

Construction Site



Photo courtesy of MoDOT

Slope & Site Stabilization

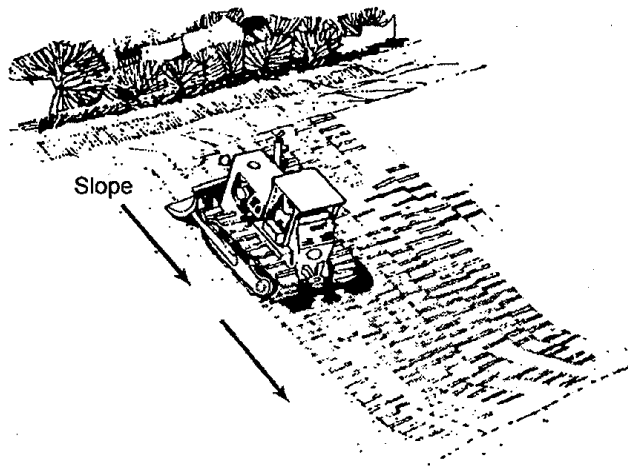
- Minnesota Pollution Control Agency

Improperly treated and untreated runoff from exposed soils on a construction site can cause soil erosion and sedimentation problems resulting in the pollution of lakes and other water bodies. This fact sheet provides guidance on temporary and permanent seeding, fertilizing, and mulching a construction site to protect the quality of our water resources.

The Erosion Process

Erosion is the natural process in which soil and rock material is weathered and carried away by wind, water, or ice. Factors such as rainfall, climate, location, and soil type influence erosion and may not be controllable.

Construction activities can increase erosion by removing vegetation, disturbing soil, and exposing sediment to the elements. Eroded soil quickly becomes a sedimentation problem when wind and rain carry the soil off the construction site and sediment is deposited in our



Slope tracking roughens the surface of a slope and decreases the velocity of runoff.

NPDES Permit Requirements

The Missouri NPDES permit identifies slope and site stabilization requirements that, if followed properly, can control erosion and sediment problems on a construction site.

- Prior to construction, areas not to be disturbed should be clearly flagged, staked, or identified with signs and noted on the plan sets.
- All exposed areas must be stabilized no later than 14 days after the construction activity is temporarily or permanently completed.
- Drainage ditches and conveyance systems must be inspected for evidence of erosion and sediment deposition. The receiving stream shall also be inspected for 50 feet downstream of the outfall.
- In order to maintain sheet flow and minimize rills and gullies, there shall be no slopes with a grade steeper than 3:1, or slopes greater than 3% and greater than 150 feet in length.

surface waters. Through proper slope and site stabilization, the use of conservation practices, and temporary and permanent cover, erosion and sedimentation problems can be managed.

What Can I Do to Control Erosion on My Site?

Construction Site Phasing is the development of a work schedule that coordinates the timing of land disturbing activities to minimize soil exposure and installation of all erosion and sediment control practices. The goal of construction site phasing is to disturb a smaller portion of an overall site, substantially finish grading and other construction activities, and achieve some stabilization before disturbing the next portion of the site.

Surface roughening involves roughening the surface of the soil on slopes in a horizontal pattern by tracking. The roughened surface reduces erosion by decreasing runoff velocity, increasing infiltration and aiding in the establishment of vegetation.

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Successfully Growing Grass

- Information from Texas Cooperative Extension and Missouri Department of Natural Resources

Successful establishment of grass on a construction site involves four critical steps - (1) proper site preparation, (2) selection of seed, (3) planting, and (4) maintenance and inspection.

1. Site Preparation

Proper site preparation is essential to the successful establishment of grass; the seedbed is the support for grass. The seedbed refers to the several inches of surface soil that are tilled and modified prior to planting. **Poor seedbed conditions result in long term maintenance problems.** Sites with severe slopes, shallow topsoils and compacted soils need modifying or amending before grass will grow.

- **Site Clearing** - Remove all debris (rocks, twigs, foreign materials, and clods) from the top two (2) inches of soil to create a more desirable and uniform seedbed for planting.
- **Cultivation** - Loosen compacted soil surfaces with a disk, ripper, chisel, or harrow to a depth of approximately three (3) inches.
- **Soil Modification** - If necessary, incorporate lime into the top three (3) to six (6) inches of soil.

2. Seed Selection

Consider site conditions including soils, plant characteristics, and desired level of maintenance. A pure stand of grass provides the best erosion control. However, a grass/legume mix provides nitrogen to the grass and often grows during hotter and drier months when the grass is dormant. Usually one grass and one or two legumes is sufficient in a mixture.

Temporary or annual grains such as wheat, rye, and oats have one growing season and are used for temporary vegetation or in a seeding mixture. These annuals can reduce weeds, control erosion and provide protection to young seedlings until the perennial species become established.

Pure Live Seed (PLS) refers to the amount of live seed in bulk seed. Calculating PLS can help save money and reduce waste. Take a look at the label on the bag of seed. You will find a lot of information such as the type of seed, the supplier, test date, and where the seed came from. More importantly, you will see seed purity and germination percent.

A high pure seed percentage provides the best results. The percentage of pure seed that will produce normal plants when planted under favorable conditions is the germination percentage.



Figuring Pure Live Seed

Example:

150 lbs. of tall fescue is needed to seed one acre of disturbed soil. The seed is 90% pure and has a 90% germination rate.

$$\frac{90\% \text{ Purity} \times 90\% \text{ Germination}}{100} = 81\% \text{ PLS}$$

$$150 \text{ lbs.} / 0.81 = 185 \text{ lbs. bulk seed needed}$$

Example Seeding Mixtures and Rates for Construction Sites:

| Grass/Legume Mixture | Seeding Rate (PLS) |
|--------------------------------------|--------------------|
| | lbs./acre |
| Tall Fescue*/Birdsfoot Trefoil | 8 + 5 |
| Tall Fescue*/White Clover | 15 + 1 |
| Tall Fescue*/Lespedeza | 15 + 15 |
| Tall Fescue*/Lespedeza/White Clover | 15 + 15 + 1/2 |
| Tall Fescue*/Red Clover | 10 + 8 |
| Tall Fescue*/Red Clover/White Clover | 10 + 6 + 1 |
| Wheat/Rye (temporary seeding) | 60 |
| Oats (temporary seeding) | 30 |

* Turf Fescue can be substituted for Tall Fescue at the same rates.

3. Planting

Permanent seeding may be done March 1 to June 1, and August 15 to November 1. Temporary seeding can occur during any season, however winter is the least tolerant. Always use mulch or other erosion control measures to protect the seed and reduce erosion until the vegetation is established. For dormant seeding dates, broadcast seed and immediately roll for good soil-to-seed contact. Dormant season seeding dates are December 15 to February 29. If unable to seed according to schedule, use temporary seeding until the preferred date for permanent seeding.

Seeding rates are based on the poor growing conditions that typically exist on a development site, a need for dense growth and high germination rates. For best results use certified seed. When using uncertified seed, use the highest recommended seeding rate. Higher seeding rates **will not** substitute for good seedbed preparation.

- Apply seed uniformly by broadcasting or drilling seed, or hydro-seeding.
- When drilling, plant companion crops about one (1) inch deep; plant grasses and legumes no more than 1/2 inch deep.
- Cover seed by harrowing or dragging a chain.

- Legumes require inoculation with nitrogen-fixing bacteria to ensure good growth. Mix inoculum with seed prior to planting.

Mulching or a rolled erosion control product is extremely important for successful seeding. Mulch helps seedlings germinate and grow by conserving moisture, protecting against temperature extremes and controlling weeds. It also maintains the infiltration capacity of the soil.

Cover ground surface with (1) straw applied at 2-2.5 tons/acre, (2) wood fiber or wood cellulose at 1/2 - 1 ton/acre, (3) wood chips at 5-6 tons/acre, and (4) bark at 35 yd³/acre. Crimp, tack or tie down mulch with netting.



4. Maintenance and Inspection

Expect emergence of perennial grasses and legumes within 28 days after seeding, with legumes following grasses. Inspect seeded areas weekly and after rain events. Check for:

- Erosion
- Seed washout
- Germination
- Vigorous seedlings
- Uniform density
- Green leaves

Cold Climate Considerations

The best approach to winter months is to plan ahead at the start of a project and develop a sequenced construction schedule to ensure that all exposed areas have cover before the first freeze. Preparation of vegetative cover should begin in the fall. Seeds must be sated early enough for them to germinate, establish roots, and provide cover before the winter begins. If construction is continuing through winter and new areas are disturbed, cover material can be applied over a snowpack.

It is important to note that all construction sites must remain in compliance with the NPDES permit throughout the winter even if no construction is occurring. For this reason, regular inspection and maintenance must continue throughout the winter months.

| Species | Seeding Rate lbs./ac (PLS) ¹ | Seeding Dates, Optimum and Acceptable | | | | | | | | | | | |
|-------------------------------------|--|---------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| ● Turf Fescue ² | 150 | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| ● Tall Fescue ² | 150 | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| ● Redtop ² | 8 | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| ● Zoysia seed cultivar ³ | 44 | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| ● Zoysia ³ | 20 bu./acre | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| ○ Birdsfoot Trefoil ⁴ | 10 | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| ● Red Clover ⁴ | 8 | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| ● White Clover ⁴ | 3 | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| ● Wheat/Rye ⁵ | 1 bu./acre | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| ● Oats ⁵ | 1.5 bu./acre | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

| | |
|------------------|--|
| Table Key | ● Low maintenance, low fertility needs, easy establishment |
| | ● Mod. maintenance, mod. fertility needs, mod. establishment |
| | ○ High maintenance, high fertility needs, hard establishment |
| | ■ Optimum seeding times |
| | ■ *With mulch - acceptable seeding times |

¹ PLS = Pure Live Seed

² Cool Season Grasses (plant in spring/fall)

³ Warm Season Grasses (plant in summer)

⁴ Legumes (use with grass in a mixture)

⁵ Companion Crops (use with grass in a mixture, or for temporary seeding applications)

How Much Fertilizer Should I Apply?

- Missouri Department of Natural Resources

Successful vegetative establishment is directly dependent on the nutrients in the soil. Most soils in Missouri are deficient in nutrients required for grass growth. For optimum results, take soil samples from the top six (6) inches in each area to be seeded. Submit samples to a soil testing laboratory for liming and fertilizer amendment recommendations.

Phosphorus helps roots develop, which will to get the plants established. Nitrogen will be taken up after the seed has germinated and the vegetation is growing. A rain event may wash the nitrogen downstream if applied heavily during seeding.

Soil samples taken in Boone County can be analyzed for a small fee at the Boone County Extension Center, 1012 N. Hwy UU, in Columbia. Recommendations will be made for nitrogen, phosphorous, potash, and liming.

Liming Requirements for Temporary Sites

Acid soils with an extremely low pH can prevent seeding success. However, most recommended temporary vegetation is tolerant of low pH soils and will establish on all but the lowest pH soils. If soil pH in the region is known to be extremely low, conduct a soil pH test to determine if limestone is necessary. Amend soils with lime according to the information in the table below. Soils with a pH above 7.0 should not be limed. Incorporate the lime three (3) to six (6) inches into the soil.

| pH Test | Plant Response | Recommended Application of Agricultural Limestone |
|-----------|----------------|---|
| Below 6.0 | Poor | Lime according to soil test |
| 6.0 - 6.5 | Adequate | No lime |
| > 6.5 | Optimum | No lime |

Temporary Seeding Fertilizer Applications

A general recommendation is to broadcast Nitrogen, Phosphorus and Potassium at 90 lbs./acre for areas receiving more than 30 inches of annual precipitation. For best results, incorporate the fertilizer into the top three (3) to six (6) inches before seeding.

What is Final Site Stabilization?

As defined in the NPDES/Missouri State Operating Permit, final stabilization is achieved when either perennial vegetation, buildings, or structures using permanent materials cover all areas that have been disturbed. With respect to areas that have been vegetated, vegetative cover shall be at least 70% of full established plant density over 100% of the disturbed area. Note that simply seeding and mulching is not considered acceptable cover for final stabilization.

Reading Fertilizer Labels



| 32-10-10 MEANS | | |
|---------------------------|---|---------------------------------------|
| 32% | 10% | 10% |
| Nitrogen (N) | Phosphorus (P ₂ O ₅) | Potash (K ₂ O) |
| OR | | |
| 12.8 lbs. N/40 lb. bag | 4 lbs. P ₂ O ₅ /40 lb. bag | 4 lbs. K ₂ O/40 lb. bag |

Fertilizing Permanent Seeding Sites

For establishment and long-term growth, apply a complete fertilizer at rates recommended by soil tests. In the absence of soil tests, use the following as a guide:

| Application | Fertilizer Mix | Application Rate |
|-------------|----------------|------------------|
| Initial | 10 - 24 - 18 | 435 lbs./acre |
| Subsequent | 20 - 10 - 5 | 435 lbs./acre |

Fertilizer can be blended to meet exact fertilizer recommendations. Take soil test recommendations to your local fertilizer dealer for bulk fertilizer blends. This may be more economical than bagged fertilizer.

Resources

Boone County Stormwater Design Manual, Chapter 8
http://www.showmeboone.com/stormwater/common/PDF/Chapter_8_final.pdf

Surface Stabilization - Erosion Controls, Missouri Department of Natural Resources
<http://www.dnr.mo.gov/env/wpp/wpcp-guide/chapt6-3.pdf>

Seeding Rates, Dates, and Depths for Common Missouri Forages, University of Missouri Extension
<http://extension.missouri.edu/p/G4652>

Minnesota Pollution Control Agency's Slope and Site Stabilization NPDES/SDS construction Stormwater Permit Requirements
http://www.co.crow-wing.mn.us/planning_zoning/water_and_wetlands/stormwater/mpca_stormwater_factsheets/docs/Slope_and_Site_Stabilization.pdf

Specifications for Turf Grass Establishment, TX Cooperative Extension
<http://aggie-horticulture.tamu.edu/archives/parsons/turf/publications/estab.html>

Seeding For Construction Site Erosion Control, Wisconsin Department of Natural Resources Conservation Practice Standard
http://dnr.wi.gov/runoff/pdf/stormwater/techstds/erosion/Seeding%20For%20Construction%20Site%20Erosion%20Control%20_1059.pdf