

Section 1 – General Information

1.1 Concept

Each year soil erodes from development sites and is deposited on streets. Sediment fills storm sewers and ditches, creates dust and mud on streets, and pollutes waterways.

This chapter provides standards for erosion and sediment control. These standards are intended to supplement local ordinances and the soil loss limit regulations of the Iowa Code. They should be useful in planning soil and water conservation as an integral part of development plans, to minimize erosion and sediment problems on land under development.

1.2 Conditions

1. Design criteria for erosion and sediment control measures and materials should be in accordance with, but not limited to, the following:
 - A. National Pollutant Discharge Elimination System (NPDES).
 - B. Field Office Technical Guide, US Natural Resources Conservation Service.
 - C. Iowa Department of Transportation Standard Specifications for Highway and Bridge Construction (current series).
 - D. The American Association of State Highway and Transportation Officials (AASHTO) - "A Guide for Highway Landscape and Environmental Design" (current Series).
 - E. Cedar Rapids Metropolitan Area Standard Specifications and Details.
 - F. Conflict - In case of a conflict between the above design standards, the Jurisdiction should be contacted for clarification.
2. Definitions:
 - A. Soil Erosion - The loss of land and soil surface occurring from land disturbing activity.
 - B. Non-Erosive Velocity - The velocity of water flow that will not cause soil erosion.
 - C. Stabilization - Erosion control placement, or covering of soil to ensure its resistance to soil erosion, sliding or other earth movement.
 - D. Permanent Soil Erosion Control - Control measures installed to control erosion on a permanent basis and regularly maintained after completion

of a project.

- E. Sediment Control - Interim control measures installed for temporary control of sedimentation until permanent soil erosion control is established. Examples are sediment traps, silt dikes, etc.
3. Performance criteria should meet the following requirements:
 - A. Land disturbing activity shall be conducted in a manner to effectively reduce soil erosion and sedimentation. Before land disturbing activities commence, sediment controls shall be installed to reduce or eliminate sedimentation damage to downslope property. Seeding immediately after grading is a highly recommended method for controlling erosion. After each disturbance, such as for utility installation, the area should be seeded, using the temporary seeding recommendations.
 4. Erosion and sediment controls, drainage outlets, and detention basins must be constructed as a first step in grading and be made functional before upslope land disturbance takes place. Earthen structures such as dams, dikes, and diversions must be mulched within 14 calendar days of installation. Earthen structures that will remain in place for a period exceeding one year must be seeded and mulched. Construction of earthen structures should be scheduled to allow prompt seeding during appropriate seasons.
 5. Stormwater runoff from disturbed drainage areas with ten acres of total tributary area or greater should pass through a temporary sediment basin providing 3,600 cubic feet of storage per acre drained. If 3,600 cubic feet per acre drained is not attainable, combinations of silt fences, multiple sediment traps, or equivalent sediment controls are required for all side slopes and downslope boundaries of the construction area.
 - 1) Velocity dissipation devices shall be used to provide non-erosive velocities in downstream drainage ways.
 - 2) Sediment traps require periodic maintenance including sediment removal whenever one-half of the sediment storage volume is filled.
 - 3) Site must be inspected once every seven calendar days and within 24 hours after a rainfall of 0.5" or greater. Reports summarizing the inspections shall be made and retained as part of the storm water pollution prevention plan until project termination.
 6. All land disturbing activities should be designed and constructed to limit the exposure time of disturbed land. Once grading operations are completed or in areas where work has been suspended, the stabilization must be initiated within 14 days. In environmentally sensitive areas, a 72 hour stabilization period is to be used.

7. Any temporary or permanent facility designed and constructed for the conveyance of water around, through, or from the land disturbing activity shall be designed to limit the water flow to a non-erosive velocity.
8. Temporary soil erosion control facilities shall be removed after disturbed areas are graded and stabilized with permanent soil erosion control.
9. Erosion and maintenance may be minimized by use of acceptable side slopes, rounded and blended with natural terrain; serrated cut slopes; drainage channels designed with due regard to width, depth, slopes, alignment, and protective treatment; inlets located and spaced with erosion control in mind; prevention of erosion at culvert outlets; proper facilities for ground water interception; dikes, berms, and other protective devices; sedimentation devices to trap sediment at strategic locations; and protective ground covers and planting.
10. All temporary and permanent erosion sediment control practices must be inspected and maintained by the Owner.
11. Permit Required:
 - A. Some Jurisdictions in the Cedar Rapids Metropolitan area have erosion control ordinances. The Jurisdiction should be contacted to determine what specific permits or plan submittals are required. In addition, the Project Engineer should prepare a National Pollutant Discharge Elimination system (NPDES) permit application as required and submit a copy of the IDNR issued storm water permit to the Jurisdictional Engineer.

Section 2 – Design for Erosion Control

2.1 Temporary Erosion and Sediment Controls

1. Seeding, sodding, mulching and soil stabilization are means of controlling soil erosion. All other practices, such as sediment basins, diversions and silt fences are sediment control practices. They control sediment runoff from the site by ponding water and causing sediment to settle out before leaving the property.
2. Temporary erosion and sediment control measures and intended uses include but are not limited to the following:
 - A. Temporary seeding
 - 1) Temporary seeding is a cost effective erosion control practice. Seed areas immediately after grading is completed provided no further disturbance is planned for 14 days. Seed the area again immediately after soil is disturbed.

B. Mulch

- 1) Mulching can be used in conjunction with or without temporary seeding for the purpose of erosion control. Materials such as hay, wood chips, fibers or straw can be used for mulch. Mulching provides immediate protection of the soil surface and will be used on slopes of 4:1 or steeper. Mulch matting or netting can be used to hold seed in place and prevent gully erosion in drainageways.

C. Sediment Trap

- 1) Sediment traps are formed by excavation or by placing an earthen embankment across a low area or drainageway for the purpose of inlet protection. Sediment traps may be designed to function independently or be incorporated into the inlet structure of a permanent water control device such as a storm sewer or road culvert.

Design requirements for sediment trap:

- Drainage area of 2.5 acres or less per trap.
- Flow length through trap is 10 feet or greater.
- Length to width ratio is at least 2:1.
- Minimum storage volume of the sediment trap is 3600 ft.³/acre drainage area.
- Embankment height will be 5 feet or less with side slopes at 2:1 or flatter.
- A stable outlet (spillway) shall be provided to handle a ten-year storm.
- Sediment will be removed when storage volume has been reduced to 2400 cubic feet per acre.

Provisions may be made to dewater the sediment trap if needed. Sediment traps may be removed after the contributing drainage area is permanently stabilized by established seeding.

D. Temporary Sediment Basin Class I and Class II

A temporary sediment basin is a short earthen embankment or a combination ridge and channel generally constructed across the slope or minor watercourses to promote the settling of soil particles from stormwater discharge and will be removed after final stabilization.

Class I Design Requirements

- D.A. 10 acres or less
- Embankment height of 5 feet or less

- No permanent pool
- Minimum top width of 4 feet
- Side slopes of 2:1 or flatter
- Storage for a minimum of 3600 cubic feet per acre of drainage area
- Stable outlet constructed of earth, pipe, stone, etc which will handle a 10 year, 24 hour storm discharge without significant erosion.

Class II Design Requirements

- Drainage area of 30 acres or less
- Maximum settled fill height of 15 feet
- Storage for a minimum of 9000 cubic feet per acre of drainage area
- Shall have a mechanical outlet which can handle the safe release of the 10 year, 24 hour storm between a 2-7 day period

E. Temporary Diversions

Diversions are used to divert excess water from one area for use or safe disposal in other areas. They are also used to reduce length of slope and carry water to a safe outlet.

Design requirements for Temporary Diversions:

- Drainage area of 5 acres or less
- Diversion shall have a 1 ft ridge and 4:1 side slope or 2:1 sideslope with a 4 ft. top width
- Channel can be parabolic, v-shaped, or trapezoidal
- Channel grade shall be limited to 0.5 - 1.0% unless lined with appropriate materials which will tolerate steeper grades
- The top of the constructed ridge shall not be lower at any point than the design height
- A stable outlet for diverted water shall be provided

Spacing of diversions shall be as follows:

Maximum Diversion Spacing	
Field Slope %	Spacing (Ft)
0-1	300
2-3	240
4-5	180
6-8	150
9-12	120
13-18	100

F. Silt Fence

Used when vertical height in cut or fill areas is over 5 feet or where concentrated or sheet flows with slopes at 2% or greater drain onto adjoining properties.

- 1) Place silt fence near the right-of-way line or a minimum of 10 feet from the back of curb or toe of the foreslope.
- 2) Locate silt fences near right-of-way line with lower end skewed towards the roadway to intercept diagonal sheet flow. The silt fence should be perpendicular to the flow (on the contour) with the ends taken to higher elevation, thereby causing temporary ponding of water.
- 3) Place silt fence around all intakes for inlet protection. Support framing of wood and wire mesh may be needed for increased stability.
- 4) Other locations of silt fences may be necessary for the control of sediment and may be required by the Jurisdictional Engineer.

G. Silt Fence as Ditch Checks

Construct at right angles to flow and intercept slope area where possible.

Ditch Grade	Approx. Spacing
1% to 2%	300 ft.
2% to 3%	200 ft
3% to 4%	100 ft.
4% or greater	Temporary sediment traps

H. Other

Temporary controls may include buffer strips, sodding, stabilized construction entrances, and rock check dams. Modifications to specified practices may be used if approved by the Jurisdictional Engineer.

2.2 Permanent Erosion and Sediment Control

1. A permanent vegetative cover should be established before the end of the construction season or maintain temporary erosion control throughout the winter months until spring planting is established. Vegetation shall not be considered established until ground cover is achieved and is mature enough to control soil erosion satisfactorily and withstand severe weather conditions. Temporary sediment control measures shall be disposed of within 30 days after final site stabilization is achieved.
2. Permanent erosion and sediment control measures shall be reviewed as to location and type. Permanent erosion and sediment control measures and intended uses include, but not limited to the following:

A. Seeding

Seeding and mulching are the principal means of erosion control for construction sites. All other practices are for sediment control only. Seed shall be sown only at times of the year when temperature, moisture, and climate conditions will promote germination and plant growth. Normal permanent seeding is established within at least 45 days. If seeding is not established in this period the exposed areas need to be reseeded.

B. Sodding

Sodding and fertilizing for erosion control may be used as a buffer strip adjacent to adjoining property. Sod may also be placed in ditch bottoms and areas where vegetation is needed quickly. All sod should be staked on slopes greater than 10% and in ditch bottoms.

C. Riprap

A layer of riprap is a popular method of controlling erosion. The best material to use for riprap is broken limestone, dolomite or quartzite. It consists of roughly broken or blasted rock. The rough, angular surfaces, and the variety of sizes help the rocks fit tightly together to form a dense barrier.

Generally, it is fast flowing streams (6-12 ft./sec.) that cause erosion problems. The rocks used for riprap on these streams should weigh from 5 pounds to 150 pounds. Most should weigh at least 90 pounds.

There should be enough small rocks in the mixture to fill the spaces between the larger ones.

Recommended Sizes for Riprap

Velocity of Stream During High Flow	Size Range (Diameter Across Longest Part of Rock)
Slow (2-4 ft/sec)	3" – 6"; Average 4"
Moderate (4-6 ft/sec)	4" – 12"; Average 6"
Fast (6-12 ft/sec)	5" – 18"; Average 14"

Before installing the riprap, reshape the bank to a slope of at least two feet of horizontal distance for each foot of vertical drop. Place a six-inch layer of clean stone (1" nominal) or engineering fabric, and the riprap. The largest, heaviest rocks should be placed along the bottom of the bank. The thickness of the rip-rap layer will be twice the diameter of the average size of the required rip-rap.

The rocks should form a layer 12 to 18 inches thick. Generally, they should cover the bank from the bottom of the stream to the top of the bank. If the eroding bank is higher than the opposite bank, the riprap layer only needs to extend to the height of the opposite bank. The rest of the eroding bank should be reshaped and planted with vegetation.

D. Gabions

Gabions (rock-filled wire baskets) can be used where the stream banks are too steep for rip-rap. They are particularly effective for protecting the submerged part of the bank. The layer of rock-filled baskets will continue to provide protection while adjusting itself to shifting in the stream bed.

E. Fabric Blanket

A fabric blanket is a flexible, mesh-like material through which vegetation can grow. It is usually about 1/2-inch thick, and consists of tightly coiled and intertwined fibers of either nylon or excelsior. In the beginning, the fabric alone protects the bank. As plants grow, their roots intertwine with the fabric making an even stronger barrier. A fabric blanket is normally used for erosion control until vegetation is established. It is normally used on slopes of 2:1 or less. Installation shall be in accordance with manufacturers specifications.

Section 3 – Erosion and Sediment Control Plan Requirements

3.1 Local Requirements

1. Check with the local jurisdiction to determine if the proposed site requires a permit for land disturbing activities. The determination as dictated by local ordinance, is usually based on overall disturbed area, proximity to floodplain

or water bodies, quantity of earthwork, and whether material is imported to the site.

2. A grading, erosion and sediment control plan submitted for review shall be prepared by a licensed professional civil engineer or certified soil erosion and sediment control specialist. As a minimum the following information shall be included:
 - A. A location map and pertinent surrounding features.
 - B. An overall site plan (minimum scale 1" = 50') clearly indicating the area of the site and the type of land disturbing activities which will take place.
 - C. Existing and proposed topography shown in one foot intervals.
 - D. The location and description of proposed stormwater management facilities.
 - E. The limits of the land disturbing activities including clearing and grubbing.
 - F. Drainage features including open channels, ponds, streams, or rivers.
 - G. Existing and proposed structures and utilities which may impact the plan.
 - H. Erosion and sediment control methods to be implemented as part of the land disturbing activities on the site:
 - 1) Location, size, maintenance requirements, and design calculations for best management practices.
 - 2) Detail drawings or reference to Metro Standard Details.
 - 3) Type and quantity of seeding, fertilizing, mulching and other plantings. Refer to the Metro Standard Specifications as necessary.
 - I. The soil types affected by the land disturbing activities, and location of highly erodible or unstable soils as determined by the most current NRCS soil survey.
 - J. The schedule and staging of grading, erosion and sediment control practices, and restoration.