules
ODOT	Oregon Department of Transportation
ORS	Oregon Revised Statutes

OSDS	On-Site Disposal System
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated Biphenyls
PCP	Pollution Control Plan
SDS	Safety Data Sheets
TMDL	Total Maximum Daily Load

1.3 DEFINITIONS

Definition of Words - Wherever in this plan the words directed, required, permitted, ordered, designated, or words of like importance are used, they shall be understood to mean the direction, requirement, permission, or order of designation of the County Engineer. Similarly, the words approved, acceptable, and satisfactory shall mean approved by, acceptable to, or satisfactory to the County Engineer.

Definitions can be found in the Glossary of Terms in Appendix G.

1.4 BACKGROUND AND POLICIES

It is the County's goal to comply with all conditions of Federal, State and County regulations and requirements. This manual is intended to comply with current Willamette Basin Total Maximum Daily Load (TMDL) requirements and the anticipated requirements of the National Pollutant Discharge Elimination System (NPDES) Phase II General Permit issued to the County for a Municipal Separate Storm Sewer System (MS4). Additionally, this manual is intended to comply with Section 860 of the Linn County Code (LCC).

1.4.1 Total Maximum Daily Loads (TMDL)

In September 2006, the Department of Environmental Quality (DEQ) issued the Willamette River Basin Total Maximum Daily Load (TMDL) Order. The TMDL is a regulatory mechanism required under the Federal Clean Water Act, and TMDLs must be issued for streams that do not meet water quality standards. For the Willamette River, current levels of bacteria, temperature, and mercury exceed state water quality limits. The TMDL issued in 2006 is the beginning of a long-term plan to reduce the pollutant load in the river. It places requirements on cities, counties, state agencies, and federal agencies and will be updated every five years as necessary. Every agency required to respond to the TMDL is labeled a Designated Management Agency (DMA). Linn County is a DMA and is required to take steps to reduce the pollutant loads within our jurisdiction that contribute to the Willamette Basin. Because the TMDL is basin-wide, it applies not just to pollutants entering the Willamette River directly, but also to those entering tributaries to the Willamette, such as the Calapooia River, Oak Creek, Truax Creek and the other creeks within Linn County. The County's Erosion and Sediment Control Program is one component of the County's efforts to meet TMDL requirements.

Linn County has developed a Total Maximum Daily Loads Program. This Program outlines the actions for minimizing mercury and sediment inputs into surface waters from those areas where the county has jurisdiction to reduce mercury and sediment in the Willamette Basin in order to protect people who regularly eat fish and shellfish from streams and lakes across the basin. Documents pertaining to Linn

County's TMDL program can be found on the Linn County Environmental Health Website at: https://www.linncountyhealth.org/eh. Documents within this program include, but are not limited to:

- TMDL Implementation Plan
- TMDL Annual Reports
- TMDL Management Strategy Matrix
- Linn County Willamette River Basin TMDL Area Maps

1.4.2 NPDES Program for Municipal Separate Storm Sewer Systems (MS4)

In 1990 the U.S. Environmental Protection Agency (EPA) began requiring large municipalities, those with a population of 100,000 or more, to obtain National Pollutant Discharge Elimination System (NPDES) permits for their municipal separate storm sewer systems (MS4). In Oregon, the Department of Environmental Quality (DEQ) has been charged with administering the MS4 NPDES permit program. An MS4 is a stormwater conveyance system that includes roads, ditches, gutters, catch basins, and storm drains owned or operated by a public body. These permits are known as "Phase I" permits and require communities to implement programs and practices that reduce the amount of stormwater pollutants discharged into local rivers and streams.

In December 1999, EPA adopted rules to implement "Phase II" of the stormwater program. Phase II expanded the stormwater permitting program to include smaller communities located in U.S. census-defined urban areas. Phase II rules require communities to develop, implement, and enforce stormwater management programs that address six minimum control measures. "Construction site runoff control" is one of six minimum control measures the County is required to include in its stormwater management program to meet the conditions of its NPDES permit.

The County has developed the ESC Program and this manual to protect water quality consistent with the Willamette Basin TMDL requirements discussed above and the NPDES MS4 Phase II permit requirements.

1.4.2.1 MS4 Area Maps

The County will maintain current MS4 Maps of the 3 urban areas included within the MS4 area; Millersburg, Albany and Tangent. These maps are included in Appendix A.

1.4.3 County Code, Title 8: Chapter 860, Surface Water

In 2023 the Linn County Commissioners adopted Erosion Prevention and Sediment Control requirements as part of Volume 1: Title 8, Chapter 860 of the Linn County Code (LCC). Specifically, 860.400 has been dedicated to Erosion Prevention and Sediment Control. Details of the County's ESC program requirements, including permitting and inspection, are included in Chapter 4 of this manual.

Section 860.400 of the LCC sets forth the requirements of the County's Erosion Prevention and Sediment Control Program. Included in that Chapter is a provision for the development, implementation, and maintenance of this manual. In the event that any provision of this manual is in conflict with any section of the LCC, the provisions of the LCC shall govern.

An educational flyer has been prepared to educated County Staff, Contractors, and the general public on erosion and sediment control best management practices for construction sites. See Appendix E.

1.4.4 Enforcement Procedures

The County has implemented and maintains a written escalating enforcement and response procedure for all qualifying construction sites, LCC 860.500. The procedure addresses repeat violations through progressively stricter response, as needed, to achieve compliance. The escalating enforcement and response procedure describes how the permit registrant will use enforcement techniques to ensure compliance. The enforcement procedures include timelines for compliance and, when formulating response procedures, considers factors such as the amount of pollutant discharged, the type of pollutant discharge, and whether the discharge was intentional or accidental.

1.4.5 Training and Education

All staff responsible for ESCP reviews, site inspections, and enforcement are trained or otherwise qualified to conduct such activities.

Orientation and training will be provided to all new staff working to implement the Construction Runoff Control program within 30 days of their assignment to this program. The staff will be properly trained and knowledgeable in the technical understanding of erosion, sediment, and waste material management controls to conduct such ESCP reviews and inspections. All staff will receive training at least once. Follow-up training will be provided as procedures and/or technology utilized in this program change.

1.4.6 Tracking and Assessment

The County will track implementation of Construction Site Runoff program's required activities through the Road Department's access permitting process.

1.5 PERMITTING

A permit may be required for some land disturbance activities.

Permits must be obtained by the owner of the property on which the activity is proposed. All land disturbing activities, whether or not qualifying for permit requirements, shall be undertaken in a manner to prevent or minimize, to the greatest extent practical, soil erosion and the deposition of sediments onto rights-of-way; or introduction of sediments into wetlands, drainage ways, the municipal stormwater system, receiving waters, and/or areas that contain or contribute directly to the Waters of the State. Approval of an erosion prevention and sediment control plan and permit issuance by the County does not relieve the applicant of his or her responsibility to ensure erosion prevention and sediment control measures are implemented and maintained effectively.

1.5.1 Grading Permit

The Linn County Building and Planning Department may require a Grading Permit before commencing land disturbing activities. Refer to LCC 850 and the Linn County Building and Planning Department website at: https://www.linncountyor.gov/planningbuilding for permitting requirements.

1.5.2 Erosion and Sediment Control permit

The County requires an Erosion and Sediment Control Permit before commencing land disturbing activities affecting an area of 1/4 acre (10,280 square feet) or greater, cumulatively. The permit shall be obtained through the Linn County Road Department and may be in conjunction with an Encroachment Permit.

1.5.3 Permit Exemptions

Some land disturbing activities that affect an area greater than 1/4 acre (10,890 square feet) do not require a permit. These include:

- Replacement or re-establishment of an existing lawn on a single lot, not exceeding 10,000 square feet (about a quarter of an acre)
- Agricultural activities. This is defined as "private or commercial activities directly engaged in the production of nursery stock, sod, fruits, vegetables, forages, cover crops, field crops (grain, corn, oats, beans, etc.) timber, and livestock, or other related activities determined by the Roadmaster to conform to this definition; but shall not include construction or other activities for structures associated with agricultural activities." This definition includes home gardening.

1.5.4 Erosion and Sediment Control Permit Process

Upon receipt of an application for an Erosion and Sediment Control Permit, the Roadmaster, or their designee, will review the submitted application and attached ESC Plan. Upon preliminary approval of the ESC Plan, the Roadmaster will schedule an appointment to meet the applicant on site to review the installed BMPs and verify that they match the ESC Plan. The ESC Permit will not be issued until after the initial site review has been conducted and the ESC Plan has been accepted. No land disturbing activities may commence until an Erosion and Sediment Control Permit has been issued.

1.5.4.1 Initial Site Review

ESC BMPs shall be installed at the time of the initial site review. The site review provides the inspector and the applicant the opportunity to review the components of the ESC Plan, and the accuracy of the plan as it reflects actual site conditions. The inspector may require changes to the ESC Plan, installed BMPs, or other provisions deemed necessary. Subsequent to the County's approval of the ESC Plan and acceptance of the installed BMPs, the ESC Permit will be issued. Land disturbing activities may only commence after an ESC Permit has been issued.

1.5.4.2 Site Inspections

For construction activities that will result in land disturbance of 10,890 square feet (a quarter of an acre) or more, cumulatively, will be inspected, at a minimum:

A. At least once during the permit term;

B. If sediment is visible or reported in stormwater discharge or dewatering activities from the construction site; or

C. If a complaint or report is received.

If a construction site is inspected, the site inspection will include and document the following:

A. A review and evaluation of the ESCP to determine if the described control measures were installed, implemented and maintained properly.

B. An assessment of the site's compliance with the County's ordinances or requirements, including the implementation and maintenance of required control measures.

C. Visual observations and documentation of any existing or potential non-stormwater discharges, illicit connections, and/or discharge of pollutants from the site. Documentation of recommendations to the construction site operator for follow-up.

D. If necessary, education or instruction provided to the construction site operator related to additional stormwater pollution prevention practices to comply with the approved ESCP.

E. A written or electronic inspection report, including documentation of all necessary follow-up actions (i.e., re-inspection, enforcement) to ensure compliance with their applicable requirements.

1.5.4.3 Permit Closeout

After the completion of all land disturbing activities, the owner will make a request to the County to perform a final inspection. Upon verification by the inspector that permanent site stabilization measures have been installed and are functioning effectively, the ESC Permit will be closed. No "in lieu of" work may be substituted for permanent stabilization within any public right-of-way.

1.5.5 Erosion and Sediment Control Permit Requirements

Applicants for an ESC Permit shall submit an ESC Plan as a part of their permit application. For minor land disturbances defined in Section 1.5.5.1 there are no special qualifications to prepare the plan. A template and sample ESC Plan can be found in Appendix C. For major land disturbing activities defined in Section 1.5.5.2, a professional design must be submitted by a person licensed in Oregon as a civil engineer, environmental engineer, landscape architect, geologist, or a certified professional in erosion and sediment control (CPESC). ESC Plan procedures for planning and design are described in Section 2 of this manual.

Approval of an ESC Plan by the County does not relieve the applicant of his or her responsibility to ensure the approved ESC Best Management Practices (BMPs) are constructed and maintained to prevent erosion and contain sediment and pollutants on the construction site. Additional ESC Best Management Practices beyond those depicted on an approved ESC Plan may be required based on specific site conditions.

Erosion prevention and sediment control BMPs are required during all land disturbing activity until permanent site ground covers are in place. Certain base measures are required for construction sites at all times of the year.

1.5.5.1 Submittal Requirements for Minor Land Disturbance Activities

An ESC Plan is required for all land-disturbing activities affecting 1/4 acre (10,890 square feet) or greater, cumulatively.

This section provides the ESC Plan requirements for minor land disturbances. Sites meeting the following conditions can be characterized as minor land disturbances:

1) Individual single-family home or duplex construction on existing lots of record, or manufactured home placement on individual lots or in manufactured home parks, and meet the following conditions:
    a. Land disturbing activities that cumulatively affect one-quarter acre throughout the duration of the project and meet the following conditions:
        i. Average slopes throughout the disturbed area do not exceed 10 percent,
        ii. Slopes within the disturbed area do not exceed six feet in height at slopes greater than 3H:1V,

iii. Concentrated runoff conveyed through the site does not originate from more than one acre off-site (outside of disturbed area), and
iv. There are no sensitive areas (wetlands, streams, etc.) located on, or adjacent to, the site work.

Table 4.1.3 and 4.1.4 designates the minimum erosion control BMPs for minor land disturbances. Each erosion control BMP presented in the table is also described in further detail with design, construction, inspection and maintenance criteria in Section 4.

Each application for an Erosion and Sediment Control Permit for minor land disturbances shall include:

1) A completed County Erosion and Sediment Control Permit Application form
2) An ESC Plan (see Appendix C for a template and sample plan), drawn to scale, showing the following (See Section 4 for Plan Development):
    a. Property lines and distances to buildings
    b. Elevations on the property to indicate the amount of fall and/or grades across the property
    c. Contour lines showing the existing grades/topography of the site
    d. Contour lines showing the proposed final grades/topography of the site
    e. Arrows to indicate existing and final flow patterns of surface water on the property. **Note: it is a violation of Oregon Drainage Law to alter the flow of surface water to harm neighboring properties.**
    f. Proximity to sensitive areas, as defined in Section 3.1.4
    g. Location of the 100-year flood plain, if applicable
    h. Location and size of drainage ways, swales, ditches, etc.
    i. Location of utilities on the property (sewer, water, etc.)
    j. All areas of land disturbances, including areas that will be cleared, graded, or excavated
    k. Location for storage of soils and/or wastes
    l. Gravel construction entrance
    m. Placement of erosion prevention and sediment control devices (e.g., sediment fences).
3) A construction schedule showing:
    a. Expected date by which ESC measures will be in place
    b. Expected date land disturbing activities will commence
    c. Expected date construction will be completed
    d. Expected date permanent ground cover will be in place

1.5.5.2 Submittal Requirements for Major Land Disturbance Activities

A ESC plan is required for all land-disturbing activities affecting 1/4 acre (10,890 square feet) or greater, cumulatively. Major land-disturbing activities include those sites that:

- Affect an area over one acre in size, or
- Contain average slopes throughout the disturbed area that exceed 10 percent, or
- Contain slopes greater than 3H:1V which exceed six feet in height, or
- Have concentrated runoff through the disturbed area that comes from over one acre off-site, or
- Contain sensitive areas (wetlands, streams, etc.) located on, or adjacent to, the site work.

Table 4.1.2 designate the minimum erosion control BMPs for major land disturbances. Each erosion control BMP presented in the table is also described in further detail with design, construction, inspection and maintenance criteria in Section 4.

The applicant shall submit the following information with a set of construction plans:

1) Completed Erosion and Sediment Control Permit Application form.
2) A copy of any applicable NPDES 1200-C permit issued by the Department of Environmental Quality (DEQ). If the site is subject to the requirements of an NPDES 1200-C permit, but it has not been issued, the County will not issue an ESC permit.
3) Construction schedule with the following information:
    a. Construction start and completion dates.
    b. Dates when erosion control measures will be in place.
    c. Timing of site clearing and grading, placement of fills, and excavations.
    d. Projected date of removal of erosion control measures (after landscaping is established or after establishment of a healthy grass stand or other approved vegetation.
4) Submit with the construction plans one set of the ESC Plan, drawn to scale, showing the following (See Section 3 for Plan development processes):
    a. Vicinity map, property address, and property owner's name and address.
    b. Locations, types, and applicable dimensions of erosion control measures.
    c. Applicable details of erosion control measures showing full dimensions and construction information.
    d. Existing and proposed ground contours, including a minimum of the first 50 feet of abutting property.
    e. Arrows to indicate existing and final flow patterns of surface water on the property. **Note: it is a violation of Oregon Drainage Law to alter the flow of surface water to harm neighboring properties.**
    f. Locations and sizes of existing and proposed channels and drainage pipes (labeled as such and with arrows indicating flow direction) on and for 100 feet upstream and downstream of the site.
    g. Location of the 100-year flood plain, if applicable.
    h. Site entrances/exits (as approved by the County).
    i. Applicable standard erosion control notes, with additions or changes as required.
    j. Other notes including references to timing of placement and removal of erosion control measures, and erosion measure specifications such that types and quantities of materials necessary for the installation of the erosion control measures are fully detailed.
    k. **Stamped or signed by a certified professional licensed in Oregon as a civil or environmental engineer, landscape architect, geologist, or certified professional in erosion and sediment control (CPESC)**.

If the site erosion control plan includes sediment traps or ponds, the applicant shall also submit calculations used for determining trap or pond sizing and pipe orifice sizing.

Because of particular site conditions or preferences, the applicant may desire in certain cases to use different erosion control measures than those recommended in Table 4.1.2. In such cases, the applicant must submit calculations or other supporting information used to determine the sizing and layout of the measures shown on the submitted erosion control plan.

Cumulative land disturbing activity in excess of one acre requires a NPDES 1200-C storm water general permit issued by the DEQ. As indicated above, a copy of the NPDES 1200-C application is required to be submitted to the County.

If the facilities and techniques approved in an ESC Plan are not effective or sufficient, the applicant shall:

- Take immediate action to stop eroded materials and/or sediment from leaving the site
- Immediately implement additional facilities and techniques as approved by the Director, or his or her designee
- Prepare and submit a revision to the ESC Plan for County approval.

1.5.6 Permit Holder

Erosion and Sediment Control Permits must be obtained by the owner of the property. The owner of the property, as permit holder, shall assume responsibility for site conditions, maintenance of the ESC Plan, and maintenance of BMPs throughout the duration of land-disturbing activities, and until such time as the site has been adequately stabilized and the permit has been closed or transferred. Permits may not be transferred to any person or entity except upon transfer of title for the property.

When the ownership of a property with an active ESC Permit is transferred, the person(s) or entity transferring title for the property is obligated to inform the person(s) or entity assuming ownership of their obligation to transfer the ESC Permit and to obtain a new permit.

The most recent ESC Permit for a property will supersede all other ESC Permits that apply to that property. For example, this provision allows for an ESC Permit to be issued for the development of a subdivision. Subsequently, individuals or entities may obtain a permit for a lot within that subdivision while the subdivision's original Erosion and Sediment Control Permit is still active. The subsequent permit for the individual lot will then nullify the obligations of the subdivision's developer for the affected lot.

1.5.7 Permit Duration

Erosion and Sediment Control Permits are valid for a period of one year, or until land disturbing activities are completed, and surface conditions stabilized with permanent measures to prevent future erosion. If land disturbing activities continue beyond the permit's expiration date, or if the land has not been permanently stabilized, the permit holder may make a written request for an extension. Extensions, if approved, shall be for twelve months and may be subject to administrative fees.

1.5.8 Enforcement

To enforce the requirements of the County's ESC program, the Roadmaster, or his or her designee may gain compliance by any or all of the means described below:

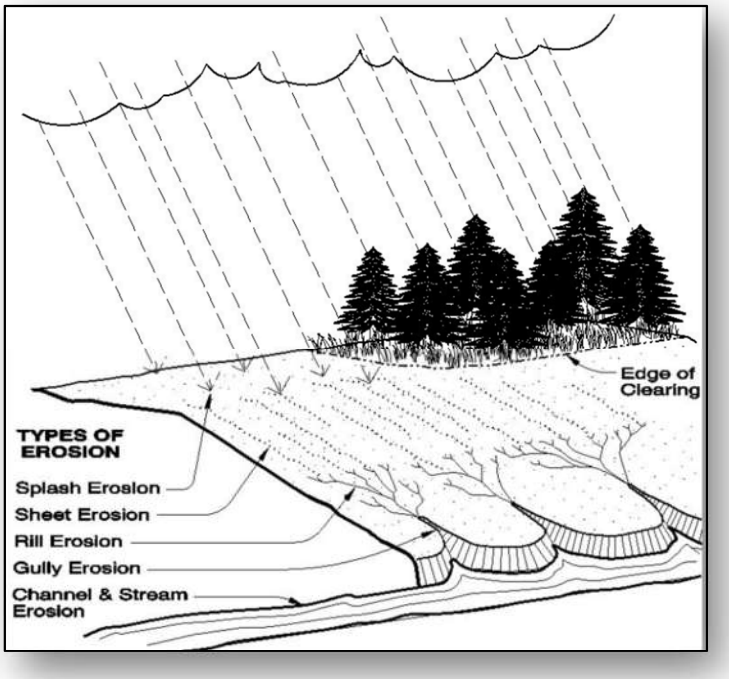
1) Suspension of access to the municipal stormwater system
2) Issuance of a Warning Notice.
3) Issuance of a Notice of Violation. This provides instructions to the permit holder and persons working under the authority of the ESC permit, and may include sanctions.
4) Issuance of an Administrative Order. This provides for penalties, fines, and cost recovery.
5) Permit suspension or revocation
6) Stop Work Order
7) Compliance Schedule

8) Abatement
9) Civil Penalties, Administrative Fines, Cost Recovery, and Criminal Penalties.

No action taken by the Roadmaster, or his or her designee, will be contingent on any requirement for any preceding or qualifying action on the part of the Roadmaster, or his or her designee.
No enforcement action taken by the Roadmaster, or his or her designee, will limit the authority of the Roadmaster from taking any other action available.

1.6 THE EROSION AND SEDIMENT PROCESS

Figure 1 Types of Erosion



Erosion occurs when rain or wind loosen soils from the surface. When land is disturbed at construction sites, the soil erosion rate accelerates dramatically. The major problem associated with erosion at a construction site is the movement of soil from the site and the impact of the transported soil on water quality in streams, rivers, and wildlife habitat.

Wind erosion creates a more consistent area-wide stripping of soils from the soil surface.

Figure 1 illustrates the erosion process of raindrops.

- Splash erosion is the process of a raindrop impacting a soil surface. Splash erosion is the initial phase of soil erosion by rain and dominates particle erosion and soil redistribution prior to the generation of overland flow.
- Sheet erosion occurs as a shallow 'sheet' of water flowing over the ground surface, resulting in the removal of a uniform layer of soil from the soil surface. Sheet erosion occurs when rainfall intensity is greater than infiltration.
- Rill erosion is removal of soil by concentrated water flow, and it occurs when the water forms small channels in the soil as it flows off site. The rills or small channels are caused when water running across the surface of the ground gathers in a natural depression in the soil, and erosion is concentrated as the water flows through the depression.
- Gully erosion is often a dramatic form of soil erosion caused by flowing surface water. It consists of open, unstable channels that have been cut into the ground. Gully erosion is a result of concentrated water flow.

Both rain and wind are capable of depositing large amounts of sediment, sometimes at great distances, away from the site of ground disturbance.

There are four main factors that influence erosion:

1. Soil Erodibility - Soil characteristics which influence the potential for erosion by rainfall and runoff are those properties which affect the infiltration capacity of a soil and those which affect the resistance of the soil to detachment and being carried away by falling or flowing water. The following four factors are important in determining soil erodibility:
    - Soil texture (particle size and gradation)
    - Percentage of organic content
    - Soil structure
    - Soil permeability

    Soils containing high percentages of fine sands and silt are normally the most erodible. As the clay and organic matter content of these soils increases, the erodibility decreases. Clays act as a binder to soil particles, thus reducing erodibility. However, while clays have tendency to resist erosion, once eroded, they are easily transported by water. Soils high in organic matter have a more stable structure which improves their permeability. Such soils resist raindrop detachment and infiltrate more rainwater. Clear, well-drained, well- graded gravel, and gravel-sand mixtures are usually the least erodible soils. Soils with high infiltration rates and permeability either prevent or delay and reduce the amount of runoff.

2. Vegetative Cover - Vegetative cover plays an extremely important role in controlling erosion as it provides the following five benefits:
    - Shields soils surface from raindrop and wind erosion.
    - Provides root systems which hold soil particles in place.
    - Aides soil in absorbing water.
    - Slows velocity of runoff.
    - Evapotransporates sub-surface water between rain storms.

    By limiting and staging the removal of existing vegetation and by decreasing the area and duration of exposure, soil erosion and sedimentation can be significantly reduced. Special consideration should be given to the maintenance of existing vegetative cover on areas of high erosion potential such as moderately to highly erodible soils, steep slopes, drainageways, and the banks of streams.

3. Topography - Topography (the size, shape, and slope) of a watershed can influence the amount and rate of stormwater runoff. High slope lengths and steep gradients increase the rate of runoff (creating a higher probability for erosion) and can limit abilities to establish and maintain vegetative cover.

4. Climate - The frequency, intensity, and duration of rainfall are fundamental factors in determining the amounts of runoff produced in a given area. As both the volume and velocity of runoff increases, the capacity of runoff to detach and transport soil particles also increases. Where storms are frequent, intense, or of long duration, erosion risks are high. Seasonal changes in temperature, as well as variations in rainfall, help to define the high erosion risk period of the year. When precipitation falls as snow, no erosion will take place. However, when the temperature rises, melting snow adds to runoff, and erosion hazards are high. Because the ground is still partially frozen, its absorptive capacity is reduced. Frozen soils are relatively erosion-resistant. However, soils with high moisture content are subject to uplift by freezing action and are usually very easily eroded upon thawing.

Although both water and wind erosion should be anticipated throughout the year, the likelihood of water erosion increases during the wet weather season (October 1st – April 30th) and wind erosion is more prevalent during the dry weather season.

Every year, tons of sediment is washed and blown from sites of ground disturbance into streams, rivers, and lakes. As the community continues to grow, our local waterways are being affected by ground disturbance, with the greatest sediment impacts occurring during the land grubbing, clearing, grading and other excavation phases of development. Responsible development requires that steps be taken to control erosion and sedimentation from construction sites.

Sediment, resulting from disturbed soils, can move onto neighboring properties and streets or into drainage systems and other bodies of water. Excessive sediment has significant negative impacts on how the natural watershed runoff and soil conveyance system works. Under natural conditions, water sheds as groundwater through infiltration or as surface water by spreading across floodplains and migrating downstream through stable stream and waterway channels. In a natural watershed system, sediment, cobbles and gravel travel throughout the stream network creating deposition, scour and gravel areas that are important for fish habitat. The natural system survives by its ability to contain flows and balance sediment loads within the stream network.

1.7 IMPACTS OF EROSION AND SEDIMENTATION

Erosion and sedimentation cause both environmental and economic impacts. Both are important, but is often only an economic impact that spurs a jurisdiction to take action. Environmental impacts are harder to see and quantify as they tend to build slowly and do not produce dramatic results for many years when it may be too late to correct the problem. Erosion and sedimentation can cause expensive site damage and construction delays. Lack of maintenance often results in failure of control practices and costly cleanup and repairs.

1.7.1 Environmental Impacts

Many environmental impacts from sediment pollution are cumulative and the ultimate results and costs may not be evident until years later. Some environmental impacts include:

- Eroded soil containing nitrogen, phosphorus, and other nutrients. When carried into water bodies, these nutrients trigger algal blooms that reduce water clarity, deplete oxygen, lead to fish kills, and create odors.
- Erosion of streambanks and adjacent areas destroys streamside vegetation that provides aquatic and wildlife habitats.
- Excessive deposition of sediments in streams (Image 1) smothers the bottom fauna, seals stream beds, and destroys fish spawning habitat.

Image 1 Stream Turbidity

- Turbidity from sediment reduces in-stream photosynthesis, which leads to reduced food supply and habitat.
- Turbidity increases the amount of sunlight absorbed in water, raising stream temperatures.
- Suspended sediment abrades and coats aquatic organisms.
- Erosion removes the smaller and less dense constituents of topsoil - those clays, fine silt particles and organic materials that hold nutrients that plants require for healthy establishment. The remaining subsoil is often hard, rocky, infertile, and fails to hold moisture; thus making reestablishment of vegetation difficult.

1.7.2 Economic Impacts

Many economic impacts are hard to quantify. How can a dollar value be assigned to loss of aquatic habitat or diminished water clarity? Other impacts may be readily quantified, for example the cost of dredging and disposing of the accumulated sediment in a silted-up reservoir. Some potential economic impacts include:

- Excessive sediment accumulation reduces reservoir storage capacity and more frequent sediment removal is required.
- Sediment deposited into streams reduces flow capacity, interferes with navigation, and increases the risks of flooding.
- Local governments and their tax payers must pay for removing sediment from streets, sewers, ditches, sumps and culverts, and for dredging sediment from harbors and navigation channels.
- Excess sediment creates cloudy or turbid water conditions, interfering with recreational uses.
- Erosion severely diminishes the ability of the soil to support plant growth. To restore this ability is costly.
- Loss of wildlife habitat due to erosion and sedimentation could lead to additional species being classified as endangered. Additional endangered species listings increases time and fees for permitting, design, and construction in the affected watersheds. Some costs are directly assessed to specific projects while many other costs are distributed statewide by spending additional monies for habitat restoration.
- Litigation is an expensive alternative.

Many of these costs could be largely avoided through implementation of adequate erosion control practices.

2 EROSION AND SEDIMENT CONTROL PLANS (ESCP)

The County requires an Erosion and Sediment Control Plan (ESCP) be submitted by contractors and requires approval of the plan before commencing land disturbing activities for Construction sites with land disturbance of 10,890 square feet (1/4 acre) or greater, cumulatively.

The Erosion and Sediment Control Plan shall be maintained and updated as site conditions change, or as needed.

Erosion and Sediment Control Plans shall be kept onsite and made available for review by the County, DEQ, or another administrating entity.

Refer to Sections 1.5.5.1 and 1.5.5.2 for Erosion and Sediment Control Plan requirements.

It is important to note that approval of an erosion and sediment control plan by the County does not relieve the contractor's responsibility to ensure erosion control measures are constructed and maintained to prevent sediment from leaving construction site and does not relieve the contractor's responsibility to comply with other regulatory permits that may be obtained. These requirements are upheld throughout the life of the construction project.

2.1 DESIGN

The Erosion and Sediment Control Plan must meet the requirements of Section 3 and, at a minimum, consist of sizing criteria, performance criteria, design specifications, and guidance on selection and placement of controls, and specifications for long term operation and maintenance, including appropriate inspection interval and self-inspection checklists for use by the construction site operator.

An Erosion and Sediment Control Designer Checklist can be found in Appendix B. The ESC plan design is expected to prevent erosion, control sediment, control the amount and velocity of runoff, and prevent sediment laden water (or other pollutants) from leaving the project site.

An ESCP template for construction site operators to document how erosion, sediment, and waste material management controls will be implemented at the construction project site is included in Appendix C. The Erosion and Sediment Control Plan must, at a minimum, consist of sizing criteria, performance criteria, design specifications, and guidance on selection and placement of controls, and specifications for long term operation and maintenance, including appropriate inspection interval and self-inspection checklists for use by the construction site operator. See Sections 1.5.5.1 and 1.5.5.2 for ESC plan requirements.

Erosion and Sediment Control Plans are to be maintained and updated as site conditions change, or as needed and are to be kept on site and made available for review by the County, DEQ, or another administrating entity.

2.2 MONITORING

An Erosion control inspection report shall be completed weekly for active sites, every 2 weeks for inactive sites, and within 24 hours after 1/2 inch or more rainfall occurs. A blank Erosion and Sediment Control Inspection form, and a sample form filled out can be found in Appendix D.
During a site inspection, document the following:

- Review and evaluate the ESCP to determine if the described control measures were installed, implemented and maintained properly.
- Visual observations and documentation of any existing or potential non-stormwater discharges, illicit connections, and/or discharge of pollutants from the site.
- A written or inspection report, including documentation of all necessary follow-up actions (i.e., re-inspection, enforcement) to ensure compliance with their applicable requirements.

3 EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN

The designer should keep in mind when laying out an erosion control plan that the purpose of the plan is to maximize erosion prevention and minimize sediment transport from disturbed ground surfaces. Erosion prevention is the most effective and inexpensive method for reducing overall environmental impacts associated with construction activities. Erosion control practices primarily involve preserving natural vegetation when possible or stabilizing exposed soils with temporary covers or permanent vegetation. Reducing the erosion associated with construction vehicle traffic is also covered in this section.

Erosion control measures are required for construction areas where the ground surface will be disturbed by clearing, grading, fills, excavations, and other construction activities.

3.1 DESIGNER RESPONSIBILITIES

A designer generally puts the ESCP together in the office based on information provided from resources obtained from local and regional agencies and a detailed field site visit. In addition, the designer must identify potential erosion and sediment problems, develop design objectives, formulate and evaluate alternatives, select best erosion prevention measures, and develop a plan. A determination is made about what best management practices are appropriate. A variety of BMPs should be included on the plan in order to provide adequate tools in the field. The following subsections will provide guidance on achieving the best overall success.

The designated person, whether contractor or erosion and sediment control specialist, and ultimately the owner, has a defined responsibility to prevent pollution from leaving the site. They must follow a plan, or obtain approval for a revised plan, and ensure the site is stable. Even though the ESCP may be followed in detail and appear to have addressed all issues, there will inevitably be obstacles along the way that will change those plans. Therefore, the best scenario includes a good plan, open lines of communication, and defined responsibilities.

Erosion control measures are required for construction areas where the ground surface will be disturbed by clearing, grading, fills, excavations, and other construction activities. When developing an effective ESC plan, there are five important concepts to consider:

1) Timing – schedule work to minimize overall impacts.
2) Stage work – identify and process critical areas first.
3) Minimize disturbance – create buffers and reduce mass grading.
4) Pre-construction – during preliminary design and prior to on site grading activities.
5) Pictures/Video – documentation throughout life of project.

The long-term benefits of an effective erosion and sediment control plan are enormous. An important concept to keep in mind when developing construction and erosion control plans is: practices which minimize the amount of disturbed land area and avoid or minimize work on steep slopes have the greatest potential to reduce erosion. There is less chance of soil washing off the site and clogging streets, drainage systems, and entering adjacent properties. The number and size of erosion control measures required will be minimized. The cost of maintaining erosion control facilities is minimized. Top soil retention on the site is maximized, making re-vegetation and landscaping easier to establish.

It is equally important to note that approval of an erosion and sediment control plan by the County does not relieve the applicant's responsibility to ensure erosion control measures are constructed and maintained to prevent sediment from leaving construction site. These requirements are upheld throughout the life of the construction project.

3.1.1 Soil Survey Information

Knowing the type of soil found on the project site will help the designer decide upon the degree of erosion protection required. Of prime importance are the predictions of soil behavior for selected land uses. As described in Section 1, the potential for erosion is highly dependent on the type of soil. This will ensure the ESCP is adequate to control soil movement without being overly conservative. The Natural Resource Conservation Service Soil Survey, a mapped inventory with physical properties and characteristics described for each soil type for Linn County is available on the County Geographic Information System (GIS) map located at:
https://gis.co.linn.or.us/portal/apps/webappviewer/index.html?id=a0ea31b0971a4f65b8d5bc4675a15534

3.1.2 Climate and Precipitation Data

The occurrence and intensity of rainfall is important for the designer when placing and sizing erosion control measures. Additionally, all erosion control measures require inspection after any rain event in excess of 0.5 inches in 24 hours. Rain gauges can be used to assist in determining on-site rainfall. Precipitation and other weather data may be found on the Internet through the National Weather Service at: https://www.weather.gov/wrh/Climate. The wet weather season extends from October 1st to April 30th.

3.1.3 Topography

From the site visit, determine the drainage patterns from the topography. Does runoff flow from offsite through the construction site? If so, measures should be taken to re-route this water around areas that will have ground disturbance.

Will areas of ground disturbance occur on long slopes that are greater than two percent grade? If so, the lengths of the uninterrupted flows should be broken up so the rainfall runoff will only flow short distances thereby decreasing flow velocity and the erosive force. In flat areas, runoff is slow and soil particles are not moved far from the point of raindrop impact. If the slopes are steep and short, surface cover may be needed to decrease runoff and promote rainfall infiltration into the soil. On steep slopes, soil movement increases dramatically. Constructing very long slopes and especially, long, steep slopes should be avoided. Those that already exist should not be disturbed.

3.1.4 Sensitive Areas; Waters of the State

Sensitive areas include steep slopes (those greater than 10 percent), wetlands, and areas that include or contribute directly to Waters of the State. "Waters of the State" means any lakes, bays, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Pacific Ocean within the territorial limits of the State of Oregon and all other bodies of surface or underground waters, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters that do not combine or effect a junction with natural surface or underground waters), which are wholly or partially within or bordering the State or within its jurisdiction.

Depending on several factors, an undisturbed corridor buffer of varying width is required adjacent to sensitive areas. The responsible party shall be aware of, and adhere to, any limitations in the work area in the proximity of sensitive areas imposed by environmental permits issued by the Division of State Lands (DSL), the U.S. Army Corps of Engineers (USACE), and the Federal Emergency Management Agency (FEMA). This includes work pertaining to, but not limited to:

- Work in or over "navigable waters" of the United States, or which affects the course, location, condition, or capacity of such waters;
- The removal of material from, or placement of fill material into, the "Waters of the State," including wetlands, and
- Work within floodways, as mapped by FEMA

3.1.5 Project Scheduling

Following a specified work schedule that coordinates the timing and land disturbing activities and the installation of control measures is perhaps the most cost-effective way of controlling erosion during construction. The removal of ground cover leaves a site vulnerable to accelerated erosion. Construction procedures that limit land clearing, provide the timely installation of erosion prevention and sedimentation controls, and restore protective cover quickly can significantly reduce the erosion potential of a site.

Construction projects should be sequenced to reduce the amount and duration of soil exposure to erosion by wind, rain, runoff, and vehicle tracking. The construction schedule is an orderly listing of all major land disturbing activities together with the necessary erosion and sedimentation control measures planned for a project. This type of schedule guides the contractor on work sequencing so serious erosion and sedimentation problems can be avoided.

The ESCP should indicate for all the scheduled work, how the proposed erosion/sediment control measures will divert flows, limit runoff from exposed areas, stabilize exposed soil and filter sediment. The following activities should be included in the schedule, if applicable:

- Clearing and grubbing for perimeter controls
- Installation of perimeter controls
- Construction phasing
- Clearing and grubbing, grading and trenching for activities other than perimeter control
- Grading (including off-site activities) related to the project
- Final grading, landscaping, and stabilization
- Work on or at bridges and other water course structures
- Utility installation and removal
- Work required in any wetland
- Monitoring of rainfall
- Inspection of controls
- Installation and maintenance of permanent controls
- Installation, maintenance, and removal of temporary controls
- Disposal of waste materials generated on-site

Note that the construction activities listed above do not usually occur in a specified linear sequence, and schedules will vary due to weather and other unpredictable factors. Schedules for temporary and

permanent erosion control work required in any wetlands, as are applicable for clearing and grubbing, grading, trenching, bridges, and other structures at water courses, construction, and paving should be submitted for review by the County.

4 EROSION AND SEDIMENT CONTROL MEASURES AND BEST MANAGEMENT PRACTICES

Section 4 presents best management practices for temporary and permanent erosion prevention and sediment control. These measures consist of controlling soil erosion by wind, water, or other means and preventing eroded sediments and other construction-generated pollutants from moving off the project site.

The details of installation can and should vary in the field depending on the site conditions. Field variations for each type of measure are encouraged. The substitution of other cost-effective products or methods that provide substantially equivalent or superior performance is allowed if approved by the County.

4.1 BMP QUICK REFERENCE MATRICIES

As implied by their name, BMPs are stabilization methods and structural erosion control measures that represent commonly accepted practices. Table 4.1.1 represents ratings for basic applications of commonly used erosion and sediment control measures.

Tables 4.1.1 through 4.1.4 are matrices presenting recommended minimum erosion control measures for various site and construction types. Additional measures may be required based on specific site conditions. Table 4.1.2 summarizes recommended erosion control measures for larger construction sites including commercial, industrial, and subdivision development and construction. Table 4.1.3 is a matrix presenting recommended erosion controls for small, linear utilities construction and ditches/swales. Table 4.1.4 is a matrix summarizing recommended erosion controls for single family residential and duplex construction activities on single lots of record.

Erosion control measures are divided into two categories:

- Base measures or alternative measures which are required for construction sites at all times while there is disturbed or unstabilized ground surface on the site, and
- Supplementary wet weather measures which are required from October through April in addition to the base measures.

Each erosion control measure presented in the matrices is presented in further detail with design, construction and maintenance criteria in the following subsections of this chapter.

Table 4.1.1 – Temporary and Permanent Erosion Control Measures and Estimated Effectiveness Rating (E = Excellent, M = Moderate, P = Poor)

BMP Application		Temporary vs Permanent	Rating	Page
4.2 EROSION PREVENTION				
4.2.1	Preserve Natural Vegetation	P	E	22
4.2.2	Plastic Sheeting	T	M	24
4.2.3	Hydraulically Applied Chemical Soil Binder or Dust Control	T	E	25
4.2.4	Dust Control (Water)	T	M	27
4.2.5	Mulching and Seeding	T / P	M	28
4.2.6	Slope and Channel Liner Matting	T / P	M	30
4.2.7	Compost Erosion Blanket	T / P	M	32
4.2.8	Straw Bales	T	M	34
4.2.9	Buffer Zone	P	E	36
4.2.10	Ground Cover	T	E	37
4.3 RUNOFF CONTROL				
4.3.1	Check Dams	T / P	M	39
4.3.2	Interceptor Dikes and Swales	T	M	41
4.3.3	Grass-Lined Swale	T / P	M	43
4.3.4	Slope Drains and Energy Dissipator	T	E	45
4.4 SEDIMENT CONTROL				
4.4.1	Construction Entrance	T	E	47
4.4.2	Tire Wash Facility	T	E	49
4.4.3	Sediment Fence	T	M	51
4.4.4	Inlet Protection	T	E	53
	Geotextile/Wire Mesh/Aggregate	T	M	54
	Prefabricated Insert	T	E	56
	Biofilter Bag	T	M	56
	Sod Protection	T	M	58
	Compost Filter Sock	T	M	59
	Curb Inlet Sediment Dam	T	E	60
4.4.5	Sediment Barriers	T / P	M	61
	Biofilter Bag	T	M	62
	Fiber Rolls	T/P	M	63
	Sand Bags	T	M	64
	Filter Berm (Aggregate Barrier)	T/P	E	65
	Compost Filter Sock	T	M	66
	Compost Filter Berm	T/P	E	67
4.4.6	Sediment Trap	T	E	69
4.4.7	Concrete Washout	T	E	71

Table 4.1.2 – Erosion Control Matrix for Commercial, Industrial, Agricultural, Subdivision and Large Site Construction (X = Base Measure, O = Optional, S = Supplemental)

BMP Application		Site Slope							
		< 2%	**< 10%**	**< 15%**	**< 20%**	**< 30%**	**< 50%**	**50%**	**Stock Piles**
Base Measures									
4.4.1	Gravel construction entrance	X	X	X	X	X	X	X	
4.4.5	Sediment barrier at toe of disturbed area	X	X	X	X	X	X	X	X
4.2.9	Undisturbed buffer at toe of disturbed area	S	S						
4.4.3	Sediment fence installed on contours (spacing)		X(300')	X(150')	X(100')	X(50')	X(25')	X(25')	
4.3.2	Temporary interceptor dikes/swales around active work areas	O	O	O	O	O	O	O	
4.4.4	Storm drain inlet protection barrier	X	X	X	X	X	X	X	X
Wet Weather Measures									
4.2.5	Established grass		S	S	S	S	S	S	
4.2.5 4.2.10	2" minimum straw mulch cover		O	O	O	O	O		O
4.2.6 4.2.7	Erosion blankets with anchors		O	O	O	O	O	O	O
4.2.2	6-mil plastic sheet cover		O	O	O	O	O	O	O
4.4.6	Sediment traps or ponds		O	O	O	O	O		
Post Construction									
	Reestablish permanent ground cover or landscape prior to removing erosion measures	X	X	X	X	X	X	X	

Table 4.1.3 – Erosion Control Matrix for Utilities Construction and Stock Pile, Ditches/Swales Protection (X = Base Measure, A = Alternate, S = Supplemental)

BMP Application		Utilities Construction		Stock Piles	Ditches/ Swales
		Catch Basin Drainage	Ditch Drainage		
Base Measures					
4.4.3	Sediment fence or barrier at toe				X
4.3.1	Check dams		X		X
4.4.4	Storm drain inlet protection barrier	X		X	
Wet Weather Measures					
4.2.5	Established grass				S
4.2.2	6-mil plastic sheet cover			S	
4.2.5 4.2.10	2” min. straw mulch cover			A	A
4.2.6 4.2.7	Erosion blanket with anchors				A
Post Construction					
	Reestablish permanent ground cover or landscape prior to removing erosion measures	X	X		X

Table 4.1.4 – Erosion Control Matrix for Single-Family, Duplex Residential, and Manufactured Homes (X = Base Measure, A – Alternate, S = Supplemental)

BMP Application		Construction Site		Stock Piles
		Slope < 2%	Slope > 2%	
Base Measures				
4.4.1	Gravel Construction Entrance	X	X	
4.4.5	Sediment Barrier at toe of disturbed area or stockpile	X	X	X
4.2.9	Undisturbed buffer at toe of disturbed area (site slopes < 10%)	A	A	
4.3.1	Check dams in ditches for culvert installation	X	X	
4.4.4	Storm drain inlet protection barrier	X	X	X
Wet Weather Measures				
4.2.2	6-mil plastic sheet cover	S	S	S
4.2.5 4.2.10	2”min. straw mulch cover	S	S	A
Post Construction				
	Reestablish permanent ground cover or landscape prior to removing erosion measures	X	X	

4.2 EROSION PREVENTION

Erosion prevention is the most effective and inexpensive method for reducing pollution associated with construction activities. Limiting the amount of exposed soil and directing surface water runoff away from exposed soil can minimize erosion during construction.

Information such as the applicability, advantages, and disadvantages, design criteria, material specifications, and inspection and monitoring guidelines for each BMP are included in the subsections below and should help the designer choose the most appropriate measure or control. In order to maximize the overall benefits of any BMP selection and location, planners and designers must have a thorough understanding of the site characteristics. In addition, preconstruction meetings provide a means of opening lines of communications between all individuals affected by the construction, either directly or indirectly.

Timing, staging, minimizing the amount of exposed soil, and directing surface water runoff away from exposed soil are all excellent ways to minimize erosion during construction.

Linn County has adopted the Oregon Department of Transportation (ODOT) Standard Drawings for installation of erosion and sediment control measures. These Standard Drawings and Details can be found on the ODOT Roadway Section website at: https://www.oregon.gov/odot/Engineering/Pages/Drawings-Roadway.aspx, under the RD1000 Series – Erosion Control Section and DET6000 Series – Environmental Series. References to these standard drawings will be identified as “RDXXXX” or “DETXXXX”, where the drawing number will be interested in place of ”XXXX”. These references will be used throughout Section 4.2, 4.3 and 4.4. The current set of the ODOT Erosion Control Standard Drawings and Details can be found in Appendix F.

4.2.1 Preserving Natural Vegetation

This BMP involves preserving natural vegetation to the greatest extent possible during the construction process, and after construction where appropriate. Maintaining natural vegetation is the most effective and inexpensive form of erosion prevention control. This method is particularly important in sensitive areas such as wetlands, stream corridors, lakes, and near steep slopes, see Figure 2. The designer should address preserving natural vegetation, where possible, on the Erosion and Sediment Control Plans. Although this is a proven BMP, it is imperative all exposed soils are covered in a timely manner.

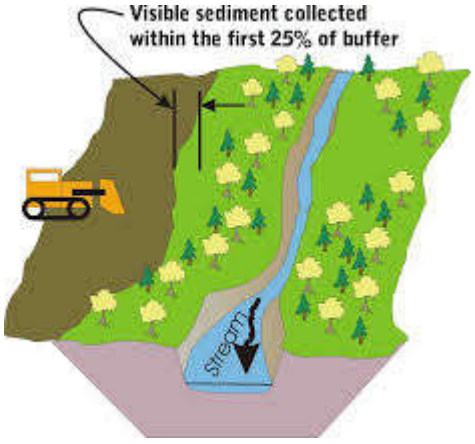


Figure 2. Natural Vegetation Buffer

Applicability

Any construction site can preserve natural or existing vegetation where vegetation exists in the predevelopment condition. Preserving natural vegetation can be particularly beneficial for floodplains, wetlands, perennial and intermittent streams, environmentally sensitive areas, steep slopes, and other areas where erosion controls would be difficult to establish, install or maintain.

Advantages

- Can withstand greater quantities of stormwater flow than newly seeded areas.
- Does not require time to establish.
- Has a higher infiltration capacity than newly planted vegetation due to a more developed and deeper root structure.
- Reduces stormwater discharge through greater interception and evapotranspiration.
- Buffers and screens against noise and visual disturbance.
- Provides habitat for wildlife.
- Improves air quality.
- Usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.
- Enhances aesthetics.

Disadvantages

- Is only suitable for sites with ample existing stands of healthy vegetation. In many urban areas, existing vegetation may be patchy and unhealthy, providing little overall benefit to site hydrology or aesthetics.
- For high-density development or where land prices are high, preserving existing vegetation may not be cost effective.

Design Guidance and Criteria

- Coordinate with the Landscape Architect and Environmental Professionals assigned to the project when determining what to save and how to save it.
- Vegetation can be preserved in natural clumps or as individual trees, shrubs, and vines.
- Clearly establish ground disturbance limits outside the dripline of preserved trees, using orange construction safety fence or flagging if approved.
- Protect vegetation from:
    - Construction equipment injury above or below the ground level. Injury occurs from scarring, cutting roots, or compaction.
    - Grade changes, which affect the plants' ability to obtain air, water, or minerals.
- Placing a layer of gravel and a tile system over the roots before a major fill allows air to circulate and protects the plant from the fill.
- Terracing the area around the plant, or leaving the plants on an undisturbed mound can increase the plants' survival chances.

Inspection and Maintenance

Even if workers take precautions, some damage to protected areas might occur. If this happens, construction staff should repair or replace damaged vegetation immediately to maintain the integrity of the natural system. They should also consider enhancing the preserved area (e.g., removing invasive species).

- Inspect once per week on active sites, once every two weeks on inactive sites, and within 24 hours following a 0.5 inch rain event.
- Repair fencing and/or flagging.
- Re-cover and/or seal exposed plant roots.

4.2.2 Plastic sheeting

Provides immediate protection to slopes and stockpiles (Image 2). Plastic sheeting has been known to transfer erosion problems because water will sheet flow off the plastic at high velocity. This is usually attributable to poor application, installation and maintenance. Use alternatives to plastic covering whenever possible.

Image 2. Plastic Sheeting

Applicability

Plastic sheeting is particularly useful for protecting cut and fill slopes and stockpiles.

Advantages

- Provides immediate, short-term erosion protection to slopes prone to erosion and to stockpiles.
- Fairly quick and easy to install.

Disadvantages

- Plastic sheeting may concentrate sunrays and burn the vegetation beneath it.
- Material generates high velocity runoff.
- Plastic breaks down quickly when exposed to ultraviolet radiation.
- Plastic, when it is not completely removed, can clog drainage system inlets and outlets.
- If not properly anchored, wind may transport plastic onto roadways and create traffic hazard
- Not effective for preventing illegal discharge.

Design Guidance and Criteria

- Do not use plastic covering upslope of areas such as steep and/or unstable slopes that might be adversely affected by concentrated runoff.
- When possible, install an interceptor dike at the top of the plastic to divert flows away from the plastic.
- Toe-in the top of the sheeting in a 6“ × 6” trench backfilled with compacted native material.
- Install a gravel berm, riprap, or other suitable protection at the toe of slope in order to dissipate runoff velocity.

Material - Use minimum 6-mil thick polyethylene plastic sheeting.

Installation - Place plastic sheeting on disturbed, temporary slopes or stockpiles according to DET6001 where immediate protection is required and mulching or other methods of soil stabilization are not feasible.

Cover exposed soil with plastic sheeting, rock, sand bags, sediment barrier or staples, or other necessary measures to ensure proper sediment control. Keep sheeting in place during rain events. Direct runoff away from areas above plastic sheeting to prevent undermining. Control runoff from plastic sheeting so water discharges without causing further pollution.

Anchor the plastic using sandbags or other suitable tethered anchoring system spaced on a 10-foot grid spacing.

Overlap seams one to two feet, tape, roll, and stake the seams and then weigh down the entire length.

Inspection and Maintenance

- Inspect once per week on active sites, once every two weeks on in-active sites, and within 24 hours following a 0.5-inch rain event.
- Replace torn sheets and repair open seams.
- Completely remove and replace plastic when it begins to deteriorate.
- Completely remove all plastic once it is no longer needed.
- Check anchoring system and repair or add anchors.

4.2.3 Hydraulically Applied Chemical Soil Binder or Dust Control

Hydraulic application is a mechanical method of applying erosion control materials to bare soil (Image 3) in order to establish erosion-resistant vegetation on disturbed areas and critical slopes. By using hydraulic equipment soil amendments, mulch, tackifying agents, bonded fiber matrix (BFM), and liquid co-polymers can be uniformly broadcast as homogenous slurry onto the soil. These erosion and dust control materials can often be applied in one operation.

Image 3. Soil Binder Being Hydraulically Applied to Bare Soil

Dust suppressants work by either agglomerating the fine particles, adhering/binding the surface particles together, or increasing the density of the road surface material. They reduce the ability of the surface particles to be lifted and suspended by either vehicle tires or wind.

Applicability

Selection of the best hydraulically applied dust control measures must include an understanding of not only the primary factors that generate dust but also the long-term cost and environmental impacts of such control measures.

Advantages

- Provides rapid installation with a one step process.
- Generally requires less seedbed preparation. The surface soil may be left irregular with large clods, stones, or rock outcropping exposed.
- Uniformly distributes seed and mulch material.
- Increases favorable conditions for quick germination and growth.

- Can be used effectively on steep slopes and other areas where access is limited.

Disadvantages

- Generally more expensive than broadcast or drilling seed applications.
- Thick mulch applications can delay germination.
- Can be blown or washed away if not adequately tackified.
- Required application rates can vary significantly dependent on site preparation.

Design Guidance and Criteria

- Divert concentrated runoff from above treated areas.
- Use hydraulic applications on slopes steeper than 4H:1V that cannot receive adequate seedbed preparation and where mulch would be difficult to otherwise anchor.
- On sites where other soil stabilization, seeding, and mulching practices would result in unacceptable levels of ground disturbance.
- Use where site conditions, such as irregular soil surfaces, existing vegetation, and shallow soils preclude the installation of erosion mats.

Material - Furnish a commercial quality tackifier containing no agent toxic to plant life. Furnish tackifier of either a liquid stabilizing emulsion or a dry powder tackifier.

a. Liquid Stabilizer Emulsion - Tackifier with a base material of liquid, polyvinyl acetate polymers, using emulsion resins and containing not less than 55 percent total solids by weight. Furnish tackifier containing no polyacrylates or polyvinyl acrylics. The emulsion shall, when diluted with water and upon drying, allow exchange of air and moisture to the seeds and have an effective life of 1 year or more.
b. Dry Powder Tackifier - Tackifier base consisting of one or more active hydrocolloids from natural plant sources, which hydrates in water and blends with other slurry materials, and upon application and drying tacks the slurry particles to the Soil surface, and exhibits no growth or germination inhibiting factors. Provide stabilizing emulsion in a dry powder form that may be re-emulsifiable, and consisting of a processed organic adhesive derivative of one of the following:
    - Gumbinder derived from guar (Cyamopsis tetragonoloba)
    - Gumbinder derived from plantain (Plantago insularis)

Installation – Install chemical methods of erosion and sediment control per the following:

a. Chemical Soil Binder - Hydraulically apply a liquid stabilization emulsion at the following rates unless the manufacturer recommends a different rate of application:
    - Long-Term Control of Exposed Soil Surfaces - Apply 35 gallons per acre of emulsion. Dilute with water at the rate of one part emulsion to 20 parts water.
    - Steep Slopes with Raveling Small Rock - Apply 45 gallons per acre of emulsion. Dilute with water at the rate of one part emulsion to 10 parts water.
b. (b) Chemical Dust Control - Apply tackifier for dust control for wind or equipment-caused erosion according to the following:
    - Liquid Stabilizer Emulsions - Dilute the emulsion with water at a rate of one part emulsion to 30 parts water. Apply the diluted mixture at the rate of 865 gallons per acre unless the manufacturer recommends a different rate of application.

- Dry Powder Tackifier - Apply at a rate of 140 pounds per acre unless the manufacturer recommends a greater rate of application.

Inspection and Maintenance

- Inspect once per week on active sites, once every two weeks on in-active sites, and within 24 hours following a 0.5-inch rain event.
- Re-mulch and/or protect with an erosion control mating any areas that experience erosion. If the erosion problem is drainage related, fix the drainage problem then make necessary repairs.
- Hydraulic mulches and tackifiers shall provide the necessary erosion protection until permanent erosion-resistant cover is established. If sheet or rill erosion is evident then prompt re-application of treatments shall be necessary.
- Areas that fail to establish 80 percent healthy stand of grass cover to prevent erosion shall be properly covered using one of the selected application.

4.2.4 Dust Control (Water)

Dust control is a preventative measures to minimize the wind transport of soil, prevent traffic hazards and reduce sediment transported by wind and deposited in water resources. See Image 4.

Applicability

Any construction site where major soil disturbances or heavy equipment construction activities, such as clearing, excavation, demolition or excessive vehicle traffic, occur.

Earthmoving activities, particularly transport of cut and fill materials, are the major source of dust from construction sites, but traffic and general disturbances can also be significant contributors.

Image 4. Water Application

Advantages

- Reduces the surface and air transport of dust.
- Increases visibility.
- Fine particles are prevented from becoming airborne and causing health issues or damaging crops and vegetation.

Disadvantages

- Over watering may cause erosion.
- Require immediate reapplication if disturbed.
- Too little watering fails to control dust.
- Must be reapplied or replenished on a regular basis.

Design Guidance and Criteria

- Install construction entrances and stabilize construction haul roads with crushed rock.
- Schedule construction operations so the least amount of project area is disturbed at one time.

Material – Furnish water free of silts and other matter harmful to the quality of the material to which it is applied.

Installation – Make all necessary arrangements to obtain water and pay all costs involved in its procurement.

Perform watering when and where approved. Water at any hour of the day, and on any day of the week as necessary for proper performance or protection of the work and for alleviation of dust nuisance.

Inspection and Maintenance

- Maintain dust control measures through dry weather periods until all disturbed areas have been stabilized.
- Immediately re-stabilize areas disturbed by contractor's operations or other activities (wind, water, vandalism, etc.).

4.2.5 Mulching and Seeding

Mulch products are intended to reduce raindrop (splash) erosion, decrease sheet erosion, promote rain or snowmelt infiltration, increase soil moisture retention, regulate soil temperature, and in most cases, improve soil texture and increase organic matter to encourage seed to establish (Image 5). A well-established vegetative cover is one of the most effective methods of reducing erosion. Vegetation should be established on construction sites as the slopes are finished, rather than waiting until all the grading is complete. Equally important and often overlooked is temporary or permanent irrigation. Temporary or permanent seeding applications should be completed prior to September 1st of each year. Reapplication may be necessary if establishment has not occurred.

Seedling vigor is an important plant characteristic to consider for erosion control seeding because the goal is to have rapid establishment and a dense fibrous root system. This holds the soil in place and provides a thick canopy over the soil to break the raindrop velocity. Some grasses do well early in the season and can act as nurse or cover crops until the slower growing species can establish. Seed mixes are developed for specific climatic zones around the state to match the optimum growing conditions for each species.

Image 5. Straw Mulch with Seed Establishing

Applicability

Mulch with seeding is used to help establish vegetation and stabilize soils, and mulch can be effective in areas where it is difficult to establish vegetation, such as areas with steep slopes.

Mulches are also effective in areas where sensitive seedlings need moisture retention or insulation from extreme temperatures.

Advantages

- It reduces erosion and sediment loss by protecting bare soil surfaces from displacement by raindrop impacts.
- Reduces stormwater flow rates and volumes.
- Provides permanent stabilization.
- Traps sediment.
- Promotes infiltration.
- Improves appearance of the site.
- Relatively inexpensive erosion control measure.
- Effective for dust control.

Disadvantages

- Potential for erosion during the establishment stage.
- A need to reseed areas that fail to establish.
- Limited periods during the year suitable for seeding.
- A need for water and appropriate climatic conditions during germination.

Design Guidance and Criteria

- Temporary grass cover measures must be fully established by October 1st or other ground cover measures will have to be implemented. In order to establish an 80 percent healthy stand of grass, all seeding applications must be completed prior to September 1st.
- Apply permanent seeding when no further disturbances are planned.

Material – Furnish mulch materials free of all weed or plant seeds and containing no substances detrimental to plant life. See Table 4.2.1 for mulch type, quality and application rates.

Furnish Oregon Certified seed.

Installation – Apply seed and fertilizer separately or together as the first step. Apply dry mulch as the second step.

a. Seeding:
    - Apply seed and fertilizer at the specified rates.
    - Bring the seedbed area to final grade, remove all rocks and debris, and smooth surface undulations larger than two inches.
    - Divert concentrated flows away from the seeded area.
    - For optimum seeding conditions preserve topsoil and stockpile material until final grades are established.
    - Roughen the soil by harrowing, tracking, grooving, or furrowing
    - The seedbed should be firm but not compact. The top four to six inches of soil should be loose, moist, and free of large clods and stones.
    - Seed to soil contact is the key to good germination.
    - Apply seed at the rates specified using calibrated seed spreaders, cyclone seeders, mechanical drills, or hydroseeder so the seed is applied uniformly on the site.

- Broadcast seed should be incorporated into the soil by raking or chain dragging, and then lightly compacted to provide good seed-soil contact.
- Apply mulch and tackifier or matting, as specified, over the seeded areas.
- Seed should be applied immediately after seedbed preparation while the soil is loose and moist

b. Mulching:
   - Evenly apply straw mulch within 24 hours after seeding and fertilizing. In areas not accessible to heavy Equipment or hose, apply straw mulch by hand or other appropriate method.
   - Place straw mulch approximately 2 inches deep, in loose condition, which requires approximately 2-1/2 tons per acre of dry mulch, depending on moisture content. Do not use straw mulch on slopes of 1.5H:1V or steeper.
   - Install mulch in loose condition is preferred for seeding during the wet season on slopes 3H:1V or flatter.
   - Mulch may be required during the dry season if grass growth is expected to be slow, the soils are highly erodible , there is a water body close to the disturbed area, or if significant precipitation is anticipated before the grass will provide effective cover.
   - Can be applied on top of the seed or applied with the seed during hydroseeding

Inspection & Maintenance
- Inspect once per week on active sites, once every two weeks on in-active sites, and within 24 hours following a 0.5-inch rain event.
- Newly seeded areas need to be inspected frequently to ensure the grass is growing.
- If the seeded area is damaged due to runoff, additional BMPs may be needed. Re-seed and mulch damaged areas.

4.2.6 Slope and Channel Liner Matting

There are numerous erosion control products available that can be described in various ways, such as matting, blankets, fabric, and nets. We will call them all matting. A wide range of materials and combination of materials are used to produce matting including, but not limited to: straw, jute, wood fiber coir (coconut fiber), plastic netting, and Bonded Fiber Matrix. The selection of matting materials for a site can make a significant difference in the effectiveness of the BMP.

Applicability

Slope and channel liner mats are appropriate for any bare soil area where temporary protection from raindrop and wind erosion is needed, or where newly seeded grass requires short-term cover and support prior to germination, early growth, and full establishment (Image 6).

Image 6. Fiber Slope Matting

Matting is typically used where vegetation requires only temporary support for establishment, such as flat upland areas and slopes less than 4H:1V and may be used on slopes

up to 1H:1V, and are effective in establishing vegetation on swales and ditches.

Advantages

- Immediate cushioning against splash erosion from raindrop impact.
- Does not generate high-velocity runoff and, therefore, offers temporary slope protection, which is superior to plastic sheeting.
- Captures a great deal of sediment due to its open, porous structure.
- Usually easy to install.
- Provides long-term protection, based on matting selection .

Disadvantages

- Correct installation is critical to the effectiveness of these products. Good ground contact during installation prevents runoff concentrating under the blanket and causing significant erosion (tenting).
- Soil surface must be graded smooth with no surface irregularities.
- Limited protection capabilities when used as flexible channel liner.

Design Guidance and Criteria

- Generally used on slopes 3H:1V and steeper.
- Surface must be graded smooth.
- Organic matting materials (excelsior, jute and coir) biodegrade and are useful for applications requiring stabilization for up to three months. Use organic blankets, which retain moisture and provide organic matter to the soil, for slope protection, and short-term waterway protection and to improve the speed and success of re-vegetation.
- Excelsior brand (aspen wood fiber), woven straw, and coir (coconut fiber) blankets may be installed without mulch because they provide complete surface protection.
- Synthetic mats are made from non-biodegradable material and will remain in place for years (some photodegradation does occur). Use purely synthetic blankets for long-term stabilization of waterways.

Material - Furnish matting appropriate for site conditions and that meets the following performance criteria categories:

- Type A - Slope protection mat, fully biodegradable, for Clay Soil Slopes 3H:1V or flatter.
- Type B - Slope protection mat, fully biodegradable, for sandy Soil Slopes 3H:1V or flatter.
- Type C - Slope protection mat, fully biodegradable, for Clay Soil Slopes steeper than 3H:1V.
- Type D - Slope protection mat, fully biodegradable, for sandy Soil Slopes steeper than 3H:1V.
- Type E - Flexible channel liner, fully biodegradable, for shear stress from 0 to 2 pounds per square foot.
- Type F - Flexible channel liner for shear stress from 2 to 4 pounds per square foot.
- Type G - Flexible channel liner for shear stress from 4 to 6 pounds per square foot.
- Type H - Flexible channel liner for shear stress from 6 to 8 pounds per square foot.

Installation – Install matting, check slot and anchor trench, and fasteners according to RD1055 and the manufacturer's recommendations, whichever is more stringent. Install fully biodegradable matting within 25 feet of water resources.

a. Area Preparation - Remove all materials larger than 2 inches in size. Smooth the surface and remove undulations sufficiently to allow the matting to be placed in complete contact with the Soil.
b. Seeding – Apply seed per the manufacturers recommended application rate. It is recommended to install seeding prior to matting installation. If seeding is installed after matting installation, double the manufacturers recommended application rate.

Matting Placement – Apply matting loosely so it is in complete contact with the soil. Avoid joining material in center of ditch or swale.

1. Channel or swale applications
   i. Lengthwise overlap: Minimum 12 inches
   ii. Crosswise overlap - Lengthwise overlap: Minimum 12 inches
2. Slope application
   i. Lengthwise overlap: Minimum 6 inches
   ii. Crosswise overlap: Minimum 6 inches
   iii. At top of slope, entrench material in a 6” x 6” trench and staple at 12-inch intervals
   iv. At bottom of slope, extend mat 2 feet beyond the toe of the slope, turn material under 4 inches, and staple at 12 inch intervals
   v. On 4H:1V slopes, rolls can be placed in horizontal strips
   vi. Mats must be stapled in place as they are installed down the slope face every 4 feet until the bottom is reached. This keeps the blanket in relaxed position, eliminating the potential for under-rilling.

Inspection and Maintenance

- Inspect once per week on active sites, once every two weeks on in-active sites, and within 24 hours following a 0.5-inch rain event.
- Repair any damaged areas of the net or blanket and staple into the ground any areas not in close contact with the ground surface.
- If erosion occurs, repair and protect the eroded area.

4.2.7 Compost Erosion Blanket

Compost erosion blankets are used for temporary and permanent slope stabilization, erosion control, and vegetation establishment. It is a layer of loosely applied composted material placed on the soil in disturbed areas to reduce stormwater runoff and erosion. This material fills in small rills and voids to limit channelized flow, provides a more permeable surface to facilitate stormwater infiltration, and promotes revegetation.

Image 7. Compost Application

It is typically applied to slopes with pneumatic blower trucks (Image 7). Compost erosion control blankets act similarly to mulch products but provide organic nutrients that promote vegetation growth, even in areas where germination, moisture management and irrigation could be challenging.

Applicability

Compost blankets are used extensively in conjunction with seeding for roadside slope stabilization and erosion control on slopes up to 3H:1V.They are also used regularly for stormwater BMPs along roadsides and road basins.

Advantages

- 2 inch depth provides intimate contact and allows nearly 100% ground contact.
- Eliminates puckering of other blankets.
- Seed mixed throughout blanket profile.
- Reduces runoff (sediment loss) by increasing infiltration.
- Provides excellent growing media for vegetation.
- Addition of organic matter improves slope ability to revegetate and establish a permanent erosion system.
- Removes pollutants such as heavy metals, nitrogen, phosphorus, fuels, grease and oil from stormwater runoff, thus improving downstream water quality.

Disadvantage

- Are far less effective at reducing soil erosion when they are exposed to concentrated surface water inflow.
- Should not be placed in locations that receive concentrated or channeled flows either as runoff or a point source discharge.

Design Guidance and Criteria

- Compost blankets can be placed on any soil surface: flat, steep, rocky, or frozen.
- The blankets are most effective when applied on slopes between 4H:1V and 1H:1V.
- On the steeper slopes (1H:1V) the compost blanket should be used in conjunction with netting or other confinement systems to further stabilize the compost and slope, or the compost particle size and depth should be specially designed for this application

Material - Furnish compost erosion control blanket materials meeting the following requirements:

a. Seeding - Furnish Oregon Certified seed.
b. Compost - Commercially manufactured medium compost material meeting the following compost particle size and media parameters requirements:

Compost Particle Size

	Compost Type		
Sieve Size	**Fine***	**Medium***	**Coarse****
	Percent Passing (By Dry Weight)		
3"	100	100	100
1"	99-100	95-100	90-100
3/4"	99-100	95-100	70-100
5/8"	95-100	90-100	70-100
1/2"	80-100	70-100	60-100
1/4"	75-100	70-90	30-60
* maximum 3 inch particle length ** maximum 6 inch particle length			

Media Parameters

Test	Test Method	Requirements
Physical Contaminants*	TMECC** 03.08-A	Less than 1.0%
Organic Matter	TMECC** 05.07-A	35% (Minimum)
pH	TMECC** 04.11-A	6.0 to 8.5
Soluble Salt Concentration	TMECC** 04.10-A	5 dS/m (Maximum)
Total Carbon Total Nitrogen	TMECC** 04.02-D TMECC** 04.02-D	Carbon/Nitrogen Ratio
Fine	Medium	Coarse
<25:1	<30:1	<35:1
Stability	TMECC** 05.08-B	≤8
Maturity	TMECC** 05.05-A	80% or Greater
Moisture Content	TMECC** 03.09-A	35-60% (Wet Weight)
* Man-made Inert ** Test Methods for Evaluation of Compost and Composting		

Installation – Apply compost with equipment that propels the material directly at the soil surface and achieves direct contact with the soil and according to DET6017.

- Apply compost at a uniform depth of 2 to 3 inches to all exposed soil surfaces.
- Seed can be planted into or on top of the soil surface, and then the compost blanket applied on top, seed can be incorporated into the compost blanket, or seed can be applied on top of the compost blanket.
- The compost blanket should extend at least 3 feet over the shoulder of the slope to ensure that stormwater runoff does not flow under the blanket.

Inspection and Maintenance

- Inspect once per week on active sites, once every two weeks on in-active sites, and within 24 hours following a 0.5-inch rain event.
- check periodically for the presence of invasive species.
- Reseed bare ground and spot application.
- If areas of the compost blanket have washed out, another layer of compost should be applied.
- The most important maintenance activity for native grass and forb plantings is appropriately timed mowing.

4.2.8 Straw Bales

Construction sites have historically used straw or hay bales for erosion and sediment control as check dams, inlet protection, outlet protection and perimeter control (Image 8). Many applications of straw bales for erosion and sediment control are ineffective due to the composition of straw bales, inappropriate placement, inadequate installation, lack of maintenance or a combination of all these factors. In addition, straw bales are maintenance-intensive and can be expensive.

Image 8. Straw Bales Retaining Sediment

Applicability

Straw or hay bales for erosion and sediment control as check dams, inlet protection, outlet protection and perimeter control.

Because many applications of straw and hay bales have been ineffective, it is recommended to carefully consider using other stormwater control measures first.

Advantages

- When properly used, they are an inexpensive method of sediment control.

Disadvantage

- Cannot reduce erosion in channel conveyances.
- These barriers often fill to capacity after small storms and can wash away if staked incorrectly.
- Straw bale structures cannot accommodate large storms and tend to fail during large storm events.
- Should not use straw bales on streets or sidewalks because they cannot properly stake the bales into concrete or asphalt, and the straw bales will wash away in higher flows.
- maintenance-intensive and can be expensive.

Design Guidance and Criteria

- Many applications of straw bales for erosion and sediment control are ineffective due to the composition of straw bales, inappropriate placement, inadequate installation, lack of maintenance or a combination of all these factors.
- Because many applications of straw and hay bales have been ineffective, EPA recommends carefully considering other stormwater control measures first.

Material – Furnish rectangular straw bales that are not moldy, caked decayed or of otherwise low quality and weighing between 80 and 100 pounds.

Installation – Install straw bales as necessary and per the appropriate ODOT standard drawings and the following:

- Bales should be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another.
- All bales should be either wire-bound or string-tied. Straw bales should be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales in order to prevent deterioration of the bindings.
- The barrier should be entrenched and backfilled. A trench should be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. The trench must be deep enough to remove all grass and other material which might allow underflow. After the bales are staked and chinked (filled by wedging),the excavated soil should be backfilled against the barrier. Backfill soil should conform to the ground level on the downhill side and should be built up to 4 inches against the uphill side of the barrier.
- Each bale should be securely anchored by at least 2 stakes or re-bars driven through the bale. The first stake in each bale should be driven toward the previously laid bale to force the bales together. Stakes or re-bars should be driven deep enough into the ground to securely anchor the

bales. For safety reasons, stakes should not extend above the bales but should be driven in flush with the top of the bale.

- The gaps between the bales should be chinked (filled by wedging) with straw to prevent water from escaping between the bales. Loose straw scattered over the area immediately uphill from a straw bale barrier tends to increase barrier efficiency. Wedging must be done carefully in order not to separate the bales.
- Straw bale barriers should be removed when they have served their usefulness, but not before the upslope areas have been permanently stabilized.
- When used in a swale, the barrier should be extended to such a length that the bottoms of the end bales are higher in elevation than the top of the lowest middle bale to assure that sediment-laden runoff will flow either through or over the barrier but not around it.

Inspection and Maintenance

- Inspect once per week on active sites, once every two weeks on in-active sites, and within 24 hours following a 0.5-inch rain event.
- Sediment deposits should be removed from behind the barrier as needed.
- Sediment should not be allowed to accumulate to a depth of more than one-half the height of the bales.
- Damaged, destroyed or rotted bales should be replaced immediately.
- Close attention should be paid to the repair of damaged bales, undercutting beneath bales, and flow around the ends of the bales.
- Any sediment deposits remaining in place after the straw bale barrier is no longer required should be dressed to conform to the existing grade, prepared and seeded.

4.2.9 Buffer Zone

A buffer zone consists of an undisturbed area or strip of natural vegetation or an established suitable planting adjacent to a disturbed area that reduces erosion and runoff (Image 9). The rooted vegetation holds soils; acts as a wind break, and filters runoff that may leave the site.

Image 9. Undisturbed Vegetative Strip

Advantages

- Filters Sediment.
- Promotes infiltration.
- Provides habitat.
- Reduces velocity and quantity of runoff, dissipates energy.
- Provides visual screening.
- Can be used to stabilize stream banks.
- Low maintenance

Disadvantages

- Requires keeping all construction equipment, debris, and soils out of the natural areas.
- Extensive buffers can cover large areas of land not available for project development.

- Are not adequate in areas of concentrated flows.

Design Criteria

The vegetative buffer zone shall be located along the entire length of the down slope edge of the entire disturbed area.

- The vegetation shall consist of 3- to 12-inch high grassy vegetation that uniformly covers at least 90 percent of a representative one square yard plot. No more than 10 percent of the surface area shall be comprised of woody vegetation.
- Clearly establish buffer zone limits with orange construction safety fence and signs spaced 100 feet apart. Entry on the buffer zone shall be prohibited.
- Vegetative buffer zone widths shall be determined in accordance with the following:
    - Minimum width shall be 10 feet for slopes less than five percent
    - An additional five feet shall be added for each degree of slope above five percent but not exceeding 10 percent. A 10 percent slope would require a 35-foot buffer zone (10’ + {5’ × 5’})
    - An additional eight feet shall be added for each degree of slope above six percent but not exceeding 15 percent. A 15 percent slope would require a 75-foot buffer zone (35’ + {5’ × 8’})
    - An additional 10 feet shall be added for each degree of slope above 15 percent but not exceeding 20 percent. A 20 percent slope would require a 125-foot buffer zone (75’ + {5’ × 10’})
    - Vegetative buffer zones are not an adequate control measure for slopes above 20 percent.
- Vegetative buffer zones for streams, lakes, or other waterways shall be a minimum 100 feet wide. An incremental adjustment in accordance with the instructions above shall be added to the minimum. A 20 percent slope above a stream would require a 215-foot buffer zone.

Inspection and Maintenance

- Inspect flagging and fencing frequently and repair any rills and replace and/or add additional plants as needed.

4.2.10 Ground Cover

Ground Cover is a protective layer of straw or other suitable material applied to the soil surface. Straw mulch and/or hydromulch (Image 10) are also used in conjunction with seeding of critical areas for the establishment of temporary or permanent vegetation. Ground cover provides immediate temporary protection from erosion. Mulch also enhances plant establishment by conserving moisture; holding fertilizer, seed, and topsoil in place; and moderating soil temperatures.

Image 10. Hydromulch Application

Advantages

- Provides immediate protection.
- Conserves moisture.
- Acts as a thermal layer for seed.

- If used in conjunction with seed, allows seed growth through the mulch.
- Protects seeding from direct heat, moisture loss, and transport due to runoff.
- Used for dust control

Disadvantages

- Thick mulches can delay germination.
- Can be blown or washed away if not adequately tackified.
- Must be removed prior to applying fill material.

Design Criteria

- Divert concentrated runoff from above mulched areas.
- Refer to Table 4.2.1 outlines mulch type, quality, and application rate.
- The following pages include specific material and application criteria.

Table 4.2.1 Ground Cover Application

Mulch Material	Quality Standards	Application Rate Per Acre	Depth of Material	Considerations
Straw	Air dried, free from unwanted seeds & coarse materials	2-2 ½ tons or 90-120 bales	2 inches minimum uniform spread	Use where the mulching effects is to be maintained < 3 months. When chopped straw is applied, use a tackifier
Yard Debris Compost	Well composted organic matter free of metals, plastics and other foreign matter	3-6 tons	4:1 slopes - use 1 inch; 3:1 slopes - use 2 inches; 2:1 slopes - use 3 inches	Excellent soil amendment. Compost size: 3/4 × 0 on 3H:1V slopes or less. 1-1/2 × 0 on 2H:1V slopes.
Wood or Cellulose Fiber	Dyed green, should not contain growth inhibiting factors	2,000 pounds	N/A	Apply with hydromulcher. May need to double the rate depending on soil and slope. Use tackifier as recommended by manufacturer.
Wood Chips or Grindings	Green or air dried free of objectionable coarse materials	5-6 tons	1-3 inches depending on slope	Very durable. Apply with mulch blower, excavation equipment, or by hand. Not suitable for areas that require close mowing.
Gravel or Crushed Rock	Washed ¾-1.5inch	9 yards/ 1,000 feet^2	3 inches	Excellent for short slopes and where subject to foot traffic. Larger pit-run can be used on steep slopes prone to sub-surface water (springs).

Inspection and Maintenance

- Inspect once per week on active sites, once every two weeks on in-active sites, and within 24 hours following a 0.5-inch rain event.
- Maintain specified thickness of the cover.
- Re-mulch and/or protect with a net or blanket any areas that experience erosion.
- If the erosion problem is drainage related, fix the drainage problem and re-mulch the eroded area.
- Hydraulically treated areas shall be inspected and monitored after installation and periodically thereafter.
- Hydraulic mulches and tackifiers shall provide the necessary erosion protection until permanent erosion-resistant cover is established. If sheet or rill erosion is evident, prompt re-application of treatments shall be necessary.
- If the hydraulic mulch or tackifiers were applied as stand-alone (without vegetation) treatments for erosion and dust control, the product longevity must match the length of time that the soil will remain bare or until revegetation occurs. Periodic inspections will assure the intended purposes will be met.
- Areas that fail to establish cover adequate to prevent erosion shall be re-mulched as soon as such areas are identified.
- If mulched areas are damaged by concentrated runoff, the prompt implementation of additional practices and BMPs may be necessary.

4.3 RUNOFF CONTROL

The greater the volume and velocity of surface water runoff on construction sites, the more sediment and other pollutants are transported to streams, wetlands, and lakes. Diverting runoff away from exposed soils can greatly reduce the amount of soil eroded from a site. Decreasing runoff velocities reduces erosion and the amount of pollutants carried off-site. Runoff controls divert runoff from exposed areas and reduce runoff velocities.

4.3.1 Check Dams

Small dams constructed across a swale or ditch to reduce velocities of concentrated flows, thereby reducing erosion in the swale or ditch. Check dams not only prevent gully erosion from occurring before vegetation is established, but also allow a significant amount of suspended sediment to settle out.

Image 10. Aggregate Check Dam

Check Dams can be constructed from a variety of materials.

- Type 1: Aggregate (Image 10)
- Type 2: Fiber Rolls/Wattles (Image 11)
- Bio-filter Bags
- Sand Bags
- Compost Filter Socks

Image 11. Wattle Check Dam

Applicability

Check dams are appropriate where temporary or permanent channels are not yet vegetated, or channel lining is infeasible and within concentrated flow areas.

Advantages

- Prevent erosion and promote settling of sediment in runoff.
- When carefully located and constructed, check dams may function as permanent installations.
- Reduces flow velocity.
- Inexpensive and easy to install.
- Rock can be spread into ditch and used as a channel lining when the check dam is no longer necessary.
- Some pre-fabricated check dams are reusable.

Disadvantage

- Removal may be costly for some types of check dams.
- Suitable only for a limited drainage area.
- May reduce hydraulic capacity of the channel.
- May create turbulence downstream, causing erosion of the channel banks.
- Ponded water may kill grass in grass-lined channels.
- May be an obstruction to construction equipment.

Design Guidance and Criteria

- In temporary or permanent channels not yet vegetated when installing channel lining is not feasible.
- In small open channels that drain 10 acres or less.
- Not for use in streams or rivers.
- Construct rock check dams sized to stay in place given the expected design flow velocity. Typical rock size of 3 to 6 inch. Place rock by hand or by mechanical means rather than dumping the rock.
- Bridge entire ditch or swale width and ensure the center of the dam is 6 inches lower than the outer ends.
- Space check dams according to Table 4.2.1.

Material – Furnish check dam materials meeting the following requirements:

a. Type 1: Aggregate – Unweathered, hard, angular, durable, free-draining aggregate sized between 12 inches maximum and 3 inch minimum.
b. Type 2: Fiber Rolls/Wattles - Fiber rolls or wattles that are pre-manufactured, filled with plant based, naturally occurring fiber (e.g.: straw, wood, excelsior, hemp or coconut fiber) that contains no weed seeds and that is not moldy, caked, decayed or of otherwise low quality. When straw is used, furnish straw meeting the requirements of Section 4.2.7. Furnish fiber roll that is fully biodegradable with enclosing netting derived from natural fibers (e.g.: jute, sisal, hemp or coir fiber). Furnish rolls with a minimum density of 2.75 pounds per cubic foot and constructed to hold its shape to provide a diameter of between 8 and 10 inches.
c. Type 3: Biofilter Bags - Minimum size 18”x 6” x 30” plastic mesh bags with 1/2 inch openings filled with approximately 45 pounds of clean, non-toxic 100 percent recycled wood product waste containing no fine materials or sediments.

d. Type 4: Sand Bags - Durable, weather-resistant bags woven tightly enough to prevent leakage of filler material. Fill bags with at least 75 pounds of firmly-packed fine PCC 3/8" – 0 Aggregate, or round 3/8" - 3/16" pea gravel.
e. Type 6: Compost Filter Sock - Filter sock material, compost, and stakes meeting the requirements of Section 4.4.4, Type 7.

Installation – Install check dams per their appropriate material type and spacing per Table 4.2.2 and per RD1005 and RD1006.

- Remove check dams from grass-lined ditches and swales when the grass is established.
- Seed, mulch, or mat the area where the check dams were, immediately following removal.

Table 4.2.2 Maximum Check Dam Spacing "L"

Ditch Grade	H = 8"	H = 12"	H = 18"	H = 24"
10%	* *	* *	15'	20'
9%	* *	* *	16'	22'
8%	* *	* *	18'	25'
7%	* *	* *	21'	28'
6%	* *	16'	25'	33'
5%	* *	20'	30'	40'
4%	16'	25'	37'	50'
3%	22'	33'	50'	66'
2%	33'	50'	75'	100'

* *Not Allowed H = Min. dam height

Inspection and Maintenance

- Inspect once per week on active sites, once every two weeks on in-active sites, and within 24 hours following a 0.5-inch rain event.
- Remove sediment once it reaches one-third the depth of the rock weir.
- Replace rock weir when filtering capacity is reduced by one-half.

4.3.2 Interceptor Dikes and Swales

A ridge of compacted soil (Image 12) or a lined swale with vegetative lining located at the top, base, or somewhere along a sloping disturbed area. The dike or swale intercepts and conveys smaller flows along low-gradient drainage ways to larger conveyances such as ditches or pipe slope drains or to a stabilized outlet. Dikes and swales may be used singly or in combination with each other.

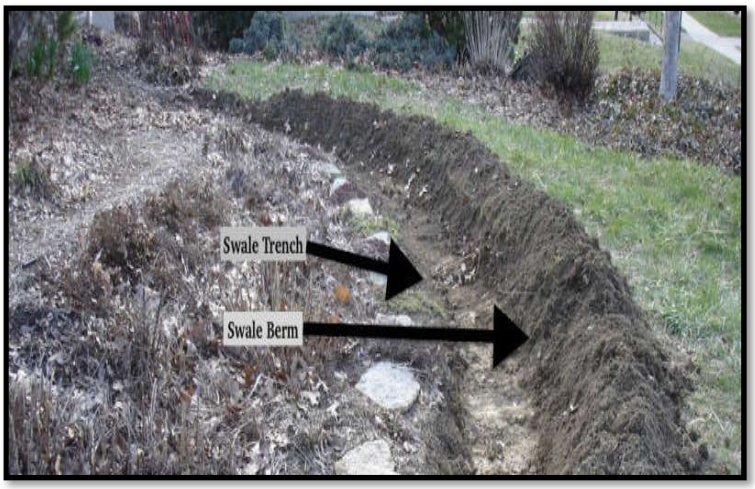


Image 12. Soil Dike with Swale

Applicability

Temporary interceptor dikes and swales are applicable where it is desirable to divert flows away from disturbed areas such as cut or fill

slopes and to divert runoff to a stabilized outlet and can be used to reduce the length of the slope across which runoff will travel, thereby reducing the erosion potential of the flow.

Advantages

- Provides a practical, inexpensive method to divert runoff.
- Can handle flows from large drainage areas.
- Can use on-site material and equipment to construct.

Disadvantage

- If improperly constructed, can contribute to erosion caused by concentrating the flow.
- High flow velocity can damage vegetation.
- Not effective for preventing illicit discharge.

Design Guidance and Criteria

- Install the dike and/or swale horizontally at intervals across a disturbed slope. Space horizontal interceptor dikes and swales according to Tables 4.3.1 and 4.3.2.
- For slopes of erodible soils, steeper than 2H:1V with more than 10 feet of vertical relief, construct benches or shorten distance between dikes or swales.
- If the dike or swale intercepts runoff from disturbed areas, discharge the runoff to a stable conveyance that routes the runoff to a sediment trap or basin.
- If the dike or swale intercepts runoff that originates from undisturbed areas, discharge the runoff to a stable conveyance that will route the runoff downslope of any disturbed areas and release the water at a stabilized outlet.
- May need matting to protect seed bed and channel from erosion.

Table 4.3.1 Interceptor Dike Design Criteria

Top Width	24 inch minimum	
Height	20 inch minimum Measured from upslope toe and at a 90% standard proctor compaction ASTM D698.	
Side Slopes	2:1 or flatter	
Grade	Topography Dependent	
Dike grade	Between 0.5-1%	
Slope of Disturbed Area vs. Horizontal Spacing	< 5%	300 feet
	5-10%	200 feet
	10-25%	100 feet
	25-50%	50 feet
Slope Stabilization	<5% Seed and mulch within 5 days following dike construction	
	5-40% Stabilize immediately using either sod or riprap	
Outlet	Upslope side of dike provides positive drainage to the outlet. Provide energy dissipation as necessary to prevent erosion. Release sediment-laden runoff to a sediment trapping facility.	

Table 4.3.2 Interceptor Dike Design Criteria

Bottom Width	24 inch. The bottom should be level across the swale.	
Depth	12 inch	
Side Slopes	2:1 or flatter	
Grade	Maximum 5% with positive drainage to a suitable outlet	
Slope of Disturbed Area vs. Horizontal Spacing	< 5%	300 feet
	5-10%	200 feet
	10-25%	100 feet
	25-50%	50 feet
Slope Stabilization	Temporarily seed or line with riprap 12 inch thick and press into the bank approximately 3-4 inch	
Outlet	Level spreader or riprap to stabilized outlet/sedimentation pond.	

Material - Furnish interceptor dike and swale seeding and mulching per Section 4.2.5.

Furnish soil from excavated or borrow material containing no particle with any dimension greater than 3 inches, or other unsuitable material.

Installation – Construct interceptor dikes and swales according to DET6007, DET6008, DET6009, DET6010, DET6011, and per the engineered construction plans.

Inspection and Maintenance

- Inspect once per week on active sites, once every two weeks on in-active sites, and within 24 hours following a 0.5-inch rain event.
- Immediately repair damage resulting from runoff or construction activity.
- If the dike or swale regularly overflows, increase the capacity and/or frequency of the dikes/swales.
- Inspect and repair as necessary after every major storm.
- Minimize construction traffic over temporary dikes and swales.
- Clean out clogged pipes (as part of the swale system) under roads.

4.3.3 Grass-Lined Swale

A channel with vegetative lining (Image 13) constructed to convey and dispose of concentrated surface runoff without damage from erosion, deposition, or flooding.

Applicability

Grass-lined swales are applicable to areas that need erosion-resistant conveyances, including areas with highly erodible soils and moderately steep slopes (only up to 5 percent).

Swales should only be installed where space is available for an adequately large cross section and should only be installed on the perimeter of a construction site to convey relatively

Image 13. Grass-Lined Swale

clean stormwater discharge. The channel should not receive direct sedimentation from other disturbed areas.

Triangular channels should be used for low velocities and small quantities of stormwater and parabolic or trapezoidal channels for larger flows.

Advantages

- Does not generate high velocity runoff and offers temporary slope protection, which is superior to plastic sheeting.
- Capture a great deal of sediment due to the filtering effect of vegetation.
- Usually easy to install .

Disadvantages

- Requires temporary irrigation to establish vegetation.
- Cannot be used until vegetation is established.
- If not properly install, the channels can change the natural flow of surface water and adversely affect downstream waters.

Design Guidance and Criteria

- As a minimum, grass-lined channels should carry a peak runoff from a 10-year storm event without eroding. Where flood hazards exist, increase the capacity according to the potential damage. The allowable design velocity for grassed-lined channels is based on soil conditions, type of vegetation, and the method of establishment. The channel shape may be parabolic, trapezoidal, or v-shaped, depending on the need and site conditions. Small check dams or flow spreaders may be necessary to minimize channelization.

Material – Furnish grass-lined swale material meeting the following requirements:

a. Check Dams – Meeting the material requirements of Section 4.3.1.
b. Flow Spreader – Meeting the Type 4 material requirements of Section 4.3.1.
c. Seeding - Meeting the requirements of Section 4.2.5.

Installation

- Construct grass-lined swale per engineered construction plan.

Inspection and Maintenance

- Inspect once per week on active sites, once every two weeks on in-active sites, and within 24 hours following a 0.5-inch rain event.
- During the initial establishment, grass-lined channels should be repaired and grass re-established if necessary.
- After grass has become established, the channel should be checked periodically to determine if the channel is withstanding flow velocities without damage.
- Check the channel for debris, scour, or erosion and immediately make repairs. It is particularly important to check the channel outlet and all road crossings for bank stability and evidence of piping or scour holes and make repairs immediately.
- Remove all significant sediment accumulations to maintain the designed carrying capacity.

- Keep the grass in a healthy, vigorous condition at all times, since it is the primary erosion protection for the channel.
- Permanent grassed waterways should be seasonally maintained by mowing and/or irrigating, depending on the type of vegetation selected.
- Newly seeded areas need to be inspected frequently to ensure the grass is growing.
- If the seeded area is damaged due to runoff, additional stormwater measures such as check dams or matting may be needed.

4.3.4 Slope Drains and Energy Dissipator

A temporary slope drain is a conduit used to convey stormwater down a disturbed slope while preventing erosion. At the top of the slope, a channel or swale diverts flow to the pipe entrance for conveyance down the slope. The discharge end of the pipe requires outlet protection (Image 14). This erosion control practice is a temporary measure that is typically used for less than 2 years during grading operations until permanent drainage structures or permanently stabilize slopes can be installed.

Image 14. Piped Slope Drain with Energy Dissipator

Applicability

Slope drains are used primarily during construction whenever runoff needs to be diverted and conveyed down a slope without causing erosion and are used on most disturbed slopes to eliminate gully erosion from concentrated flows.

Advantages

- Temporary slope drains can be used on most disturbed slopes to eliminate gully erosion from concentrated flows.
- Slope drains provide a potentially effective method of conveying water safely down steep slopes.
- Easy installation and little maintenance.

Disadvantages

- The area that a temporary slope drains should not exceed 5 acres.
- Physical obstructions substantially reduce the conduit's effectiveness.
- Overtopping can occur because of inadequate inlet capacity, leakage at joints and slides.

Design Guidance and Criteria

- Consider using continuously fused, welded, or flange-bolted mechanical joint systems with proper anchoring or HDPP (high-density polyethylene pipe) for outfalls on steep slopes.
- Conduit material typically includes corrugated metal, corrugated plastic or flexible tubing.
- The area upstream of the conduit should be stable and large enough to direct flow to the conduit inlet.
- The size of the conduit should be able to handle flow from a 10-year, 24-hour storm event.
- A conduit 12 inches wide or wider should have a standard flared section to prevent stormwater from undercutting the inlet.

- Construction staff may use sandbags near the conduit inlet as temporary reinforcement.
- The conduit inlet should have at least 6 inches of freeboard.
- The conduit outlet should have suitable erosion protection or be in an erosion-resistant location.
- Slope drains must extend downslope to stable outlets, or special outlet protection must be provided.
- The area below the outlet must be stabilized with a riprap energy dissipator.

Material - Furnish either plastic pipe and flared end sections or metal pipe and flared end sections and riprap energy dissipator.

a. Plastic Pipe – Corrugated polyethylene pipe, polyethylene pipe, solid-wall polyethylene pipe, polypropylene pipe, or polyvinyl chloride pipe.
b. Metal Pipe – Corrugated steel pipe, ductile iron, or corrugated aluminum alloy pipe.
c. Class 100 Riprap – Loose riprap meeting the following grading requirements:

Weight of Rock (Pounds)	Percent (By Weight)
100-60	20
60-25	30
25-2	40
2-0	10-0

d. Geotextile – Material meeting the following requirements:

Geotextile Property Values for Riprap Geotextile [1, 2]

Geotextile Property	ASTM Test Method	Unit	Geotextile Property Requirements			
			Type [1]		Type [2]	
			Woven	Nonwoven	Woven	Nonwoven
Grab Tensile Strength (minimum) Machine and Cross Machine Directions	D 4632	lb	250	160	315	200
Grab Failure Strain (minimum) Machine and Cross Machine Directions	D 4632	%	< 50	≥ 50	< 50	≥ 50
Tear Strength (minimum)	D 4533	lb	90	56	110	80
Puncture Strength (minimum)	D 6241	lb	495	310	620	430
Apparent Opening Size (AOS) (maximum) U.S. Standard Sieve	D 4751	—	40	40	40	40
Permittivity (minimum)	D 4491	sec^{-1}	0.5	0.5	0.5	0.5
Ultraviolet Stability Retained Strength (minimum)	D 4355 (at 500 hours)	%	70	70	70	70

[1] All geotextile properties are Minimum Average Roll Values (MARV). The test results for any sampled roll in a lot shall meet or exceed the values shown in the table.
[2] Woven slit film geotextiles (geotextiles that are made from yarns of a flat, tape-like character) are not acceptable.

Installation – Install slope drains according to RD1045 and RD1050.

- Pipe shall be placed on undisturbed soil or well compacted fill.
- Thoroughly compact and stabilize the soil around the conduit inlet.
- Securely fasten together the slope drain sections with gasketed watertight fittings, and securely anchor the sections into the soil.
- The drain pipe sections shall be securely fastened together and have watertight fittings.
- Securely connect the standard flared end section at the entrance to the slope drain, using watertight connecting bands.
- Pipe should be staked securely to prevent movement.
- Stabilize the area below the outlet following the energy dissipater.

Inspection and Maintenance

- Inspect once per week on active sites, once every two weeks on in-active sites, and within 24 hours following a 0.5-inch rain event.
- Inspect the slope drain to determine whether it exceeded capacity, blockages occurred, leakages developed, anchoring is secure and positioning is appropriate for the site.
- Check inlet and outlet structures for undercutting and conduct repairs immediately, as needed.
- Adjust lengths of pipe when cut and fill slopes are extended.
- Regularly check at connection points for signs of erosion. Tighten fittings and repair erosion as needed.

4.4 SEDIMENT CONTROL

Once soil erosion occurs, sediment trapping or removal techniques can reduce the amount of sediment and associated pollutants that leave the site, thus protecting nearby streams, wetlands, and lakes. Sediment controls are usually placed around the perimeter of a disturbed area and where concentrated water leaves the site. Sediment control BMPs should be in place before land clearing and grading begins. It is important to note that sediment controls, if poorly maintained, can become sources of sediment and other pollutants during larger storms.

4.4.1 Construction Entrance

A construction entrance consists of a stabilized rock pad placed at construction site ingress/egress locations that reduces the amount of sediment transported onto paved roads by vehicles or runoff (Image 15). The Construction Entrance may also include a curb ramp designed out of wood.

Applicability

A construction entrance at all defined points where traffic enters or leaves a construction site and moving directly off or onto a public road should be installed.

Image 15 Aggregate Construction Entrance

Advantages

- Reduces traffic hazards caused by debris on public roadways.
- Reduces sediment and other debris from entering roadways, which can then be washed into the storm.

Disadvantages.

- Only effective if erosion and sediment control employed elsewhere onsite.
- Only works if installed at every location where significant construction traffic leaves the site.
- Fills with sediment quickly and requires frequent maintenance and/or replacement of rock.

Design Guidance and Criteria

- Install construction entrance prior to any site work.
- Whenever possible, construct the pad on a firm, compacted subgrade.
- Install geotextile under rock.
- Minimum length:
    - 20 feet - all single family sites
    - 50 feet – all other development sites
- Minimum width:
    - 20 feet – all construction sites
- Minimum Depth:
    - 8 inches – all construction sites
- Rock Size:
    - 4”-1” open graded – all other construction sites
- Wood Curb ramps should be made out of 2” × 6” material, nailed together
- Include a tire wash facility if the entrance does not prove effective in retaining sediment onsite.

Material – Furnish construction entrance materials meeting the following requirements:

a. Prefabricated Construction Entrance - Furnish reusable prefabricated construction entrance mats (track out mats) with the following characteristics:
    - Track out mats consisting of irregular driving surface provided by ridges, knobs or pyramidal extensions (protrusions) not less than 2-1/2 inches height that collects dislodged material off Equipment tires and surface below protrusions.
    - Modular and designed to be fixed together into widths and lengths as needed and anchored in place.
    - High visibility coloration
    - Chemical and UV resistant
    - Crush strength not less than 20,000 pounds
b. Aggregate - Clean, durable, open-graded angular Aggregate sized according to the following grading requirments:

Sieve Size	Percent Passing (by weight)
6”	100
4”	60 - 90
3”	40 - 70
2”	20 - 50
1”	0 - 20
#4	0 - 2

c. Geotextile - Subgrade geotextile meeting the following requirements:

Geotextile Property Values for Subgrade Geotextile (Separation) [1]

Geotextile Property	ASTM Test Method	Unit	Geotextile Property Requirements	
			Woven	Nonwoven
Grab Tensile Strength (minimum) Machine and Cross Machine Directions	D 4632	lb	180	113
Grab Failure Strain (minimum) Machine and Cross Machine Directions	D 4632	%	< 50	≥ 50
Tear Strength (minimum)	D 4533	lb	68	41
Puncture Strength (minimum)	D 6241	lb	371	223
Apparent Opening Size (AOS) (maximum) U.S. Standard Sieve	D 4751	—	30	30
Permittivity (minimum)	D 4491	sec^{-1}	0.05	0.05
Ultraviolet Stability Retained Strength (minimum)	D 4355 (at 500 hours)	%	50	50
[1] All geotextile properties are Minimum Average Roll Values (MARV). The test results for any sampled roll in a lot shall meet or exceed the values shown in the table.				

Installation – Install construction entrance at every point of access onto paved surfaces and according to RD1000.

- Do not install rock on paved surfaces. (Use wood curb ramps.)

Inspection and Maintenance

- Requires ongoing inspection.
- Immediately sweep up and remove or stabilize onsite any sediment that is tracked onto pavement.
- If the sediment poses a threat to public safety and street sweeping proves ineffective, consider washing the street and collecting the water in a sediment pond or sump before it leaves the site.
- Add or replace rock as needed to maintain the specified dimensions.
- Immediately remove any rock, which gets carried from the pad to the roadway.

4.4.2 Tire Wash Facility

Two types of tire wash facilities are available depending on the severity of sediment tracking and the size and duration of project. Type 1, manual hose wash, consists of installing a subgrade geotextile under an open graded aggregate and a cattle guard or other appropriate material, prior to the beginning of the construction entrance. Like a stabilized construction entrance, it is graded so collected wash water is conveyed to a sediment trap, basin, or other suitable treatment facility.

Type 2 is a shallow subgrade geotextile-lined basin partially filled with water, through which exiting vehicles drive.

Applicability

Tire washes may be used on construction sites where dirt and mud tracking onto public roads by construction vehicles may occur. Consideration of soil type and weather conditions encountered during construction should be considered to incorporate the appropriate tire wash facility.

Advantages

- Reduces traffic hazards caused by debris on public roadways.
- Reduces sediment on roadways, which can wash into the storm sewer system.
- Type 1 is easy to construct and is relatively inexpensive.
- Type 2 is useful for high traffic volumes or large projects of long duration.

Disadvantages

- Only works if installed at every location where construction traffic leaves the site.
- Fills with sediment quickly and requires frequent maintenance.
- Requires a source of wash water.
- Requires a turnout or doublewide exit to avoid entering vehicles having to drive through wash area.
- Type 2 is costly to construct.
- Both facilities will generate large volumes of sediment-laden water, requiring treatment elsewhere onsite.

Design Guidance and Criteria

- Remove all vegetation and other objectionable material from the foundation area. Grade and crown foundation for positive drainage.
- A geotextile filter fabric shall be placed between the aggregate and the soil surface below the pad to reduce the migration of soil particles from the underlying soil into the aggregate and vice versa.
- All surface water that is flowing to or diverted toward the construction entrance should be piped beneath the entrance.
- Wash water should be directed into a sediment trap, a vegetated filter strip, or other approved sediment trapping device. Sediment should be prevented from entering any watercourses.

Material – Furnish tire wash facility materials meeting the following requirements:

a. Aggregate - Material meeting the requirements of Section 4.4.1.
b. Geotextile – Subgrade geotextile meeting the requirements of Section 4.4.1.
c. Corrugated Steel Panels - With flexural strength adequate to bear the weight of the vehicles accessing the construction site without deformation.

Installation – Install tire wash facility according to RD1060.

Inspection and Maintenance

- Inspect once per week on active sites, once every two weeks on in-active sites, and within 24 hours following a 0.5-inch rain event.
- The entrance should be maintained in a condition that will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic topdressing with additional aggregate.

- Remove mud and sediment tracked or washed onto public roadway immediately.
- Mud and soil particles will eventually clog the voids in the gravel and the effectiveness of the gravel pad will not be satisfactory. When this occurs, the pad should be top-dressed with new aggregate. Complete replacement of the pad may be necessary when the pad becomes completely clogged.
- If washing facilities are used, the sediment traps should be cleaned out as often as necessary to assure that adequate trapping efficiency and storage volume is available. Vegetative filter strips should be maintained to insure a vigorous stand of vegetation at all times.
- Reshape pad as needed for drainage and runoff control.
- Repair any broken road pavement immediately.
- All temporary erosion and sediment control measures shall be removed within 30 days after final site stabilization is achieved or after the temporary practices are no longer needed. Trapped sediment shall be removed or stabilized on site. Disturbed soil areas resulting from removal shall be permanently stabilized.

4.4.3 Sediment Fence

Temporary sediment fence consisting of an entrenched geotextile stretched across and attached to supporting posts (Image 16). Sediment fences are adequate to treat flow depths consistent with overland or sheet flow. The sediment fence is constructed of stakes and synthetic filter fabric with a rigid wire fence backing, where necessary, for support. Sediment fence can be purchased with pockets pre-sewn to accept use of steel fence posts.

<u>Applicability</u>

The primary function of the sediment fence is to slow and pond the water and allow soil particles to settle. Silt fences should be located where only shallow pools can form. Their use is limited to areas where overland sheet flows are expected.

Image 16. Parameter Sediment Fence

<u>Advantages</u>

- Intercepts and detains small amounts of sediment from disturbed areas during construction operations.
- Removes sediments and prevents downstream damage from sediment deposits.
- Reduces runoff velocity.
- Requires minimal ground disturbance to install.
- Relatively inexpensive.

<u>Disadvantages</u>

- Applicable to small drainage areas and overland flow; not applicable to concentrated flows.
- Incorrect geotextile or installation decreases sediment fence performance.
- Requires frequent maintenance and inspection.
- Can’t be installed across streams, ditches, or waterways.

- Relatively short life expectancy, generally six months.

Design Guidance and Criteria

- Sediment fence should be installed along ground contours.
- Sediment fence should only be used for sheet and rill erosion.
- Sediment fences have a low permeability to enhance sediment trapping. This will create ponding behind the fence, so they should not be located where ponding will cause property damage or a safety hazard.
- Sediment fences may be designed to store all the runoff from the design storm or located to allow bypass flow when the temporary sediment pool reaches a re-determined level.

Material – Furnish sediment fence materials meeting the following requirements:

a. Posts – Untreated wood posts (wood stain is acceptable).
b. Geotextile – Sediment fence geotextile meeting the following requirements:

Geotextile Property Values for Sediment Fence[1]

Geotextile Property	ASTM Test Method	Unit	Geotextile Property Requirements		
			Supported	Unsupported	
			—	Elongation [2] ≥ 50%	Elongation [2] ≤ 50%
Grab Tensile Strength (minimum) Machine and Cross Machine Directions	D 4632	lb	90 90	120 100	120 100
Apparent Opening Size (AOS) (maximum) U.S. Standard Sieve	D 4751	—	30	30	30
Permittivity (minimum)	D 4491	sec^{-1}	0.05	0.05	0.05
Ultraviolet Stability Retained Strength (minimum)	D 4355 (at 500 hours)	%	70	70	70

[1] All geotextile properties are Minimum Average Roll Values (MARV). The test results for any sampled roll in a lot shall meet or exceed the values shown in the table.
[2] Measured according to ASTM D4632

Installation – Install sediment fence according to RD1040.

- Sediment fences should be installed a minimum of 3 feet from toe of slope in order to maximize storage.
- A trench should be excavated 6 inches deep along the line of the posts.
- Trench should be backfilled and the soil compacted on both sides of the sediment fence.
- Posts should be spaced a maximum of 6 feet apart and driven securely into the ground a minimum of 12 inches.
- When sediment fence approaches it's termination point, turn fence uphill and extend one full panel (6 feet).
- When joining two or more sediment fences together, join the two end stakes by wrapping the two ends at least one and one half turns and driving the joined stakes into the ground together.

- Height of a sediment fence should not exceed 3 feet. Storage height and ponding height should never exceed 1.5 feet.

Inspection and Maintenance

- Inspect once per week on active sites, once every two weeks on in-active sites, and within 24 hours following a 0.5 inch rain event.
- Immediately repair any damage.
- Remove accumulated sediment once it has reached 1/3 the height of the sediment fence or 1 foot maximum.
- Inspect for channel formation parallel to the fence, which indicates the geotextile is acting as a flow barrier.
- Replace deteriorated or clogged geotextile.
- Check for under cutting or piping under fence.

4.4.4 Inlet Protection

Storm drain inlet protection controls prevent soil and debris from entering storm drain inlets. These controls are usually temporary and allow storm drain inlets onsite to remain operational prior to permanent site stabilization. Inlet protection is often the last opportunity to provide treatment to stormwater prior to discharge. Inlet protection prevents coarse sediment from entering the storm drainage system by filtering runoff and retaining sediment before it reaches a drainage inlet or the storm sewer system.

There are many options and variations of inlet protection:

- Type 2: Geotextile/Wire Mesh/Aggregate
- Type 3: Prefabricated Insert
- Type 4: Biofilter Bags
- Type 6: Sod Protection
- Type 7: Compost Filter Sock
- Type 10: Curb Inlet Sediment Dam

Applicability

Inlet protection devices may be applied to any curb inlet, drop inlet, manhole, catch basin, or other entry point to the stormwater drainage system that might receive inflows with high sediment levels. Inlet protection is critical because it often is the last treatment measure before stormwater enters receiving waters.

Advantages

- Prevents sediment from entering the storm drain system.
- Reduces amount of sediment leaving the site.
- Properly selected, installed, and maintained inlet protection devices remove total solids and nutrients from incoming flows.

Disadvantages

- May result in ponding of water above the catch basin.
- Sediment removal may be difficult under high-flow conditions.
- May result in a traffic hazard.
- Short-circuiting of flow may occur if not properly installed.

- Useful only for low flows having low sediment loading.
- Improper installation, maintenance, or removal may introduce sediment into the storm drain system.

Design Guidance and Criteria

- Place inlet protection in areas where water can pond, and where ponding will not have adverse impacts.
- Inlet protection must allow for overflow in a severe storm event.
- Additional measures must be considered depending upon soil type.
- Inlet protection should only be used in locations where sediment can be removed and temporary ponding will not create a public safety hazard or cause property damage.

Type 2: Geotextile/Wire Mesh/Aggregate – A temporary sediment control barrier formed around a storm drain inlet by the use of aggregate (Image 17) and wire mesh and protected with geotextile fabric. The aggregates are able to filter out sediment mainly through slowing down flows directed to the inlet by creating an increased flow path for the stormwater.

Image 17. Aggregate Inlet Protection

Applicability

An aggregate and wire mesh type of inlet protection applies where new or existing storm sewers receive sediment-laden runoff.

This method of inlet protection applies to both drop inlets and curb inlets where heavy flows are expected and ponding in front of the structure is not likely to cause inconvenience or damage to adjacent structures and unprotected areas.

Advantages

- Easy to constructed and maintain.
- Relatively inexpensive.

Disadvantages

- Usually requires regular maintenance to remove sediment and replace aggregate.
- Drainage problems can occur if poorly designed or poorly maintained.
- High sediment concentrations can quickly block the aggregate filter.
- Can be damaged by construction traffic.

Material – Furnish Geotextile/Wire Mesh/Aggregate materials meeting the following requirements:

a. Wire Mesh - 19-gauge steel-wire mesh with 3/8 x 3/8-inch openings.
b. Aggregate – Open-graded aggregate meeting the following grading requirements:

Sieve Size	Percent Passing (by Weight)
1"	100
3/4"	80 - 98
1/2"	60 - 85
3/8"	30 - 65
No. 10	5 - 20
No. 40	0 - 6
No. 100	0 - 3 (Dry Sieve)

c. Geotextile –Drainage geotextile material meeting the following requirements:

Geotextile Property Values for Drainage Geotextile [1, 2]

Geotextile Property	ASTM Test Method	Unit	Geotextile Property Requirements			
			Type 1		Type 2	
			Woven	Nonwoven	Woven	Nonwoven
Grab Tensile Strength (minimum) Machine and Cross Machine Directions	D 4632	lb	180	115	250	160
Grab Failure Strain (minimum) Machine and Cross Machine Directions	D 4632	%	< 50	≥ 50	< 50	≥ 50
Tear Strength (minimum)	D 4533	lb	67	40	90	56
Puncture Strength (minimum)	D 6241	lb	370	220	495	310
Apparent Opening Size (AOS) (maximum) U.S. Standard Sieve	D 4751	—	40	40	40	40
Permittivity (minimum)	D 4491	sec^{-1}	0.5	0.5	0.5	0.5
Ultraviolet Stability Retained Strength (minimum)	D 4355 (at 500 hours)	%	50	50	50	50

[1] All geotextile properties are Minimum Average Roll Values (MARV). The test results for any ampled roll in a lot shall meet or exceed the values shown in the table.
[2] Woven slit film geotextiles (geotextiles that are made from yarns of a flat, tape-like character) are not

Installation – Install inlet protection according to RD1010 and the following:

- Install inlet protection devices prior to upslope soil disturbance occurs.
- In newly developed areas, inlet protection should be installed immediately after the storm sewer inlets are installed.
- It is critical that the storm sewer inlet not be completely blocked by inlet protection when public safety is a concern.
- Place the wire mesh over the grate. Place geotextile fabric over the wire mesh. The wire mesh and geotextile fabric shall be placed over the inlet structure extending a minimum of 20 inches beyond each side of the inlet opening.
- Gravel shall be placed over the geotextile and wire mesh to a minimum depth of 12 inches. The gravel shall extend beyond the inlet opening a minimum of 20 inches on all sides.

Inspection and Maintenance

- Sediment shall be removed and the barrier restored to its original dimensions when the sediment has accumulated to one-half the barrier height.

Type 3: Prefabricated Insert – The geotextile fabric insert (Image 18) is to collect and filter all of those contaminants such as debris, fertilizers, hydrocarbons, oil, silt particles, sediment, trash from construction sites. It is made of a permeable geotextile that allows water to pass through but prevents silt and sediment from clogging the drainage system or leaving the site.

Applicability

Prefabricated inserts are used in areas with fine soils for more effective filtering.

Image 18. Fabric Insert (Witches Hat)

Advantages

- Easy to install and maintain.
- Relatively inexpensive.
- Is reusable.
- Is available in many sizes and shapes to accommodate different inlet types.
- Will not be damaged by construction traffic

Material – Furnish prefabricated insert materials meeting the following requirements:

- Prefabricated filter inserts manufactured specifically for collecting sediment in drainage inlets. Include handles and fasteners sufficient to keep the insert from falling into the inlet during maintenance and removal of the insert from the inlet.

Installation – Install prefabricated inserts according to RD1010 and the following:

- Install inlet protection devices prior to upslope soil disturbance occurs.
- In newly developed areas, inlet protection should be installed immediately after the storm sewer inlets are installed.
- It is critical that the storm sewer inlet not be completely blocked by inlet protection when public safety is a concern.
- Prefabricated insert shall fit the dimensions of the inlet.
- Keep the bottom of the geotextile filter bag above pipe crowns.

Inspection and Maintenance

- Remove sediment when it accumulates to within 6 inches of the bottom of the overflow holes.
- If standing water remains within 6 inches of the bottom of the overflow holes 24 hours after a runoff event, remove accumulated sediment to restore the fabric's filtering capacity.
- Holes in the fabric less than 2 inches in length may be repaired by stitching. The bag must be replaced if holes greater than 2 inches are observed in the fabric.

Type 4: Biofilter Bags - Biofilter bags are manufactured from 100 percent recycled wood-product waste placed in plastic mesh bags (Image 19).

Applicability

Biofilter bags can be installed around catch basins, area drains and ditch inlets to collect and filter all of those contaminants such as debris, fertilizers, hydrocarbons, oil, silt particles, sediment, trash from construction sites.

Image 19. Biofilter Bags

Advantages

- Relatively low cost.
- Wood-product can be recycled or used on site when no longer needed.
- Installation is simple, can be done by hand.
- Bags are easy to move, replace, and reuse on paved surfaces.
- Are good short-term solution in situations where concentrated flows are causing erosion.

Disadvantages

- Generally effective for only a few months.
- Can be easily damaged by construction equipment or by traffic in paved areas.
- Can become clogged with sediment and cease to filter runoff.
- Not effective where water velocities or volumes are high.
- Light weight results in higher buoyancy if not properly installed.
- Low sediment retention capacity may require frequent maintenance.

Material – Furnish biofilter bag material meeting the requirements of Section 4.3.1.

Installation – Install biofilter bags according to RD1015 and the following:

- Install inlet protection devices prior to upslope soil disturbance occurs.
- In newly developed areas, inlet protection should be installed immediately after the storm sewer inlets are installed.
- It is critical that the storm sewer inlet not be completely blocked by inlet protection when public safety is a concern.
- Turn the ends of the biofilter bag barriers up slope to prevent runoff from going around the berm.
- Allow sufficient space up slope from the biofilter bag berm to allow ponding, and to provide room for sediment storage.
- Biofilter bags should be overlapped 6 inches, not abutted.
- Where applicable, stake biofilter bags into a 1 to 2 inch deep trench with a width equal to the bag. Drive one stake at each end of the bag. Use wood stakes with a nominal classification of 2” x 2”.

Inspection and Maintenance

- Biofilter bags exposed to sunlight will need to be replaced every two to three months due to degrading of the bags.
- Reshape or replace biofilter bags as needed.
- Repair washouts or other damage as needed.

- Sediment that is retained by the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.

Type 6: Sod Protection - A permanent grass sod filter formed around a storm drain inlet to help prevent sediment and mulch materials from entering storm drains before permanent seeding has become established (Image 20).

Applicability

Sod protection can be installed where the drainage area of the inlet has been permanently seeded and mulched, and the immediate surrounding area is to remain in dense vegetation. This application is well suited for lawns adjacent to large buildings.

Advantages

- Aesthetically pleasing.

Image 20. Grass Sod

Disadvantages

- Can only be installed after entire drainage area has been stabilized.

Material – Furnish material meeting the following requirements:

- Grass sod grown on agricultural land that is commercially cultivated specifically for turf sod. Furnish sod that is free of weeds, diseases, harmful nematodes and insects. Provide sod that is mature, not less than 10 months old, and machine cut to a uniform thickness of 5/8 inch or more, excluding top growth and thatch. Broken pieces and torn or uneven ends will not be accepted. Plant sod within 36 hours of harvest.

Installation – Install sod according to RD1010 and the following:

- Install inlet protection devices prior to upslope soil disturbance occurs.
- In newly developed areas, inlet protection should be installed immediately after the storm sewer inlets are installed.
- It is critical that the storm sewer inlet not be completely blocked by inlet protection when public safety is a concern.
- Bring the area to be sodded to final grade elevation with top soil.
- Lay all sod strips perpendicular to the direction of flows.
- Keep the width of the sod at least 6 feet from edge of inlet.
- Stagger sod strips so that adjacent strip ends are not aligned.

Inspection and Maintenance

- During the first 4 weeks, water sod as often as necessary to maintain moist soil to a minimum depth of 2 inches.
- Maintain grass height at least 2 inches with no more than one-third the shoot height (grass leaf) removed in any mowing.

- Apply fertilizer as necessary to maintain the desired growth and sod density.

Type 7: Compost Filter Sock - Compost filter socks can be used for curb inlet and drop inlet protection. When placed in front of a grate or inlet, filter sock filters sediment laden runoff before it enters the stormwater system. It also prevents leaves, sticks and other debris from polluting the storm system.

Applicability

Compost filter socks can be installed on construction sites or other disturbed areas where stormwater discharge occurs as sheet flow. They are used for perimeter sediment control, as inlet protection (Image 21). Compost filter socks can lie beside and/or on top of each other, have larger diameters, or work in combination with other stormwater controls such as sand bags.

Advantages

- They are flexible.
- Can be filled in place or fill and move them into position.
- Are made from bio-based, recycled, and locally available materials.

Image 21. Compost Filter Sock

Disadvantages

- Freezing temperatures and prolonged dry periods can impact the compost's effectiveness and life span.
- Requires testing of compost to ensure appropriate particle size and that the nutrients in the composted material are in organic form.
- Can be damaged by construction traffic.

Material – Furnish material meeting the following requirements:

a. Compost Filter Sock - Material meeting the requirements of Sections 4.2.7 and 4.3.1.
b. Sand Bags – Material meeting the requirements of Section 4.3.1.

Installation – Install compost filter socks according to RD1010 and the following:

- Install inlet protection devices prior to upslope soil disturbance occurs.
- In newly developed areas, inlet protection should be installed immediately after the storm sewer inlets are installed.
- It is critical that the storm sewer inlet not be completely blocked by inlet protection when public safety is a concern.
- Use sandbags to hold wattles in place. Sandbags are not necessary for compost filter socks.
- Place sandbags at each end of wattle and 3 foot on-center to hold in place.
- If applicable, drive 2" x 2" wood stakes a minimum of 6 inches into the ground and flush with the top of the sock.
- Overlap ends of sock 12 inch minimum.

Inspection and Maintenance

- Excessive upstream ponding or overtopping indicates that the current configuration is not adequate.
- Sediment that is retained by the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Reshape or replace compost filter socks as needed.

Type 10: Curb Inlet Sediment Dam - The curb inlet sediment dam is an "L" shaped, temporary sediment barrier, made from polyfiber, high-density polyethylene (HDPE), polypropylene or geotextile fabric, that provides vertical protection for recessed curb inlets (Image 22).

Applicability

Curb inlet sediment dam is used to intercept sediment laden water at the curb gutter opening and prevent sediment, debris, and associated pollutants from entering the stormwater underground pipe systems.

Image 22. Curb Inlet Sediment Dam

Advantages

- Easy to install and maintain.
- Relatively inexpensive.
- Is reusable.
- Not likely to be damaged by construction traffic

Disadvantages

- Can become clogged with sediment and cease to filter runoff.
- Not effective where water velocities or volumes are high.

Material – Provide one (or more) of the following curb inlet sediment barriers from the following manufacturers or equivalent:

- Ertec - Curb Inlet Protection
- ACF - Econo Curb
- GEI Works - Taurus Curb Inlet Filter
- GEI Works - Ultra-Curb Inlet Guard
- Ultratech - Ultra-Curb Guard Plus

Installation - Install sediment dam according to the manufacturer's recommendations, per RD1010 and the following:

- Install inlet protection devices prior to upslope soil disturbance occurs.
- In newly developed areas, inlet protection should be installed immediately after the storm sewer inlets are installed.
- It is critical that the storm sewer inlet not be completely blocked by inlet protection when public safety is a concern.
- Fit curb inlet sediment dam snugly into inlet mouth.
- Install per manufacturers recommendations.

Inspection and Maintenance

- Sediment that is retained by the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed after each storm event.

Inspection and maintenance for all types of inlet protection:

- Inspect once per week on active sites, once every two weeks on in-active sites, and within 24 hours following a 0.5 inch rain event.
- Clean inlet protection during and after each significant storm and remove sediment from behind structure before they reach halfway up to the overflow point after every storm.
- Look for and document sediment deposits on the pavement and sediment on inlet filters.
- Ensure that there are no large holes or gaps in the inlet protection.
- Remove sediment deposits on the pavement.
- Remove sediment deposits immediately if they might affect traffic safety.
- Repair or replace materials as needed to ensure proper functioning.

4.4.5 Sediment Barriers

Sediment barriers, sometimes also called sediment filters, are temporary structures that are typically used around the edge of construction sites or other locations with bare soil. They are meant to separate any potential sediment pollution from stormwater that might flow off the site. They allow the stormwater to flow through while trapping sediment behind or inside them. They are used primarily as temporary structures to slow stormwater runoff into streams, filter sediment, and promote stormwater infiltration.

Applicability

Erosion, sedimentation and hazardous materials are the primary concerns related to construction and site development. Perimeter controls are universally used to ensure that sediment and other contaminants are contained on the construction site. The wide variety of perimeter control materials, configurations, and uses make them a standard practice on nearly all construction sites where clearing, grading, stockpiling (Image 23), excavation, or fill activities occur.

Image 23. Sediment Barrier at Parameter of Stockpile

Design Guidance and Criteria

- Install perimeter controls downslope from disturbed areas and soil stockpiles, so that they intercept all sediment-laden flows.
- Perimeter controls are not needed upslope of disturbed areas, except when used to divert flows away from disturbed areas (i.e., interceptor dikes and swales).

There are several types of sediment barriers:

- Type 2: Biofilter Bags
- Type 3: Fiber Rolls
- Type 4: Sand Bags
- Type 6: Aggregate Barrier

- Type 8: Compost Filter Sock
- Type 9: Compost Filter Berm

Type 2: Biofilter Bags - Biofilter bags are manufactured from 100 percent recycled wood-product waste placed in plastic mesh bags (see Image 19).

Applicability
Biofilter bags can be used on sloping surfaces, and in ditches or swales to collect and filter all of those contaminants such as debris, fertilizers, hydrocarbons, oil, silt particles, sediment, trash from construction sites.

Advantages
- Relatively low cost.
- Can be used in place of sediment fences at toe of slope, without trenching in.
- Wood-product can be recycled or used on site when no longer needed.
- Installation is simple, can be done by hand.
- Bags are easy to move, replace, and reuse on paved surfaces.
- Good short-term solution in situations where concentrated flows are causing erosion.

Disadvantages
- Generally effective for only a few months.
- Can be easily damaged by construction equipment or by traffic in paved areas.
- Can become clogged with sediment and cease to filter runoff.
- If improperly installed can allow undercutting or end-flow.
- Not effective where water velocities or volumes are high.
- Light weight results in higher buoyancy if not properly installed.
- Low sediment retention capacity may require frequent maintenance.

Material – Furnish sediment barrier materials meeting the requirements of Section 4.4.1.

Installation – Install biofilter bags according to RD1030 and the following:
- Turn the ends of the biofilter bag barriers up slope to prevent runoff from going around the berm.
- Allow sufficient space up slope from the biofilter bag berm to allow ponding, and to provide room for sediment storage.
- Stake biofilter bags into a 1 to 2 inch deep trench with a width equal to the bag.
- Drive one stake at each end of the bag.
- Use wood stakes 2” x 2” x 36”.
- Biofilter bags should be overlapped 6 inches, not abutted.

Inspection and Maintenance
- Check that stakes are secure and ends of bags are tightly overlapped. Check that undercutting or end-flow is not occurring.
- Inspect plastic mesh bags for tears.
- Remove sediment when accumulation reaches one-third of the barrier height.
- Repair or replace split, torn, unraveled, or slumping bags.

Type 3: Fiber Rolls - Fiber rolls (also called fiber logs or straw wattles) are tube-shaped erosion control devices filled with straw, flax, rice, coconut fiber material, or composted material (Image 24). Each roll is wrapped with UV-degradable polypropylene netting for longevity or with 100 percent biodegradable materials like burlap, jute, or coir. Fiber rolls complement permanent best management practices used for source control and revegetation.

Applicability

Fiber rolls help reduce overland flow velocities by interrupting and intercepting runoff and capturing sediment on steep slope settings. Placing multiple strings of fiber rolls in a system along the contours of a slope, or used as check dams, provide a benefit by helping interrupt overland flow and intercepting sediment loads before they migrate to receiving surface waters.

Fiber rolls can also be used to control erosion from entering paved areas by installing behind sidewalks or curbs.

Image 24. Fiber Rolls

Advantages

- Can be used at projects with minimal slopes.
- Allow water to flow through while capturing runoff sediments.
- Fiber rolls placed along the shorelines of waterways provide immediate protection by dissipating the erosive force of small waves.
- They install more easily, particularly in shallow soils and rocky material.
- They are more adaptable to slope applications and contour installations than other erosion and sediment control practices.
- They are readily molded to fit the bank line.
- They blend in with the landscape and are less obtrusive than other erosion and sediment controls such as silt fence.
- They do not obstruct hydraulic mulch and seed applications.
- They can be removed or left in place after vegetation is established.

Disadvantages

- Are not effective unless trenched.
- Can be difficult to move once saturated.
- To be effective, fiber rolls at the toe of slopes greater than 5H:1V must be at least 20 inches in diameter. An equivalent installation, such as stacked smaller-diameter fiber rolls, can be used to achieve a similar level of protection.
- If not properly staked and entrenched, fiber rolls can be transported by high flows.
- Have a very limited sediment capture zone.
- Should not be used on slopes subject to creep, slumping, or landslide.

Material – Furnish sediment barrier materials meeting the requirements of Section 4.3.1.

Installation – Install fiber rolls according to RD1030 and the following:

- Stake fiber rolls securely into the ground, countersunk 3 inches, and orient them perpendicular to the slope.
- Use wood stakes 2” x 2” x 36”.
- For installations along sidewalks and behind street curbs, it might not be necessary to stake the fiber rolls, but trenches must still be dug.

Inspection and Maintenance

- Ensure that the rolls remain firmly anchored in place and are not crushed or damaged by equipment or traffic.
- Repair or replace split, torn, unraveled, or slumping fiber rolls.
- Remove sediment when accumulation reaches one-third of the barrier height.

Type 4: Sand Bags - Sandbags are manufactured from durable, weather-resistant, tightly-woven, Geotextile fabric material sufficient to prohibit leakage of the filler material. The bags should measure 24” × 12” × 6” and be filled with firmly packed sand weighing at least 75 pounds.

Image 25. Sand Bags

Applicability

Sand bags can be used on paved surfaces, such as streets and parking lots, where it is difficult to install posts and stakes for other types of sediment control devices (Image 25), as check dams across a ditch or channel, or to create a temporary sediment trap or dewatering basin.

Advantages

- Relatively low cost**.**
- Installation is simple, can be done by hand.
- Bags are easy to move, replace, and reuse on paved surfaces.
- Good short-term solution in situations where concentrated flows are causing erosion
- Can be used to divert and slow velocity of small flows.
- Can be used in concrete lined ditches to capture sediment and reduce water velocity.

Disadvantages

- Generally effective for only a few months.
- Can be easily damaged by construction equipment or by traffic in paved areas.
- Can contribute sediment to runoff if bags rupture.
- Cannot be staked and are not appropriate on steep slope applications.
- Not effective in steep swales, channels, or ditches.
- If improperly installed can allow undercutting or end-flow.
- Not effective where water velocities or volumes are high, can get washed away.

Material – Furnish sediment barrier materials meeting the requirements of Section 4.3.1.

Installation – Install sand bags according to RD1030 and the following:

- Turn the ends of the sandbag barrier up slope to prevent runoff from going around the barrier.
- Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, sand bag barriers should be set back from the slope toe to facilitate cleaning. Where specific site conditions do not allow for a set-back, the sand bag barrier may be constructed on the toe of the slope. To prevent flows behind the barrier, bags can be placed perpendicular to a berm to serve as cross barriers.
- Butt ends of bags tightly.
- Overlap butt joints of row beneath with each successive row.
- Use a pyramid approach when stacking bags.

Inspection and Maintenance

- Sandbags exposed to sunlight will need to be replaced every two to three months due to degradation of the bags.
- Reshape or replace sandbags as needed.
- Repair washouts or other damage as needed.
- Remove sediment when accumulation reaches one-third of the barrier height.
- Remove sandbags when no longer needed and recycle sand fill whenever possible and properly dispose of bag material.
- Remove sediment accumulation, and clean, re-grade, and stabilize the area.
- Repair or replace split, torn, unraveled, or slumping bags.

Type 6: Filter Berm (Aggregate Barrier) - A rock filter berm can be created from clean rock at the project site, or from clean imported gravel and rock. It is placed and compacted along a level contour, where sheet flow may be detained and ponded to promote sedimentation (Image 26). Aggregate is placed over a geotextile fabric.

Image 26. Aggregate Filter Berm

Applicability

Filter berms are generally used along the perimeter of a construction site or along the toe of slope for sites with relatively small drainage areas to capture and treat stormwater sheet flow.

Advantages

- Very efficient method for sediment removal.
- Reduces runoff velocity, allowing sediment to settle out.

Disadvantages

- More expensive than some other measures because it requires clean gravel or crushed rock that may not be found on site.

- Clogging from mud and soil may make maintenance difficult.
- Has a limited life span.

Material – Furnish filter berm material meeting the following requirements:

a. Aggregate – Material meeting the requirements of Section 4.4.1.
b. Subgrade Geotextile – Material meeting the requirements of Section 4.4.1.

Installation – Install filter berm according to RD1031 and the following:

- Embed aggregate a minimum of 4 inches.

Inspection and Maintenance

- Repair ends of berms where bypassing occurs or areas of undercutting.
- Repair damaged areas of the berm (washed out, eroded, and flattened areas).
- Recompact soil around the berm as necessary to prevent breakouts and/or piping.
- Perform repairs using a piece of equipment or hand tool capable of excavating, contouring, and compacting back to the berm's original design.
- Remove accumulated sediment and debris once sediment depth reaches one-half of berm height.
- Repair any damage to vegetative cover.
- Prevent damage to the berm by ensuring that equipment operators do not drive over the berm.
- If the rock becomes clogged with sediment, it must be carefully removed from the inlet and either cleaned or replaced.
- Geotextiles, rock, and perforated pipe can easily become plugged with sediment. These should be routinely cleaned and/or replaced.
- Remove berm once the site reaches final stabilization. Fill, compact, and vegetate areas of ground disturbance to blend with adjacent ground.

Type 8: Compost Filter Sock - A compost filter sock is a type of contained compost filter berm. The filter sock is typically a mesh tube filled with composted material. It has an oval or round cross-section and provides a three-dimensional filter to retain sediment and other pollutants and allow clean water to flow through.

Applicability

Compost filter socks can be installed on construction sites or other disturbed areas where stormwater discharge occurs as sheet flow.

They are used for perimeter sediment control (Image 27), as check dams in swales or ditches. Compost filter socks can be installed on steeper slopes with faster flows if they have closer spacing, lie beside and/or on top of each other, have larger diameters, or work in combination with other stormwater controls such as compost blankets.

Advantages

- They are flexible.
- Can be filled in place or fill and move them into position.
- Has more surface area contact with the underlying soil than typical sediment control devices.

- The greater contact area and weight of compost filter socks also allows water to pond upgradient and suspended sediments to settle out.
- Can be vegetated or unvegetated.
- Vegetated filter socks can remain in place to provide long-term stormwater filtration as a post-construction stormwater control measure.
- Does not require trenching for installation.
- Are made from bio-based, recycled, and locally available materials.

Image 27. Compost Filter Sock

Disadvantages

- Not appropriate for use in streams.
- Freezing temperatures and prolonged dry periods can impact the compost's effectiveness and life span.
- Requires testing of compost to ensure appropriate particle size and that the nutrients in the composted material are in organic form.

Material – Furnish filter sock material, compost and stakes meeting the following requirements:

a. Filter Sock – 5-mil thick woven tubular mesh netting with 1/8" to 3/8" openings, and consisting of continuous HDPE filament or polypropylene material or 100 percent biodegradable mesh netting.
b. Compost – Commercially manufactured course compost material meeting the requirements of Section 4.2.7.
c. Stakes – 2" x 2" (nominal) untreated wood stakes.

Installation – Install compost filter socks according to RD1032 and the following:

- Trim or remove vegetation and debris to ensure full contact with the ground surface.
- Anchor it to the slope once it has been filled and placed.
- Cut open unvegetated filter socks upon project completion, and spread the compost around the site as soil amendment or mulch.
- Dispose of the mesh sock unless it is biodegradable.

Inspection and Maintenance

- Inspect once per week on active sites, once every two weeks on in-active sites, and within 24 hours following a 0.5 inch rain event.
- Place an additional filter sock further up the slope or use an additional erosion control, such as a compost blanket, in conjunction with the filter sock if excessive upstream ponding or overtopping is observed.
- Remove accumulated sediment when it reaches one half the height of the filter sock.
- At the completion of the project, construction staff can spread the compost material in areas that do not receive concentrated flow.

Type 9: Compost Filter Berm - A compost filter berm consists of compost or a compost product placed perpendicular to sheet flow to control erosion in disturbed areas and retain sediment. It provides a

three-dimensional filter that retains sediment and other pollutants (e.g., suspended solids, metals, oil and grease) while allowing the cleaned water to flow through the berm.

Image 28. Compost Filter Berm

Applicability

Compost filter berms are generally used along the perimeter of a construction site with relatively small drainage areas, or at intervals along a slope (Image 28) , to capture and treat stormwater sheet flow. They can be used on steeper slopes with faster flows if they place the berms closer together or use them in combination with other erosion and sediment control practices, such as compost blankets or compost filter socks, to slow stormwater flow velocities.

Compost berms can also be particularly useful in areas where ground penetration is not desirable.

Advantages

- Can be vegetated or unvegetated.
- Vegetated filter berms normally remain in place and provide longterm stormwater filtration as a post-construction stormwater control.
- Can be installed fairly easily.
- Can be installed on frozen or rocky ground.
- Retains a large volume of water, which helps prevent or reduce rill erosion as well as establish vegetation on the berm.

Disadvantages

- Filter berms are not suitable for areas where large amounts of concentrated flow is likely.
- The initial cost can be higher than the cost for other sediment control practices.
- Maintenance can be difficult.

Material – Furnish Commercially manufactured coarse compost material meeting the requirements of Section 4.2.7.

Installation – Install compost filter berm according to RD1033 and the following:

- Trim or remove vegetation and debris to ensure full contact with the ground surface.
- Can be installed by hand; by using a backhoe, bulldozer or grading blade; or by using specialized equipment such as a pneumatic blower or side discharge spreader with a berm attachment.
- Break down unvegetated berms once construction is complete and spread the compost around the site as a soil amendment or mulch.

Inspection and Maintenance

- Inspect after each rainfall to ensure that they are intact and that silt has not filled the area behind the berm.

- Remove accumulated sediments behind the berm when they reach approximately one-third the height of the berm.
- Replace any areas of berm that have eroded.
- Consider increasing the size of the filter berm if the berm has experienced significant washout.
- Inspect the berm for parallel channel formation, which indicates that the berm acts as a flow barrier and needs repositioning.

Installation for all types of sediment barriers:

- Where possible, leave room between the perimeter control BMP and the disturbed area for any equipment that will be used to remove sediment from or otherwise service the BMP.
- Install initial perimeter control BMPs before clearing, grubbing, grading, and other earth-disturbing activities occur.
- Keep perimeter controls in place until all upslope areas are fully stabilized.
- For larger sites and/or those with steeper slopes (greater than 2 percent slopes, greater than 1/2 acre), perimeter controls are placed on the topographic contour, with the ends turned up to prevent bypasses.

Inspection and maintenance for all types of sediment barriers:

- Inspect once per week on active sites, once every two weeks on in-active sites, and within 24 hours following a 0.5 inch rain event.
- Ensure that controls are intercepting all upslope runoff from disturbed areas.
- Check upslope areas to determine if there are opportunities to reduce the volume of runoff being handled by perimeter controls.
- Reduce the amount of sediment in the runoff (i.e., by installing diversions above the disturbed area).
- Immediately stabilize idle bare areas and/or portions of the site that are at final grade.
- Ensure that berms or ditches are stable, flow paths are unobscured, and that the treatment BMP is able to handle inflows appropriately and are functioning properly.

4.4.6 Sediment Trap

A sediment trap consists of a small, temporary ponding area, with a rock weir or perforated riser pipe at the outlet, formed by excavation or by constructing a weir (Image 29). The sediment trap serves drainage areas five acres and smaller. They are a retention structure designed to remove sediment from runoff by holding a volume of water for a length of time, allowing particles 0.02 mm and larger to settle out.

Image 29. Sediment Trap

Applicability

Sediment retention should be used as a last line of defense when included in a ESCP and never used by itself. Combine with Permanent Drainage Facilities:

- If a project includes a permanent stormwater retention/detention pond, the rough-graded or final-graded facility could function as a trap during construction. Design features of the permanent structure, such as surface area, retention time, and outlet control, should meet the design requirements of the temporary facility. Completion of the permanent facility should occur only when all upstream control structures are in place and stabilization of contributing drainage areas is complete.
- If a project includes an infiltration facility, the roughly excavated facility could be used as a trap or basin providing the facility provides the surface area and retention time required by the trap or basin. Excavate the sides and bottom of the facility to a minimum of three feet above final grade with a backhoe working at "arm's length" to minimize disturbance and compaction of the infiltration surface.
- Additionally, any required pretreatment facilities should be fully constructed prior to any release of sediment-laden water to the facility. Pretreatment and shallow excavations are intended to prevent the clogging of soil with fines.

Advantages

- Suitable in almost all locations for stormwater runoff from small drainage areas.
- Requires minimal area to install and is typically easy to install.
- Provides maintenance access points for drainage systems and can decrease maintenance needs for downstream BMPs.
- Allows the water to slow, pool, giving the sediment the chance to settle.
- Retains valuable soil and nutrients on-site, rather than losing them to stormwater runoff.

Disadvantages

- Typically requires frequent maintenance to remove captured sediment to avoid re-suspension and transport of sediment during subsequent runoff events.
- Cannot remove significant amounts of pollutants.
- Limited structure life.

Material – Furnish sediment trap materials meeting the following requirements:

a. Geotextile – Type 2 drainage geotextile meeting the requirements of Section 4.4.4.
b. Aggregate Base – Either 3/4" - 0 or 1" - 0, clean, hard durable aggregates, reasonably well-graded from the maximum size to dust.
c. Aggregate - Material meeting the requirements of Section 4.4.1.

Installation – Install sediment trap per engineered construction plans and according to RD1065.

- Install sediment trap prior to upslope soil disturbance.
- Clear, grub, and strip the area under the embankment of all vegetation and root mat and remove all surface soil containing high amounts of organic matter.
- Stabilize the embankment and all disturbed areas above the sediment pool and downstream from the trap immediately after construction.

Inspection and Maintenance

- Inspect once per week on active sites, once every two weeks on in-active sites, and within 24 hours following a 0.5 inch rain event.

- Remove trash accumulation.
- Remove sediment accumulations once sediment reaches 50 percent capacity.
- Repair and revegetate any erosion damage. Repair settlement, cracking, piping holes, or seepage at embankment.
- Inspect the sediment trap after each rainfall event for damage from erosion and to ensure that the trap is draining properly.

4.4.7 Concrete Washout

A Concrete Washout Containment prevents the discharge of concrete waste pollutants to stormwater by providing on-site washout containment in a designated and contained area.

Never dispose of concrete washout or cutting slurry into the street, storm drains, drainage ditches or streams.

Applicability

After concrete is poured at a construction site, the chutes of ready mixed concrete trucks and hoppers of concrete pump trucks must be washed out to remove the remaining concrete before it hardens. Equipment such as wheelbarrows and hand tools also need to be washed down.
A leak proof concrete washout containment (Image 30) is required on projects where concrete, stucco, mortar, grout, and/or cement are used as construction materials.

Advantages

- Minimizes stormwater contamination which can leach into the ground and contaminate groundwater.
- Requires minimal area to install and is typically easy to install.
- Keeps the site clean and safe during construction.

Image 30. Plastic Sheeting Lined Concrete Washout Basin

Disadvantages

- Miscalculated capacity and installation can compromised the structural integrity of the facility.
- Straw bale and plastic washout pit require regular replacement due to damage.
- For disposal, it requires a vacuum truck or natural evaporation which can be time consuming, labor intensive and costly.
- Solids from the washout are often unable to be recycled due to the mixing of materials from multiples uses.

Material – Furnish concrete washout materials meeting the following requirements:

a. Straw Bales – Material meeting the requirements of Section 4.2.8.
b. Plastic Sheeting – Minimum 10-mil thick polyethylene plastic sheeting.
c. Staples - 1/8-inch diameter steel wire staples. Two inch "U" width with a length of 6 inches minimum.

Installation – Install concrete washout according to RD1070.

- Concrete washout areas shall be installed prior to concrete placement on site.
- Should be located far away from any storm drain or open drainage facility.
- Should be placed in locations that provide convenient access to concrete trucks and near where the concrete is being placed.
- Concrete washout shall be entirely self-contained.
- Place 2” x 2” wood stakes at each end of the straw bales.
- Staple plastic lining to bales with two “U” staples per bale.

Inspection and Maintenance

- Ensure containment area is covered prior rainfall and/or accumulated liquid wastes have been removed prior to use to eliminate overflow and discharge of wastewater onto the site.
- Replace torn or damaged liners and straw bales.
- After the washout has been used and the washwater has evaporated or has been vacuumed off, the remaining hardened solids can be broken up and removed.
- When the washout container is filled to over 75 percent of its capacity, the washwater should be vacuumed off or allowed to evaporate. When the remaining cementitious solids have hardened, they should be removed and recycled.

5 CONSTRUCTION SITE POLLUTION CONTROL MEASURES AND BMPs

Sediment carries a significant load of nutrients and other pollutants that can harm water quality. Virtually all construction sites will affect water quality; however, proper pollution control can minimize these impacts.

Although this manual is not intended to address all aspects of construction site pollution control, some issues overlap with erosion and sediment control and must be taken into account in the overall planning process.

5.1 GENERAL

Allow no pollutant of any kind (e.g., petroleum products or fresh "green" concrete) to come in contact with an active flowing stream or waters of the State and U.S.

Comply with the erosion prevention and sediment control requirements of Section 3 and all applicable DEQ Permit requirements.

Do not cause turbidity to waters of the State and U.S. outside of regulated levels.

5.2 MANGEMENT OF CONSTRUCTION SITE POLLUTANTS

Store construction equipment, materials and debris in a manner that prevents contamination of water and soil (Image 31) and prevents fugitive dust.

Store hazardous substances in the original containers or labeled compatible containers according to State Fire Marshal's regulations, International Fire Code and product SDS.

Locate areas for storing fuels and other potentially hazardous materials at least 150 feet away from any waters of the State and U.S. or storm inlet, unless otherwise approved by the County Engineer.

Do not use treated timbers within any waters of the State and U.S.

Image 31. Spill Prevention Measures

5.2.1 Waste, Hazardous Waste, and Hazardous Substances

Comply with all applicable federal, State, and local Laws as they pertain to the storage, handling, management, transportation, disposal, and documentation of waste, hazardous waste, and hazardous substances.

5.2.1.1 Hazard Communication

Ensure the following documents are readily available on-site to employees, Subcontractors and inspectors:

- Safety Data Sheets (SDS) for all hazardous substances stored or used on-site.
- Written hazard communication program, including employee training documentation.

5.2.1.2 Fuel Storage

Store fuel according to the current edition of the International Fire Code and all applicable federal, State, and local Laws.

5.2.1.3 Waste Management

Prepare a hazardous waste determination for all waste generated on-site to determine whether the waste is classified as hazardous waste, universal waste, excluded waste, waste water, or solid waste.

Segregate all demolition and construction debris according to its intended end use (reuse, recycle, or dispose). If required, store in designated areas in a manner that prevents contamination to soil and water and prevents fugitive dust emissions. All waste materials should be recovered from the site.

Do not reuse demolition material, coated or treated materials, or concrete and masonry materials in waters of the State or U.S.

a. Clean Fill - Clean fill, as defined by OAR 340-093-0030, becomes the property of the Contractor at the place of origin.
b. Reuse, Recycle, Compost and Dispose of Materials - Waste materials become the property of the Contractor at the place of origin. Unless prohibited by Law, treat waste materials according to the following priority:
    - Reuse demolition and construction debris.
    - Recycle demolition and construction debris.
    - Compost or mulch yard waste material from lawn and landscape maintenance.
    - If it is not feasible to reuse, recycle, or compost, ("feasible" is defined as a facility that is capable of handling the material, will take the material and the cost of transportation plus the cost to reuse or recycle the material is equal to or less than the costs of disposal) dispose of waste material according to the following:
        1. Burnable Materials - Obtain and comply with all required permits including DEQ permits and local fire district permits. Do not conduct burning within riparian areas. Conduct burning at locations where existing structures will not be damaged and where smoke will not impact traffic.

           Do not burn the following materials on-site:
            - Rubber products
            - Tires
            - Plastic
            - Wet garbage
            - Petroleum and petroleum treated materials
            - Asphalt or industrial waste
            - Any material that creates dense or noxious odors
            - Painted materials
            - Asbestos, mercury or PCB-containing materials or equipment
            - Hazardous wastes
            - Scrap wiring or electrical equipment
            - Painted or treated wood

5.2.1.4 Unexpected Contamination - If, during construction, unanticipated hazardous substances are discovered that threaten the health and safety of workers, the public, or the environment, do the following:

- Immediately remove all affected employees and secure the area to prevent access.
- Notify the appropriate authorities.

5.2.1.5 Spills and Releases - In the event of a spill or release of a hazardous substance or hazardous waste or the release of many other material that has the potential to harm human health or the environment, do the following:

- Immediately commence response actions to protect human health and the environment.
- If the spill cannot be safely contained and cleaned up with on-site resources, activate then notify a professional spill response professional.
- Conduct cleanup of the released material according to all applicable Laws and DEQ requirements.

5.2.2 Equipment Fueling, Repair and Maintenance

Promptly correct or repair operational procedures, leaks, or equipment problems that may cause pollution at the Site. If soils or other media become contaminated as a result of operational procedures or equipment problems, remove and dispose of them according to applicable Laws and Section 5.1.13.

Locate areas for parking, refueling and servicing mobile equipment and vehicles at least 150 feet away from any waters of the State and U.S. or storm inlet.

For large equipment that is not easily moved, prevent fuel and operating fluids from reaching any waters of the State and U.S. or storm inlet by, at a minimum, using spill containment systems designed to completely contain potential spills during all refueling and equipment repair operations.

5.2.3 Equipment Cleaning and Washouts

Inspect and clean all equipment prior to operating it within 150 feet of any waters of the State and U.S. or storm inlet. Check for fluid leaks and remove all external oil, grease, weed seed, and dirt.

Do not discharge untreated wash and rinse water into any waters of the State and U.S. or storm inlet. Establish wash areas that contain all fluids and debris, at least 150 feet from any waters of the State and U.S. or storm inlet, such that untreated waste water does not impact those systems.

Clean concrete equipment in washout areas that contain all fluids and debris. Recycle washout materials into fresh mixes or dispose of according to applicable permits.

5.2.4 Off Site Tracking

Limit water leakage from trucks carrying saturated soils to less than 1 gallon per hour before allowing them to leave the Site.

Remove all loose dirt and debris from trucks prior to leaving the Project Site.

5.2.5 Other Spill Prevention and Response Measures

Inspect heavy equipment, storage containers, staging areas and other potential sources of hazardous substances daily to identify and prevent potential releases.

If flooding of the Project site is expected to occur within 24 hours, evacuate areas used for staging, access roads, or storage and remove materials, equipment, and fuel.

Immediately contain and repair leaking equipment or containers and clean up any releases according Section 5.1.15.

Maintain hazardous material containment kits and spill containment kits on-site to facilitate the cleanup of hazardous material spills on dry land and/or waters of the State and U.S.

5.3 POLLUTION CONTROL BMPs

Prevent, control, and abate pollution of the environment.

This section describes specific BMPs for common construction activities that may pollute stormwater. The BMPs listed are not an exhaustive list, nor will every BMP be appropriate for every situation. Therefore, suggested BMPs that are inappropriate may be deleted and additional BMPs for specific site conditions should be added. In addition, the selection and implementation of BMPs should be reviewed on a regular basis to match the changing conditions at construction sites.

The BMPs identified in the following sections were adapted from the 1996 ODOT Pollution Control Plan Contractor Packet. These BMPs give information for prevention and control of pollution which can result from construction activities.

5.3.1 Dewatering Operations

Prevent or reduce the discharge of pollutants to stormwater from dewatering operations with use of sediment controls. Dispose of the water in an approved manner without damage to adjacent property.

Approach

There are two general classes of pollutants that may result from dewatering operation:

1) Sediment; and
2) Toxics and Petroleum Products.

A high sediment content in dewatering discharges is common because of the nature of the operation. On the other hand, toxics and petroleum products are not commonly found in dewatering discharges unless the site or surrounding area has been used for light or heavy industrial activities or the area has a history of groundwater contamination. Applying the following procedures will help reduce stormwater pollution from dewatering discharges:

a. Sediment
   - Use a sediment trap or a sediment basin to remove sediment from water generated by dewatering.
   - Use filtration to remove sediment from a sediment trap or sediment basin. Filtration can be achieved with:
     - A sump pit with a perforated or slit standpipe (Image 32) wrapped in filter fabric. Surround the standpipe with stones to help filter the water as it collects in the pit before being pumped out. An increased suction inlet area will help avoid clogging and unacceptable pump operation.
     - Floating suction hose allowing cleaner surface water to be pumped out.

Image 32. Pipe and Perforated Pipe

b. Toxics and Petroleum Products
   - In areas suspected of having groundwater pollution, check with the Linn County Health Department for dewatering requirements.

Design and operate dewatering systems to prevent removal of the natural soils and so that the groundwater level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property.

Inspection and Maintenance

- Maintain sediment controls and filters in good working order.
- Inspect excavated areas daily for signs of contaminated water as evidenced by discoloration, oily sheen, or odors.

Limitations

The presence of contaminated water may indicate contaminated soil as well.

5.3.2 Paving Operations

Prevent or reduce the discharge of pollutants resulting from paving operations by using measures to prevent run-on and runoff pollution, properly disposing of wastes, and training employees and subcontractors.

Approach

The following are paving operation measures to help protect stormwater:

- Avoid paving during wet weather.
- Store materials 150 feet away from drainage courses to prevent stormwater run-on.
- Protect drainage courses, particularly in areas with a grade, by employing BMP's to divert runoff or trap/filter sediment.
- Leaks and spills from paving equipment can contain toxic levels of heavy metals, oil and grease. Place drip pans or absorbent/adsorbent materials to collect leaks and spills. Refer to Sections 5.3.6 and 5.3.14
- Cover catch basins and manholes when applying seal coat, tack coat, slurry seal, fog seal, etc..
- Shovel or vacuum saw-cut slurry and remove from site. Cover or barricade storm drains during saw-cutting to contain slurry.
- If paving involves Portland cement concrete, see Section 5.3.10.
- If paving involves asphalt concrete:
    - Prevent sand or gravel placed over new asphalt from washing into storm drains, streets, or creeks by sweeping. Properly dispose of this waste by referring to Section 5.3.7.
    - Old asphalt must be disposed of properly. Collect and remove all broken asphalt from the site and recycle whenever possible.
    - Paving involving an on-site mixing plant may need to meet stormwater permitting requirements for industrial activities.
    - Train employees and subcontractors.

Inspection and Maintenance

- Inspect employee and subcontractor activities to insure that measures are being followed.
- Keep ample supplies of drip pans or absorbent/adsorbent materials on-site.

Limitations

There are no major limitations to this best management practice.

5.3.3 Structure Construction and Storage

Prevent or reduce the discharge of pollutants to stormwater resulting from structure construction and painting by:

1) Enclosing (containment),
2) Covering or burying building material storage areas,
3) Using good housekeeping practices,
4) Using safer alternative products, and
5) Training employees and subcontractors.

Approach

- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep the area.
- Use soil erosion control techniques if bare ground is exposed.
- Buy recycled or less hazardous products to the maximum extent practicable.
- Conduct painting operations consistent with local air quality and OSHA regulations.
- Properly store paints and solvents. See Section 5.3.4.
- Properly store and dispose of waste materials generated from the construction activity. See Sections 5.3.7 through 5.3.11.
- Recycle residual paints, solvents, lumber, and other materials to the maximum extent practicable.
- Make sure that nearby storm drains are well marked to minimize the chance of inadvertent disposal of residual paints and other liquids.
- Clean the storm drain system in the immediate construction area after construction is completed.
- Educate employees who are doing the work.
- Inform subcontractors of policies on these matters to make certain proper housekeeping and disposal practices are implemented.

Inspection and Maintenance

Inspection and maintenance should be minimal.

Limitations

- Safer alternative products may not be available, suitable, or effective in every case.
- Hazardous waste that cannot be re-used or recycled must be disposed of by a licensed hazardous waste hauler.
- Construction and painting activities can generate pollutants that can reach stormwater if proper care is not taken. The source of these contaminants may be solvents, paints, paint and varnish removers, finishing residues, spent thinners, soap cleansers, kerosene, asphalt and concrete materials, adhesive residues, and old asbestos insulation. Actions to maintain stormwater quality should be consistent with air quality regulations. For specific information on some of these wastes see the following BMP sections.
    - 5.3.7 Solid Waste Management,
    - 5.3.8 Hazardous Waste Management, and
    - 5.3.10 Concrete Waste Management

More specific information on structure construction:

a. Erosion and Sediment Control - If the work involves exposing large areas of soil or if old buildings are being torn down and not replaced in the near future, employ the appropriate soil erosion and control techniques. Refer to Section 4.
b. Storm/Sanitary Sewer Connections - Carefully install all drainage systems. Cross connections between the sanitary and storm drain systems as well as any other connections into the drainage system are illegal. Color coding or flagging pipelines on the project site can help prevent such connections.
c. Painting - Air pollution regulations specify painting requirements which, if met, are usually sufficient to protect stormwater quality. These regulations may require that painting operations be properly enclosed or covered to avoid drift. Temporary scaffolding helps when hanging drop cloths or draperies to prevent drift. Application equipment that minimizes overspray also helps. When using sealants on wood, pavement, roofs, etc, quickly clean up spills. Remove excess liquid with absorbent/adsorbent material or rags.

   If painting requires scraping or sand blasting of the existing surface, use a drop cloth to collect most of the chips. Properly dispose of the residue. If the paint contains lead or tributyl-tin, hazardous waste disposal is probably required. Refer to the waste management BMP's in Section 5.3 for more information.

   Mix paint indoors, in a container area or in a flat unpaved area not subject to significant erosion. Do so even during dry weather because cleanup of a spill will never be 100% effective. If using water based paints, clean the application equipment in a sink that is connected to the sanitary sewer or in a containment area where the dried paint can be readily removed. Properly store leftover paints or dispose of properly.
d. Roof Work - When working on roofs, either sweep accumulated particles out of the gutter or wash the gutter and trap the particles at the outlet of the downspout. A sock or geotextile placed over the outlet may effectively trap the materials. If the downspout is lined tight, place a temporary plug at the first convenient point in the storm drain, pump out the water with a vactor truck and clean the catch basin sump where you placed the plug.

5.3.4 Material Delivery and Storage

Prevent or reduce the discharge of pollutants to stormwater from material delivery and storage by:

1) Minimizing the storage of hazardous materials on-site,
2) Storing materials in a designated area,
3) Installing secondary containment,
4) Conducting regular inspections, and
5) Training employees and subcontractors.

This best management practice covers only material delivery and storage. For other information on materials, see Sections 5.3.5 or 5.3.6. For information on wastes, see Sections 5.3.7, 5.3.8, 5.3.10 and 5.3.11.

Approach

- Keep an accurate, up-to-date inventory of materials delivered and stored on-site.
- Keep your inventory down.

- Storage of reactive, ignitable, or flammable liquids must comply with the fire codes of your area. The Safety Data Sheet (SDS) or the local Fire Marshall will help determine specific requirements.
- Minimize hazardous materials stored on-site.
- Handle hazardous materials as infrequently as possible.
- During the rainy season, consider storing materials in a covered area. Store materials in secondary containments such as an earthen dike, horse trough, or even a children's wading pool for non-reactive materials such as detergents, oil, grease, and paints. Small amounts of material may be secondarily contained in "bus boy" trays or concrete mixing trays.
- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and when possible, in secondary containment.
- If drums must be kept uncovered, store them at a slight angle to reduce ponding of rainwater on the lids and to reduce corrosion.
- Try to keep chemicals in their original containers, and keep them well labeled.
- Train employees and subcontractors.
- Employees trained in emergency spill cleanup procedures should be present when dangerous materials or liquid chemicals are unloaded.
- If significant residual materials remain on the ground after construction is complete, properly remove materials and any contaminated soil (See 5.3.9).

The following materials are commonly stored on construction sites:

- Soil;
- Pesticides and herbicides;
- Fertilizers;
- Detergents;
- Plaster or other products;
- Petroleum products such as fuel, oil, and grease; and
- Other hazardous chemicals such as acids, lime, glues, paints, solvents, and curing compounds.

Storage of these materials on-site can pose the following risks:

- Stormwater pollution;
- Injury to workers or visitors;
- Groundwater pollution; and
- Soil contamination.

The following steps should minimize the risk of pollution:

- Designate areas of the construction site for material delivery and storage.
- Place materials near the construction entrances, away from waterways.
- Avoid transport near drainage paths or waterways.
- Surround with earth berms.
- Place in an area which will be paved.

<u>Inspection and Maintenance</u>

- Keep the designated storage area clean and well organized.
- Conduct routine weekly inspections and check for external corrosion of material containers.
- Keep an ample supply of spill cleanup materials near the storage area.

Limitations
Storage sheds often must meet building and fire code requirements.

5.3.5 Material Use

Prevent or reduce the discharge of pollutants to stormwater by using alternative products, minimizing hazardous material use on-site, and training employees and subcontractors.

Approach
The following materials are commonly used on construction sites:

- Pesticides and herbicides;
- Fertilizers;
- Detergents;
- Plaster and other products;
- Petroleum products such as fuel, oil, and grease; and
- Other hazardous chemicals such as acids, lime, glues, paints, solvents, and curing compounds.

Use of these materials on-site can pose the following risks:

- Stormwater pollution;
- Injury to workers or visitors;
- Groundwater pollution; and
- Soil contamination.

Taking the following steps should minimize the risk of pollution:

- Use less hazardous, alternative materials as much as possible.
- Minimize use of hazardous materials on-site.
- Use materials only where and when needed to complete the construction activity.
- Follow manufacturer's instructions regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals.
- Personnel who use pesticides should be trained in their use.
- Do not over-apply fertilizers, herbicides, or pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried off-site by runoff. Do not apply these chemicals just before it rains.
- Train employees and subcontractors in proper material use

Inspection and Maintenance
Inspection and maintenance of this best management practice is minimal.

Limitations
Alternate materials may not be available, suitable, or effective in every case.

5.3.6 Spill Prevention and Control

Prevent or reduce the discharge of pollutants to stormwater from leaks and spills by:

1) Reducing the chance for spills,
2) Stopping the source of spills,
3) Containing and cleaning up spills,

4) Properly disposing of spill materials, and
5) Training employees.

This best management practice covers only spill prevention and control. However, Sections 5.3.4 and 5.3.5, also contain useful information, particularly on spill prevention. For information on wastes, see Sections 5.3.7, 5.3.8, 5.3.10 and 5.3.11.

Approach

Make sure that each employee knows what a "significant spill" is for each material they use and what is the appropriate response for "significant" and "insignificant" spills.

The following steps will help reduce the stormwater impacts of leaks and spills:

a. General Measures
   - Hazardous materials and wastes should be stored in covered containers and protected from vandalism.
   - Place a stockpile of spill cleanup materials where it will be readily accessible (Image 33).
   - Train employees in spill prevention and cleanup.
   - Designate responsible individuals.

Image 33. Spill Kit

b. Cleanup
   - Clean up leaks and spills immediately.
   - On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent/adsorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to either a certified laundry (rags) or disposed of as hazardous waste.
   - Never hose down or bury dry material spills. Clean up as much of the material as possible and dispose of properly. For information on wastes, see Sections 5.3.7, 5.3.8, 5.3.10 and 5.3.11.

c. Reporting
   - Report significant spills to the appropriate authority.
   - Federal regulations require that any significant oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 1- 800-424-8802 within 24 hours.
   - Use the following measures related to specific activities:
     1. Vehicle and Equipment Maintenance
        - If maintenance must occur on-site, use a designated area and/or a secondary containment, located away from drainage courses, to prevent the run-on of stormwater and the runoff of spills.
        - Regularly inspect on-site vehicles and equipment for leaks, and repair immediately.
        - Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment on-site.
        - Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.

- Place drip pans or absorbent/adsorbent materials under paving equipment when not in use.
- Use absorbent/adsorbent materials on small spills rather than hosing down or burying the spill. Remove the absorbent/adsorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- Oil filters disposed of in trash cans or dumpsters can leak oil and pollute stormwater. Place the oil filter in a funnel over a waste-oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask you oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it were cracked and put it into the containment area until you are sure it is not leaking.

2. Vehicle and Equipment Fueling
    - If fueling must occur on-site, use designated areas, located away from drainage courses, to prevent the run-on of stormwater and the runoff of spills.
    - Discourage "topping-off" of fuel tanks.
    - Always use secondary containment, such as a drain pan, when fueling to catch spills/leaks.

Inspection and Maintenance

- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil or water can be quite expensive.
- Keep ample supplies of spill control and cleanup materials on-site, near storage, unloading, and maintenance areas.
- Update your spill prevention and control plan and stock cleanup materials as changes occur in the types of chemicals on-site

Limitations

A private spill cleanup company may be necessary.

5.3.7 Solid Waste Management

Prevent or reduce the discharge of pollutants to stormwater from solid or construction waste by:

1) Providing designated waste collection areas and containers,
2) Arranging for regular disposal, and
3) Training employees and subcontractors.

Approach

Solid waste is one of the major pollutants resulting for construction activities. Construction debris includes:

- Solid waste generated from trees and shrubs removed during land clearing, demolition of existing structures (rubble), and building construction;
- Packaging materials including wood, paper and plastic;

- Scrap or surplus building materials including scrap metals, rubber, plastic, glass and masonry products; and
- Domestic wastes including food containers such as beverage cans, coffee cups, paper bags, plastic wrappers and cigarettes.

The following steps will help keep a clean site and reduce stormwater pollution:

1) Select designated waste collection areas on-site.
2) Inform trash hauling contractors that you will accept only water-tight dumpsters for on-site use. Inspect dumpsters for leaks and repair any dumpster that is not water tight.
3) Locate containers in a covered area and/or in a secondary containment.
4) Provide an adequate number of containers with lids or covers that can be placed over the container to keep rain out or to prevent loss of wastes when it's windy.
5) Plan for additional containers and more frequent pickup during the demolition phase of construction.
6) Collect site trash daily, especially during rainy and windy conditions.
7) Erosion and sediment control devices tend to collect litter. Remove this solid waste promptly.
8) Make sure that toxic liquid waste (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
9) Salvage or recycle any useful material. For example, trees and shrubs from land clearing can be used as a brush barrier or converted into wood chips.
10) Do not hose out dumpsters on the construction site. Leave dumpster cleaning to trash hauling contractor
11) Arrange for regular waste collection to prevent containers overflowing.
12) If a container does spill, clean up immediately.
13) Make sure that construction waste is collected, removed, and disposed of only at authorized disposal areas.
14) Train employees and subcontractors in proper solid waste management.

<u>Inspection and Maintenance</u>

- Collect site trash daily.
- Inspect construction waste area regularly.
- Arrange for regular waste collection.

5.3.8 Hazardous Waste Management

Prevent or reduce the discharge of pollutants to stormwater from hazardous waste through

1) Proper material use,
2) Waste disposal, and
3) Training of employees and subcontractors.

<u>Approach</u>

Many chemicals used on-site can be hazardous materials which become hazardous waste upon disposal. These wastes may include:

- Paints and solvents;
- Petroleum products such as oils, fuels, and grease;
- Herbicides and pesticides;

- Acids for cleaning masonry; and
- Concrete curing compounds.

In addition, sites with existing structures may contain wastes which must be disposed of in accordance with Federal State, and local regulations. These wastes include;

- Sandblasting grit mixed with lead-, cadmium-, or chromium-based paints;
- Asbestos; and
- PCB's (particularly in older transformers).

The following steps will help reduce stormwater pollution from hazardous wastes;

a. Material Use
   1) Use all of the product before disposing of the container.
   2) Retain the original product label; it contains important safety and disposal information.
   3) Do not over-apply herbicides and pesticides. Prepare only the amount needed and follow the recommended usage instructions. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried off-site by runoff. Do not apply these chemicals just before it rains.
   4) "Paint out" brushes as much as possible. Rinse water-based paints to the sanitary sewer. Filter and re-use thinners and solvents. Dispose of excess oil-based paints and sludge as hazardous waste. Do not clean out brushes or rinse paint containers into the dirt, street, gutter, storm drain, or stream.

b. Waste Recycling/Disposal
   1) Select designated hazardous waste collection areas on-site.
   2) Hazardous materials and wastes should be stored in covered containers and protected from vandalism.
   3) Place hazardous waste containers in secondary containment.
   4) Separate wastes. Mixing wastes can cause chemical reactions, make recycling impossible and complicate disposal.
   5) Recycle any useful material such as used oil or water based paint.
   6) Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
   7) Arrange for regular waste collection before containers overflow.
   8) Make sure that hazardous waste (e.g. excess oil-based paint and sludge) is collected, removed, and disposed of in accordance with local, state and Federal requirements.

c. Training
   - Train employees and subcontractors in proper hazardous waste management.
   - Warning signs should be placed as needed in areas recently treated with chemicals.
   - Place a stockpile of spill cleanup materials where it will be readily accessible.
   - If a container does spill, clean up immediately.

Inspection and Maintenance

- Inspect hazardous waste receptacles and area regularly.
- Arrange for regular hazardous waste collection.

Limitations

Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.

5.3.9 Contaminated Soil Management

Prevent or reduce the discharge of pollutants to stormwater from contaminated soil and highly acidic or alkaline soils by inspecting excavations regularly and remediating contaminated soil promptly.

Approach

Contaminated soils may occur on your site for several reasons including:

- Past site uses and activities;
- Detected or undetected spills and leaks; and
    1) Acid or alkaline solutions from exposed soil or rock formations high in acid or alkaline-forming elements.

Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil can be quite expensive. The following steps will help reduce stormwater pollution from contaminated soil:

- Look for contaminated soil as evidenced by discoloration, odors, differences in soil properties, abandoned underground tanks or pipes, or buried debris.
- Prevent leaks and spills to the maximum extent practicable

Inspection and Maintenance

- Inspect excavated areas for signs of contaminated soil.
- Implement Section 5.3.6 Spill Prevention and Control to prevent leaks and spills as much as possible.

Limitations

- Contaminated soils that cannot be treated on-site may require transport, treatment and disposal by a licensed hazardous waste handlers.
- The presence of contaminated soil may indicate contaminated water as well. See Section 5.3.1 for more information

5.3.10 Concrete Waste Management

Prevent or reduce the discharge of pollutants to stormwater from concrete waste by:

1) Conducting off-site washout,
2) Performing on-site washout in a designated area (Image 34), and
3) Training employees and subcontractors.

Image 34. Designated Concrete Washout Area

Approach

The following steps will help reduce stormwater pollution from concrete wastes:

1) Store dry and wet materials under cover, away from drainage areas.
2) Avoid mixing excess amounts of fresh concrete or cement on-site.

3) Perform washout of concrete trucks off site or in designated areas only.
4) Do not wash out concrete trucks into storm drains, open ditches, streets, or streams.
5) Do not allow excess concrete to be dumped on-site, except in designated areas.

For on-site washout:

1) Locate washout area at least 50 feet from storm drains, open ditches, or water bodies. Do not allow runoff from this area by constructing a temporary pit or bermed area large enough for liquid and solid waste.
2) Wash waste into the temporary pit where the concrete can set, be broken up, and then disposed of properly.
3) When washing concrete to remove fine particles and expose the aggregate, avoid creating runoff by draining the water to a bermed or level area.
4) Do not wash sweepings from exposed aggregate concrete into the street or storm system. Collect and return sweepings to aggregate base stock pile or dispose in the trash.
5) Train employees and subcontractors in proper concrete waste management.

Inspection and Maintenance

- Inspect subcontractors to ensure that concrete wastes are being properly managed.
- If using a temporary pit, dispose of hardened concrete on a regular basis

Limitations

- Off-site washout of concrete wastes may not always be possible.

5.3.11 Sanitary/Septic Waste Management

Prevent or reduce the discharge of pollutants to stormwater from sanitary/septic waste by providing convenient, well-maintained facilities, and arranging for regular service and disposal.

Approach

Sanitary or septic wastes should be treated or disposed of in accordance with State and local requirements. These requirements may include:

- Locate sanitary facilities in a convenient location.
- Untreated raw wastewater should never be discharged or buried.
- Temporary septic systems should treat waste to appropriate levels before discharging.
- An on-site disposal system (OSDS), must comply with local health agency requirements. Temporary sanitary facilities that discharge to the sanitary sewer system should be properly connected to avoid illicit discharges.
- If discharging to the sanitary sewer, contact the local waste water treatment plant for their requirements.
- Sanitary/septic facilities should be maintained in good working order by a licensed service.

Inspection and Maintenance

- Inspect facilities regularly.
- Arrange for regular waste collection.

Limitations

There are no major limitations to this best management practice.

5.3.12 Vehicle and Equipment Cleaning

Prevent or reduce the discharge of pollutants to stormwater from vehicle and equipment cleaning by:

1) Using off-site facilities,
2) Washing in designated, contained areas only,
3) Eliminating discharges to the storm drain by infiltrating or recycling the wash water, and
4) Training employees and subcontractors.

Approach

- Use off-site commercial washing businesses as much as possible. Washing vehicles and equipment outdoors or in areas where wash water flows onto paved surfaces or into drainage pathways can pollute stormwater. If you wash a large number of vehicles or pieces of equipment, consider conducting this work at on off-site commercial business which is better equipped to handle and dispose of the wash waters properly.
- If washing must occur on site, use designated, bermed wash areas to prevent wash water contact with stormwater, creeks, rivers, and other water bodies. The wash area can be sloped for wash water collection and subsequent infiltration into the ground.
- Use as little water as possible to avoid having to install erosion and sediment controls for the wash area.
- Use phosphate-free, biodegradable soaps.
- Do not permit steam cleaning on-site. Steam cleaning can generate significant pollutant concentrations.
- Educate employees and subcontractors on pollution prevention measures.

Inspection and Maintenance

Minimal; some berm repair may be necessary.

Limitations

- Even phosphate-free, biodegradable soaps have been shown to be toxic to fish before the soap degrades.
- Sending vehicles/equipment off-site should be done in conjunction with an aggregate construction entrance.

5.3.13 Vehicle and Equipment Fueling

Prevent fuel spills and leaks and reduce their impacts to stormwater by:

1) Using off-site facilities,
2) Fueling in designated areas only,
3) Enclosing or covering stored fuel,
4) Implementing spill controls, and
5) Training employees and subcontractors.

Approach

- Use off-site fueling stations as much as possible. Fueling vehicles and equipment outdoors or in areas where fuel may spill/leak onto paved surfaces or into drainage pathways can pollute stormwater. If you fuel a large number of vehicles or pieces of equipment, consider using an off-site fueling station. These businesses are better equipped to handle fuel and spills properly.

- If fueling must occur on-site, use designated areas located away from drainage courses to prevent the run-on of stormwater and the runoff of spills.
- Discourage "topping-off" tanks.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills/leaks.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Use absorbent/adsorbent materials on small spills rather than hosing-down or burying the spill. Remove the absorbent/adsorbent materials promptly and dispose of properly.
- Carry out all Federal and State requirements regarding stationary above ground storage tanks.
- Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas.
- Train employees and subcontractors in proper fueling and cleanup procedures

Inspection and Maintenance

- Keep ample supplies of spill cleanup materials on-site.
- Inspect fueling areas and storage tanks on a regular schedule.

Limitations

Sending vehicles/equipment off-site should be done in conjunction with an aggregate construction entrance.

5.3.14 Vehicle and Equipment Maintenance

Prevent or reduce the discharge of pollutants to stormwater from vehicle and equipment maintenance by running a "dry site". This involves:

1) Using off-site facilities,
2) Performing work in designated areas only,
3) Providing cover for materials stored outside,
4) Checking for leaks and spills,
5) Containing and cleaning up spills immediately, and
6) Training employees and subcontractors.

Approach

- Keep vehicles and equipment clean. Prevent excessive build-up of oil and grease.
- Maintaining vehicles and equipment outdoors or in areas where vehicle or equipment fluids may spill or leak onto the ground can pollute stormwater. If you maintain a large number of vehicles or pieces of equipment, consider using an off-site repair shop which is better equipped to handle vehicle fluids and spills properly.
- If maintenance must occur on-site, use designated areas located away from drainage courses to prevent the run-on of stormwater and the runoff of spills.
    - Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
    - Place a stockpile of spill cleanup materials where it will be readily accessible.
    - Use absorbent/adsorbent materials on small spills rather than hosing down or burying the spill. Remove the absorbent/adsorbent materials promptly and dispose of properly.
- Regularly inspect on-site vehicles and equipment for leaks and repair immediately.

- Check incoming vehicles and equipment (including delivery trucks and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment on site.
- Segregate and recycle wastes such as, greases, used oil or oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic, and transmission fluids.
- Train employees and subcontractors in proper maintenance and spill cleanup procedures.

Inspection and Maintenance

- Keep ample supplies of spill cleanup materials on-site.
- Inspect maintenance areas on a regular schedule.

Limitations

- Sending vehicles/equipment off-site should be done in conjunction with an aggregate construction entrance.
- Outdoor vehicle or equipment maintenance is a potentially significant source of stormwater pollution. Activities that can contaminate stormwater include engine repair and service, changing or replacing fluids and outdoor storage and parking of equipment and vehicles. For further information on vehicle or equipment servicing see Sections 5.3.12 and 5.3.13.

The following information may apply if you must perform vehicle or equipment maintenance on-site:

a. Waste Reduction
   - Parts are often cleaned using solvents such as trichloroethylene or methylene chloride. Many parts cleaners are harmful and must be disposed of as a hazardous waste. Reducing the number of solvents makes recycling easier and reduces hazardous waste management costs. Often, one solvent can perform a job as well as two different solvents. Also, if possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous materials. For example, replace chlorinated organic solvents (1,1,1-trichloroethane, methylene chloride, etc.) with non-chlorinated solvents such as kerosene or mineral spirits which are less toxic and less expensive to dispose of properly.

b. Recycling/Disposal
   - Separating hazardous and non-hazardous wastes makes recycling easier and may reduce disposal costs.
   - Store used oil, used chlorinated solvents (like 1,1,1-trichloroethane) and used non-chlorinated solvents (like kerosene and mineral spirits) separately.
   - Promptly transfer used fluids to the proper waste or recycling drums.
   - Placing the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal helps prevent oil leaking into stormwater. Oil filters can also be recycled.
   - Dispose of extra paints and coatings by allowing coatings to dry or harden before disposal into covered dumpsters.
   - Store cracked batteries in a non-leaking secondary container. If you drop a battery, place it in the containment area until you are sure it is not leaking.
   - Do not bury used tires.

5.3.15 Employee/Subcontractor Training

Employee/subcontractor training, like maintenance of a piece of equipment, is not so much a best management practice as it is a method by which to implement Best Management Practices.

Objectives

Employee/subcontractor training should be based on four objectives:

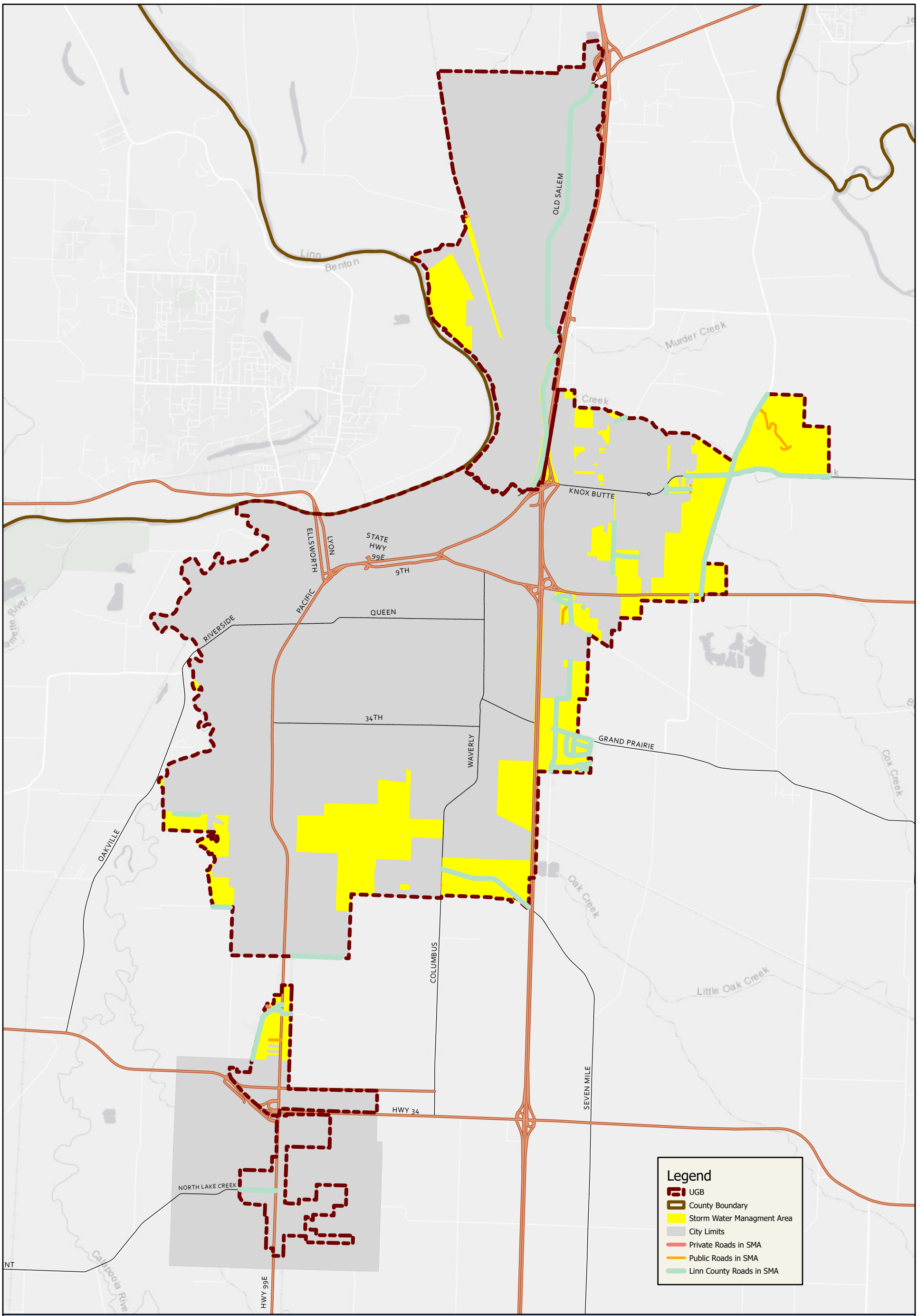
- Promote a clear identification and understanding of the problem, including activities with the potential to pollute stormwater.
- Identify solutions (BMP's);
- Promote employee/subcontractor ownership of the problem and the solutions; and
- Integrate employee/subcontractor feedback into training and BMP implementation.

Approach

- Integrate training regarding stormwater quality management with existing training programs that may be required by other regulations the Hazardous Waste Operations and Emergency Response standard (29CFR 1910.120), the Spill Prevention Control and Countermeasure Plan (40CFR 112).
- Train employee/subcontractors in standard operating procedures and spill cleanup techniques. Employee/subcontractors trained in spill containment and cleanup should be present during the loading/unloading and handling of materials.
- Personnel who use pesticides should be trained in their use.
- Educating off-site contractors and subcontractors supports the efforts of well-trained employees.

APPENDIX A

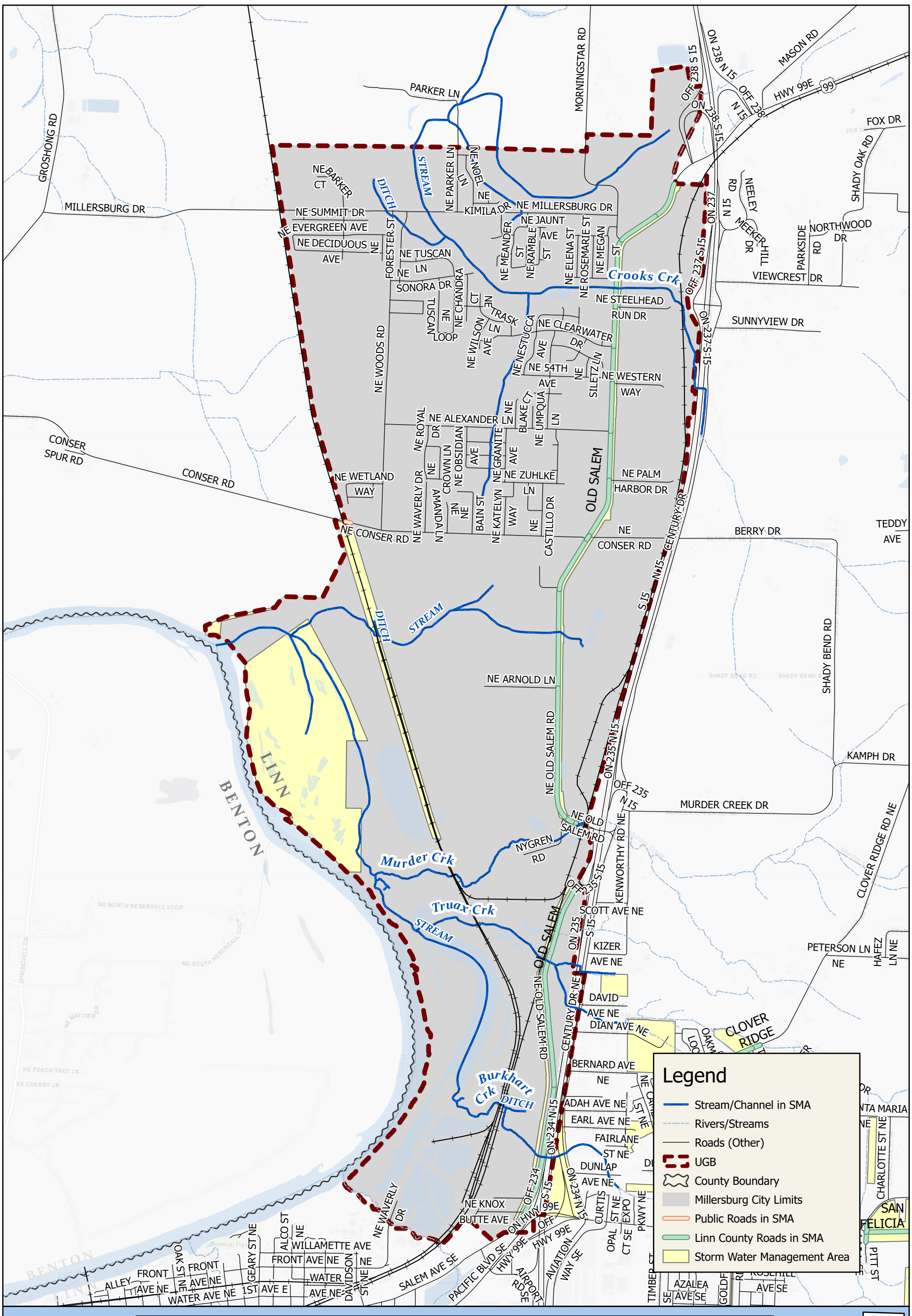
MS4 STORMWATER MANAGEMENT AREA MAPS



Linn County Stormwater Management Area

Map by Linn County GIS Department
Printed on July 20, 2023

Linn County Storm Water Management Area
Millersburg



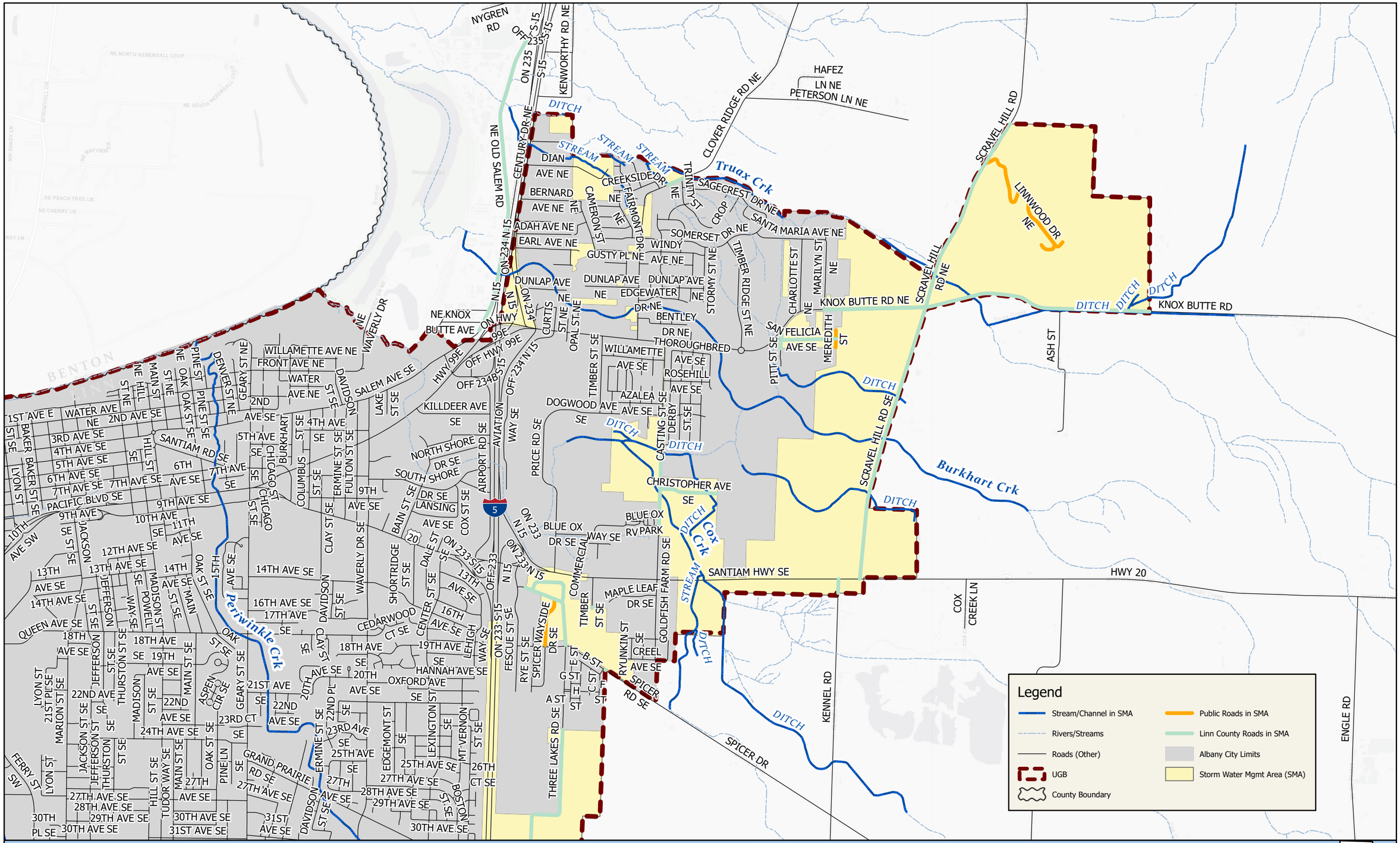
Legend

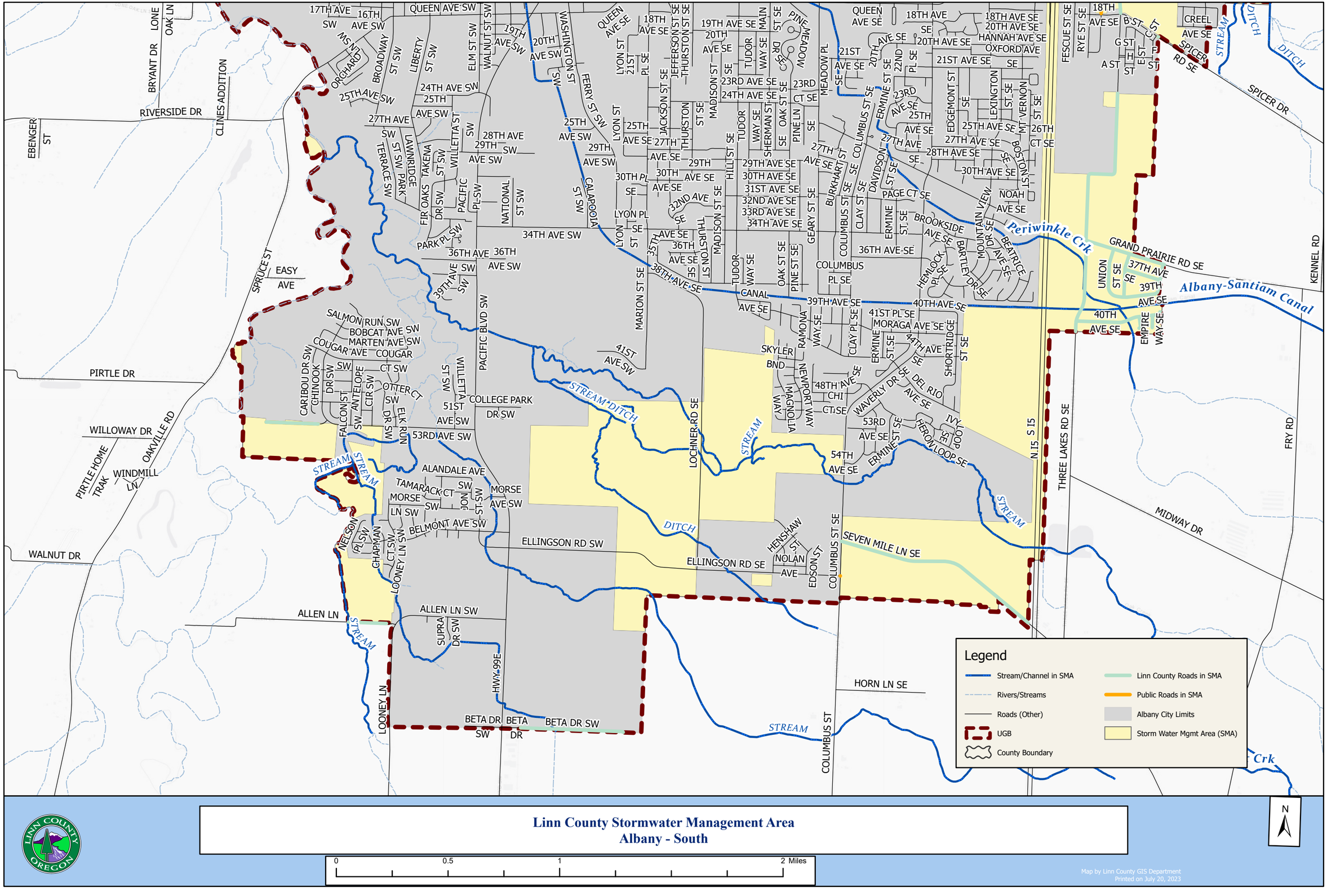
- Stream/Channel in SMA
- Rivers/Streams
- Roads (Other)
- UGB
- County Boundary
- Millersburg City Limits
- Public Roads in SMA
- Linn County Roads in SMA
- Storm Water Management Area

N

0 0.38 0.75 1.5 Miles

Map by Linn County GIS Department
Printed on July 20, 2023


Truax Crk
Burkhart Crk
Cox Crk
Periwinkle Crk
STREAM
DITCH
NE OLD SALEM RD
CENTURY DR NE
CLOVER RIDGE RD NE
SCRAVEL HILL RD
SCRAVEL HILL RD NE
SCRAVEL HILL RD SE
KNOX BUTTE RD NE
KNOX BUTTE RD
NE KNOX BUTTE AVE
SANTIAM RD SE
SANTIAM HWY SE
HWY 20
SPICER DR
KENNEL RD
ENGLE RD
COX CREEK LN
ASH ST
Legend
Stream/Channel in SMA
Rivers/Streams
Roads (Other)
UGB
County Boundary
Public Roads in SMA
Linn County Roads in SMA
Albany City Limits
Storm Water Mgmt Area (SMA)
Linn County Storm Water Management Area
Albany - North
0
0.5
1
2 Miles
N
Map by Linn County GIS Department
Printed on July 20, 2023


17TH AVE SW
16TH AVE SW
QUEEN AVE SW
BRYANT DR
LONE OAK LN
RIVERSIDE DR
EBENGER ST
CLINES ADDITION
ORCHARD ST SW
BROADWAY ST SW
LIBERTY ST SW
ELM ST SW
WALNUT ST SW
19TH AVE SW
20TH AVE SW
WASHINGTON ST SW
FERRY ST SW
25TH AVE SW
24TH AVE SW
25TH AVE SW
27TH AVE SW
TERRACE ST SW
LAWNRIDGE PARK SW
TAKENA ST SW
WILLETTA ST SW
28TH AVE SW
29TH AVE SW
FIR OAKS DR SW
PACIFIC PL SW
NATIONAL ST SW
CALAPOOIA ST SW
30TH PL SW
34TH AVE SW
PARK PL SW
36TH AVE SW
36TH AVE SW
39TH AVE SW
SPRUCE ST
EASY AVE
SALMON RUN SW
BOBCAT AVE SW
MARTEN AVE SW
COUGAR AVE
COUGAR CT SW
CARIBOU DR SW
CHINOOK DR SW
ANTELOPE CIR SW
OTTER CT SW
FALCON ST SW
ELK RUN DR SW
WILLETTA ST SW
PACIFIC BLVD SW
COLLEGE PARK DR SW
51ST AVE SW
53RD AVE SW
PIRTLE DR
WILLOWAY DR
OAKVILLE RD
PIRTLE HOME TRAK
WINDMILL LN
STREAM
STREAM
ALANDALE AVE
TAMARACK CT SW
MORSE AVE SW
MORSE LN SW
BELMONT AVE SW
NELSON PL SW
CHAPMAN CT SW
LOONEY LN SW
ELLINGSON RD SW
WALNUT DR
ALLEN LN
ALLEN LN SW
SUPRA DR SW
HWY-99E
LOONEY LN
BETA DR SW
BETA DR
BETA DR SW
STREAM
STREAM DITCH
41ST AVE SW
MARION ST SE
LYON ST SE
LYON PL SE
30TH PL SE
29TH AVE SW
25TH AVE SW
25TH AVE SE
27TH AVE SE
29TH AVE SE
30TH AVE SE
31ST AVE SE
32ND AVE SE
33RD AVE SE
34TH AVE SE
35TH AVE SE
36TH AVE SE
38TH AVE SE
39TH AVE SE
40TH AVE SE
CANAL AVE SE
LOCHNER RD SE
STREAM
DITCH
STREAM
QUEEN AVE SE
18TH AVE SE
19TH AVE SE
20TH AVE SE
21ST AVE SE
23RD AVE SE
24TH AVE SE
LYON ST
21ST PL SE
JEFFERSON ST SE
THURSTON ST SE
MADISON ST SE
JACKSON ST SE
HURSTON ST SE
TUDOR WAY SE
MAIN ST
PINE MEADOW DR
MEADOW PL SE
23RD CT SE
OAK ST SE
PINE LN SE
HILL ST SE
SHERMAN ST SE
GEARY ST SE
PINE ST SE
TUDOR WAY SE
MADISON ST SE
THURSTON ST SE
BURKHART ST SE
COLUMBUS ST SE
CLAY ST SE
COLUMBUS PL SE
QUEEN AVE SE
18TH AVE SE
20TH AVE SE
21ST AVE SE
22ND PL SE
23RD AVE SE
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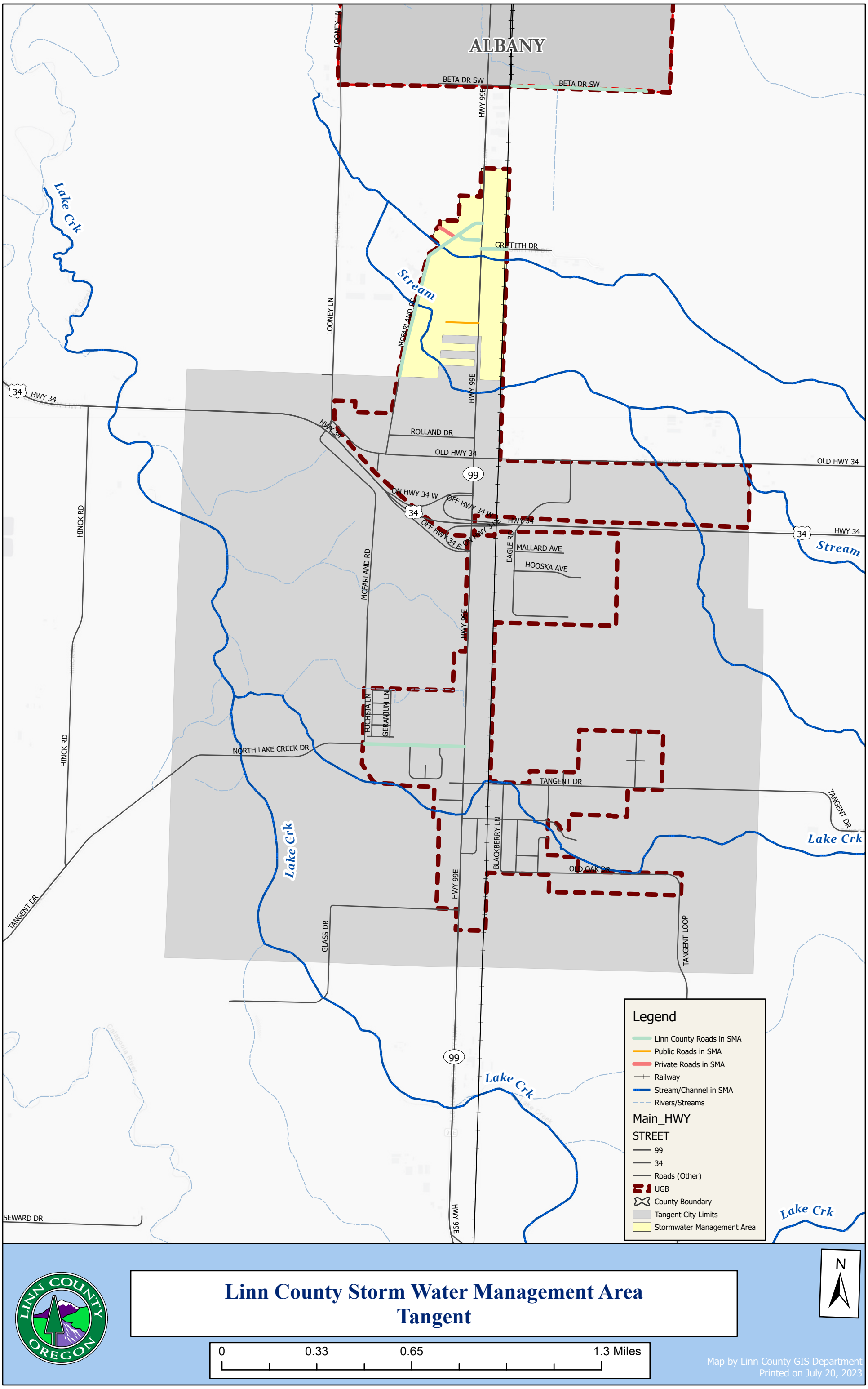
DAVIDSON ST SE
PAGE CT SE
BROOKSIDE AVE SE
HEMLOCK PL SE
BARTLEY DR SE
MOUNTAIN VIEW DR SE
BEATRICE AVE SE
NOAH AVE SE
EDGEMONT ST SE
LEXINGTON ST SE
MT VERNON ST SE
BOSTON ST SE
26TH CT SE
HANNAH AVE SE
OXFORD AVE SE
18TH AVE SE
20TH AVE SE
21ST AVE SE
23RD AVE SE
25TH AVE SE
27TH AVE SE
28TH AVE SE
30TH AVE SE
41ST PL SE
MORAGA AVE SE
44TH AVE SE
SHORTRIDGE ST SE
SKYLER BND
RAMONA WAY SE
CLAY PL SE
ERMINE ST SE
48TH AVE SE
CHI CT SE
NEWPORT WAY
MAGNOLIA WAY
WAVERLY DR SE
DEL RIO AVE SE
53RD AVE SE
54TH AVE SE
ERMINE ST SE
HERON LOOP SE
HERON LOOP SE
FESCUE ST SE
RYE ST SE
18TH AVE SE
B ST SE
C ST SE
G ST SE
A ST SE
E ST SE
CREEL AVE SE
SPICER RD SE
STREAM
DITCH
DITCH
SPICER DR
Periwinkle Crk
GRAND PRAIRIE RD SE
Albany-Santiam Canal
KENNEL RD
UNION ST SE
37TH AVE SE
39TH AVE SE
40TH AVE SE
EMPIRE WAY SE
S I5
N I5
THREE LAKES RD SE
FRY RD
MIDWAY DR
SEVEN MILE LN SE
ELLINGSON RD SE
AVE
HENSHAW ST
NOLAN ST
EDSON ST
COLUMBUS ST SE
DITCH
STREAM
HORN LN SE
COLUMBUS ST
STREAM
Crk
Legend
Stream/Channel in SMA
Rivers/Streams
Roads (Other)
UGB
County Boundary
Linn County Roads in SMA
Public Roads in SMA
Albany City Limits
Storm Water Mgmt Area (SMA)
Linn County Stormwater Management Area
Albany - South
0
0.5
1
2 Miles
N
Map by Linn County GIS Department
Printed on July 20, 2023


ALBANY
BETA DR SW
BETA DR SW
LOONEY LN
HWY 99E
Lake Crk
GRIFFITH DR
Stream
LOONEY LN
MCFARLAND RD
HWY 99E
34
HWY 34
ROLLAND DR
OLD HWY 34
OLD HWY 34
99
ON HWY 34 W
OFF HWY 34 W
34
OFF HWY 34 E
ON HWY 34 E
HWY 34
34
HWY 34
Stream
EAGLE RD
MALLARD AVE
HOOSKA AVE
HINCK RD
MCFARLAND RD
HWY 99E
FUCHSIA LN
GERANIUM LN
HINCK RD
NORTH LAKE CREEK DR
TANGENT DR
TANGENT DR
Lake Crk
BLACKBERRY LN
OLD OAK DR
HWY 99E
TANGENT DR
GLASS DR
TANGENT LOOP
99
Lake Crk
Lake Crk
SEWARD DR
HWY 99E
Legend
Linn County Roads in SMA
Public Roads in SMA
Private Roads in SMA
Railway
Stream/Channel in SMA
Rivers/Streams
Main_HWY
STREET
99
34
Roads (Other)
UGB
County Boundary
Tangent City Limits
Stormwater Management Area
N
Linn County Storm Water Management Area
Tangent
0
0.33
0.65
1.3 Miles
Map by Linn County GIS Department
Printed on July 20, 2023

APPENDIX B

EROSION AND SEDIMENT CONTROL DESIGNER CHECKLIST

EROSION AND SEDIMENT CONTROL PLAN

DESIGNER'S CHECKLIST

The ESCP design is expected to prevent erosion, control sedimentation and prevent sediment laden water (or other pollutants) form leaving the project site.

Designers shall provide BMP's for anticipated disturbances during all phases of construction and for final stabilization of construction sites. Items such as schedule of work, storage and stockpile areas, haul routes and wet season work plan are determined by contractor and will be provided in the Project's working ESCP. Verify that the following are provided:

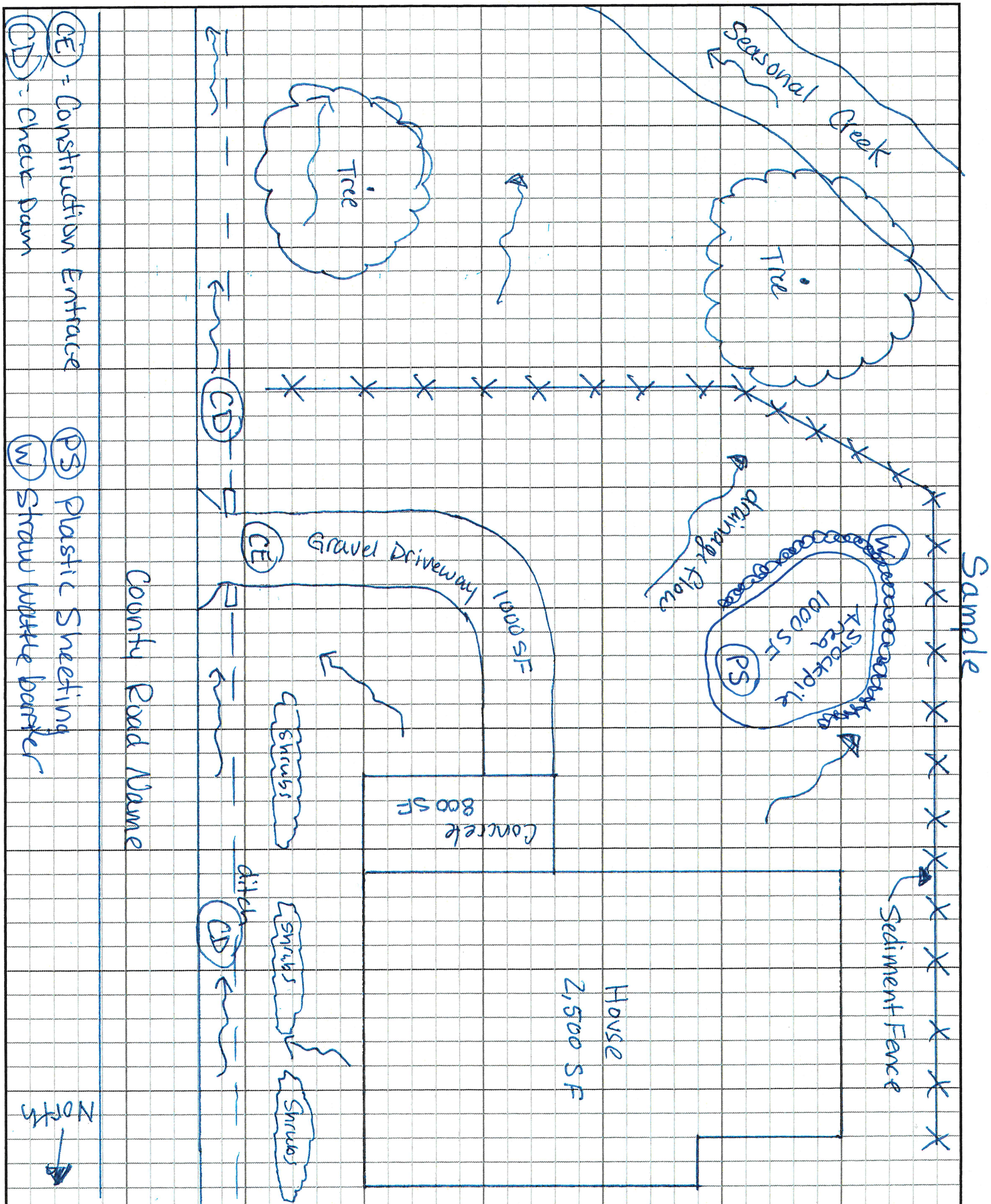
SITE DESCRIPTION		
Yes	**No/NA**	**Project Narrative Items**
☐	☐	Nature of construction activities
☐	☐	Timetable for major activities
☐	☐	Total area (acres) of site of permitted work
☐	☐	Area (acres) that will undergo clearing and/or earthwork
☐	☐	Nature of in-situ soils, especially erosion potential of soils
☐	☐	Fill material and erosion potential of that material
☐	☐	Names of receiving waters from site stormwater runoff

SITE MAP (PLAN SHEETS)		
Yes	**No/NA**	**Plan Sheet Items**
☐	☐	Show area of total development, including property lines and existing roadways and roadway features
☐	☐	Drainage patterns (show with slope arrows)
☐	☐	Show area of total soil disturbance (cut and fill lines, detour routes, staging areas, etc.)
☐	☐	Location of all erosion and sediment control BMP's
☐	☐	Location of all impervious surfaces (roads, buildings, other pavement, etc.)
☐	☐	Springs, wetlands & other surface waters located on site
☐	☐	100-year flood elevation, if applicable
☐	☐	Location of storm drainage outfalls to receiving waters, if applicable
☐	☐	Erosion control notes
☐	☐	Location of drinking water wells & underground injection controls
☐	☐	Details of erosion and sediment controls (ODOT Standard Drawings or engineered details)
☐	☐	Details of detention ponds, storm drain piping, inflow and outflow details
☐	☐	Stabilized construction entrance
☐	☐	Stabilized staging/parking area location
☐	☐	Stockpile locations
☐	☐	Show areas receiving vegetation stabilization

REQUIRED DESIGN FEATURES		
Yes	**No/NA**	**Required Measures**
☐	☐	Sediment barrier perimeter control BMP (downslope barrier preventing sediment from leaving project site)
☐	☐	Other sediment control BMP's (to capture sediment on slopes and to contain/filter sediment from turbid water
☐	☐	Erosion prevention BMP's not relying on vegetation (matting, compost, mulch, plastic sheeting, etc.)
☐	☐	Runoff control BMP's (divert water from off-site, check velocity of flowing water, reinforce ditches/channels
☐	☐	Pollution control/prevention (concrete truck washout, etc.)
☐	☐	Emergency materials (anticipate and prepare for the worst case events)

APPENDIX C

EROSION AND SEDIMENT CONTROL PLAN TEMPLATE



PROJECT ADDRESS: 123 Dirt Rd, Rain, OR

CONTRACTOR/OWNER: ABC Contractor

DATE: 8/1/23

EROSION CONTROL SITE PLAN

PERMIT NO: 23-E00

PROJECT ADDRESS: _____

CONTRACTOR/OWNER: _____ DATE: _____

EROSION CONTROL SITE PLAN

PERMIT NO: _____

APPENDIX D

EROSION AND SEDIMENT CONTROL INSPECTION FORM

SAMPLE

EROSION AND SEDIMENT CONTROL INSPECTION FORM

PROJECT LOCATION (Site Address)	PROJECT LOCATION (Township, Range, Section, Tax Lot)	PERMIT NUMBER(S)
123 S. 10th St, Rain OR	01S, 01W, 88, TL 444	23-000

CONTRACTOR/SUBCONTRACTOR NAME	ADDRESS	PHONE
ABC Contractor	Business Address	555-867-5309

1. Identify the Erosion Control Measures from the ESCP:

EROSION CONTROL MEASURES	DATE INSTALLED	FUNCTIONING AS DESIGNED?	DESCRIBE WHAT IS NOT FUNCTIONING	LOCATION OF DEFICIENCY	CORRECTIVE ACTION	DATE CORRECTIVE ACTION COMPLETE	IS THERE VISIBLE OR MEASURABLE SEDIMENT?	HAS SEDIMENT ENTERED A BODY OF WATER?	DATE MEASURE REMOVED
sediment fence	1/5/23	Y	N/A	N/A	N/A	N/A	Y	N	
plastic sheeting	1/6/23	N	tear in plastic	top NE side	replaced plastic	1/22/23	N	N	2/22/23

DESCRIBE ANY EROSION CONTROL MEASURES NOT LISTED ABOVE

2. Add or Attach Any Additional Information as Needed:

ADDITIONAL INFORMATION MAY BE INCLUDED IN THIS FIELD or ATTACHED TO THIS REPORT

3. Weekly Rainfall Amounts:

RAINFALL REPORTING STATION	MONITORING PERIOD								
rain gauge on fence post or on-line weather report site	2/6 to 2/12	☒ ACTIVE	24-HOUR RAINFALL AMOUNT:	0.01	0.00	0.14	0.06	0.02	0.11	0.04
		☐ INACTIVE	ENDING DATES:	2/6/23	2/7/23	2/8/23	2/9/23	2/10/23	2/11/23	2/12/23

4. Signature:

PRINTED NAME	SIGNATURE	DATE	PHONE
Inspector's Name	Inspector's Name	Date of Inspection	Inspector's Phone

Minimum Monitoring Requirements: Inspect all erosion control facilities at least every 7 calendar days on active sites and two weeks on inactive sites. Inspect daily during stormwater or snowmelt runoff and within 24 hours after more than 0.5 inch of rain per 24-hour period. See Linn County Erosion and Sediment Control Manual for additional information.

EROSION AND SEDIMENT CONTROL INSPECTION FORM

PROJECT LOCATION (Site Address)	PROJECT LOCATION (Township, Range, Section, Tax Lot)	PERMIT NUMBER(S)

CONTRACTOR/SUBCONTRACTOR NAME	ADDRESS	PHONE

1. Identify the Erosion Control Measures from the ESCP:

EROSION CONTROL MEASURES	DATE INSTALLED	FUNCTIONING AS DESIGNED?	DESCRIBE WHAT IS NOT FUNCTIONING	LOCATION OF DEFICIENCY	CORRECTIVE ACTION	DATE CORRECTIVE ACTION COMPLETE	IS THERE VISIBLE OR MEASURABLE SEDIMENT?	HAS SEDIMENT ENTERED A BODY OF WATER?	DATE MEASURE REMOVED
DESCRIBE ANY EROSION CONTROL MEASURES NOT LISTED ABOVE									

2. Add or Attach Any Additional Information as Needed:

ADDITIONAL INFORMATION MAY BE INCLUDED IN THIS FIELD or ATTACHED TO THIS REPORT

3. Weekly Rainfall Amounts:

RAINFALL REPORTING STATION	MONITORING PERIOD	☐ ACTIVE	24-HOUR RAINFALL AMOUNT:							
		☐ INACTIVE	ENDING DATES:							

4. Signature:

PRINTED NAME	SIGNATURE	DATE	PHONE

Minimum Monitoring Requirements: Inspect all erosion control facilities at least every 7 calendar days on active sites and two weeks on inactive sites. Inspect daily during stormwater or snowmelt runoff and within 24 hours after more than 0.5 inch of rain per 24-hour period. See Linn County Erosion and Sediment Control Manual for additional information.

APPENDIX E

BEST MANAGEMNET PRACTICES FOR CONSTRUCTION SITE FLYER

BEST MANAGEMENT PRACTICES (BMP's) FOR CONSTRUCTION SITES

The best way to keep sediments out of the waterway is to have a plan and materials in place to prevent erosion before it can travel offsite.

Planning

An effective plan for runoff management on construction sites will control erosion, retain sediments on site, to the extent practicable, and reduce the adverse effects of runoff.

-Schedule projects so clearing and grading are done during the time of minimum erosion potential (dry season).

Stage construction. Avoid area-wide clearance of construction sites. Plan and stage land disturbance activities so that only the area currently under construction is exposed.

-Clear only areas essential for construction – all other areas should remain undisturbed.

Locate potential nonpoint pollutant sources *away from steep slopes, waterbodies, and critical areas.* Material stockpiles, borrow areas, access roads, and other land-disturbing activities can often be located away from critical areas such as steep slopes, highly erodible soils, and areas that drain directly into sensitive waterbodies.

-Route construction traffic over areas that must be disturbed for other construction activity. This practice will reduce the area that is cleared and susceptible to erosion.

-Protect natural vegetation

Erosion Control

Erosion controls are used to reduce the amount of sediment that is detached during construction and to prevent sediment from entering runoff.

-Stockpile topsoil and reapply to revegetate site. After a site is cleared, the topsoil is typically removed. Since topsoil is essential to establish new vegetation, it should be stockpiled and then reapplied to the site for revegetation, if appropriate.

-Cover or stabilize topsoil stockpiles. Small stockpiles can be covered with a tarp to prevent erosion. Large stockpiles should be stabilized by erosion blankets, seeding, and/or mulching.

-Intercept runoff above disturbed slopes and convey it to a permanent channel or storm drain. Earth dikes, perimeter dikes or swales, or diversions can be used to intercept and convey runoff above disturbed areas.

-On long or steep, disturbed, or man-made slopes- construct benches, terraces, or ditches at regular intervals to intercept runoff.

-Use check dams across a swale, channel or ditch.

-Seeding and mulching. Seeding establishes a vegetative cover on disturbed areas and the mulch protects the disturbed area while the vegetation becomes established.

Sediment Control

Sediment controls capture sediment that is transported in runoff. Filtration and detention (gravitational settling) are the main processes used to remove sediment from runoff.

-Sediment/silt Basins and Sediment Traps are impoundment structures that allow sediment to settle out of the runoff.

-Silt Fence Sediment is filtered out as runoff flows through the fabric.

-Straw Bale Barrier straw bales can be effectively used as temporary check dams in channels.

-Inlet Protection a barrier placed around a storm drain inlet, which traps sediment before it enters the storm sewer system.

-Construction Entrance located where traffic leaves a construction site. As vehicles drive over the gravel, mud, and sediment are collected from the vehicles' wheels and offsite transport of sediment is reduced.

Continued

BEST MANAGEMENT PRACTICES (BMP's) FOR CONSTRUCTION SITES

Pollution Control

Practices such as trash disposal, recycling, proper material handling, and spill prevention and cleanup measures can reduce the potential for stormwater flow to mobilize construction site wastes and contaminate surface or ground water.

Pollutants commonly associated with construction sites:

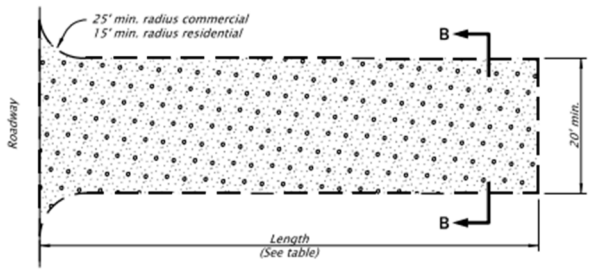
- ***Solid and sanitary wastes*** – Properly collect and treat any wastewater that you produce.
- ***Oil and grease*** - Inspect construction vehicles daily and repair any leaks immediately.
- ***Disposing of*** - all used oil, antifreeze, solvents and other automotive-related chemicals and materials (e.g., oily rags) according to manufacturer instructions.
- ***Concrete truck washout*** - Washout only in designated areas that are lined to contain the wastes and protect soil. Wet saw cutting Use storm drain protection when working near storm drains and sloped areas.
  - ◊ Use absorbent gels to contain the liquid waste;
  - ◊ Scoop up waste and dispose of properly; and
  - ◊ Small vacuums and vac-trucks can be used.
- ***Storing chemicals*** – Store construction chemicals off the bare ground and away from vehicular traffic and drainage pathways. Leave chemicals in original, labeled containers and keep Safety Data Sheets on-site
- ***Construction debris*** - Designate a waste collection area on-site that does not receive a substantial amount of stormwater
- ***Containers*** - Ensure that all containers have lids to cover them when it rains
- ***Prohibit the Discharge of***:
  - ◊ Wastewater from concrete washout, stucco, paint, release oils, or other wastewater materials;
  - ◊ Fuels, oils, or other pollutants used for vehicles; and
  - ◊ Soaps or solvents to wash vehicles and equipment.

For more information:
Linn County Road Department
Stormwater Management Program
Office: 3010 Ferry St SW, Albany, OR 97322
Phone: 541-967-3919
Online materials: https://www.linncountyor.gov/roads

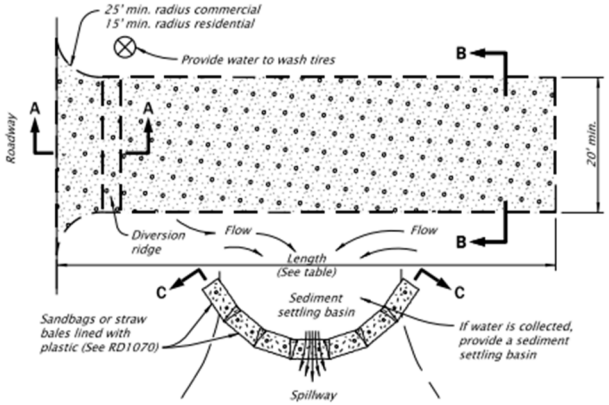
APPENDIX F

ODOT STANDARD DRAWINGS AND DETAILS

RD1000



CONSTRUCTION ENTRANCE - TYPE 1
NOT TO SCALE



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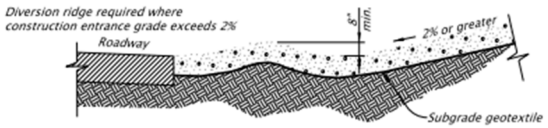
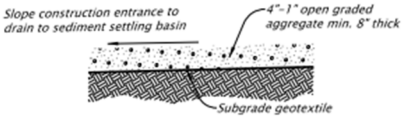
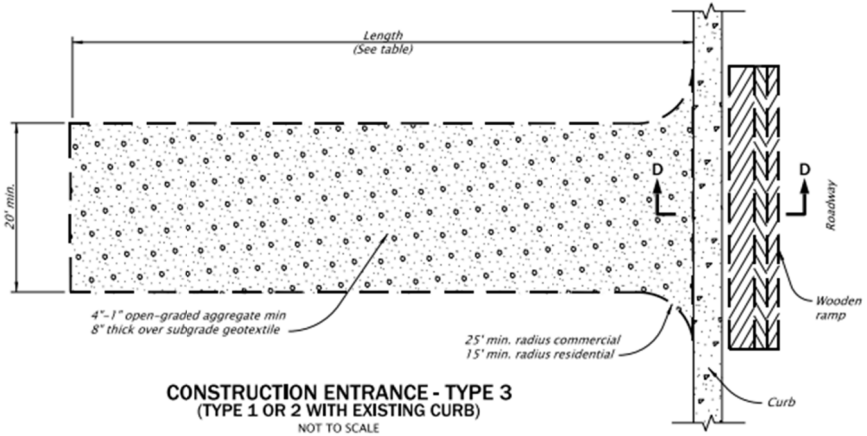


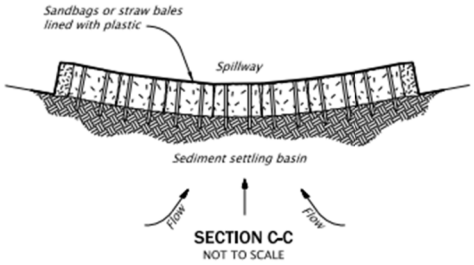
SECTION A-A
NOT TO SCALE



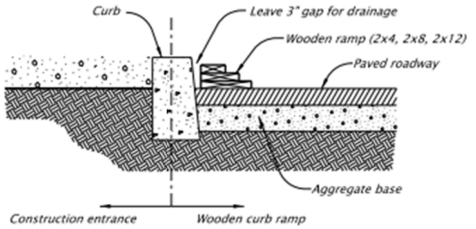
SECTION B-B
NOT TO SCALE



CONSTRUCTION ENTRANCE - TYPE 3
(TYPE 1 OR 2 WITH EXISTING CURB)
NOT TO SCALE



SECTION C-C
NOT TO SCALE



WOODEN CURB RAMP SECTION D-D
NOT TO SCALE

NOTES:
1. *The Type 1 entrance is a simple entrance without a diversion ridge or settling basin.*
2. *The wooden ramp may be used on either Type 1 or Type 2 entrances in situations where there is curb and the curb is not removed for the construction entrance.*

CONSTRUCTION ENTRANCE TABLE MINIMUM LENGTH	
Length (FT)	*Area Of Exposed Soil (Acre)*
20	*0.25*
50	*0.25 < A < 1.0*
100	*A > 1.0*

CALC. BOOK NO. N/A

SDR DATE January, 2021

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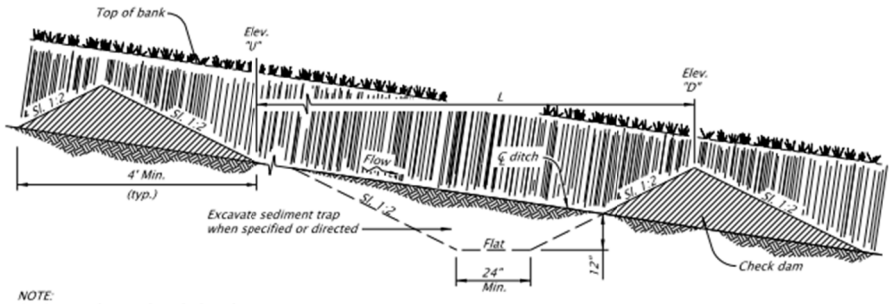
OREGON STANDARD DRAWINGS

CONSTRUCTION ENTRANCES

2021

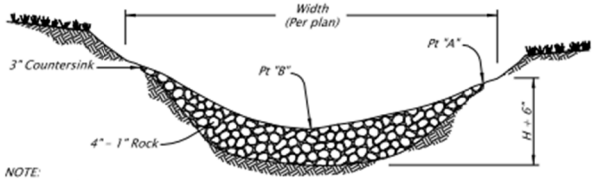
DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers

RD1005



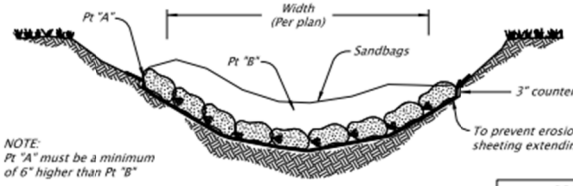
NOTE:
L = Spacing along swale or ditch so that Elevation "U" equals Elevation "D".

TYPICAL PROFILE SECTION CHECK DAMS (SHOWN WITH AGGREGATE)
NOT TO SCALE



NOTE:
Pt "A" must be a minimum of 6" higher than Pt "B"

AGGREGATE CHECK DAM - TYPE 1
NOT TO SCALE



NOTE:
Pt "A" must be a minimum of 6" higher than Pt "B"

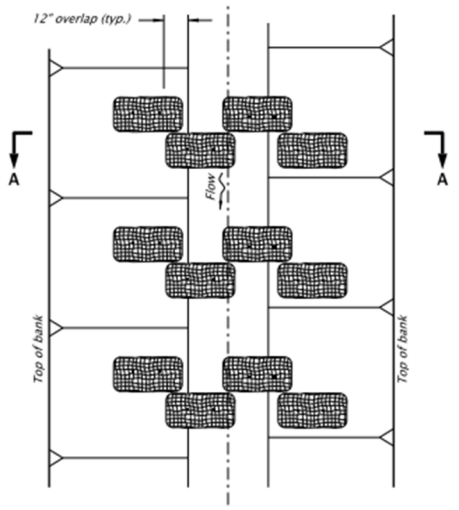
SANDBAG CHECK DAM - TYPE 4
NOT TO SCALE

MAXIMUM CHECK DAM SPACING "L"

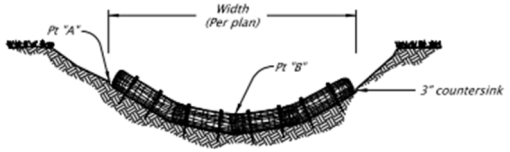
Ditch Grade	H=8"	H=12"	H=18"	H=24"
10%	* *	* *	15'	20'
9%	* *	* *	16'	22'
8%	* *	* *	18'	25'
7%	* *	* *	21'	28'
6%	* *	16'	25'	33'
5%	* *	20'	30'	40'
4%	16'	25'	37'	50'
3%	22'	33'	50'	66'
2%	33'	50'	75'	100'

* * Not allowed H = Min. dam height

NOTES:
1. Type 3 - stake biofilter bags with two 2"x2"x18" (minimum) wood stakes per bag. Drive stakes a minimum of 6" into the ground and flush with the top of the bags. Omit stakes if placed over paved surfaces. Overlap bags 12" minimum at each joint.
2. Type 4 - Tightly abut or overlap ends of sandbags at each joint.
3. Spacing between check dams for all check dam types shall comply with the typical profile section shown above.



PLAN



SECTION A-A

BIOFILTER BAG CHECK DAM - TYPE 3
NOT TO SCALE

CALC. BOOK NO. N/A

SDR DATE January, 2021

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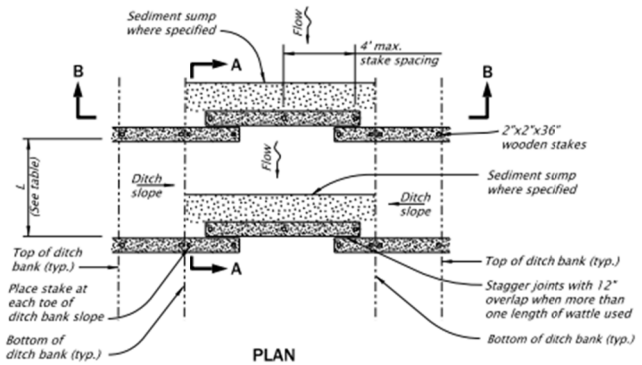
OREGON STANDARD DRAWINGS

CHECK DAMS TYPE 1, 3 AND 4

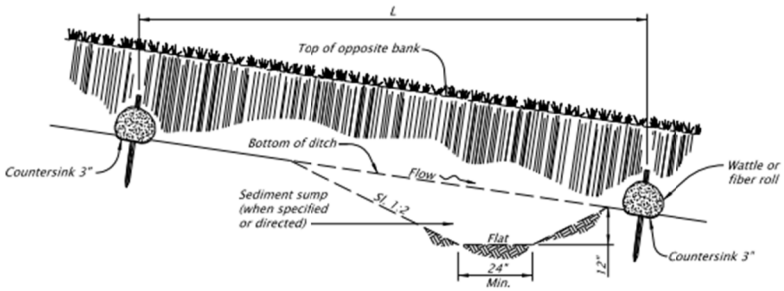
2021

DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers

RD1006



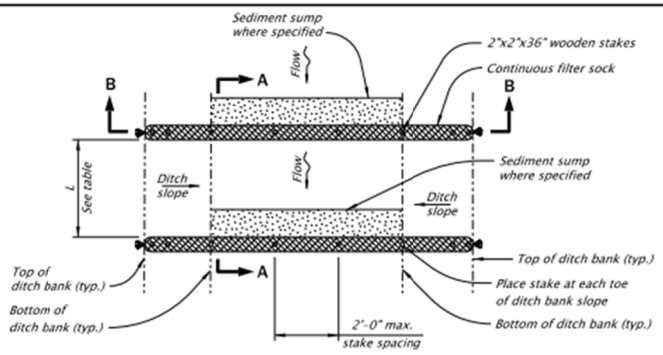
PLAN



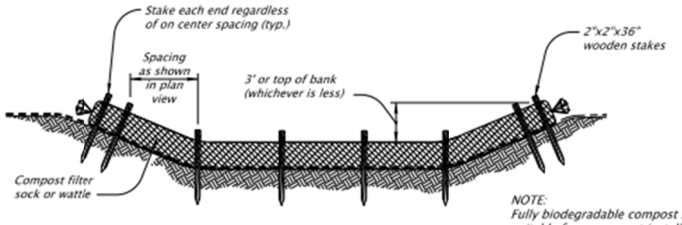
SECTION A-A

WATTLE / FIBER ROLL CHECK DAM - TYPE 2

NOT TO SCALE



PLAN

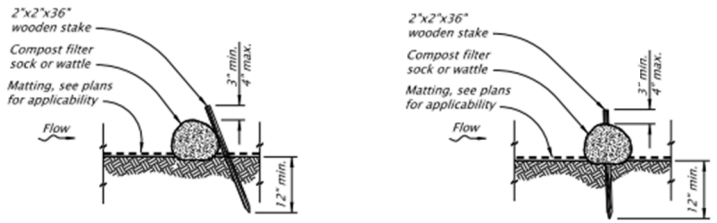


SECTION B-B

NOTE:
Fully biodegradable compost socks are suitable for permanent installation only. Product becomes too fragile to be moved or removed intact.

COMPOST FILTER SOCK CHECK DAM - TYPE 6

NOT TO SCALE



FIBER ROLL AND COMPOST SOCK STAKING ALTERNATIVES

NOT TO SCALE

MAXIMUM CHECK DAM SPACING "L"

Ditch Grade	H=8"	H=12"	H=18"	H=24"
10%	* *	* *	15'	20'
9%	* *	* *	16'	22'
8%	* *	* *	18'	25'
7%	* *	* *	21'	28'
6%	* *	16'	25'	33'
5%	* *	20'	30'	40'
4%	16'	25'	37'	50'
3%	22'	33'	50'	66'
2%	33'	50'	75'	100'

* * Not allowed H = Min. dam height

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CALC. BOOK NO. N/A

SDR DATE January, 2021

NOTE: All material and workmanship shall be in accordance with the current Oregon Standard Specifications

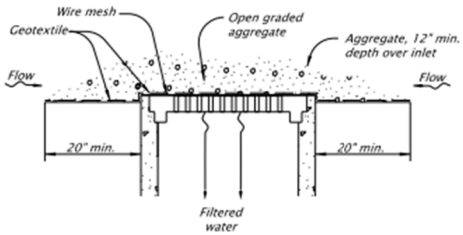
OREGON STANDARD DRAWINGS

CHECK DAMS TYPE 2 AND 6

2021

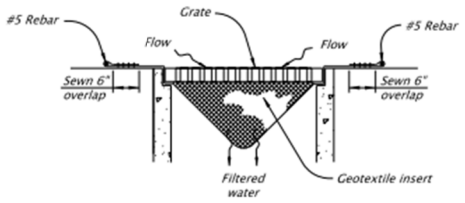
DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers

RD1010



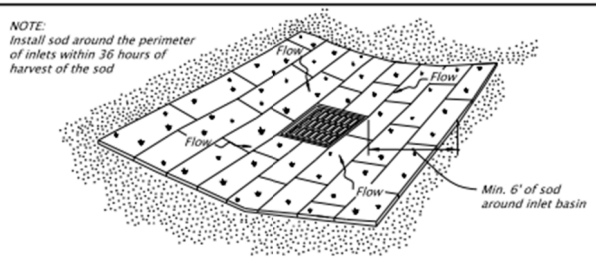
GEOTEXTILE/WIRE MESH/AGGREGATE - TYPE 2

NOT TO SCALE



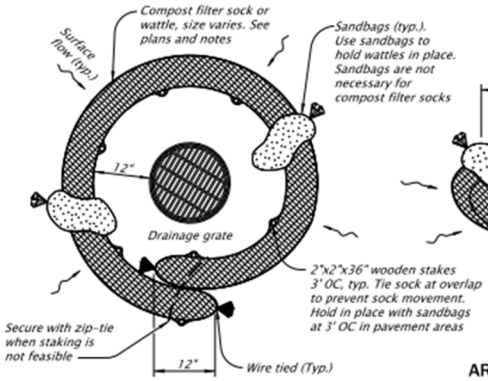
PREFABRICATED FILTER INSERT - TYPE 3

NOT TO SCALE

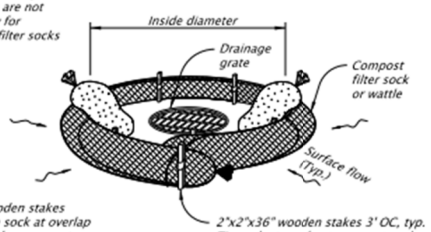


SOD PROTECTION - TYPE 6

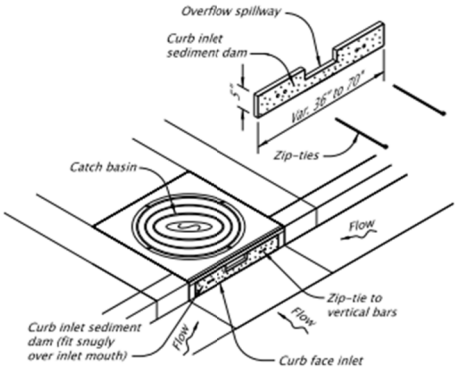
NOT TO SCALE



AREA DRAIN PLAN

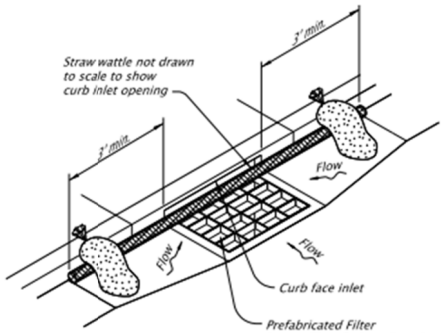


AREA DRAIN PERSPECTIVE VIEW



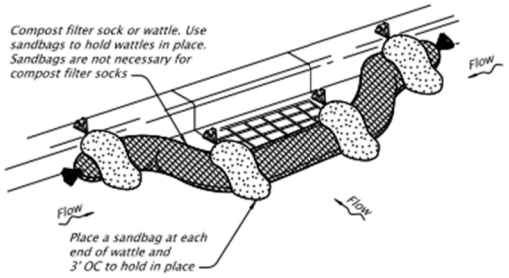
CURB INLET SEDIMENT DAM - TYPE 10

NOT TO SCALE



WATTLE BARRIER WITH FILTER INSERT - TYPE 11

NOT TO SCALE



CURB INLET PERSPECTIVE VIEW

COMPOST FILTER SOCK OR WATTLE - TYPE 7

NOT TO SCALE

NOTES:
Type 2 – Geotextile/wire mesh/aggregate
Place the wire mesh over the grate.
Place sediment fence geotextile over the wire mesh and perimeter area around structure.
Install aggregate over the geotextile fabric.

Type 3 – Prefabricated filter inserts
Install prefabricated filter inserts according to the plans, special provisions, and manufacturer recommendations.
Prefabricated inserts with provisions for overflow are allowed only when accompanied by additional BMP's to prevent the potential of sediments entering project storm systems.
Field fabricated inserts are not allowed.

Type 7 – Compost filter sock
Drive 2"x2" wood stakes a minimum of 6" into ground and flush with the top of the sock.
Overlap ends of sock per manufacturers recommendations (12"min., 36" max.).
Use 8" to 12" dia sock on curbside in traffic areas.

(Type 7 cont.)
Use 12" to 18" dia sock in non-traffic areas or areas where the larger socks can be used safely.
use synthetic mesh socks for temporary installations.

Type 10 – Curb inlet sediment dam
Fit curb inlet sediment dam snugly into inlet mouth. Curb inlet sediment dam is required for use with inlet filter insert where at-grade inlet grate and curb inlet are combined at a catch basin.

Type 11 – Wattle barrier with filter insert
Install prefabricated filter insert per Type 3 detail.
Install wattles over opening and 36" to each side of opening tight against curb. Adjust wattle to force storm water to flow through filter insert or wattle prior to leaving the site.
Adjust, replace or modify the inlet protection as needed to prevent sediment laden water from entering the catch basin.

CALC. BOOK NO. N/A

SDR DATE January, 2021

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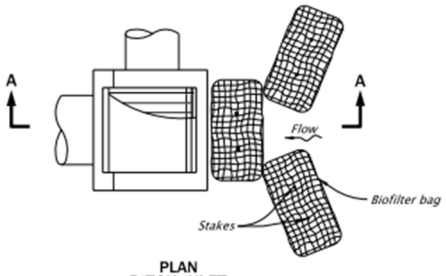
OREGON STANDARD DRAWINGS

INLET PROTECTION TYPE 2, 3, 6, 7, 10 AND 11

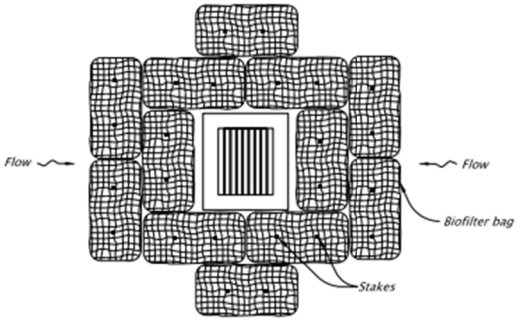
2021

DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers
Jan 2021	Moved notes up from overlapping the sheet border

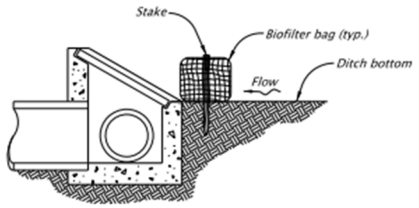
RD1015



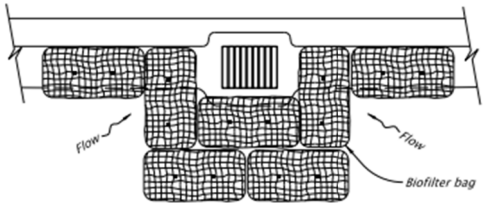
PLAN
DITCH INLET



PLAN
AREA DRAIN



SECTION A-A
DITCH INLET



PLAN
CATCH BASIN

BIOFILTER BAGS - TYPE 4

NOT TO SCALE

NOTES:

1. *Stake biofilter bags with 2"x2"x36" wood stakes, and use a minimum 2 stakes per bag. Drive stakes a minimum of 6" into the ground and flush with the top of the bags.*
2. *Omit stakes when bags are placed on pavement surface.*
3. *Overlap all bag joints 6".*
4. *Biofilter bags used on active roadways are easily displaced and made ineffective if struck by vehicles. If struck by a cyclist, falls with injury could result. On active roadways alternative inlet protection should be considered.*

CALC. BOOK NO. N/A

SDR DATE January, 2021

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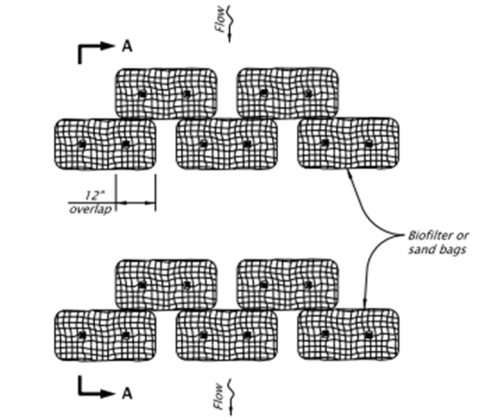
OREGON STANDARD DRAWINGS

INLET PROTECTION TYPE 4

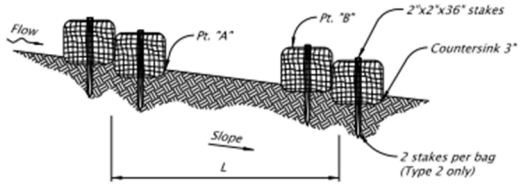
2021

DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers

RD1030



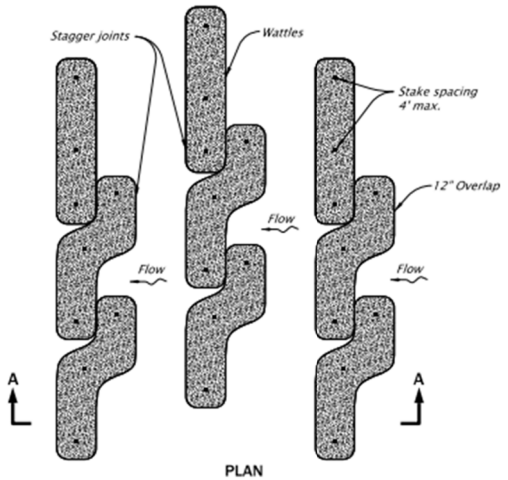
PLAN



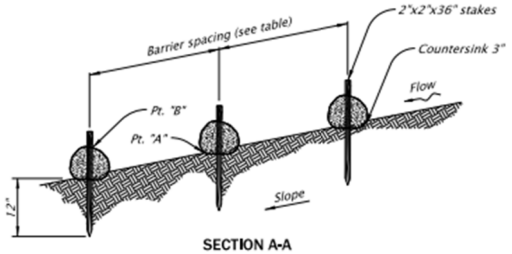
SECTION A-A

BIOFILTER BAG / SAND BAG BARRIER - TYPE 2 AND 4

NOT TO SCALE



PLAN



SECTION A-A

FIBER ROLL BARRIER - TYPE 3

NOT TO SCALE

NOTES:

1. *For Type 2 barrier, drive stakes flush with top of bag and into undisturbed ground a min. of 12". Omit stakes if bags are placed on paved surface.*
2. *For Type 2 and Type 4 barriers, space bags (L) so that the elevation of point "A" is less than or equal to the elevation of point "B".*

Type 2 – Biofilter bags
Type 3 – Wattles
Type 4 – Sand bags

BARRIER SPACING		
INSTALL PARALLEL ALONG CONTOURS AS FOLLOWS		
% SLOPE	% SLOPE	MAXIMUM SPACING ON SLOPE
10% Flatter	1:10 or Flatter	300'
10 > % ≥ 15	10 > X ≥ 7.5	150'
15 > % ≥ 20	7.5 > X ≥ 5	100'
20 > % ≥ 30	5 > X ≥ 3	50'
Steeper than 30%	Steeper than 1:3	25'

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CALC. BOOK NO. N/A

SDR DATE January, 2021

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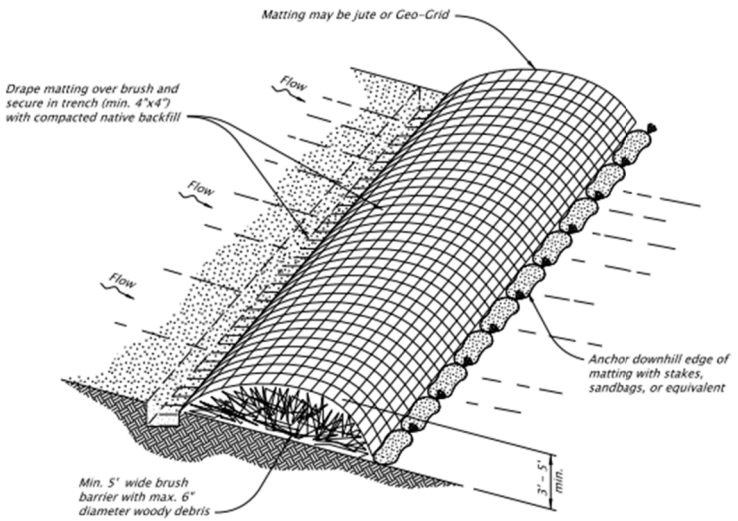
OREGON STANDARD DRAWINGS

SEDIMENT BARRIER TYPE 2, 3 AND 4

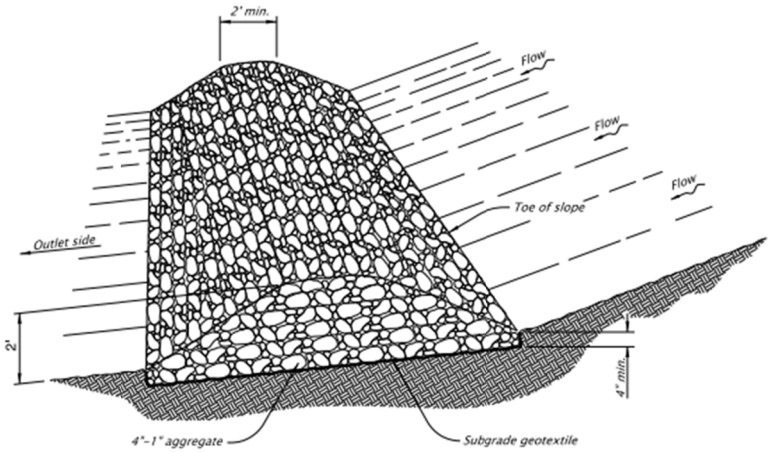
2021

DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers

RD1031



BRUSH BARRIER - TYPE 5
NOT TO SCALE



AGGREGATE BARRIER - TYPE 6
NOT TO SCALE

NOTES:
1. Direct diverted flows from the outlet side of the rock filter berm/dams onto a stabilized area, such as vegetation and or rock, or into a sediment trapping facility.
2. Embed barrier a min. of 4" into the existing ground/embankments.
3. Use 1:3 or flatter side slope. Within the safety clear zone, use 1:6 or flatter side slopes.
4. Use 4"-1" clean aggregate.

CALC. BOOK NO. N/A

SDR DATE January, 2021

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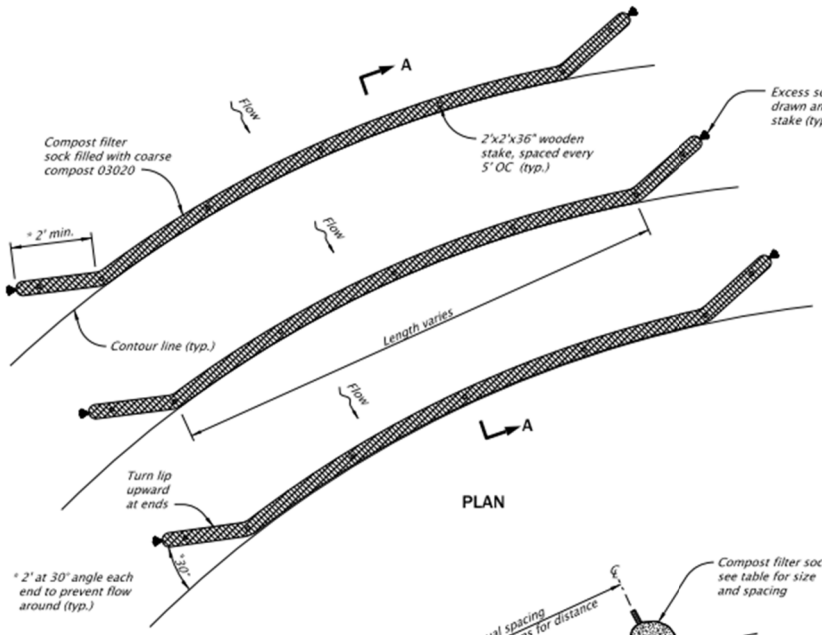
OREGON STANDARD DRAWINGS

SEDIMENT BARRIER TYPE 5 AND 6

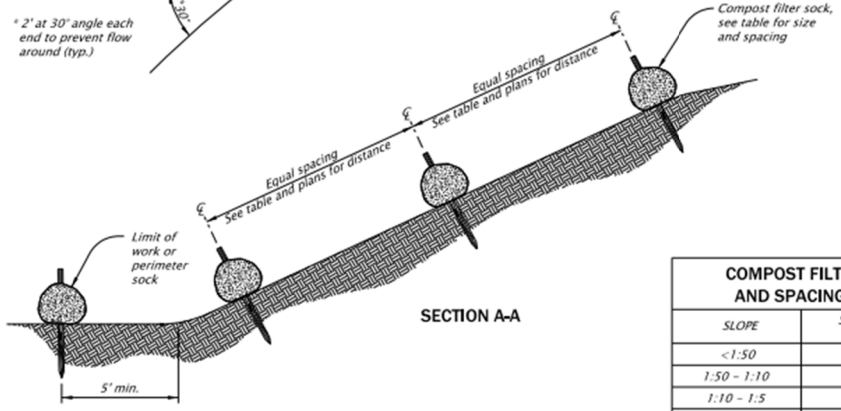
2021

DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers

RD1032

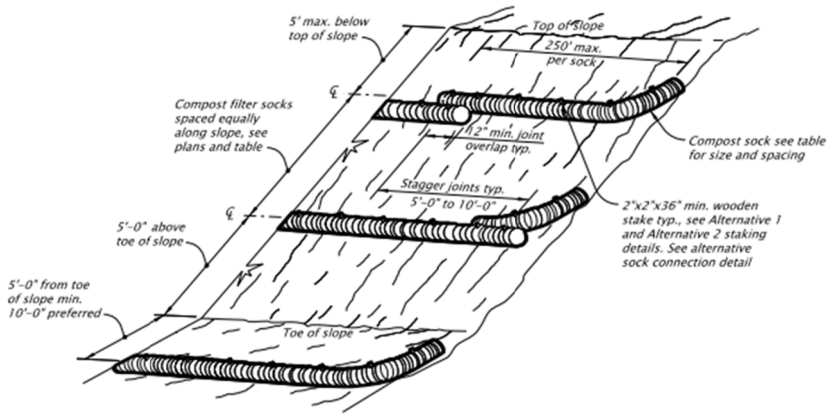


PLAN

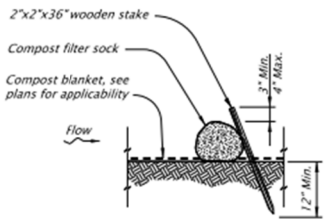


SECTION A-A

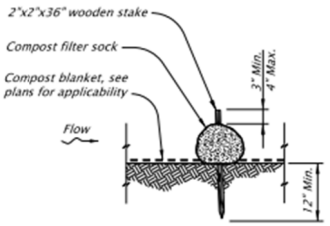
NOTE:
Fully biodegradable compost sock mesh is recommended for permanent installations. Where compost socks must be moved or removed, synthetic sock mesh should be used.



SLOPE APPLICATION - PERSPECTIVE VIEW



ALTERNATIVE 1 (Staking)



ALTERNATIVE 2 (Staking)

COMPOST FILTER SOCK DIAMETER AND SPACING BASED ON SLOPE		
SLOPE	SPACING (ft)	DIAMETER (in)
<1:50	250	8
1:50 – 1:10	125	12
1:10 – 1:5	100	12
1:5 – 1:2	50	18
>1:2	25	18

COMPOST FILTER SOCK

NOT TO SCALE

CALC. BOOK NO. N/A

SDR DATE January, 2021

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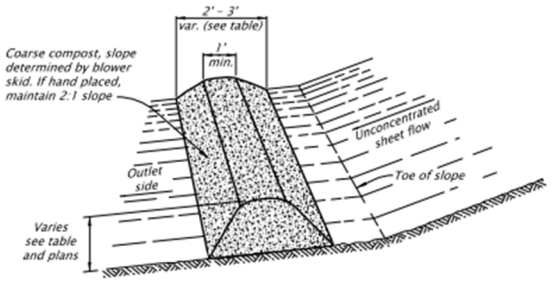
OREGON STANDARD DRAWINGS

SEDIMENT BARRIER TYPE 8

2021

DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers

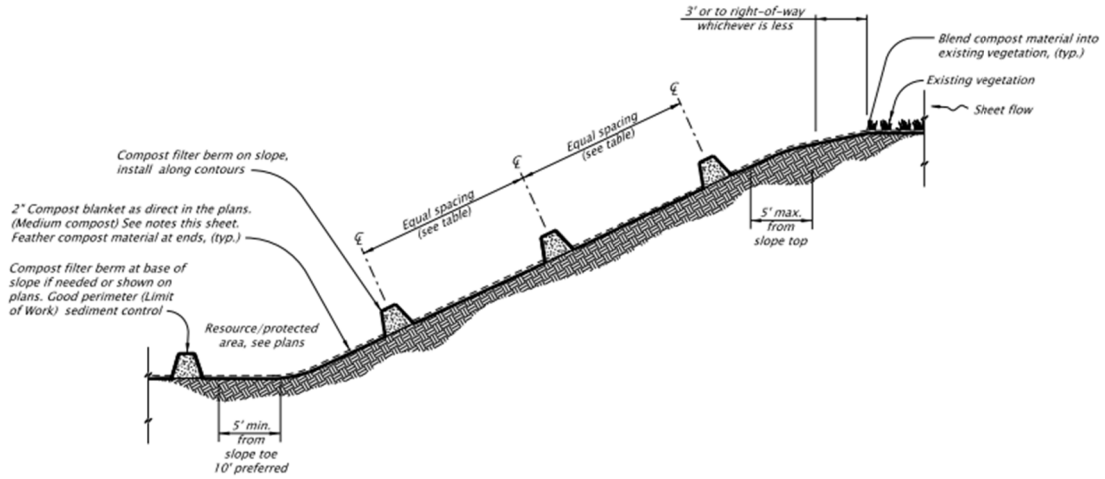
RD1033



COMPOST FILTER BERM - TYPE 9
NOT TO SCALE

COMPOST 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	1.3 ft	2.6 ft (min.)	1 ft
> 2:1		1.5 ft	3 ft (min.)	1 ft

NOTES:
1. Compost filter berm's are sediment control devices for areas where runoff occurs as sheet flow. See Section 00280, Oregon Standard Specifications.
2. The maximum drainage area for a continuous berm shall be 1/4 acre per 100 linear feet of filter berm.
3. Where possible, berm's should be placed away from the toe of slopes a minimum of 5 feet (10 feet preferred) to allow for energy dissipation and sediment storage.
4. Direct the outlet side of filter berm, located at base of slope, onto a stabilized area, such as vegetation and/or aggregate.
5. Place filter berm's along or on the ground contour with the ends of the filter berm turned up slope. Adequate area shall be provided behind berm for ponding.
6. Compost filter berm's may be vegetated with temporary or permanent seeding after placement.
7. If placed in area with existing ground vegetation, cut vegetation to 2-4 inches above grade at berm footprint. Do not remove existing vegetation or cut back outside berm footprint unless directed by Agency.
8. If soils are exposed apply compost blanket per details and specifications.



COMPOST FILTER BERM SERIES
NOT TO SCALE

CALC. BOOK NO. N/A

SDR DATE January, 2021

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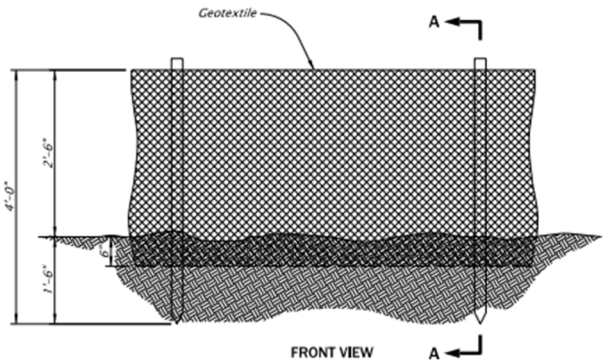
OREGON STANDARD DRAWINGS

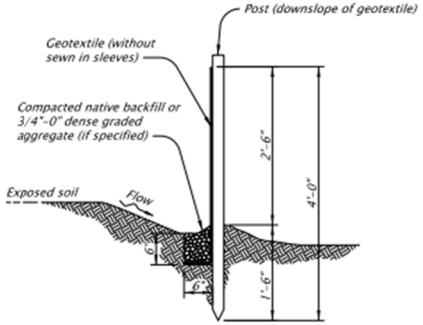
SEDIMENT BARRIER TYPE 9

2021

DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers

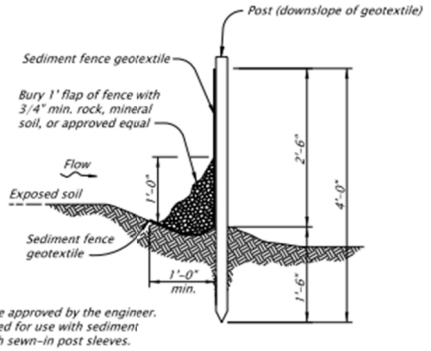
RD1040





SEDIMENT FENCE AND GEOTEXTILE BURY DETAIL - TYPE 1

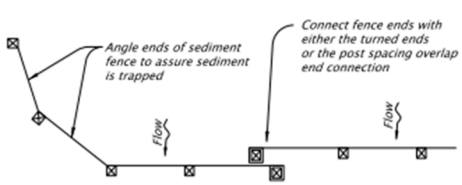
NOT TO SCALE



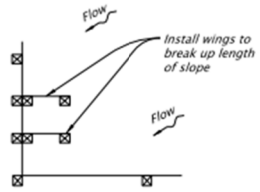
NOTES:
1. Use must be approved by the engineer.
2. Not approved for use with sediment fencing with sewn-in post sleeves.

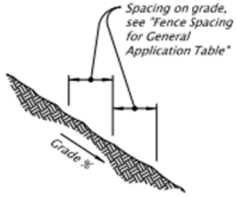
ALTERNATE SEDIMENT FENCE WITHOUT TRENCHING - TYPE 2

NOT TO SCALE



PLAN VIEW





TERMINATION AT CORNER OR PROPERTY LINE

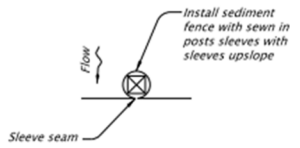
GENERAL NOTES:
1. Use 2"x2" wood fence posts.
2. Posts to be installed on downhill side of sediment fence geotextile. Position posts to prevent separation from geotextile.
3. Compact filter fabric trench backfill and soil on uphill side of fence.
4. Locate fence no closer than three feet to the toe of a slope.
5. Wing spacing shall comply with "Fence Spacing for General Application Table".

FENCE SPACING FOR GENERAL APPLICATION TABLE

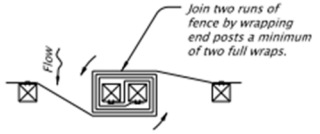
INSTALL PARALLEL ALONG CONTOURS AS FOLLOWS	
GRADE	MAXIMUM SPACING ON GRADE
Grade < 10%	300'
10% ≤ Grade < 15%	150'
15% ≤ Grade < 20%	100'
20% ≤ Grade < 30%	50'
30% ≤ Grade	25'

POST SPACING TABLE

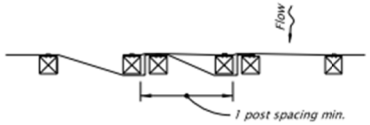
6'	Sediment Fence with Geotextile elongation less than 50%
4'	Sediment Fence with Geotextile elongation 50% or more



GEOTEXTILE WITH POST SLEEVES



TURNED ENDS CONNECTION



POST SPACING OVERLAP CONNECTION

GEOTEXTILE END CONNECTIONS

NOT TO SCALE

CALC. BOOK NO. N/A

SDR DATE January, 2021

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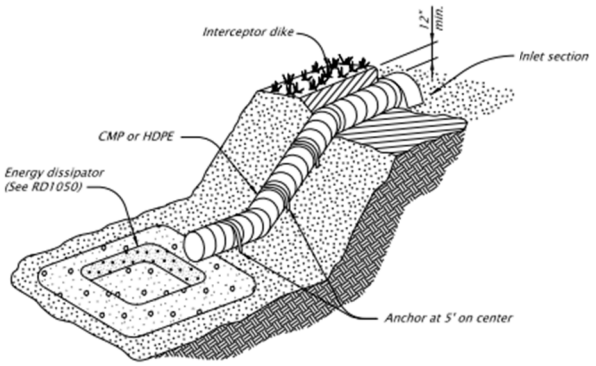
OREGON STANDARD DRAWINGS

SEDIMENT FENCE

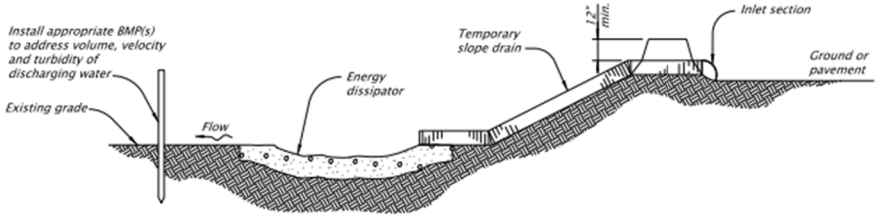
2021

DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers

RD1045



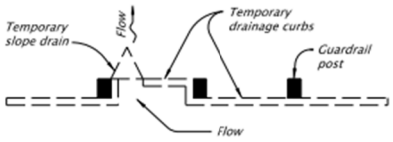
PERSPECTIVE



PROFILE

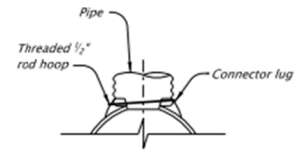
TEMPORARY SLOPE DRAIN
NOT TO SCALE

NOTES:
1. Temporary slope drains shall be used at the top of fill slopes as the embankment is constructed to prevent erosion.
2. Temporary drainage curbs shall be used in conjunction with temporary slope drains to prevent erosion on completed slopes and to direct flow into end section.
3. All dimensions not indicated will be as directed.

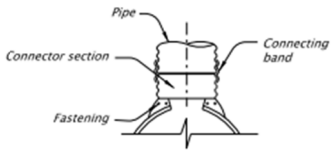


PLAN

TEMPORARY DRAIN AT GUARDRAIL
NOT TO SCALE

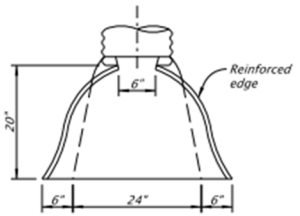


OPTION 1

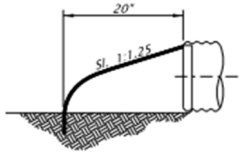


OPTION 2

CONNECTION DETAILS
NOT TO SCALE

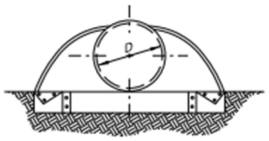


PLAN



SIDE VIEW

PIPE SIZE TABLE		
PIPE		CONTRIBUTING AREA TO SLOPE DRAIN (sq ft)
Slope (min.)	D in. (min.)	
3.8%	6	A < 200
2.5%	8	200 ≤ A < 500
1.9%	10	500 ≤ A < 850
1.5%	12	850 ≤ A < 1400
–	special design reqd.	1400 ≤ A



FRONT VIEW

INLET SECTION DETAILS
NOT TO SCALE

CALC. BOOK NO. N/A

SDR DATE January, 2021

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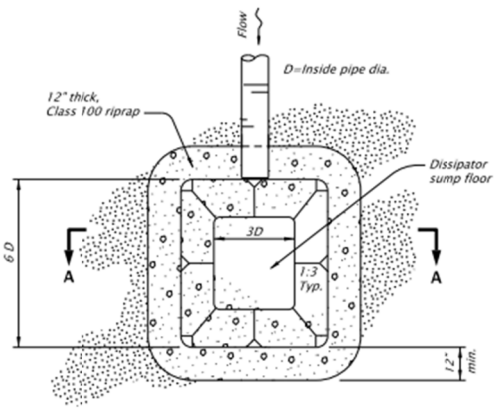
OREGON STANDARD DRAWINGS

TEMPORARY SLOPE DRAIN WITH ENERGY DISSIPATOR

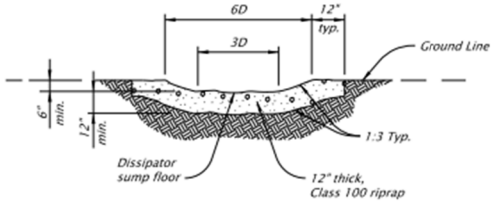
2021

DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers

RD1050



PLAN



SECTION A-A

NOTES:
1. *All dimensions not indicated will be as directed.*
2. *Install level spreader, sediment barrier(s), check dam(s) or other appropriate BMP(s) to address volume, velocity and turbidity of discharge water.*

TEMPORARY SCOUR BASIN / ENERGY DISSIPATOR

NOT TO SCALE

CALC. BOOK NO. N/A

SDR DATE January, 2021

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OREGON STANDARD DRAWINGS

TEMPORARY SCOUR BASIN / ENERGY DISSIPATOR

2021

DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers

RD1055

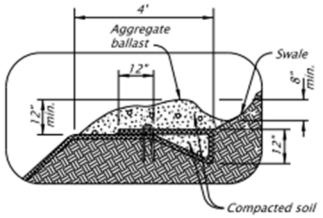


FIGURE A1:
TOP OF BANK ANCHOR TRENCH, H>3' AND TERMINAL SLOPE
NOT TO SCALE

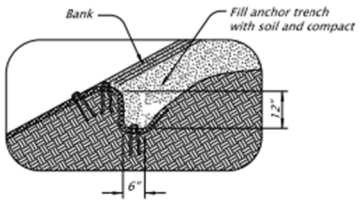


FIGURE A2:
TOP OF BANK ANCHOR TRENCH, H<3'
NOT TO SCALE

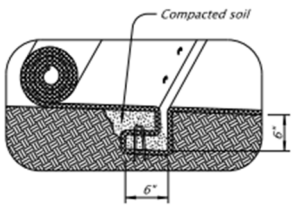


FIGURE A3:
CHANNEL CHECK SLOT
NOT TO SCALE

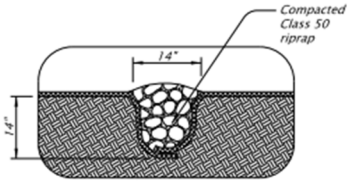


FIGURE A4:
CHANNEL CHECK SLOT WITH ROCK BACKFILL
NOT TO SCALE

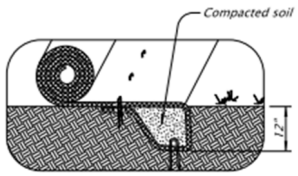
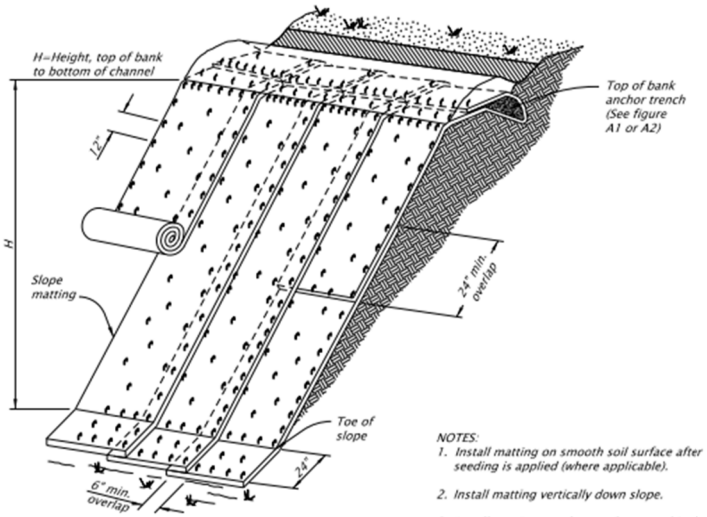
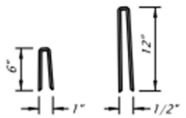


FIGURE A5:
INITIAL CHANNEL ANCHOR TRENCH
NOT TO SCALE



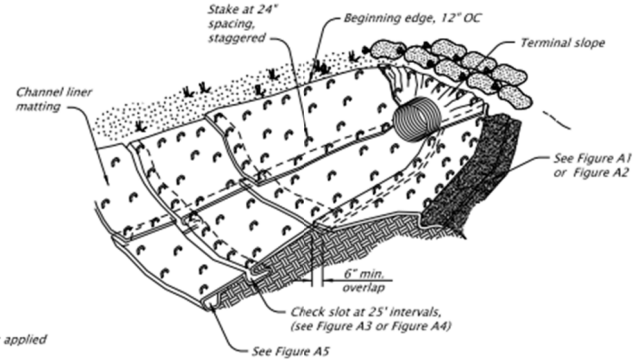
SLOPE MATTING ISOMETRIC VIEW
NOT TO SCALE

NOTES:
1. Install matting on smooth soil surface after seeding is applied (where applicable).
2. Install matting vertically down slope.
3. Install matting so edge overlaps are shingled away from prevailing winds.
4. Place fastener at 12" OC on matting edges
5. Overlap upper mat over lower mat, and fasten.
6. Stagger alternate rows of fasteners placed at 24" OC
7. Extend mat 24" beyond toe of slope; fold mat back under 4" and fasten.
8. Matting Types A through E: Furnish fully biodegradable product. Matting with plastic or photodegradable components will not be accepted.



STAPLES
NOT TO SCALE

NOTES:
1. Install matting on smooth soil surface after seeding is applied (where applicable).
2. Install channel liner matting, in the direction of water flow. Anchor upstream end of mat with check slot for culvert outfalls, place mat under pipe 12" minimum upstream from pipe outlet.
3. Construct check slots across channel bottom at 25' spacing and at the end of each mat (Fig. A3 or A4).
4. Overlap side channel liner matting edges 6" over the center channel liner matting and fasten edges 12" OC Continue overlap and stapling pattern for each additional side channel liner mat.
5. Lap upstream matting end 12" over beginning edge of downstream matting. Fasten 12" OC
6. Anchor top edge of side channel matting in trench and fasten 12" OC (Fig. A2).
7. Fasten matting interior at 24" OC with staggered spacing.
8. Construct initial anchor trench at downstream end of matting and terminal slope anchor at upstream end.
9. Matting Types A through E: Furnish fully biodegradable product. Matting with plastic or photodegradable components will not be accepted.



CHANNEL MATTING ISOMETRIC VIEW
NOT TO SCALE

CALC. BOOK NO. N/A

SDR DATE January, 2021

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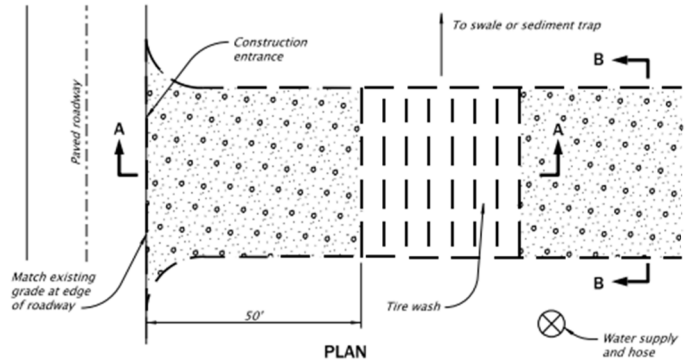
OREGON STANDARD DRAWINGS

SLOPE AND CHANNEL MATTING

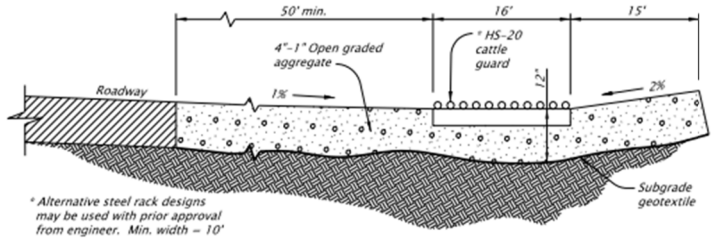
2021

DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers

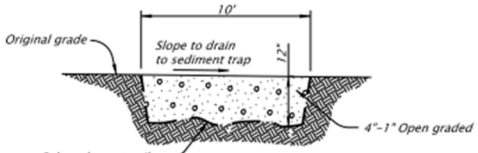
RD1060



PLAN



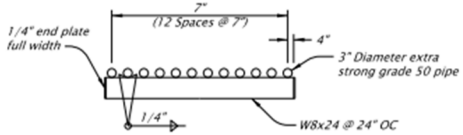
SECTION A-A



SECTION B-B

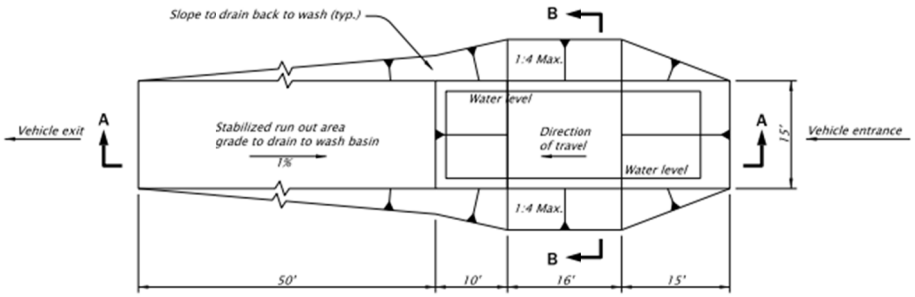
TIRE WASH - TYPE 1 (MANUAL HOSE WASH)

NOT TO SCALE

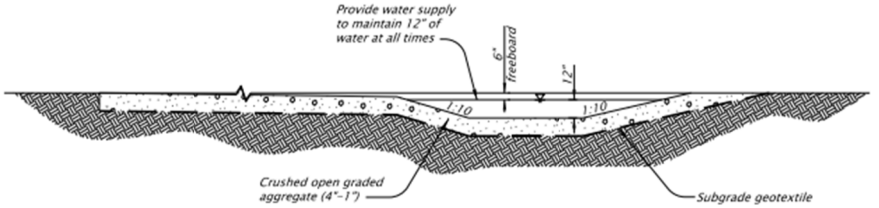


HS-20 CATTLE GUARD

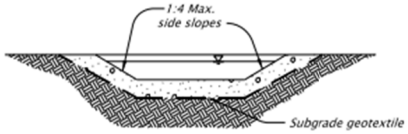
NOT TO SCALE



PLAN



SECTION A-A



SECTION B-B

TIRE WASH - TYPE 2

NOT TO SCALE

CALC. BOOK NO. N/A

SDR DATE January, 2021

NOTE: All material and workmanship shall be in accordance with the current Oregon Standard Specifications

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without consulting a Registered Professional Engineer.

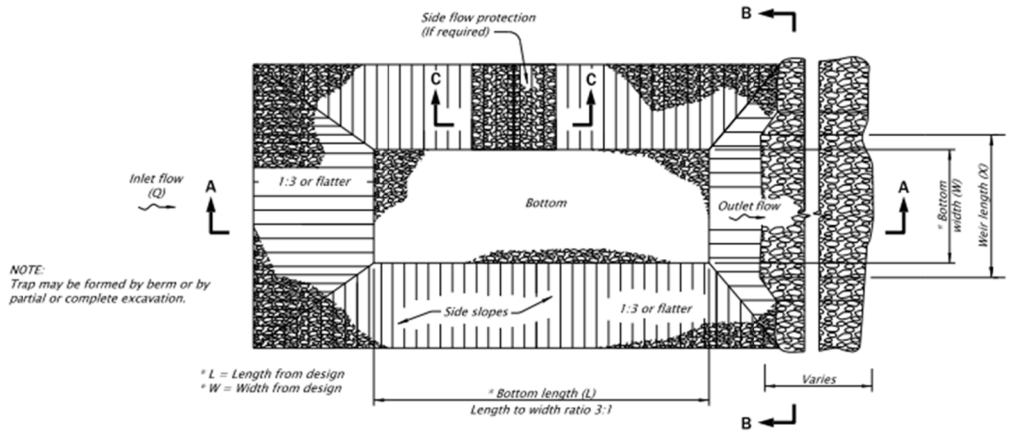
OREGON STANDARD DRAWINGS

TIRE WASH FACILITY TYPE 1 AND 2

2021

DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers

RD1065



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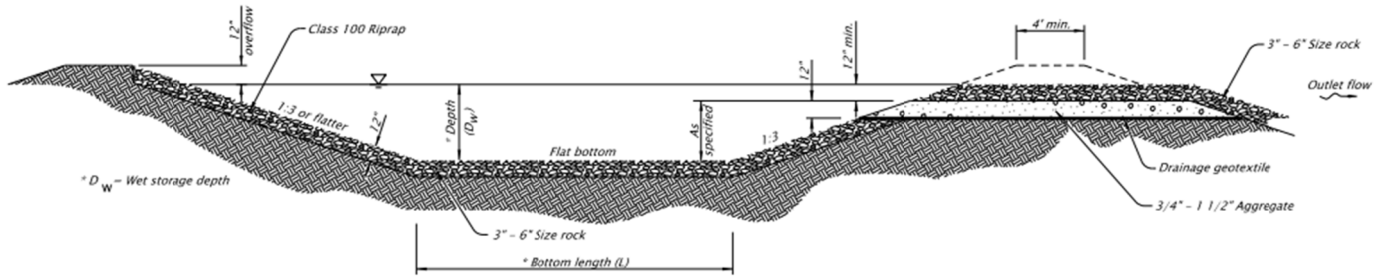
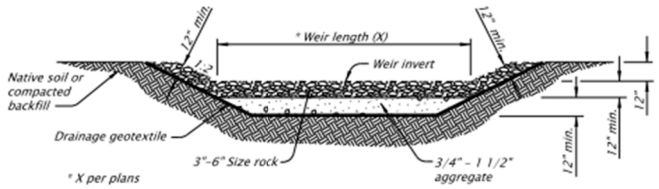
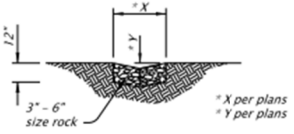


SECTION A-A



SECTION B-B



SECTION C-C

SEDIMENT TRAP
NOT TO SCALE

CALC. BOOK NO. N/A

SDR DATE January, 2021

NOTE: All material and workmanship shall be in accordance with the current Oregon Standard Specifications

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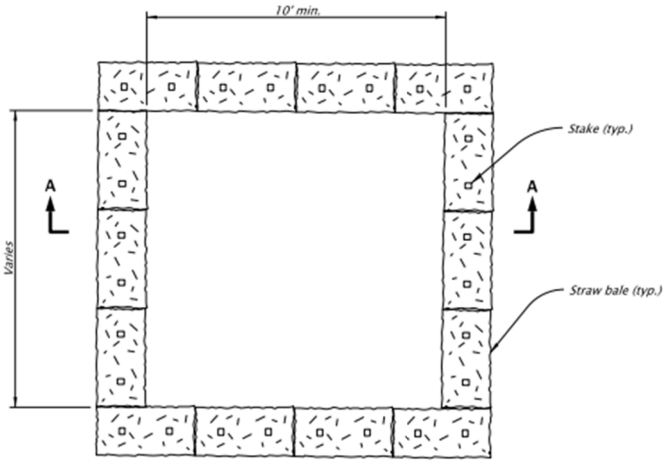
OREGON STANDARD DRAWINGS

SEDIMENT TRAP

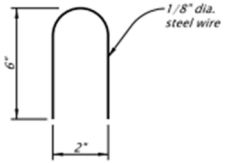
2021

DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers

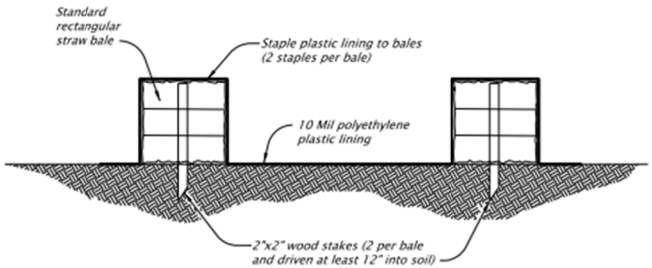
RD1070



PLAN



STAPLE DETAIL
NOT TO SCALE



SECTION A-A

CONCRETE TRUCK WASH OUT FACILITY
NOT TO SCALE

CALC. BOOK NO. N/A

SDR DATE January, 2021

NOTE: All material and workmanship shall be in accordance with the current Oregon Standard Specifications

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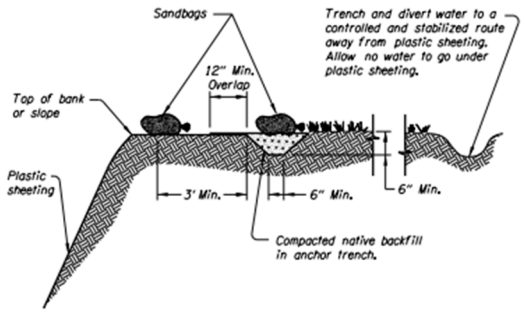
OREGON STANDARD DRAWINGS

CONCRETE TRUCK WASH OUT

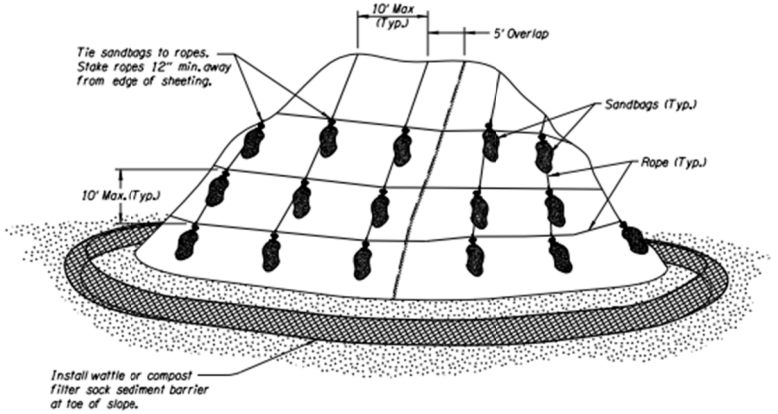
2021

DATE	REVISION DESCRIPTION

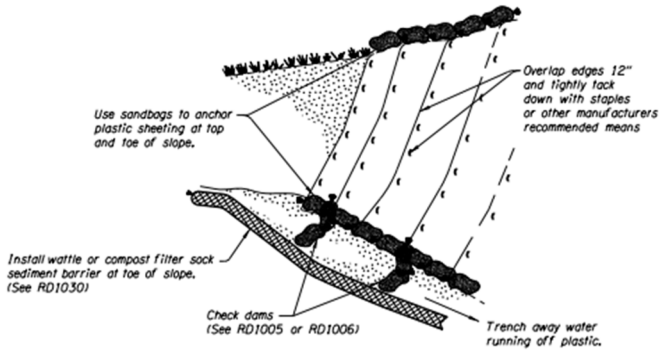
DET6001



TOP OF SLOPE TIE DOWN



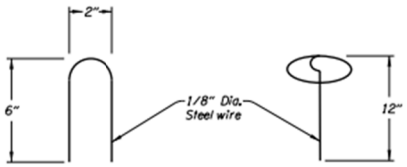
STOCKPILE



SLOPES

NOTES:

1. Install plastic sheeting vertically down slope.
2. Install plastic sheeting so edges overlap and are shingled away from prevailing winds.



STAPLE DETAIL PIN STAPLE

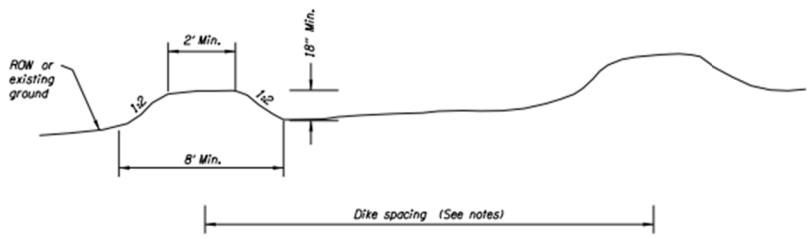
OREGON DEPARTMENT OF TRANSPORTATION
TECHNICAL SERVICES
DETAILS

PLASTIC SHEETING

DETAIL NO. DET6001

DET6007

TEMPORARY INTERCEPTOR DIKE
TYPE 1



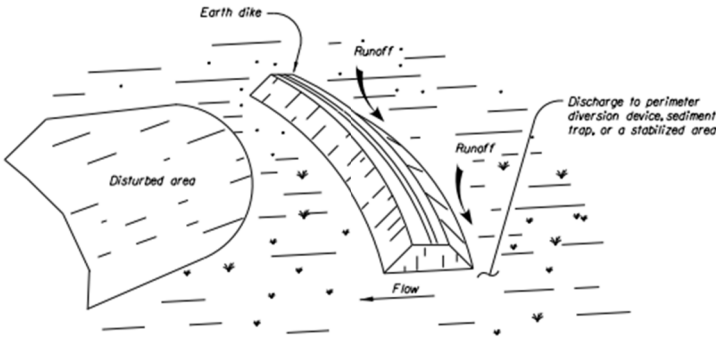
SECTION

Dike Spacing

Slope	Spacing
3-5%	300'
5-10%	200'
10-25%	100'
25-50%	50'

Notes:

1. *Compact dike material to 95% modified proctor.*
2. *Maximum 5% grade with positive drainage to a suitable outlet (such as a sedimentation trap).*



The selection and use of this detail, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without consulting a Registered Professional Engineer.

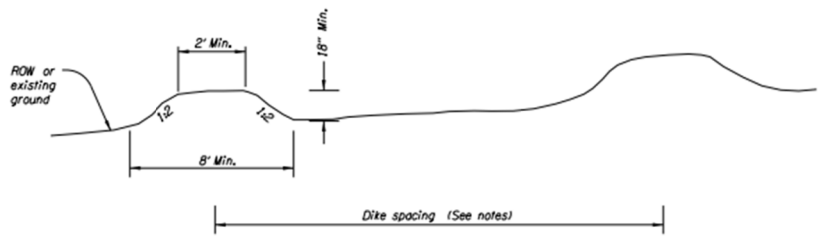
OREGON DEPARTMENT OF TRANSPORTATION
TECHNICAL SERVICES
DETAILS

TEMPORARY INTERCEPTOR DIKE TYPE 1

DETAIL NO. DET6007

DET6008

TEMPORARY INTERCEPTOR DIKE
TYPE 2



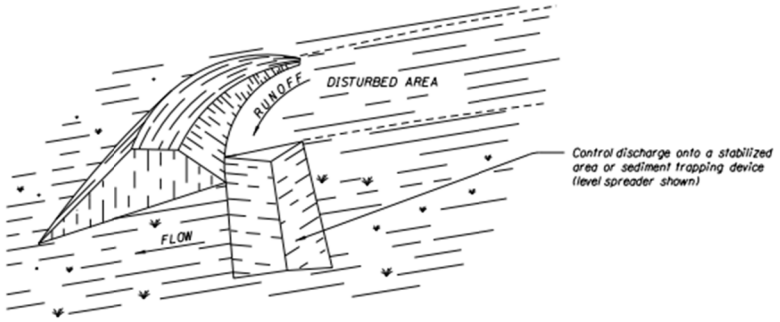
SECTION

Notes:

1. Compact dike material to 95% modified proctor.
2. Maximum 5% grade with positive drainage to a suitable outlet (such as a sedimentation trap).

Dike Spacing

Slope	Spacing
3-5%	300'
5-10%	200'
10-25%	100'
25-50%	50'



PERIMETER DIKE

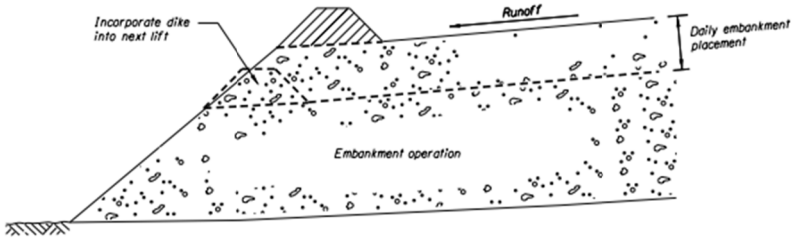
OREGON DEPARTMENT OF TRANSPORTATION
TECHNICAL SERVICES
DETAILS

TEMPORARY INTERCEPTOR DIKE TYPE 2

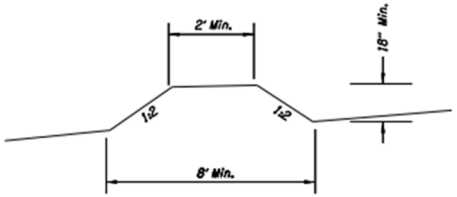
DETAIL NO. DET6008

DET6009

TEMPORARY INTERCEPTOR DIKE
TYPE 3



EMBANKMENT SECTION



DIKE SECTION

Notes:

1. Compact dike material to 95% modified proctor. (90% of standard proctor.)

The selection and use of this detail, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without consulting a Registered Professional Engineer.

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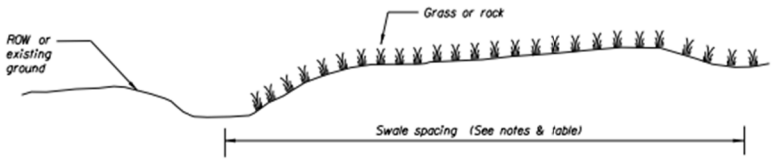
TECHNICAL SERVICES
DETAILS

TEMPORARY INTERCEPTOR DIKE TYPE 3

DETAIL NO. DET6009

DET6010

TEMPORARY INTERCEPTOR SWALE
TYPE 1



SECTION

Swale Spacing

Slope	Spacing
3-5%	300'
5-10%	200'
10-25%	100'
25-50%	50'

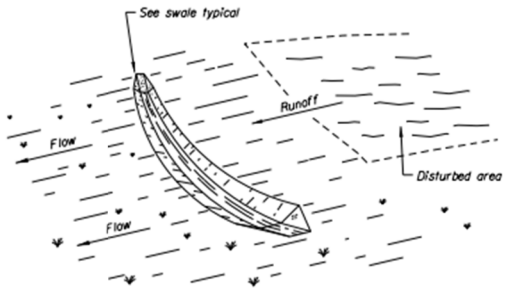
Notes:

Bottom width = 24" minimum at a 0% grade.

Depth = 12" minimum

Side slope = 1:2 or flatter

Grade = maximum 5 percent with positive drainage to a suitable outlet (such as sedimentation pond)



Notes:
Discharge onto undisturbed area or alternate sediment trapping device

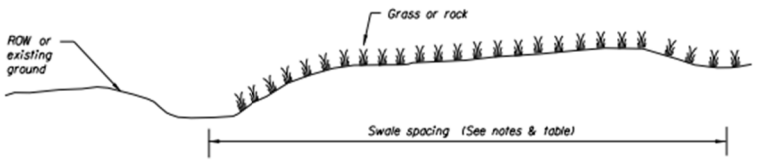
OREGON DEPARTMENT OF TRANSPORTATION
TECHNICAL SERVICES
DETAILS

TEMPORARY INTERCEPTOR SWALE TYPE 1

DETAIL NO. DET6010

DET6011

TEMPORARY INTERCEPTOR DIKE/SWALE
TYPE 3



SECTION

Swale Spacing

Slope	Spacing
3-5%	300'
5-10%	200'
10-25%	100'
25-50%	50'

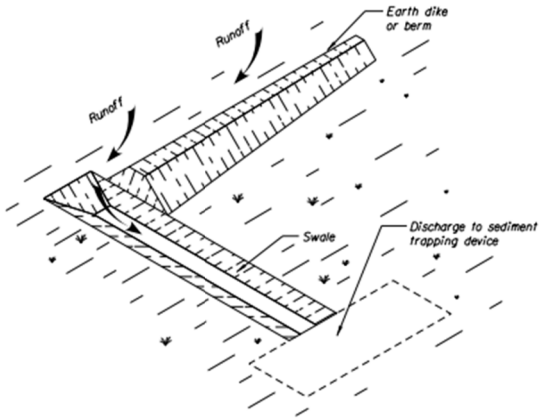
Notes:

Bottom width = 24" minimum at a 0% grade.

Depth = 12" minimum

Side slope = 1:2 or flatter

Grade = maximum 5 percent with positive drainage to a suitable outlet (such as sedimentation pond)



DIVERSION DIKE/SWALE

OREGON DEPARTMENT OF TRANSPORTATION
TECHNICAL SERVICES
DETAILS

TEMPORARY INTERCEPTOR DIKE/SWALE TYPE 3

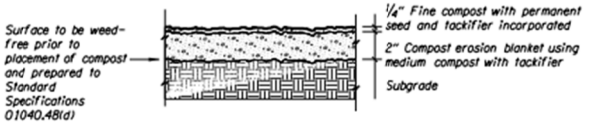
DETAIL NO. DET6011

DET6017

COMPOST BLANKET

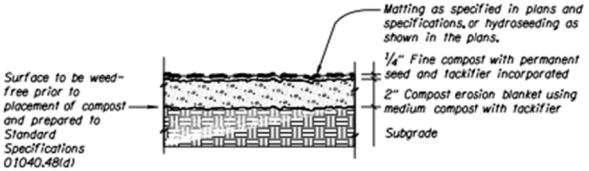
Note: See Standard Specifications 03020 for compost specifications.

APPLICATION - TEMPORARY/PERMANENT MULCHING
N.T.S.



Note: See Standard Specifications 03020 for compost specifications.

APPLICATION - TEMPORARY/PERMANENT VEGETATIVE COVER
N.T.S.



Note: See Standard Specifications 03020 for compost specifications.
See plans and specifications for matting when required.

APPLICATION - STEEP SLOPES, SHALLOW DITCHES & BIO-SWALES
N.T.S.

OREGON DEPARTMENT OF TRANSPORTATION
TECHNICAL SERVICES
DETAILS

COMPOST BLANKET

DETAIL NO.
DET6017

APPENDIX G

GLOSSARY OF TERMS

GLOSSARY OF TERMS

Accelerated Erosion	Erosion much more rapid than normal or geologic erosion, primarily as a result of the activities of man.
Adsorption	The adhesion of a substance to the surface of a solid or liquid. Heavy metals such as zinc and lead often adsorb onto particles.
Berm	A constructed barrier of compacted earth or aggregate.
Best Management Practices	Physical, structural and/or managerial practices employed to (BMP's) avoid or mitigate damage or potential damage from the contamination or pollution of surface waters or wetlands. Structural BMP's are actual physical installations rather than procedural/managerial BMP's, such as good housekeeping and employee training.
Catch Basin	A grated inlet, curb opening or combination inlet with or without a sump which admits storm water to a sewer or sub-drain.
Channel	A natural stream or excavated ditch that conveys water.
Channel Erosion	The erosion process whereby the volume and velocity of flow wears away the bed and/or banks of a well-defined channel.
Channel Stabilization	Protecting the sides and bed of a channel from erosion by controlling flow velocities and flow directions using jetties, drops or other structures and/or by lining the channel with a suitable liner such as vegetation, riprap, concrete or other similar material.
Channelization	Alteration of a stream channel by widening, deepening, straightening, or paving certain areas to improve flow characteristics.
Check Dam	A small dam constructed in a gully or other small watercourse to decrease flow velocity , minimize channel scour and promote sediment deposition.
Chute	A high-velocity, open channel for conveying water down a steep slope without erosion , usually paved.
Clay	(1) Soil fraction consisting of particles less than 0.002 mm in diameter. (2) A soil texture class which is dominated by clay or at least has a larger proportion of clay than either silt or sand.
Climate	The weather conditions prevailing in an area in general or over a long period.
Coir	Fiber made from coconut husks.
Compost	A mixture that consists largely of decayed organic matter and is used for fertilizing and conditioning land.
Conventional Pollutants	Contaminants (other than nutrients) such as sediment, oil, and vehicle fluids.
Contour	An imaginary line on the surface of the earth connecting points of the same elevation.
Culvert	A structure, such as a pipe, that channels water past an obstacle or to a subterranean waterway.
Cut	Portion of ground surface or area from which earth has been removed or will be removed by excavating; the depth below the original ground surface to the excavated surface.
Cut and Fill	Process of earth grading by excavating part of a higher area and using the excavated material for fill to raise the surface of an adjacent lower area.
Cutting	leaf, stem or branch cut form a plant to establish a new plant.
Design Life	The period of time for which a facility is expected to perform its intended function.
Design Storm	Selected storm of a given frequency used for designing a design storm system. Hypothetical storm derived from intensity- duration-frequency curves. A prescribed hydrograph and total precipitation amount (for a specific duration recurrence frequency) used to estimate runoff in order to analyze

	existing drainage, design new drainage facilities or assess impacts of a proposed project on surface water flow.
Detention	Storage and subsequent release of excess stormwater runoff.
Detention Facility	An above or below ground facility, such as a pond or tank, which temporarily stores storm water runoff and releases it at a controlled rate. There is little or no infiltration of the stored storm water.
Detention Time	The theoretical time required to displace the contents of a tank or unit at a given rate of discharge (volume divided by rate of discharge).
Dewatering	The removal of water temporarily impounded in a holding basin.
Dike	An embankment to confine or control water, often built along the banks of a river to prevent overflow of lowlands; a levee.
Discharge	Usually the rate of water flow; a volume of fluid passing a point per unit time commonly expressed as cubic feet per second, cubic meters per second, gallons per minute, or millions of gallons per day.
Dispersion, Soil	The breaking down of fine soil aggregates into individual particles, resulting in single-grain structure. Ease of dispersion influences the erodibility of soils. Generally speaking, the more easily dispersed the soil, the more erodible it is.
Ditch	A narrow channel dug in the ground, typically used for drainage alongside a road.
Diversion	A channel with a supporting ridge on the lower side constructed at the top, across, or at the bottom of a slope for the purpose of controlling surface runoff.
Drain	A buried slotted or perforated pipe or other conduit (subsurface drain) or a ditch (open drain) for carrying off surplus groundwater or surface water.
Drainage	The removal of excess surface water or groundwater from land by means of ditches or subsurface drains.
Drainageway	A natural or artificial depression that carries surface water to a larger watercourse or outlet such as a river, lake, or bay.
Drop Inlet	Below ground structure in which the water drops through a vertical riser connected to a discharge conduit or storm sewer.
Dry Pond	A facility which provides storm water quantity control by detaining runoff in a detention basin , then releasing the runoff at allowable rates.
Effective Functioning	Preventing erosion, controlling runoff, or controlling sediment in each location where an ESC is needed so erosion-related impacts of site construction are mitigated as required.
Elongation	The increase in length produced in the gage length produced by a tensile load.
Embankment	A man-made deposit of soil, rock, or other material often used to form an impoundment.
Energy Dissipator	Devices designed to protect downstream areas from erosion by reducing the velocity of flow to acceptable limits.
Environment	The sum total of all the external conditions that may act upon a living organism or community to influence its development or existence.
Erodibility	Susceptibility to erosion.
Erosion	The wearing away of the land surface by water, wind, ice, gravity, or other geological agents. The following terms are used to describe different types of water erosion and can be found in the glossary: **Accelerated Erosion**, **Channel Erosion**, **Gully Erosion**, **Rill Erosion**, **Splash Erosion**, and **Sheet Erosion**.
Erosion and Sediment Control (ESC)	Any temporary or permanent measures taken to reduce erosion, control siltation and sedimentation, and ensure that sediment- laden water does not leave a site.

Erosion and Sediment Control Plan (ESCP)	Plans, specification and BMP details intended to prevent and control erosion and sediment related to the project construction activities.
Establishment	The act of starting or creating something that will last a long time.
Evapotranspiration	The combined loss of water from an area by evaporation from the soil surface and by transpiration of plants.
Excavate	To uncover, or dig away earth.
Excess Rain	The amount of rainfall that runs directly off an area.
Filter Blanket	A layer of sand and/or gravel designed to prevent the movement .1 of fine-grained soils.
Filter Fabric	A woven or non-woven, water penetrable material generally made of synthetic products such a polypropylene and used in erosion and sediment control applications to trap sediment or prevent the movement of fine soil particles. Often used instead of a filter blanket.
Floodplain	The lowland that borders a stream and is subject to flooding when the stream overflows its banks.
Floodway	A channel, either natural, excavated, or bounded by dikes and levees, used to carry flood flows.
Flow Spreader	An erosion control device designed to reduce water pollution by mitigating the impact of high-velocity stormwater surface runoff.
Forb	A herbaceous flowering plant that is not a graminoid (grass, sedge, or rush)
Foundation	The part of a building that fixes it into the soil and provides support for the main structures that appear above the ground.
Freeboard	Vertical clearance between the normal operating level and the top side of an open conduit or channel. Vertical distance between the design water surface elevation and the elevation of the barrier retaining the water.
Free-Draining	
Frequency of Storm (design storm frequency)	The anticipated period in years that will elapse before another storm of equal intensity and/or total volume will recur: a 10-year storm can be expected to occur on the average once every 10 years.
Gauge	Device for measuring precipitation, water level., discharge, velocity, pressure, temperature, etc., e.g., a rain gauge. A measure of the thickness of metal, e.g., diameter of wire or wall thickness of steel pipe.
Geotextile	Any permeable textile used with foundation, rock, earth or any other geotechnical engineering-related material as an integral part of a human-made project, structure or system.
Grade	(1) The slope of a road, a channel, or natural, ground. (2) The finished surface of canal, bed, roadbed, top of embankment, or bottom of excavation; any surface prepared to a design elevation for the support of construction such as paving or the laying of a conduit. (3) To finish the surface of a canal bed, roadbed, top of embankment , or bottom of excavation, or other land area to a smooth, even.
Gradient	Change of elevation, velocity , pressure, or other characteristics per unit length; slope.
Grading	The cutting and/or filling of the land surface to a desired slope or elevation.
Grass	A member of the botanical family Gramineae, characterized by blade-like leaves that originate as a sheath wrapped around the stem.
Grassed Lined Waterway	A natural or constructed waterway, usually broad and shallow, covered with erosion-resistant grasses and used to safely conduct surface water from an area.
Ground Cover	Low-growing, spreading plants useful for low- maintenance landscape areas.

Gully Erosion	The erosion process whereby runoff water accumulates in narrow channels and, over relatively short periods, removes the soil to considerable depths, ranging from 1 to 2 feet to as much as 75 to 100 feet.
Habitat	The environment in which the life needs of a plant or animal are c supplied.
Harmful Pollutant	A substance which has adverse effects on an organism. Adverse effects include immediate death , chronic poisoning, impaired reproduction and other conditions.
Hazardous Waste	A waste with properties that make it dangerous or capable of having a harmful effect on human health or the environment.
Head	The height of water above any plain of reference. The energy, either kinetic or potential, possessed by each unit weight of a liquid, expressed as the vertical height through which a unit weight would have to fall to release the average energy possessed. Used in various compound terms such as pressure head of velocity head.
Head Loss	Energy loss due to friction, eddies, changes in velocity, elevation or direction of flow.
Headwater	The source of a stream. The water upstream from a structure or point a stream.
Heavy Metals	Metals having a high specific gravity , present in municipal and industrial wastes, that pose long-tern environmental hazards. Such metals include cadmium, chromium , cobalt, copper, lead, mercury, nickel and zinc.
Hydrologic Cycle	The circuit of water movement from the atmosphere to the earth and back to the atmosphere through various stages or processes such as precipitation, interception, runoff, infiltration, percolation, storage, evaporation, and transpiration.
Hydrology	The science of the behavior of water in the atmosphere; on the surface of the earth, and underground.
Impervious	A surface which water cannot easily penetrate. Can include graveled surface as well as paved surfaces.
Inlet Protection	A temporary sediment control barrier placed around an inlet that minimizes sediment from entering the storm drain.
Interceptor Dike	A barrier built to divert surface runoff.
Matting	Material used for mats, especially coarse fabric woven from a natural fiber.
Mean Depth	Average depth; cross-sectional area of stream or channel divided by its surface or top width.
Mean Velocity	The average velocity of a stream flowing in a channel or conduit at a given cross-section or in a given reach. It is equal to the discharge divided by the cross-section area of the reach.
Mitigation	Means in the following order of importance: (1) A voiding the impact altogether by not taking a certain action or part of an action. (2) Minimizing impacts by limiting the degree or magnitude of the action and its implementation, by using appropriate technology, or by taking affirmative steps to avoid or reduce impacts. (3) Rectifying the impact by repairing, rehabilitating or restoring the affected environment. (4) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action, and (5) Compensation for the impact by replacing, enhancing, or providing substitute resources or environments.

Mulch	A natural or artificial layer of plant residue or other materials covering the land surface which conserves moisture, holds soil in place, aids in establishing plant cover , and minimizes temperature fluctuations.
Municipal Separate Storm Sewer System (MS4)	Is a conveyance or system of conveyances that is: (1) Owned by a state, city, town, village, or other public entity that discharges to waters of the U.S., (2) Designed or used to collect or convey stormwater (e.g., storm drains, pipes, ditches), (3) Not a combined sewer, and (4) Not part of a sewage treatment plant, or publicly owned treatment work.
National Pollutant Discharge Elimination System (NPDES)	The part of the Federal Clean Water Act which requires permits (NPDES permits) for point and nonpoint source discharges.
Natural Drainage	The flow patterns of storm water runoff over the land in its pre- development state.
Nonpoint Source Pollution	Pollution that enters a waterbody from diffuse origins on the watershed and does not result from discernible, confined, or discrete conveyances.
Nutrients	Essential chemicals for plant and animal growth. Excessive amounts can lead to water quality degradation and algae blooms. Some nutrients are toxic at high concentrations.
Open Drain	Natural watercourse or constructed open channel that conveys drainage water.
Orifice	An opening with closed perimeter, usually of regular form, through which water may flow, generally to control outlet flow.
Outfall	The point, location, or structure where wastewater or drainage discharge from a sewer to a receiving body of water.
Outlet	Point of water disposal from a stream, river, lake, tidewater, or artificial drain.
Particle Size	The diameter or volume of the grains in a sediment or sedimentary rock.
Peak Discharge	The maximum, instantaneous flow rate during a storm, usually in ~ reference to a specific design storm event.
Permanent Stabilization	Maintenance-free measures or methods necessary to prevent erosion or sediments from leaving the Project Site.
Permeability	A generic term for the ability of a material to allow liquids to pass through.
Permeable Soils	Soil materials with filtration rate of 10 minutes per inch or better. Such soils allow infiltration and reduce or eliminate surface and storm water runoff. Classified as SCS (Soil Conservation Services) Type A.
Permeability Rate	The rate at which water will move through a saturated soil. Permeability rates are classified as follows: **Very slow** - Less than 0.06 inches per hour. **Slow** - 0.06 to 0.20 inches per hour. **Moderately slow** - 0.20 to 0.63 inches per hour. **Moderate** - 0.63 to 2.0 inches per hour. **Rapid** - 6.3 to 20.0 inches per hour. **Very rapid** - More than 20.0 inches per hour.
Permittivity	For a geotextile, the volumetric flow rate if water per unit cross- y section area, per unit head, under laminar flow conditions, in the normal direction through the fabric.
Petroleum Product	Are materials derived from crude oil (petroleum) as it is processed in oil refineries.
Phase II MS4s	The Phase II regulation requires small MS4s in U.S. Census Bureau defined urbanized areas, as well as MS4s designated by the permitting authority, to obtain NPDES permit coverage for their stormwater discharges.

Plasticity Index	The numerical difference between the liquid limit and the plastic limit of soil; the range of moisture content within which the soil remains plastic.
Plastic Limit	The moisture content at which a soil changes from a semi-solid to a plastic state.
Point Source	Any discernible, confined an discrete conveyance, including but not limited to any pipe ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock , concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged.
Point Source Pollutants	Pollution which enters a water body resulting from discernible confined or discrete conveyances.
Pollution Control Plan (PCP)	Consists of Pollution Control Plan form, narrative, site map and details describing measures to prevent pollution related to contractor activities.
Pervious	Allowing movement of water.
Porosity	The volume of pore space in soil or rock.
pH	A numerical measures of hydrogen ion activity .The neutral point is pH 7.0. All pH values below 7.0 are acid and all above 7.0 are alkaline.
Rainfall Intensity	The rate at which rain is falling at any given instant, usually expressed in inches per hour.
Rational Method	A means of computing storm drainage flow rates, Q, by use of the formula Q=CIA, where C is a coefficient describing the physical drainage area, I is the rainfall intensity and A is the area.
Receiving Bodies of Water	Creeks, streams, lakes, and other bodies of water into which waters are artificially or naturally directed.
Retention	The process of collecting and holding surface and storm water runoff with no surface overflow.
Retention/Detention Facility	A type of drainage facility designed either to hold water for a considerable length of time and then release it by evaporation, plant transpiration, and/or infiltration into the ground, or to hold surface and storm water runoff for a short period of time and then release it to the surface and storm water management system.
Retention Structure	A natural or artificial basin that functions similar to a detention structure except that it maintains a permanent water supply.
Rill Erosion	An erosion process in which numerous small channels only several inches deep are formed; occurs mainly on recently disturbed and exposed soils.
Riparian	Pertaining to banks of streams, wetlands, lakes or tide waters.
Riser	The inlet portions of a drop inlet spillway that extends vertically from the pipe conduit barrel to the water surface.
Precipitation	Rain, snow, sleet, or hail that falls to the ground.
Runoff	That portion or precipitation that flows from a drainage area on the land surface, in open channels or in storm water conveyance systems.
Safety Data Sheets (SDS)	Data sheets which come with materials. The sheets contain (SDS) information such as pH, flashpoint, reactivity, first aid recommendations and indicate material classification and handling requirements.
Salmonid	A member of the fish family salmonidae. Includes Chinook, coho, chum, sockeye and pink salmon, cutthroat, steelhead, rainbow, Dolly varden, brook, kokanee and whitefish.
Sand	(1) Soil particles between 0.05 and 2.0 mm in diameter. (2) A soil textural class inclusive of all soils which are at least 70% sand and 15% or less clay.
Saturation	In soils, the point at which a soil or an aquifer will no longer absorb any amount of water without losing an equal amount.

Scour	The clearing and digging action of flowing water, especially the downward erosion caused by stream water in sweeping away mud and silt from the stream bed and outside bank of a curved channel.
Sediment	Fragmented material originated from weathering and erosion of rocks and unconsolidated deposits. The material is transported by, suspended in, or deposited by water.
Sedimentation	Deposition or formation of sediment.
Sediment Barrier	A temporary sediment control device used on construction sites to protect water quality in nearby streams, rivers, lakes and seas from sediment (loose soil) in stormwater runoff.
Sediment Delivery Ratio	The fraction of the soil eroded from upland sources that actually reaches a stream channel or storage reservoir.
Sediment Discharge	The quality of sediment, measured in dry weight or by volume, transported through a stream cross-section in a given time. Sediment discharge consists of both suspended load and bedload.
Seedling	A young plant grown from seed.
Settling Basin	An enlargement in the channel of a stream to permit the settling of debris carried in suspension.
Sheet Erosion	The gradual removal of a fairly uniform layer of soil from the land surface by runoff water.
Sheet Flow	Relatively uniform flow over a plane surface without concentration of water into conspicuous channels.
Silt	(1) Soil fraction consisting of particles between 0.002 and 0.05 mm in diameter. (2) A soil textural class indicating more than 80% silt.
Siltation	Process by which a river, lake or other water body becomes clogged with sediment. Siltation can clog gravel beds and prevent successful salmon spawning.
Slope	Degree of deviation of a surface from the horizontal; measured as a numerical ratio or percent. Expressed as a ratio, the first number is the horizontal distance (run) and the second is the vertical distance (rise), e.g., 2:1. Slope can also be expressed as the rise over the run. For instance, a 2:1 slope is a 50 percent slope.
Soil	The unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.
Soil Horizon	A horizontal layer of soil that, through processes of soil formation, has developed characteristics distinct from the layers above and below.
Soil Profile	A vertical section of the soil from the surface through all horizons.
Soil Stabilization	Use of rock-lining, vegetation or other methods to prevent soil movement when loads are applied to the soil.
Soil Structure	The relation of particles or groups of particles which impart to the whole soil a characteristic manner of breaking; some types are crumb structure, block structure , platy structure, and columnar structure.
Soil Survey	The systematic examination, description, classification, and mapping of soils in an area.
Soil Texture	The physical structure or character of soil determined by the relative proportions of the soil separates (sand, silt and clay) of which it is composed.
Spillway	A passage such as a paved apron or channel for surplus water over or around or through a dam or similar structure. An open or closed channel, or both, used to convey excess water from a reservoir. It may contain gates, whether manually or automatically controlled, to regulate the discharge of excess water.

Splash Erosion	The spattering of small soil particles caused by the impact of raindrops on wet soils. The loosened and spattered particles mayor may not be subsequently removed by surface runoff.
Stockpile	A large accumulated stock of goods or materials, especially one held in reserve for use at a time of shortage or other emergency.
Storm Frequency	The statistical time interval between major storms of predetermined intensity and runoff volumes for which storm sewers and other structures are designed and constructed to handle hydraulically without surcharge or backflood.
Storm Sewer	A sewer that carries storm water, surface drainage, street wash and other wash waters , but excludes sewage and industrial wastes. Also called a storm drain.
Stormwater	That portion of precipitation that does not percolate into the ground or evaporate, but flows via overland flow, interflow, channels or pipes into a defined surface water channel, or a constructed infiltration facility.
Stormwater Facility	A constructed component of a storm water drainage system, designed or constructed to perform a particular function, or multiple functions. Storm water facilities include pipes, swales, ditches, culverts, street gutters, detention basins, retention basins, constructed wetlands and other.
Streambanks	The usual boundaries, not the flood boundaries, of a stream channel. Right and left banks are named facing downstream.
Structural BMPs	Actual physical installations rather than procedural/managerial BMPs, such as good housekeeping and employee training.
Subsurface Drain	A pervious backfilled trench-usually containing stone and perforated pipe for intercepting groundwater or seepage.
Surface Runoff	Precipitation that falls onto the surfaces of roofs, streets, the ground, etc., and is not absorbed or retained by that surface, but collects and runs off.
Suspended Solids	Organic or inorganic particles suspended in and carried by water: sand, mud, clay as well as solids.
Swale	An elongated depression in the land surface that is at least seasonally wet, is usually heavily vegetated, and is normally without flowing water. Swales conduct storm water into primary drainage channels and may provide some groundwater recharge.
Tackifier	Are chemical compounds used in formulating adhesives to increase the tack, or the stickiness of the surface of the adhesive.
Temporary Stabilization	Measures or methods necessary to prevent erosion until permanent stabilization measures are in place and established.
Tile	Drain Pipe made of perforated plastic, burned clay, concrete, or similar material, laid to a designed grade and depth, to collect and carry excess water from the soil.
Time of Concentration	The time period necessary for surface water runoff to reach the outlet of a subbasin from the hydraulically most remote point in the tributary drainage area.
Toe of Slope	The base or bottom of a slope at the point where the ground surface abruptly changes to a significantly flatter grade.
Topography	General term to include characteristics of the ground surface such as plains, hills, mountains, degree of relief, steepness of slopes and other physiographic features.
Topsoil	The dark-colored surface layer of A horizon of a soil. When present it ranges in depth from a fraction of an inch to 2 or 3 feet; equivalent to the plow layer of cultivated soils. Commonly used to refer to the surface soil layer(s),

	enriched in organic matter and haying textural and structural characteristics favorable for plant growth.
Total Maximum Daily Loads (TMDL)	Is a regulatory term in the U.S. Clean Water Act, describing a plan for restoring impaired waters that identifies the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards.
Total Solids	Solids in water , sewage or other liquids including dissolved, filterable and nonfilterable solids. The residue left when moisture evaporates and the remainder is dried at a specified temperature.
Total Suspended Solids (TSS)	The entire amount of organic and inorganic particles dispersed in water. TSS are the larger particles in the water which are more easily removed by sedimentation than smaller particles which cause turbidity.
Toxicity	The characteristic of being poisonous or harmful to plant animal life; the relative degree or severity of this characteristic.
Turbidity	Is caused by silt and clay particles, particles smaller than 0.02 mm, suspended in water. Measurement of turbidity can be done by turbidimeter which measures light-beam scatter caused by small suspended particles and converts it to NTU (national turbidity units).
Unified Soil Classification	A classification system based on the identification of soils System according to their particle size, gradation, plasticity index, and liquid limit.
Unstable Ground	A portion of land surface or area which is prone to slipping, sloughing or landslides.
Vactor Waste	The waste material in the bottom of a catch basin or other stormwater structure.
Vegetative Stabilization	Protection of erodible or sediment-producing areas with: **Permanent seeding**, producing long-term vegetative cover, **Short-term (Temporary) seeding**, producing temporary vegetative cover, or **Sodding**, producing areas covered with a turf of perennial sod-forming grass.
Vegetative Cover	The ground area that is covered by vegetation that may be in natural landscapes or agricultural areas.
Waste	A material, substance, or byproduct eliminated or discarded as no longer useful or required after the completion of a process.
Watercourse	A definite channel with bed and banks within which concentrated water flows, either continuously or intermittently.
Water Quality	A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.
Water Resources	The supply of groundwater and surface water in a given area.
Watershed	All land and water within the confines of a drainage divide.
Waters of the State	Any lakes, bays, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Pacific Ocean within the territorial limits of the State of Oregon and all other bodies of surface or underground waters, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters that do not combine or effect a junction with natural surface or underground waters), which are wholly or partially within or bordering the State or within its jurisdiction.
Water Table	The free surface of the groundwater. That surface subject to atmospheric pressure under the ground, generally rising and falling with the season, or from other conditions such as water withdrawal.
Weir	Device for measure or regulating the flow of water . Weir Notch The opening in a weir for the passage of water.

Wet Pond	A facility treating storm water by utilizing a permanent pool of water to remove conventional pollutants from runoff. Treatment mechanisms include sedimentation, biological uptake and plant filtration.
Wet Season	October 1 to April 30.