SEEDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Certification of Products

B. Acceptance and Warranty

C. Seed Types and Mixes

D. Equipment

E. Application of Seed

1.02 DESCRIPTION OF WORK

A. This specification includes materials, equipment, and labor requirements for the complete and satisfactory installation and maintenance for all seeding.

B. The requirements for the work on this project are familiarity with the site, scope of work of the project, and coordination of the seeding with related work.

C. Seeding includes the operations of seedbed preparation, furnishing, applying, and covering the seed, and compaction of the seedbed.

1.03 SUBMITTALS

Follow the General Provisions (Requirements) and Covenants, as well as the following:

A. Submit certification of products to the Engineer prior to seed placement:

1. Seed: Submit a mechanically printed seed tag from an Iowa Crop Improvement Association-approved seed conditioner or grower. Submit a laboratory analysis for all seeds, specifying the purity and germination. Provide 48 hours notice prior to mixing the seed and give the Engineer an opportunity to witness the seed mixing.

2. Fertilizer: Submit certification of the fertilizer analysis with scale weight and statement of guaranteed analysis. Submit from a certified fertilizer dealer, a mechanically printed commercial fertilizer label or bill of lading. All fertilizer will meet the inspection and acceptance requirements of Iowa DOT Materials I.M. 469.03.

3. Wood Cellulose Fiber Mulch: Submit certification of the degradable wood cellulose fiber mulch ingredients with applicable use and rate, and the water retention capacity by manufacturer or supplier.

4. Wood Excelsior Mulch: Bale wood excelsior and determine the mass (weight). Use the mass of the material, furnished by the manufacturer, to determine the rate of application.

5. Straw Mulch: Certify weight. Furnish a list of the number of bales and a corresponding ticket from an approved scale for the mulch material to be used on the project.

6. Compost: Submit certification of composted organics analysis with U.S. Compost Council's Seal of Testing Assurance (STA), recommended rates of application, and manufacturer's estimated cubic yards per ton.

1.03 SUBMITTALS (Continued)

7. Inoculant: Furnish information from inoculant packaging.

8. Tackifier: Submit certification of the tackifier ingredients, recommended rates of application, and expiration date.

B. When requested, submit written instructions recommending procedures for maintenance of seeded areas.

1.04 SUBSTITUTIONS

Follow the General Provisions (Requirements) and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Follow the General Provisions (Requirements) and Covenants, as well as the following:

A. Deliver packaged materials in original, unopened, and undamaged containers. Do not mix or blend materials except in the presence of the Engineer.

B. Deliver, handle, and store all materials according to product recommendations, and protect from loss, damage, and deterioration.

C. Materials not meeting these requirements will be rejected.

1.06 SCHEDULING AND CONFLICTS

Follow the General Provisions (Requirements) and Covenants, as well as the following:

A. Coordinate the seeding schedule with all other work on the project. Notify the Engineer at least three calendar days prior to the start of seeding operations.

B. Perform seeding operations after all land-disturbing activities are completed, and after the seedbed has been approved by the Engineer.

1.07 SPECIAL REQUIREMENTS

Follow the General Provisions (Requirements) and Covenants, as well as the following:

A. Acceptance:

1. Guarantee in writing that all work has been completed as specified and provide the date that all activities were completed. When a warranty is a separately-bid item, this also establishes the beginning of the warranty period.

2. Acceptance will occur, provided seeded areas are in a live, healthy, growing, and well-established condition without eroded areas, bare spots, weeds, undesirable grasses, disease, or insects.
   a. Projects without a separately-bid warranty will be accepted no sooner than 60 days from the date that all activities were completed.
   b. When a warranty is established as a bid item and the warranty period excludes 60 days, projects may be accepted after all specified work, excluding the warranty, is satisfactorily completed, and a supplemental contract for the warranty is executed according to the Code of Iowa Section 573.27.

1.07 SPECIAL REQUIREMENTS (Continued)

B. Warranty:

1. Required only when established as a bid item by the Engineer.

2. The warranty is to guarantee completed seeding areas for a maximum period of twelve months.

3. During the warranty period, correct and reseed as originally specified, any defects in the seeded areas and grass stand, such as weedy areas, eroded areas, and bare spots, until all affected areas are accepted by the Engineer.

4. Replace or repair to original condition, all damages to property resulting from the seeding operation or from the remedying of defects, at the Contractor's expense.

5. Replacement costs are the Contractor's responsibility, except for those resulting from loss or damage due to occupancy of the project in any part, vandalism, civil disobedience, acts of neglect on the part of others, physical damage by animals, vehicles, fire, or losses due to curtailment of water by local authority, or by "Acts of God."

1.08 MEASUREMENT FOR PAYMENT

A. Conventional Seeding:

1. Seeding:
   a. Seeding for a completed installation will be measured in squares, each square containing 100 square feet, or by acres, as specified, of accepted seeding within the contract or easement limits. Areas outside of construction limits or easement limits will not be measured for payment.
   b. Payment for seeding will be full compensation for furnishing all materials, equipment, tools, and labor necessary to complete the work. It includes removal of rock and other debris from the area, repairing rills and washes, preparing the seedbed, furnishing and placing seed, including any treatment required, and furnishing water and other care during the care period, unless these items are bid separately.
   c. Each type of seeding specified will be measured and paid for separately.

2. Fertilizing: For fertilizer furnished and placed, payment will be made at the contract unit price per acre or square as specified. Payment for fertilizing will be full compensation for furnishing all materials, equipment, tools, and labor necessary to complete the work. It includes spreading fertilizer and mixing it into the soil if specified.

3. Mulching: For mulch furnished and placed, payment will be made at the contract unit price per acre or square as specified. Payment for mulching will be full compensation for furnishing all materials, equipment, tools, and labor necessary to complete the work. It includes placing and tucking the mulch.

B. Seeding, Fertilizing, and Mulching for Hydraulic Seeding:

1. Seeding for a completed installation will be measured in squares, each square containing 100 square feet, or by acres, as specified, of accepted seeding within the contract or easement limits. Areas outside of construction limits or easement limits will not be measured for payment.

1.08 MEASUREMENT FOR PAYMENT (Continued)

2. Payment for seeding will be full compensation for furnishing all materials, equipment, tools, and labor necessary to complete the work. It includes removal of rock and other debris from the area, repairing rills and washes, preparing the seedbed, furnishing and placing seed, including any treatment required, furnishing and placing fertilizer and mulch, and furnishing water and other care during the care period, unless these items are bid separately.

3. Each type of seeding specified will be measured and paid for separately.

C. Seeding, Fertilizing, and Mulching for Pneumatic Seeding:

1. Seeding for a completed installation will be measured in squares, each square containing 100 square feet, or by acres, as specified, of accepted seeding within the contract or easement limits. Areas outside of construction limits or easement limits will not be measured for payment.

2. Payment for seeding will be full compensation for furnishing all materials, equipment, tools, and labor necessary to complete the work. It includes removal of rock and other debris from the area, repairing rills and washes, preparing the seedbed, furnishing and placing seed, including any treatment required, furnishing and placing fertilizer and mulch, and furnishing water and other care during the care period, unless these items are bid separately.

3. Each type of seeding specified will be measured and paid for separately.

D. Watering: When bid separately, watering will be measured by metering. If not available, measurement can be done by counting the loads from a transporting tank of known volume. Payment will be at the contract unit price per 1,000 gallons.

E. Warranty: Warranty for seeding will be based on lump sum. Lump sum items will not be measured.

PART 2 - PRODUCTS

2.01 SEED

This section includes both temporary and permanent seeding.

A. Provide fresh, clean, new crop, certified seed complying with tolerance for germination and purity and free of poa annua, bent grass, and noxious weed seed. Furnish all seeds, including grass, legume, forbs, and cereal crop seeds, from an established seed dealer or certified seed grower. All materials and suppliers are to follow Iowa Seed Law and Iowa Department of Agriculture and Land Stewardship regulations, and be labeled accordingly.

1. Turfgrass will have a certified “blue tag.”

2. Native grass and forbs that are source-identified as G-0 Iowa certified yellow tag, when available.

B. Mix seed to the specified proportions by weight by methods approved by the Engineer.

C. Seed Quality: Ensure the seed provided meets or exceeds the minimum requirements of purity and germination stated on an analysis document that specifies quality. Approval of all seed for use will be based on the accumulated total of Pure Live Seed (PLS) for each phase of work. PLS is obtained by multiplying purity times germination. PLS shall not be less than the accumulated total of the PLS specified. If the purity and/or germination of native grasses exceeds the minimum required, adjust the application rate based on PLS.

If the seed does not comply with minimum requirements for purity and germination and such seed cannot be obtained, the Engineer may approve use of the seed on a basis of PLS or may authorize a suitable substitution for the seed specified.

D. Requirements on Containers:

1. Seed: Provide seed with a tag on each container. The seed analysis on the label shall be mechanically printed.

2. Mulch: When packaged, provide mulch in new labeled containers.

3. Tackifier: Provide tackifier packaged in new labeled containers.

4. Inoculant: Use inoculant that has a manufacturer’s container, indicating the specific legume seed to be inoculated and the expiration date. All inoculant must meet requirements of the Iowa Seed Law. Follow precautions specified on the product label.

5. Sticking Agent: Use a commercial sticking agent recommended by the manufacturer of the inoculant. For quantities less than 50 pounds, the sticking agent need not be a commercial agent, but requires approval by the Engineer. Apply sticking agent separately prior to application of inoculant. Follow safety precautions specified on the product label.

2.01 SEED (Continued)

Common Name	Scientific Name	Purity (%)	Germination (%)
DOMESTIC GRASSES:			
Bluegrass, Kentucky	*Poa pratensis*	98	85
Brome, smooth	*Bromus inermis*	90	85
Fescue, tall-Fawn	*Festuca arundinacea-Fawn*	98	85
Fescue, chewings, red, hard	*Festuca rubra var. cummutata*	98	85
Fescue, creeping, red, hard	*Festuca rubra*	98	85
Fescue, red-Pennlawn	*Festuca rubra-Pennlawn*	98	85
Fescue, Sheeps	*Festuca ovina*	98	85
Orchardgrass	*Dactylis glomerata*	90	90
Red Top	*Agrostis alba*	92	85
Wildrye, Russian	*Elymus junceus*	95	85
Ryegrass, Perennial	*Lolium perenne*	95	90
Timothy	*Phleum pretense*	99	90
LEGUMES:			
Alfalfa, Ranger/Vernal	*Medicago sativa*	99	90*
Alfalfa, Travois	*Medicoa spp.*	99	90*
Birdsfoot Trefoil Empire	*Lotus coniculatus*	98	85*
Crownvetch, Emerald	*Coronilla varia*	98	70*
Hairy Vetch	*Vicia villosa*	96	85*
Lespedeza, Korean	*Lespedeza stipulacea*	98	80*
Red Clover, medium	*Trifolium pretense*	99	90*
White Clover	*Trifolium repens*	98	90*
NURSE CROP OR STABILIZING CROP:			
Oats	*Avena sativa*	97	90
Rye	*Secale cereale*	97	90

*Includes hard seed.

2.01 SEED (Continued)

Common Name	Scientific Name	Min. PLS (%)
IOWA NATIVE GRASSES:		
Big Bluestem	*Andropogon gerardii*	30
Little Bluestem	*Andropogon scoparius*	30
Switchgrass	*Panicum virgatum*	63
Indiangrass	*Sorghastrum nutans*	60
Sideoats Grama	*Bouteloua curtipendula*	30
Prairie Dropseed	*Sporobolus heterolepis*	65
Sand Lovegrass	*Eragrostis trichodes*	65
Weeping Lovegrass	*Eragrostis curvula*	65
Hairy Wood Chess	*Bromus purgans*	60
Blue-Joint Grass	*Calamagrostis canadensis*	47
Bottlebrush Sedge	*Carex comosa*	62
Tussock Sedge	*Carex stricta*	78
Fox Sedge	*Carex vulpinoidea*	64
Virginia Wildrye	*Elymus virginicus*	60
Reed Manna Grass	*Glyceria grandis*	50
Fowl Manna Grass	*Glyceria striata*	72
Common Rush	*Juncus effuses*	80
Rice Cut Grass	*Leesia oryzoides*	62
Fowl Bluegrass	*Poa palustris*	72
Green Bulrush	*Scirpus atrovirens*	45
Wool Grass	*Scirpus cyperinus*	78
Soft-Stem Bulrush	*Scirpus vallidus*	78
Spike Rush	*Eleocharis palustris*	71
Wildrye, Canada	*Elymus canadensis*	80

If the purity and/or germination of native grasses exceed the minimum required, the application rate may be adjusted based on PLS.

Common Name	Scientific Name	PLS (%)
FORBS:		
Canada Anemone	*Anemone canadensis*	72
Marsh Milkweed	*Asclepias incarnate*	25
New England Aster	*Aster novae-angliae*	25
Swamp Aster	*Aster puniceus*	25
Showy Tick-Trefoil	*Desmodium canadense*	25
Joe-Pye Weed	*Eupatorium maculatum*	66
Boneset	*Eupatorium perfoliatum*	41
Ox Eye Sunflower	*Heliopsis helianthoides*	38
Blue-Flag Iris	*Iris virginica-shrevii*	19
Tall Blazingstar	*Liatris pycnostachya*	24
Great Blue Lobelia	*Lobelia siphilitica*	13

2.02 SEED MIXTURES AND SEEDING DATES

See the contract documents for the specified seed mixture. If none is specified, use the following. The Contractor may submit a modification of the mixture for the Engineer's consideration.

A. Type 1 (Permanent Lawn Mixture): Used for residential and commercial turf site, fertilized, typically mowed.

Seeding Dates: March 1 – May 31, August 10 – September 30	
Common Name	**Application Rate lb/acre**
Kentucky Bluegrass Cultivar[1]	65
Kentucky Bluegrass Cultivar[1]	65
Kentucky Bluegrass Cultivar[1]	65
Creeping Red Fescue	25
Fine-Leafed Perennial Ryegrass[2]	20
Fine-Leafed Perennial Ryegrass[2]	20
Annual Ryegrass	40

[1]Choose three different cultivars of Kentucky Bluegrass, at 65 pounds/acre each.
[2] Choose two different cultivars of Fine-Leafed Perennial Ryegrass, at 20 pounds/acre each.

B. Type 2 (Permanent Cool-Season Mixture for Slopes and Ditches): Not typically mowed. Reaches maximum heights of 2-3 feet, low fertility requirements, grows in spring and fall, can go dormant in summer.

Seeding Dates: March 1 – May 31, August 10 – September 30	
Common Name	**Application Rate lb/acre**
Fawn Fescue	65
Ryegrass (perennial)	45
Birdsfoot Trefoil (Empire)	5
Annual Ryegrass	40

C. Type 3 (Permanent Warm-Season Slope and Ditch Mixture): Not typically mowed. Reaches heights of 5-6 feet, stays green throughout summer, responds well to being burned in spring, no fertilizer.

Seeding Dates: March 1 – June 30	
Common Name	**Application Rate lb/acre**
Little Bluestem	3 PLS
Indiangrass	4 PLS
Sideoats Grama	5 PLS
Switchgrass	1 PLS
Big Bluestem	3 PLS
Oats	16
Annual Ryegrass	40

2.02 SEED MIXTURES AND SEEDING DATES (Continued)

D. Type 4 (Urban Temporary Erosion Control Mixture): Short-lived (6-8 months) mix for erosion control.

Common Name	Application Rate lb/acre
SPRING – March 1 - May 20	
Oats*	65
Annual Ryegrass	40
SUMMER – May 21- August 14	
Oats*	95
Annual Ryegrass	50
FALL – August 15-September 30	
Oats*	65
Annual Ryegrass	40

* Engineer may delete for previously established urban areas.

E. Type 5 (Rural Temporary Erosion Control Mixture): Short-lived mix for erosion control.

Common Name	Application Rate lb/acre
SPRING – March 1 - May 20	
Oats	65
Grain Rye	25
Red Clover	5
Timothy	5
SUMMER – May 21- August 14	
Oats	95
Grain Rye	35
Red Clover	5
Timothy	5
FALL – August 15-September 30	
Oats	65
Grain Rye	25
Red Clover	5
Timothy	5

2.02 SEED MIXTURES AND SEEDING DATES (Continued)

F. Wetland Seeding: Use the following seed mixture for areas designated for wetland grass seeding.

Seeding Dates: April 1 – June 30, August 1 – August 31			
Common Name	**Scientific Name**	**oz per acre**	**lbs/acre**
WETLAND FORBS:			
Water Plantain	*Alisma subcordatum*	16	1.00
Swamp Milkweed	*Asclepias incarnate*	8	0.50
New England Aster	*Aster novae-angliae*	8	0.50
Nodding Bur Marigold	*Bidens cernua*	5	0.31
Boneset	*Eupatorium perfoliatum*	4	0.25
Sneezeweed	*Helenium autumnale*	7	0.44
Arrowhead	*Sagittaria graminea*	8	0.50
Blue Vervain	*Verbena hastate*	5	0.31
	TOTAL	**61.00**	**3.81**
WETLAND GRASSES, RUSHES, AND SEDGES:			
Big Bluestem	*Andropogon gerardi*	32	2.00
Barnyard Grass*	*Echinochloa muricata*	16	1.00
Blue-Joint Grass	*Calamagrostis Canadensis*	16	1.00
Fox Sedge	*Carex vulpinoidea*	8	0.5
Spike Rush	*Eleocharis palustris*	8	0.5
Rice Cut Grass	*Leersia oryzoides*	16	1.00
Switchgrass	*Panicum virgatum*	8	0.50
Dark Green Bulrush	*Scirpus atrovirens*	8	0.50
Softstem Bulrush	*Scirpus validus*	11	0.69
	TOTAL	**123.00**	**7.69**

*Do not use in urban areas

2.02 SEED MIXTURES AND SEEDING DATES (Continued)

G. Native Grass and Wildflower Seeding: Use the following seed mixture for areas designated for native grass and wildflower seeding.

Seeding Dates: April 1 – June 30		
Common Name	**Scientific Name**	**lbs/acre**
NATIVE GRASSES:		
Oats	*Avena sativa*	32
Canada Wildrye	*Elymus Canadensis*	6
Switchgrass	*Panicum virgatum*	1
Big Bluestem	*Andropogon gerardi*	4
Indiangrass	*Sorghastrum nutans*	4
Little Bluestem	*Andropogon scoparius*	2
Sideoats Grama	*Bouteloua curtipendula*	1.5
FORBS:		
Purple Prairieclover	*Petalostemum purpureum*	0.25 (4 oz)
Blackeyed Susan	*Rudbecka hirta*	0.25 (4 oz)
Prairie Blazing Star	*Liatris pycnostachya*	0.25 (4 oz)
Pale Purple Coneflower	*Echinacea pallida*	0.25 (4 oz)
Grayhead Prairie	*Ratibida pinnata*	0.25 (4 oz)
New England Aster	*Aster novac-angliae*	0.125 (2 oz)

2.03 FERTILIZER

Use fertilizer of the grade, type, and form specified, that complies with rules of the Iowa Department of Agriculture and Land Stewardship and the following requirements:

A. Grade: Identify the grade of fertilizer according to the percent nitrogen (N), percent of available phosphoric acid (P_2O_5), and percent water soluble potassium (K_2O), in that order, and base approval on that identification.

The Contractor may substitute other fertilizer containing analysis percentages different from those specified, provided that the minimum amounts of actual nitrogen, phosphate, and potash per acre are supplied, and that in no case does the total amount per acre of the three fertilizer elements be exceeded by 30% of the following minimum amounts:

1. **For Conventional Seeding, Permanent:** Apply a 13-13-13 commercial fertilizer or the equivalent units of nitrogen, phosphate, and potash at the rate of 450 pounds per acre.

2. **For Conventional Seeding, Temporary:** Apply commercial fertilizer to all seeded areas at the rate of 450 pounds per acre of 13-13-13 (or equivalent) unless otherwise specified in the contract documents.

3. **For Hydraulic Seeding:** Apply fertilizer in combination with seeding by a hydraulic seeder and as specified in Iowa DOT Article 2601.03, B. Apply a 13-13-13 commercial fertilizer or the equivalent units of nitrogen, phosphate, and potash at the rate of 450 pounds per acre.

4. **For Pneumatic Seeding:** Based on the compost nutrient analysis, supply any additional commercial fertilizer necessary to meet the 13-13-13 units of nitrogen, phosphate, and potash at the rate of 450 pounds per acre as the compost is applied.

B. Type: Use fertilizer that can be uniformly distributed by the application equipment. Furnish fertilizer either as separate ingredients or in chemically-combined form.

2.04 STICKING AGENT

A. Use a sticking agent that is a commercial material recommended by the manufacturer to improve adhesion of inoculant to the seed. For small quantities less than 50 pounds, the sticking agent need not be a commercial agent, but it must be approved by the Engineer and must be applied separately, prior to application of inoculant.

B. Follow safety precautions specified on the product label. A sticking agent is not required if a liquid formulation of inoculant is used.

2.05 INOCULANT FOR LEGUMES

An inoculant is a culture of bacteria specifically formulated for each legume seed (alfalfa, clovers, lespedesa, birdsfoot trefoil, hairy vetch, and crown vetch).

2.06 WATER

Use water that is free of any substance harmful to seed germination or plant growth.

2.07 MULCH

A. For Conventional Seeding:

1. Material used as mulch may consist of the following:
   a. Dry cereal straw (oats, wheat, barley, or rye)
   b. Prairie hay
   c. Wood excelsior composed of wood fibers, at least 8 inches long, based on an average of 100 fibers, and approximately 0.024 inch thick and 0.031 inch wide. The fibers must be cut from green wood and be reasonably free of seeds or other viable plant material.

2. Do not use other hay (bromegrass, timothy, orchard grass, alfalfa, or clover).

3. All material used as mulch must be free from all noxious weed, seed-bearing stalks, or roots and will be inspected and approved by the Engineer prior to its use.

4. The Contractor may use other materials, subject to the approval of the Engineer.

B. For Hydraulic Seeding:

1. Wood Cellulose:
   a. Use material that is a natural or cooked cellulose fiber processed from whole wood chips, or a combination of up to 50% recycled paper (by volume).
   b. Product contains a colloidal polysaccharide tackifier adhered to the fiber to prevent separation during shipment and avoid chemical co-agglomeration during mixing.
   c. Form a homogeneous slurry of material, tackifier, and water.
   d. Use a slurry that can be applied with standard hydraulic mulching equipment.
   e. Dye the slurry green to facilitate visual metering during application.
   f. Do not use materials that have growth or germination-inhibiting factors or any toxic effect on plant or animal life when combined with seed or fertilizer.

2.07 MULCH (Continued)

2. Bonded Fiber Matrix (BFM):
   a. Produced from long-strand wood fibers, held together by organic tackifiers and bonding agents that, when dry, become insoluble and non-dispersible.
   b. Upon curing 24-48 hours, form a continuous, 100% coverage, flexible, absorbent, erosion-resistant blanket that encourages seed germination.
   c. Manufactured to be applied hydraulically.
   d. Physical Properties:
      1) Fibers: Virgin wood, greater than 88% of total volume.
      2) Organic Material: Greater than 96% of total volume.
      3) Tackifier: 8-10%.
      4) pH: 4.8 minimum.
      5) Moisture Content: 12% +/- 3%.
      6) Water-Holding Capacity: 1.2 gal/lb.

3. Mechanically-Bonded Fiber Matrix (MBFM):
   a. Produced from long-strand wood fibers and crimped, interlocking synthetic fibers.
   b. Within two hours of application, form a continuous, 100% coverage, flexible, absorbent, porous, erosion-resistant blanket that encourages seed germination.
   c. Manufactured to be applied hydraulically.
   d. Physical properties:
      1) Wood Fibers: 73% minimum.
      2) Tackifier: 10% +/- 1%.
      3) Crimped, Interlocking Synthetic Fibers: 5% +/- 1%.
      4) Moisture Content: 12% +/- 3%.

C. For Pneumatic Seeding: Use compost meeting the following requirements:

1. Derived from a well-decomposed source of organic matter.

2. Produced using an aerobic composting process, meeting Code of Federal Regulations (CFR) 503 for time, temperature, and heavy metal concentrations.

3. No visible admixture of refuse or other physical contaminants, nor any material toxic to plant growth.

4. Certified by the U.S. Composting Council's Seal of Testing Assurance (STA) program.

5. Conforms to chemical, physical, and biological parameters of AASHTO MP 10-03, with the following additional requirements:
   a. Follow U.S. Composting Council's TMECC guidelines for all testing.
   b. Organic Matter Content: 30% minimum.
   c. pH: between 6.0 and 8.0.
   d. Maturity (growth screening): Minimum 90% emergence for all compost to be vegetated.
   e. Particle Size:

Sieve Size	Percent Passing*
2"	100
1"	90-100
3/4"	65-100
3/8"	0-75

*6 inch maximum particle length.

2.08 EQUIPMENT

A. Aerial Equipment: When aerial application of seed and fertilizer is specified, use aerial equipment capable of providing a uniform distribution of seed and fertilizer on the specified area.

B. Compost Blower: A compost blower is pneumatic equipment to blow compost over the desired area. It may be equipped with a supplemental seed injection system.

C. Cultipacker: Use a pull-type cultipacker with individual rollers or wheels. Cultipackers with sprocket-type spacers between the wheels may be used. The cultipacker must produce a corrugated surface on the area being compacted. Operate the cultipacker separately from all other operations, and do not attach the cultipacker to the seeder or disk, unless combined cultipacker seeder is manufactured to operate as a unit. Make provisions for addition of weight.

D. Disk: When preparing a seedbed on ground having heavy vegetation, use a disk with cutaway blades. Make provisions for the addition of weight to obtain proper cutting depth.

E. Endgate Cyclone Seeders: Endgate cyclone seeders must be suitably mounted. Movement must be provided by mechanical means. The seed drops through an adjustable flow regulator onto a rotating, power driven, horizontal disk or fan.

F. Expanded Mesh Roller: Use equipment that is an open grid type or a cultipacker type, modified by covering with expanded metal mesh.

G. Field Tiller: Use equipment designed for the preparation of the seedbed to the degree specified.

H. Gravity Seeders: Gravity seeders must provide agitation of the seed, have an adjustable gate opening, and uniformly distribute seed on the prepared seedbed. Use a seed hopper equipped with baffle plates spaced not more than 2 feet apart. The baffle plates must extend from the agitator shaft to within approximately 2 inches of the top of the seed hopper. Wind guards are required to facilitate seeding when moderate wind conditions exist and when ordered by the Engineer. Place wind guards in front or in back (or both) of the seed outlet and extend them to near the ground line. This seeder may be used for application of fertilizer.

I. Hand Cyclone Seeders: Hand cyclone seeders are carried by the person dispensing seed. The seed drops through an adjustable flow regulator onto a rotating, hand driven, horizontal disk or fan.

J. Hydraulic Seeder: Use hydraulic seeding equipment with a pump rated at not less than 100 gallons per minute. Inoculant, seed, and fertilizer may be applied in a single operation. The equipment must have a suitable working pressure and a nozzle adapted to the type of work. Supply tanks must have a means of agitation. Calibrate tanks and provide them with a calibration stick or other approved device to indicate the volume used or remaining in the tank.

K. Interseeder/Slit Seeder: An interseeder/slit seeder is an implement that cuts a slit into the soil and drops the seed into the slit.

L. Mowers: Use mowers that are rotary, flail, disk, or sickle type. Do not use mowers that bunch or windrow the mowed material.

2.08 EQUIPMENT (Continued)

M. Mulch Stabilizer: Use a mulch stabilizer designed to anchor straw or hay mulch into soil by means of dull blades or disks. It should have flat blades or disks, may have cutaway edges, must have a nominal minimum diameter of 20 inches, and must be spaced at approximately 8 inch intervals. The mulch stabilizer must be pulled by mechanical means and weigh approximately 1,000 pounds. When directed by the Engineer, increase the weight by addition of ballast.

N. Native Grass Seed Drill: Use a native grass seed drill designed to provide uniform distribution of native grass and wildflower seeds. Provide separate seed boxes to apply both small seeds as well as fluffy bearded seeds. If a no-till attachment is specified, use an attachment of the same manufacturer as the drill.

O. Pulverizer: A pulverizer is equipment designed to break up compacted soil to prepare a seedbed.

P. Rotary Tiller: Use equipment with rotary-type blades designed for the preparation of seedbed to the degree specified.

Q. Slope Harrow: Use a slope harrow, consisting of a rolling weight attached by heavy chain to a tractor. The chain must be of suitable length, with picks attached, and a means of rotating the picks as the rolling weight is pulled in a direction parallel to the movement of the tractor.

R. Spike Tooth Harrow: Use equipment designed to provide adjustment of the spike teeth to level the ground, or to be used as specified by the Engineer.

S. Straw Mulching Machine: Use a machine to uniformly apply mulch material over the desired area without excessive pulverization. The Engineer may consider excessive pulverization as the general absence of straw longer than 6 inches after distribution.

PART 3 - EXECUTION

3.01 AREA OF SEEDING

Seed only the areas shown on the plans and in the contract documents. Seed damaged areas that are disturbed outside the contract limits at the expense of the Contractor. Do not disturb areas having a satisfactory growth of desirable grasses or legumes.

3.02 FINISH GRADING AND TOPSOIL

See Section 2010 for finish grading and topsoil placement.

3.03 CONVENTIONAL SEEDING

A. Order of Operations:

1. Fertilizing
2. Seedbed preparation
3. Seed preparation/application
4. Mulching

B. Fertilizing:

1. Apply fertilizer immediately prior to seedbed preparation. Incorporate the fertilizer into the top 2 to 3 inches of topsoil during the seedbed preparation. Equipment that results in ruts or excessive compaction will not be permitted.

2. Do not apply fertilizer with native grass, wildflower, or wetland seeding.

C. Seedbed Preparation, Permanent:

1. Limit preparation of seedbed to areas that will be seeded immediately upon completion.

2. Work areas accessible to field equipment to a depth of not less than 3 inches. Use mechanical rotary tillage equipment for the preparation of seedbed on earth shoulders, urban or raised medians, rest areas, and islands. Prepare by hand areas inaccessible to field machinery, to a depth of not less than 2 inches. Use care that the entire width of the shoulder and areas around headwalls, wingwalls, flumes, and other structures are prepared in the manner specified. Where weed growth has developed extensively, they may be disked into the ground. If weed growth develops sufficiently to interfere with proper seedbed preparation, mow the weeds and remove them from the project at the Contractor's expense.

   Use crawler type or dual-wheeled tractors for seedbed preparation. Operate equipment in a manner to minimize displacement of soil and disturbance of the design cross section. Harrow ridging in excess of 4 inches due to operation of tillage equipment prior to rolling with the cultipacker. Roll the area with not less than one pass of the cultipacker prior to permanent seeding.

3. Shape and fine grade to remove rills or gullies, water pockets, undesirable vegetation, and irregularities to provide a smooth, firm, and even surface true to grade and cross-section. Disk and rototill seedbed to a minimum 3 inch depth. For Type 1 (lawn seeding), prepare to a fine texture and without soil lumps. Coordinate preparation of all ditches designated for special ditch control with the seedbed preparation. Till parallel to the contours.

3.03 CONVENTIONAL SEEDING (Continued)

4. Smooth the seedbed with a cultivator-type tillage tool having a rake bar or a rock rake. Pick up and remove all debris, such as rocks, stones, concrete larger than 2 inches (1/2 inch maximum for lawn seeding), or roots and other objectionable material that will interfere with the seeding operation. A spring tooth cultivator may be used in lieu of a rock picker. Remove the rock by hand after each use of the cultivator; repeat the process until the soil is relatively free of rock as determined by the Engineer.

5. Choose equipment to minimize soil compaction. Operate equipment in a manner to minimize displacement of soil and disturbance of the design cross-section. Smooth ridging in excess of 3 inches due to operation of tillage equipment prior to rolling with the cultipacker. Roll the area with at least one pass of the cultipacker. Remove ruts that develop during the sequence of operations before subsequent operations are performed. This must be completed just prior to seeding and the work approved by the Engineer before the seeding application.

D. Seedbed Preparation, Temporary: Till the soil to a minimum depth of 5 inches with a disk, harrow, or field cultivator.

E. Seeding:

1. Seed Preparation:

a. Thoroughly mix all seed specified for the contract prior to placing the seed in the seed hopper. Provide 48 hours notice prior to mixing the seed, and give the Engineer an opportunity to witness the seed mixing. The mixing of a certified blue tag seed mix at an approved (by Iowa Crop Improvement Association) seed conditioner's facility need not be witnessed.
b. Treat all legume seed with a commercial sticking agent to be applied prior to application of inoculant, or as a mixture when the sticking agent is compatible with other materials. A sticking agent is not required if a liquid formulation of inoculant is used.
c. Inoculate all legumes with a standard product humus culture before being mixed with other seeds for sowing.
d. Inoculate all legumes with a standard culture at the rate specified by the manufacturer of the inoculant according to Iowa DOT Article 4169.04. Do not expose inoculated seed to direct sunlight for more than 30 minutes. Re-inoculate seed that is not sown within 8 hours after inoculation prior to use. Pre-inoculated seed with manufacturer's recommended protective coating may be used in lieu of seed with Contractor-applied inoculant.
e. When the gravity or cyclone seeder is used for application of seed, inoculate legume seed according to the manufacturer's recommended procedures, before mixing with other grass seeds for sowing. Furnish and apply inoculant.

2. Seed Application, Permanent:

a. Prior to seeding, the seedbed will be inspected and approved by the Engineer. Use methods and procedures consistent with equipment manufacturer's recommendations; however, do not operate ground-driven equipment at speeds greater than 10 mph.
b. On all areas accessible to machinery, sow seed with a gravity seeder, endgate cyclone seeder, or seed drill.
c. On areas inaccessible to field machinery, the use of hand-operated cyclone seeders will be permitted, but no other hand-seeding methods will be accepted.
d. The application of grass and legume seed with hand seeders on early spring work must be performed as separate operations. No mixing of the two types of seed will be permitted.
e. All seeded areas will have one pass with a roller or cultipacker to firm the soil.

3.03 CONVENTIONAL SEEDING (Continued)

3. Seed Application, Temporary:

a. On areas accessible to field machinery, sow seed with an endgate cyclone seeder.
b. On areas inaccessible to field machinery, the use of hand-operated cyclone seeders will be permitted, but no other hand-operated seeding methods will be accepted.
c. Cover the seed and fertilizer by lightly tilling the seeded area with a disk, rigid harrow, spring tooth harrow, or field cultivator.

4. Seeding Outside of the Specified Seeding Dates: With the agreement of the Engineer and at the full responsibility of the Contractor, seeding operations may be conducted outside the specified seeding dates. Should the seeded areas require reseeding, it must be done as specified and at the Contractor's expense.

a. Dormant Seeding: When winter dormant seeding is allowed or specified by the Jurisdiction, complete it when air temperatures are consistently below 40 degrees and prior to December 25 of a given year. Dormant seeding is not allowed on snow.
1) Prepare the seedbed before the ground freezes.
2) To ensure protection of the seed, apply on a frosty morning or before a predicted snow.
3) Seeding may be done by hand or with seeding equipment.
4) For hydraulic seeding, apply the fertilizer at no more than 0.5 pounds nitrogen per 1000 square feet, followed by the seed.

b. Frost Seeding (Overseeding):
1) Complete frost seeding, also referred to as overseeding, in the spring when the ground is friable from frost action (February 1 to April 1).
2) Frost seeding is not allowed on more than 1 inch of snow.
3) Seeding can be done with a hand-operated cyclone seeder or other equipment.

F. Mulching:

1. Mulch all conventionally seeded areas the same day the seed is sown. Uniformly distribute the mulch over the required areas at a rate of 1.5 tons/acre for dry cereal straw, 2 tons/acre of wood excelsior, or 2 tons/acre for prairie hay. Prairie hay is not suitable for Type 1 (lawn seeding).

2. Work the mulch into the soil with a mulch tucker designed to anchor the mulch into the soil by means of dull blades or disks. Operate equipment in a manner to minimize displacement of the soil and disturbance of the design cross-section.

3.04 HYDRAULIC SEEDING

A. Order of Operations:

1. Seedbed preparation

2. Seed application, fertilizing, and mulching

B. Seedbed Preparation: Follow seedbed preparation for conventional seeding in Section 9010, 3.03.

C. Seed Preparation: Inoculant, in the quantities specified above, may be applied directly into the supply tank with seed, water, and other material.

D. Seed Application, Fertilizing, and Mulching:

1. Place all material, seed, fertilizer, mulch, and tackifier (if applicable) in hydraulic mulching equipment specifically manufactured for hydraulic seeding. Do not apply fertilizer with native grass, wildflower, or wetland seeding.

3.04 HYDRAULIC SEEDING (Continued)

2. Ensure that the hydraulic equipment, pump, and application process do not damage or crack seeds.

3. Mix materials with fresh potable water using a combination of both recirculation through the equipment's pump, and mechanical agitation to form a homogeneous slurry.

4. If necessary, dampen dry, dusty soil, to prevent balling of the material during application.

5. Apply the slurry evenly over all specified areas at component material rates specified:
   a. Wood Cellulose Mulch:
      1) Mulch: Minimum 2600 lb/acre dry weight.
      2) Tackifier: Minimum 50 lb/acre.
   b. Bonded Fiber Matrix: Minimum 3600 lb/acre dry weight.
   c. Mechanically-Bonded Fiber Matrix: Minimum 3600 lb/acre dry weight.

6. Retain and count empty bags of mulch to ensure final application rate.

7. Hydromulching: Hydromulching may be done over conventional seeding and/or fertilizing, if approved by the Engineer.

3.05 PNEUMATIC SEEDING

A. Order of Operations:

1. Seedbed preparation

2. Seed preparation

3. Seed application

B. Seedbed Preparation: Follow seedbed preparation for conventional seeding in Section 9010, 3.03.

C. Seed Preparation: Follow seed preparation for conventional seeding in Section 9010, 3.03. Pre-inoculate seed in the quantities specified above prior to placing in the seed equipment.

D. Seed Application:

1. Place all material, seed, fertilizer, and compost in equipment with a calibrated seeder attachment specifically designed for pneumatic seeding. Do not apply fertilizer with native grass, wildflower, or wetland seeding.

2. Apply the compost evenly over specified areas at material rates specified.

3. Inject seed and fertilizer into the top 1/4 inch to 1/2 inch of compost during application with a calibrated seed injector at the specified rate.

3.06 WATERING

A. Provide water, equipment, transportation, water tanker, hoses, sprinklers, and labor necessary for the application of water.

B. Use enough water to keep the soil and mulch moist to a depth of 1 inch and ensure growth of the seed. For turfgrass seeding areas, sufficiently water to keep the soil moist for a minimum of 21 days. If natural rainfall is adequate to keep the soil and mulch moist, artificial watering may not be needed.

3.07 RE-SEEDING

A. When all work related to seeding, fertilizing, and/or mulching has been completed on an area, and is washed out or damaged, re-seed, fertilize, and/or mulch the area at the contract unit price(s) when so ordered by the Engineer.

B. When work related to seeding, fertilizing, and/or mulching has not been completed in an area, and is washed out or damaged, re-seed, fertilize, and/or mulch the area as necessary, at the Contractor's expense.

3.08 CLEANUP

All work related to cleanup throughout the project and upon completion is the responsibility of the Contractor, at the Contractor's expense.

A. Remove all excess materials, debris, and equipment upon completion of work.

B. Clean all paved surfaces open for public use at the end of each day and prior to forecasted precipitation.

C. Repair any damage resulting from seeding operations.

D. Remove hydraulic slurry and other excess debris related to seeding operations from buildings, landscaping, mulch, pavement, and any other areas not specified for application, at the end of each day.

END OF SECTION