

Section VI – Technical Specifications

ITEM VII - GRASSING , PLANTING AND EROSION CONTROL

7.01 Scope

- (a) Grassing, planting and surface restoration consists of performing all labor and furnishing all materials to do the grassing and planting work complete as shown on the plans and specified herein, including ground preparation and fertilizing, seeding, hydro-seeding, mulching, erosion control netting, and tree root protection, vines, shrubs and tree planting and transplanting. This work shall also include the maintenance and watering and any necessary replanting.
- (b) Fertilizing, seeding, and mulching of disturbed areas shall be completed within thirty (30) working days following the initial ground disturbing activity. This may require that a temporary seeding mixture be used during given dates of the year when permanent seeding would not be allowed. Said temporary seeding for compliance shall be replaced by permanent seeding during allowed seeding dates.
- (c) Slopes steeper than 3:1 shall require Hydro-seeding unless otherwise approved by the Engineer.
- (d) The area within the limits shown on the plans, (and upon the direction of the Engineer, all areas disturbed as a result of the construction of the water and sewer) shall be planted with a mixture of grassing seeds and mulched as herein specified.
- (e) Vines, shrubs and trees shall be placed as shown on the planting plan or as authorized by the Engineer.
- (f) Grassing shall be seeding and mulching or hydroseeding. Mulching shall be straw as specified herein.

7.02 Materials

- (a) Fertilizer
 - (1) The quality of all fertilizer and all operations in connection with the furnishing of this material shall comply with the requirements of the South Carolina Fertilizer Law and with the rules and regulations, adopted by the South Carolina Department of Agriculture in accordance with the provisions of said law, in effect at the time of sampling. All fertilizer will be subject to sampling and testing by the Engineer, or by an authorized representative of the South Carolina Department of Agriculture, or both.
 - (2) Dry fertilizer shall have been manufactured from cured stock. During

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handling and storing the fertilizer shall be cared for in such a manner that it will be protected against hardening, caking, or loss of plant food values. Any hardened or caked fertilizer shall be pulverized to its original condition before being used.

- (3) Liquid fertilizer shall be stored and cared for after manufacture in a manner that will prevent loss of plant food values, and a homogeneous blend of plant food elements shall be maintained or re-blended to the original condition immediately before use.

(b) Limestone

- (1) The quality of all limestone and all operations in connection with the furnishing of this material shall comply with the requirements of the South Carolina Lime Law and with the rules and regulations, adopted by the South Carolina Board of Agriculture in accordance with the provisions of said law, in effect at time of sampling. All limestone will be subject to sampling and testing by the Engineer, or by an authorized representative of the South Carolina Department of Agriculture, or both.
- (2) Limestone shall be agricultural grade ground limestone. Either dolomitic or calcitic limestone may be used. All limestone shall contain not less than 90 percent calcium carbonate equivalents. Dolomitic limestone shall contain not less than 10 percent of magnesium. Dolomitic limestone shall be so graded that at least 90 percent will pass through a U.S. Standard 20 mesh screen, and at least 35 percent will pass through a U.S. Standard 100 mesh screen. Calcitic limestone shall be so graded that at least 90 percent will pass through a U.S. Standard 20 mesh screen, and at least 25 percent will pass through a U.S. Standard 100 mesh screen. Where current grading requirements of the South Carolina Department of Agriculture are different from the above, the requirements of the Department of Agriculture shall apply.
- (3) During handling and storing, the limestone shall be cared for in such manner that it will be protected against hardening or caking. Any hardened or caked limestone shall be pulverized to its original condition before being used.

(c) Seed

- (1) The quality of all seed and all operations in connection with the furnishing of this material shall comply with the requirements of the South Carolina Seed Law and with the rules and regulations, adopted by the South Carolina Department of Agriculture in accordance with the provisions of said law, in effect at time of sampling. All seed will be subject to

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sampling by the Engineer, or by an authorized representative of the South Carolina Department of Agriculture, or both; and will be tested by the South Carolina Department of Agriculture. Supplementary testing for seed germination may be performed by the Engineer.

- (2) The quality of all seed will be based on the percentage of pure live seed, which will be computed by multiplying the percentage of purity by the percentage of germination and dividing the result by 100.
 - (3) Seed shall have been approved by the South Carolina Department of Agriculture before being sown. No seed will be accepted with a date of test more than eight (8) months prior to the date of sowing, excluding the month in which the test was completed. Such testing, however, will not relieve the Contractor from the responsibility for furnishing and sowing seed that meets these specifications at the time of sowing. The Engineer may retest seed for germination after a five (5) month storing period; at the beginning of each normal seeding season for the particular kind of seed involved; or at any time that the condition of the seed appears to have deteriorated.
 - (4) When a low percentage of germination causes the quality of the seed to fall below the minimum pure live seed specified, the Contractor may elect, subject to the approval of the Engineer, to increase the rate of application sufficiently to obtain the minimum pure live seed content specified, provided that such an increase in the rate of application does not cause the quantity of noxious weed seed per acre or square yard, as the case may be to exceed the quantity that would be allowable at the regular rate of application.
 - (5) Each of the species or varieties of seed shall be furnished and delivered in separate bags. If seed is to be mixed before sowing, such mixing shall be done in a commercial seed mixing machine or by equally thorough means after sampling and testing have been completed.
 - (6) During handling and storing, the seed shall be cared for in such a manner that it will be protected from damage by heat, moisture, rodents, or other causes.
- (d) **Straw Mulch**
- (1) Straw mulch shall be threshed straw of oats, rye, or wheat and shall be free of mature seed, and free of any weed or grass species which would germinate and be detrimental to the specified grass.
- (e) **Erosion Control Matting**

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- (1) Erosion Control Matting shall be jute, cotton, excelsior, or plastic material. Matting shall not be dyed, bleached or otherwise treated in a manner that will result in toxicity to vegetation. When used within SCDOT right-of-ways, matting shall be either jute or excelsior and shall be certified in accordance with SCDOT specifications.

- (2) Jute matting shall be woven from plain single jute yarn, averaging 130 pounds per spindle of 14,400 yards. The yarn shall be loosely twisted and shall not vary in thickness by more than 1/2 its normal diameter. The finished mesh shall be of uniform, open (nominal one inch) plain weave, furnished in rolls as follows:

Width: 48 inches, plus or minus one inch, with 78 warp ends, plus or minus 2 ends, per width of matting.

Length: Convenience lengths, 50 yards minimum, with 41 weft ends, plus or minus 1 end, per linear yard.

Weight: Average 1.22 pounds per linear yard, plus or minus 5 percent.

- (3) Cotton netting shall be woven from undyed and unbleached cotton yard. The finished netting shall be of uniform open weave forming an open rectangular or square mesh of 1/4 to 1/2 inch, and furnished in rolls with the following characteristics:

Width: 48 inches minimum

Length: Convenient lengths, 50 yards minimum

Weight: Minimum average 0.12 pounds per linear yard of 48 inch wide material

- (4) Excelsior matting shall consist of a machine produced mat of curled wood Excelsior at least 47 inches in width. The mat shall be 0.975 pounds per square yard with a tolerance of plus or minus 10 percent. At least 80 percent of the individual excelsior fibers shall be 6-inches or more in length. The Excelsior fibers shall be evenly distributed over the entire area of the blanket. One side of the Excelsior matting shall be covered with a woven fabric of twisted paper cord or cotton cord, or with an extruded plastic mesh. The mesh size of either the fabric or plastic mesh shall be a minimum of 1" x 1 and a maximum of 1 1/2" x 3".

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- (5) Plastic netting shall be an extruded polypropylene or other acceptable plastic material, extruded in such a manner as to form a net with 1/4 to 1/2 inch rectangular or square openings with strands of approximately nine (9) millimeters thickness. The netting shall be furnished in rolls meeting the following characteristics:

Width: 48 inches minimum

Length: Convenient lengths, 50 yards minimum

Weight: Minimum average five (5) pounds per 1,000 square feet

- (6) Staples to hold erosion control netting in place shall be "U" shaped and shall be approximately six (6) inches long and one inch wide. Machine made staples shall be of No. 11 gauge or heavier steel wire. Hand made staples shall be made from 13-inch lengths of No. 9 gauge or heavier steel wire.

(f) Shrubs and Trees

- (1) Samples of materials proposed to be furnished hereunder shall be submitted to the Engineer for inspection prior to delivery of materials. All materials delivered hereafter shall conform to accepted samples, which shall be stored on the site and protected until the delivery of like materials has been completed.
- (2) Shrubs and plants shall be inspected for quality, size and variety, either at the place of growth or after delivery at the site of the work; as authorized by the Engineer. No shrubs or plants rejected at place of growth or at the site of the work shall be used or paid for under the item. Certificates of inspection as required by federal, state or other authorities shall accompany each shipment.
- (3) Plants shall be freshly dug, vigorous, of normal habit of growth, free of disease, insects, insect eggs and larvae. Plants shall be nursery grown under climatic conditions similar to those in locality of project. The height of plants and branching shall be measured when branches are in normal positions. Caliper shall be diameter of trunk one foot above surface of ground and shall be the determining measurement be considered a primary stem which starts from or close to the ground or at a point not higher than one fourth of the height of the plant. Plants shall conform to measurements of plant list in the plans, except that oversize plants may be used at no increase in contract price. Plants shall not be pruned prior to delivery except upon special approval. The variety of any shrub or plant shown on the plans may be changed prior to delivery to another variety of

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equal cost, at the option of the Engineer.

- (4) Stakes for supporting trees shall be of sound wood of uniform size, capable of standing in ground at least two years. They shall be at least two (2)-inches in diameter and not less than 9 feet in length, except that for trees under 6 feet in height stakes shall be not less than 8 feet in length. Ties shall be strips of canvas not less than 3-inches in width and 10 ounces in weight or equal fabric. Wrapping materials shall be of first quality burlap or waterproof crepe paper not less than 6 or more than 10 inches in width and of suitable strength.
- (5) Scientific and common plant names are used on the plans conform to Standardized Plant Names prepared for the American Joint Committee of Horticulture Nomenclature. Names of varieties not included therein conform generally with names accepted in the nursery trade. Substitutions will not be permitted, except that if proof is submitted that any plant specified is not obtainable a proposal will be considered for use of nearest equivalent size or variety with an equitable adjustment of contract price. The plants to be furnished and planted are shown on the plans.

7.03 Seedbed Preparation

- (a) After all other construction work is completed and the surface of the ground finished to subgrade the topsoil that was removed and stockpiled as specified in Item I of the specifications shall be spread over the area to be planted. This topsoil shall be uniformly spread in a layer not less than four inches thick. Additional topsoil from other sources shall be furnished by the Contractor if necessary, to cover the area to be planted to the specified depth. The entire area to be planted shall be carefully finished to exact line and grade before planting. Care shall be used to shape the surface of the ground properly around structures. Topsoil to be furnished shall be fertile, friable, natural topsoil typical of topsoil of locality. It shall be without admixture of subsoil and shall be reasonably free of stones, lumps, plants, roots, sticks, and other extraneous matter, and shall not be used for planting operations while in a frozen or muddy condition.
- (b) The Contractor shall cut and satisfactorily dispose of weeds or other unacceptable growth on the areas to be seeded. Uneven and rough areas, such as crop rows, farm contours, ditches and ditch spoil banks, fence line and hedgerow soil accumulations, and other minor irregularities which cannot be obliterated by normal seedbed preparation operations, shall be shaped and smoothed as directed by the Engineer to provide for more effective seeding and for ease of subsequent mowing operations.
- (c) The soil shall then be scarified or otherwise loosened to a depth of not less than 4-inches except as otherwise provided below or otherwise directed by the Engineer.

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Clods shall be broken and the top 2 to 3 inches of soil shall be worked into an acceptable seedbed by the use of soil pulverizers, drags, or harrows, or by other methods approved by the Engineer. All rock and debris shall be removed prior to the application of seed and fertilizer.

- (d) Prior to distribution of topsoil the sub-grade shall be scarified as described above. After the topsoil is spread the surface of all areas to be planted shall be prepared by plowing and discing in both direction, when feasible, to a depth of not less than four (4) inches. After removal of all large particles which cannot be broken, the surface shall then be harrowed and cultivated. Plowing and harrowing shall be performed with proper equipment and in such manner as to break up all clods, lumps, or earth balls, and to remove all rocks, stumps, large roots, or other particles so as to provide a suitable planting bed. Hand tools shall be used in inaccessible small areas.
- (e) The preparation of seedbeds shall not be done when the soil is frozen, extremely wet, or when the Engineer determines that it is an otherwise unfavorable working condition.
- (f) All soil to be used in a tree, shrub and vine pit for planting operations shall be conditioned by thoroughly mixing one part by volume of peat, one part by volume of rotted manure and four parts by volume of topsoil.

7.04 Applying and Covering Limestone, Fertilizer, and Seed

(a) General

- (1) Seasonal limitation for seeding operations; the kinds of grades of fertilizers; the kinds of seed; and the rates of application of limestone, fertilizer, and seed shall be as stated in the special provisions.
- (2) Equipment to be used for the application, covering, or compaction of limestone, fertilizer, and seed shall have been approved by the Engineer before being used on the project. Approval may be revoked at any time if equipment is not maintained in satisfactory working condition, or if the equipment operation damages the seed.
- (3) Limestone, fertilizer, and seed shall be applied within 24 hours after completion of seedbed preparation unless otherwise permitted by the Engineer, but no limestone or fertilizer shall be distributed and no seed shall be sown when the Engineer determines that weather and soil conditions are unfavorable for such operations.
- (4) During the application of fertilizer, adequate precautions shall be taken to prevent damage to traffic, structures, houses, vehicles, or any other

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appurtenances. The Contractor shall either provide adequate covering or change methods of application as required to avoid such damage. When such damage occurs the Contractor shall repair it, including any cleaning that may be necessary.

(b) Limestone and Fertilizer

- (1) Limestone may be applied as a part of the seedbed preparation, provided it is immediately worked into the soil. If not so applied, limestone and fertilizer shall be distributed uniformly over the prepared seedbed at the specified rate of application and then harrowed, raked, or otherwise thoroughly worked or mixed into the seedbed.
- (2) If liquid fertilizer is used, storage containers for the liquid fertilizer shall be located on the project and shall be equipped for agitation of the liquid prior to its use. The storage containers shall be equipped with approved measuring or metering devices which will enable the Engineer to record at any time the amount of liquid
- (3) Fertilizers shall be applied uniformly into the areas to be planted or improved in such amount and to such depth and according to the methods indicated in the specifications for the various ground covers. The fertilizer shall be well pulverized and free of lumps when applied. In no case shall full strength fertilizer be permitted in direct contact with roots. When fertilizers are applied hydraulically they must be diluted sufficiently as directed so that no damage is done to either seed or established grasses and legumes. Agricultural limestone and basic slag shall be applied in a separate operation but may be incorporated in soil with fertilizers in one operation.

(c) Seed

- (1) The Contractor shall notify the Engineer at least twenty-four hours in advance of the time he intends to start inoculating and mixing seed or begin sowing seed and shall not proceed with such work until permission to do so has been given.
- (2) Prior to sowing, the seed accepted for use shall be inoculated as provided herein. Each kind of seed shall be inoculated separately with the appropriate commercial culture according to instructions of the manufacturer of the material accepted for use, then allowed to surface dry to a free flowing state before mixing or sowing. In general, no greater quantity of seed shall be inoculated at one time than can be sowed by the end of the following working day. All inoculated seed shall be protected from the sun and direct contact with commercial fertilizers.

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- (3) Seed shall be distributed uniformly over the seedbed at the required rate of application, and immediately harrowed, dragged, raked, or otherwise worked so as to cover the seed with a layer of soil. **The depth of covering shall be as recommended by the seed company.** If two kinds of seed are to be used which require different depths of covering, they shall be sown separately.
- (4) Sowing of seed shall follow promptly after incorporation of fertilizer. Sowing shall be done uniformly at the specified rate by approved mechanical seeders. Hand operated cyclone sowers will be considered mechanical seeders. No sowing shall be done during windy weather, when the prepared surface is crusted, or when the ground is frozen, wet or otherwise in a nontillable condition. When a combination seed and fertilizer drill is used, fertilizer may be drilled in with the seed after limestone has been applied and worked into the soil. If 2 kinds of seed are being used which require different depth of covering, the seeding requiring the lighter covering may be sown broadcast or with a special attachment to the drill, or drilled lightly following the initial drilling operation.
- (5) When a hydraulic seeder is used for application of seed and fertilizer, the seed shall not remain in water containing fertilizer for more than 30 minutes prior to application unless otherwise permitted by the Engineer.
- (6) Immediately after sowing, the seeded area shall be harrowed, dragged, raked or otherwise worked so as to work the seed into the soil. Care shall be exercised during covering operations to preserve the line, grade and cross-section of the seeded areas and to see that areas adjacent to pavement, walks, etc., are not left higher than the paved surface. After the seed has been properly covered the seed bed shall be compacted immediately by means of a cultipacker, light roller or approved drag. Rolling or covering of seed may be omitted when seeding is done hydraulically and mulched.
- (7) The Contractor shall water, fill washes, and otherwise protect and maintain the seeded areas until permanent grass is established. Damage by either pedestrian, vehicular traffic, or other causes shall be repaired by the Contractor. It shall be the responsibility of the Contractor to establish and maintain a satisfactory stand of grass until final acceptance of the project and for the warranty period. A satisfactory stand of established grass shall be defined as a dense uniform growth three (3) inches high with complete cover of living grass (limited to the species of seed that are expected to germinate in the current season). If a satisfactory stand of grass is not established, the area shall be reseeded by the Contractor until permanent grass is established. Seeded areas shall be mowed as required

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and when weeds or other undesirable vegetation threaten to smother the planted species.

- (8) Existing privately maintained lawns shall be matched with a permanent seeding mixture. Said mixture rates and dates of seeding are to be documented by the Contractor and approved by the Engineer prior to application. Certain lawns may require sodding or sprigging in order to match existing lawns within the warranty period.

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(9) **TEMPORARY SEEDING MIXTURE – WINTER, EARLY SPRING AND FALL**

Seed Application Rates

<u>Species*</u>	<u>Rate (lb./acre)*</u>
Rye (Grain)	120

*-If above species of seed or application rate is different from current SCDOT specifications and seeding in highway right-of-ways, use SCDOT seeding specifications.

Suggested Seeding Dates

January through April and September through December

Soil Amendments

Apply lime and fertilizer according to soil tests or apply 2,000 lb./acre ground agricultural limestone and 750 lb./acre 10-10-10 fertilizer.

Mulch

Apply 3,000 - 4,000 lb./acre grain straw or equivalent cover of another suitable mulching material. Anchor mulch by tacking with asphalt, roving or netting, if specified on the plans, in the Special Conditions, or if directed by the Engineer or his representative.

Jute, Excelsior or other specified erosion control material shall be used in ditches and swales.

Maintenance

In all areas where an adequate stand of grass is not established and where erosion damage has occurred, rework the seed bed, as specified and seed and mulch again.

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(10) **TEMPORARY SEEDING MIXTURE – SUMMER**

Seed Application Rates

<u>Species*</u>	<u>Rate (lb./acre)*</u>
German Millet	50

*-If above species of seed or application rate is different from current SCDOT specifications and seeding in highway right-of-ways, use SCDOT seeding specifications.

The plans or Technical Special Conditions may specify seed other than above for specific properties or areas.

Suggested Seeding Dates

May through August

Soil Amendments

Apply lime and fertilizer according to soil tests or apply 2,000 lb./acre ground agricultural limestone and 750 lb./acre 10-10-10 fertilizer along with 500 lb./acre of 0-20-0 superphosphate.

Mulch

Apply 3,000 - 4,000 lb./acre grain straw or equivalent cover of another suitable mulching material. Anchor mulch by tacking with asphalt, roving or netting, if specified on the plans, in the Special Conditions, or if directed by the Engineer or his representative.

Jute, Excelsior or other specified erosion control material shall be used in ditches and swales.

Maintenance

In all areas where an adequate stand of grass is not established and where erosion damage has occurred, rework the seed bed, as specified and seed and mulch again.

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(11) **PERMANENT SEEDING MIXTURE - LAWNS**

Seed Application Rates

<u>Species*</u>	<u>Rate (lb/acre)*</u>
Annual Rye	109
Fescue	36
Hulled Bermuda	36
Bahia	<u>36</u>
TOTAL = 217	

*-If above type of seed or application rate is different from current SCDOT specifications and seeding in highway right-of-ways, use SCDOT seeding specifications.

The plans or Technical Special Conditions may specify seed other than above for specific properties or areas.

Planting Season

Planting season for permanent mixture is April to September. Planting during other seasons will be considered temporary and the basis for reworking and reseeding during the April to September time frame.

Soil Amendments

Apply lime and fertilizer according to soil tests or apply 4,000 lb/acre ground agricultural limestone and 1,000 lb/acre 5-10-10 fertilizer along with 500 lb/acre of 0-20-0 superphosphate.

Mulch

Apply 4,000 - 5,000 lb/acre grain straw or equivalent cover of another suitable mulching material. Anchor mulch by tacking with asphalt, roving or netting, if specified on the plans, in the Special Conditions, or if directed by the Engineer or his representative.

Jute, Excelsior or other specified erosion control material shall be used in ditches and swales.

Maintenance

In all areas where an adequate stand of grass is not established rework the seed bed, as specified and seed and mulch again.

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(12) **PERMANENT SEEDING MIXTURE – OPEN FIELDS AND PASTURES OR THROUGH WOODS**

Seed Application Rates

<u>Species*</u>	<u>Rate (lb./acre)*</u>
Annual Rye	109
Fescue	36
Hulled Bermuda	36
Bahia	<u>36</u>
	TOTAL = 217

*-If above type of seed or application rate is different from current SCDOT specifications and seeding in highway right-of-ways, use SCDOT seeding specifications.

The plans or Technical Special Conditions may specify seed other than above for specific properties or areas.

Planting Season

Planting season for permanent mixture is April to September. Planting during other seasons will be considered temporary and the basis for reworking and reseeding during the April to September time frame.

Soil Amendments

Apply lime and fertilizer according to soil tests or apply 4,000 lb./acre ground agricultural limestone and 1,000 lb./acre 5-10-10 fertilizer along with 500 lb./acre of 0-20-0 superphosphate.

Mulch

Apply 3,000 – 4,000 lb./acre grain straw or equivalent cover of another suitable mulching material. Anchor mulch by tacking with asphalt, roving or netting, if specified on the plans, in the Special Conditions, or if directed by the Engineer or his representative.

Jute, Excelsior or other specified erosion control material shall be used in ditches and swales.

Maintenance

In all areas where an adequate stand of grass is not established, rework the seed bed as

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specified and seed and mulch again.

7.05 Mulching

(a) General

- (1) All seeded areas shall be mulched unless otherwise indicated in the special provisions or directed by the Engineer.
- (2) Grain straw may be used as mulch at any time of the year. If permission to use material other than grain straw is requested by the Contractor and the use of such material is approved by the Engineer, the seasonal limitations, the methods and rates of application, the type of binding material, or other conditions governing the use of such material will be established by the Engineer at the time of approval.

(b) Applying Mulch

- (1) Mulch shall be applied within 24 hours after completion of seeding unless otherwise permitted by the Engineer. Care shall be exercised to prevent displacement of soil or seed or other damage to the seeded area during the mulching operations.
- (2) Mulch shall be uniformly spread by hand or by approved mechanical spreaders or blowers which will provide an acceptable application. An acceptable application will be that which will allow some sunlight to penetrate and air to circulate but also partially shade the ground, reduce erosion, and conserve soil moisture.
- (3) Straw mulch shall be applied at the rate of not less than 2 tons per acre.
- (4) Straw mulch may be applied by hand or with a mechanical mulch spreader. The spreader shall be designed to break up balls or clusters of the mulch and apply it evenly and uniformly over the surface so as not to exclude penetration of sunlight.
- (5) Immediately after the area to be mulched has received ground preparation and specified planting, the mulch shall be applied at the rates specified above. Mulch which is too fresh, or excessively brittle, or so decomposed as to retard growth of grass will not be acceptable. The asphalt adhesive shall be applied at a rate of 200 to 250 gallons per acre of undiluted asphalt.
- (6) Mulch shall not be applied during period of high winds or other unfavorable conditions. Care shall be exercised to protect the public, adjacent

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property, buildings, curbs, sidewalks, and the like form discoloration by the asphalt adhesive. The Contractor shall be responsible for any such damage to public or private property. Any damage or discoloration to structures shall be repaired without delay at the Contractor's expense.

(c) **Holding Mulch**

- (1) Where directed by the Engineer or his representative or called for on the plans or in the Special Conditions, mulch shall be held in place by applying a sufficient amount of asphalt or other approved binding material. The rate and method of application of binding material shall meet the approval of the Engineer. Where the binding material is not applied directly with the mulch it shall be applied immediately following the mulch application.
- (2) During the application of asphalt binding material, or other approved binding materials, adequate precautions shall be taken to prevent damage to traffic, structures, sidewalks, houses, or any other appurtenances. The Contractor shall either provide adequate covering or change methods of application as required to avoid such damage. When such damage occurs the Contractor shall immediately repair it, including any cleaning that may be necessary.

7.06 Hydro-Seeding and Mulching

- (a) Hydro-seeding and mulching shall consist of sowing seeds by hydraulic equipment and covering, compacting, mulching, and maintaining seeded areas. Seeds, hydro-seeding and mulching shall comply with applicable portions of these specifications. Hydro-seeding and mulching shall be performed at the locations and at the time shown on the plans and in conformity with these specifications.
- (b) Hydro-seeding shall be performed by approved equipment designed for the purpose. The equipment shall be designed to pump a water-seed-inoculant uniformly over the areas to be seeded. It shall include a power driven agitator to keep the mixture uniform during application. The equipment shall be of sufficient force and capacity to apply a uniform application to the upper limits of all cut slopes and the lower limits of all fill slopes. For hay or straw mulch, equipment shall be as specified herein.
- (c) Apply legume inoculates at four (4) times the manufacturer's recommended rates when adding inoculant to hydro-seeder slurry. The seeds shall be placed in the culture solution and mixed by mechanical agitator in the hydraulic feeder. Seeds shall be applied at the rate specified herein, and shall not remain in contact with the fertilizer for more than one hour prior to application.

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7.07 Maintenance of Seed and Mulching

- (a) Areas where seeding and mulching have been performed shall be maintained in a satisfactory condition until final acceptance of the project. Maintenance shall include mowing at the location and times directed by the Engineer.
- (b) Areas of damage or failure due to any cause shall be corrected by being repaired or by being completely redone as may be directed by the Engineer.
- (c) Where correction will require extensive seedbed preparation, or where earthwork repairs or complete reshaping are necessary, the seeding and mulching shall be redone in accordance with this section.
- (d) As an exception to the above, areas of damage or failure resulting either from negligence on the part of the Contractor in performing subsequent construction operations or from not taking adequate precautions to control erosion and siltation as required throughout the various sections of the specifications, shall be repaired by the Contractor as directed by the Engineer at no cost to the Owner.

7.08 Erosion Control Netting (Jute)

- (a) Erosion control netting shall be applied to seeded and mulched ground areas where directed by the Engineer or his representative, or where called for on the plans or in the Special Conditions.
- (b) Erosion control netting shall be placed immediately after completion of ground preparation, fertilizing, seeding, and mulching in accordance with these specifications. The netting strips shall be rolled out flat, parallel to the direction of flow. When 2 or more strips are required to cover an area, they shall overlap 3 inches, minimum. Ends of strips shall overlap 6 inches, minimum, with the upgrade section on top. The upslope end (anchor slot) of each strip shall be buried in 6 inch vertical slots, and soil tamped firmly against it. When, in the opinion of the Engineer, conditions warrant, any other edge exposed to excessive flow shall be buried similarly.
- (c) The netting shall be spread evenly and smoothly, and in contact with the mulch at all points. It shall be tamped or stapled to assure close contact with the mulch. Each strip shall be stapled in 3 rows; each edge and the center, spaced at not more than 3 feet longitudinally. Ends of strips shall be stapled at 9 inch intervals across their width.
- (d) Care during construction shall consist of protection and of repairs made necessary by erosion, wind, fire, and/or other causes. Repairs shall be such as to re-establish the condition and grade of the soil as existing prior to application of the netting,

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restoring damaged ground preparation, refertilization and replanting of damaged areas, without additional compensation. The period of care shall continue until acceptance of the contract. Care shall be performed without additional compensation.

7.09 Excelsior Matting

- (a) Excelsior matting may be used instead of erosion control netting and mulching on ground areas having a slope greater than 5 to 1 or at other locations as directed by the Engineer or his representative, or where called for on the plans or in the Special Conditions.
- (b) The area to be covered by the matting shall be properly prepared, fertilized, and seeded before the matting is applied. When the matting is unrolled, the netting shall be on top and the fibers in contact with the soil over the entire area. In ditches the matting shall be applied in the direction of the flow of water, butted snugly at ends and sides and stapled. On slopes the matting shall be applied either horizontally or vertically to the slope and ends and sides butted snugly and stapled.
- (c) Staples shall vary with soil conditions. The staples shall be driven vertically into the ground, spaced approximately two lineal yards apart, on each side, and one row in the center alternately spaced between each side (60 staples on each blanket) a common row of staples shall be used on adjoining blankets.

7.10 Planting Shrubs and Trees

- (a) Remove rock or other underground obstructions to the depths necessary to permit proper installation of planting, unless other locations are selected by the Engineer.
- (b) Stake plant locations and secure approval before excavating pits, making any adjustments necessary; locate no plants, except vines, closer than two feet to pavement or structure.
- (c) Excavate pits in circular outline, with vertical sides, for all plants except hedge plants.
- (d) Tree pits shall be at least two feet greater in diameter than diameter of ball or spread of roots; and at least two feet in depth. Shrub pits shall be at least one foot greater in diameter than diameter of ball or spread of roots and at least one foot in depth.
- (e) Set plants in center of pits, placing ball or roots on a layer of topsoil at least two inches in depth, adjusting depth as necessary so that crown of plant will stand at finished grade; set hedge plants, evenly spaced, along center line of trench.

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Compact soil around balls or roots of plants and water thoroughly. Form ridge of soil around edge of pit to facilitate watering. Use clean soil excavation from plant pits between shrub pits, if arranged in groups, as necessary to bring planted areas to finished grade, and dispose of excess excavated soil as directed; cultivate between pits to a depth of 6 inches, rake smoothly and neatly outline.

- (f) Prune plant in accordance with standard horticultural practice. Mulch plant pits one inch deep, using well rotted manure lightly incorporated in soil.
- (g) Stake trees as follows: setting each stake vertically and at least one third of its length in ground, approximately 12 inches from trunk; guy trees to upper end of stakes with canvas ties folded to a 1 1/2 inch width. Single stake trees under two inches in caliper if so indicate by drawings. Double stake each tree two or three inches in caliper setting each stake vertically at least one third of its length in the ground, approximately 12 inches from trunk. Guy trees to upper end of stake with canvas ties folded to one and one half inches in width.
- (h) Wrap trunk of trees, spirally to height of second branches and tie the wrapping in place with suitable cord.

7.11 Guaranty and Replacements

- (a) The Contractor will replace during the next planting season all dead trees, shrubs, and grass at no additional cost. Plants used for replacement shall be of the same kind and size removed or as specified elsewhere and shall be furnished, planted and mulched as specified.
- (b) The Contractor shall maintain planting at his own expense until expiration of the warrantee period, and until one (1) year after planting. Maintenance shall consist of preserving, protecting, watering, replacing, and such other work as may be necessary to keep the work in a satisfactory condition.

7.12 Erosion Control

- (a) The Owner will obtain the Certificate of Plan approval of the erosion and sedimentation control plan and a general stormwater NPDES Permit, if required, prior to beginning construction. A copy of the Permit is included in the Special Conditions.
- (b) The Contractor shall be required to perform the items of work shown on the plans, described in the Special Conditions of the Specifications and listed in the Permit.
- (c) During the construction of the project, the Contractor shall be required to take the necessary steps to minimize soil erosion and siltation of rivers, streams, lakes and property. The Contractor shall comply with the applicable regulations of the

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appropriate governmental agencies in regard to soil erosion control and sedimentation prevention.

- (d) The Owner will limit the area over which clearing and grubbing and excavation operations are performed whenever the Contractor's operations do not make effective use of proper erosion control measures.
- (e) Prior to the end of each work day on the project, the Contractor shall take the necessary measures to protect the construction area from erosion.
- (f) Temporary and permanent erosion control measures shall be accomplished at the earliest practicable time. Temporary erosion control measures shall be coordinated with permanent measures to insure economical effective and continuous erosion control during the life of the project.
- (g) Temporary erosion control measures shall include but not be limited to the use of temporary berms, dams, dikes, drainage ditches, silt ditches, silt fences, vegetation, mulches, mats, netting or any other methods or devices that are necessary.
- (h) Erosion control measures installed by the Contractor shall be suitably maintained by the Contractor, until the site is fully stabilized.
- (i) Where excavation is adjacent to streams, lakes or other surface waters, the Contractor shall not place excavated materials between the excavation and the surface waters. Where this practice is impractical, the Contractor shall provide temporary erosion control measures as authorized by the Owner, shown on the plans, described in the Special Conditions of the specifications, or listed in the permit.
- (j) Where live streams are crossed by the project, the Contractor shall exercise particular care to minimize siltation of the stream. Disturbance shall be limited to the width allowed by the US Army Corps of Engineers Permit, if applicable, at all live streams. Temporary erosion control measures shall be constructed as authorized by the Owner. These may include but not be limited to use of coffer dam in the stream, dikes, diversion ditches and/or temporary sediment traps at the top of the banks, and silt fences on all creek banks. All temporary erosion control measures shall be acceptably maintained until permanent erosion control measures at stream crossings shall include but not be limited to filter fabric and dumped rip-rap on the creek banks and the establishment of permanent grass cover on all disturbed and exposed soil.
- (k) Where runoff on natural ground may cause erosion of the trench or erosion of the backfill in the trench, the Contractor shall construct temporary erosion control measures. These may include but not be limited to diversion ditches, check dams

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and silt basins or other suitable erosion control measures as authorized by the Owner's representative.

- (l) Clearing and grubbing operations shall be limited to a maximum of three thousand (3,000) feet ahead of pipe installation crews. Temporary erosion control measures shall be constructed by the Contractor on cleared areas of the project as authorized by the Owner. These shall include but not be limited to dikes, diversion ditches, silt basins, check dams and silt fences.
- (m) Permanent seeding of disturbed areas shall be accomplished at the earliest practicable time. Temporary seeding may be required. The Contractor shall perform temporary seeding on disturbed areas as authorized by the Owner's representative. The Contractor shall not place more than 500 feet of water or sewer line ahead of temporary or permanent seeding of disturbed areas. Seeding shall meet the requirements of Item V of the Technical Specifications.
- (n) Gravel construction entrances shall be installed at all locations used regularly as ingress and egress to the project site.
- (o) **Stream and River Crossings**
 - (1) Stream and River Crossings shall include all equipment, labor and materials for complete construction of crossing including all excavations, coffer dams, ductile iron pipe installation, concrete encasement of pipe, stream or river diversion, shoring, backfill or excavations, removal of fill from the water course, rip-rap on stream banks, and all related work required to complete the river stream crossing, and any work required by US Army Corps of Engineers, US Fish and Wildlife Service, or any other Federal, State, or Local Agency having jurisdiction in the area of work.
 - (2) The sides and ends of concrete encasements shall be formed.
 - (3) Diversion ditches shall be constructed at or near the top of each river bank at river crossings. Localized stormwater runoff shall be diverted by way of the diversion ditches away from the disturbed stream bank. Water coming into contact with uncured concrete shall be pumped to a separate holding tank or basin and shall not be returned to the river until proper settlement of solids and adjustment of pH to between seven (7) and nine (9). Temporary sediment traps may be required if determined necessary by the Engineer.
 - (4) Stream and River Crossings shall meet the requirements of Item V of the Technical Specifications.

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(p) Dumped Rip Rap for River and Stream Bank Protection

- (1) Rip-Rap, where specified on the plans, shall be placed to provide a minimum of 1.5 feet of cover and shall conform to the existing river bank slope and alignment. Where rip-rap is to be placed on river banks, the banks shall be excavated to accommodate the proposed rip-rap, leaving the rip-rap surface flush with the adjoining existing surfaces.
- (2) Geotextile fabric shall be placed on stream banks prior to placing rip-rap as shown on plans and shall meet the following requirements: Grab tensile strength shall be a minimum of 200 lbs. in accordance with ASTM-D4632. Elongation at failure shall be 50% minimum in accordance with ASTM D4632. Burst strength shall be minimum 360 PSI in accordance with ASTM D3786. Coefficient of normal permeability shall not be less than 0.1 CM/SEC. Vertical water flow shall be a minimum of 80 GPM/F² in accordance with ASTM D4491. Apparent opening size shall be 70 (US Std. Sieve Number).
- (3) Puncture strength shall be a minimum of 90 lb in accordance with ASTM D3787. Trapezoid tear strength shall be a minimum of 75 lbs. in accordance with ASTM D4533. The above values shall be taken as minimum average roll value in the weakest principal direction. The geotextile fabric shall be Trevira Spunbond Type 1125 as manufactured by Hoechst Celanese, or approved equal.
- (4) Rip-Rap shall conform to SCDOT requirements.
- (5) Select excavated trench rock may be used in lieu of quarry stone for dumped rip-rap. Stones shall be well graded weighing from 10 to 250 pounds each. Generally, not more than 10 (10%) percent by total weight shall weigh less than ten (10) pounds each, and not more than ten (10%) percent by total weight shall weigh more than three hundred (250) pounds each. Select excavated trench rock used for dumped rip-rap shall be free of excessive fines.
- (6) Payment for dumped rip-rap shall be made at the contract unit price in the proposal.