SECTION 03162 – CONCRETE AND ROCK STABILIZATION STRUCTURES

PART 1 – GENERAL

1.1 DESCRIPTION:

A. This section covers rock check dams, rock vanes, cross vanes, engineered rock riffles, bendway weirs, and longitudinal peaked stone toe protection (LPSTP) to be used at various locations within the project area as shown on the project design sheet. Items include, but are not limited to:

1. Rock gradation, procurement, storage, and handling.

2. Sub-grade preparation prior to rock installation.

3. Rock installation.

B. Types of structures covered by this specification:

1. Rock Vanes

2. Rock Bendway Weirs

3. LPSTP

4. Rock Chute

5. Stream Barbs

6. Crib Walls

7. Rootwad Revetments

C. Related Work in Other Sections:

1. Excavating, Back Filling, and Grading: Section 02200

1.2 REFERENCES:

A. The publications listed below form a part of this specification to the extent referenced. The latest revision of the following standards shall apply to work hereunder:

1. ASTM C 88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

2. ASTM C 127-88: Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate

3. ASTM D 5312-92: Standard Test Method for Evaluation of Durability of Rock for Erosion Control under Freezing and Thawing Conditions

1.3 LINES AND GRADES:

A. Rock placement shall conform to the lines and grades shown on the technical drawings.

PART 2 – PRODUCTS

2.1 MATERIALS:

A. Material shall be reasonably free from dirt, clay, sand, rock fines and other materials not meeting the required gradation limits.

B. Except as otherwise specified, the rock shall be angular to sub rounded in shape. The rock shall be dense, sound and free from cracks, seams and other defects conducive to accelerated weathering. The least dimension of an individual rock fragment shall not be less than one-third the greatest dimension of the fragment. Except as otherwise provided, the rock shall be tested and shall have the following properties:

1. Bulk Specific Gravity (saturated surface-dry basis) shall not be less than 2.4 when tested in accordance with ASTM C 127.

2. Absorption shall not be more than 4 percent when tested in accordance with ASTM C 127.

3. The weight loss in 5 cycles shall not be more than 20 percent when sodium sulfate is used or more than 25 percent when magnesium sulfate is used when tested in accordance with ASTM C 88 for soundness

4. Rock that fails to meet the requirements stated above in 1, 2, or 3 may be accepted only if similar rock from the same source has been demonstrated to be sound after 5 years or more of service under conditions of weather, wetting and drying, and erosive forces similar to those anticipated for the rock to be installed under this specification.

C. Poorly sorted rock materials shall be reasonably well graded by weight and poorly sorted by size, within the limits stated below or on the Drawings to meet the following requirements:

Aggregate Gradation A (D_{50} = 24 in.)

Size (lbs)	Percent Heavier
10	90
450	50
1000	0-10

Aggregate Gradation A (D_{50} = 18 in.)

Size (lbs)	Percent Heavier
10	85-100
100	60-80
250	30-60
600	0-10

Aggregate Gradation A (D_{50} = 12 in.)

Size (lbs)	Percent Heavier
5	85-100
50	50-70
100	5-15
400	0

D. Sorted riprap rock material shall be well graded by weight and size; within the limits stated below or on the Drawings to meet the following requirement. Riprap shall be free from earth, soapstone, shale, shalelike or other easily disintegrated material that decreases material durability after placement.

Aggregate Gradation B (D_{50} = 18 in.)

Size (lbs)	Percent Heavier
5	90
100	50
250	0-10

Aggregate Gradation B (D_{50} = 12 in.)

Size (lbs)	Percent Heavier
5	90
75	50
200	0-10

E. Crushed rock for filter course material shall be within the limits stated blow or on the Drawings to meet the following requirement.

Aggregate gradation C (Crushed Rock)

Size (In.)	Percent Retained on Sieve Size
No. 4	70-95
3/8	55-85
1	25-60
2	10-40
4	0-5

PART 3 – INSTALLATION

3.1 INSTALLING ROCK STRUCTURES:

A. The sub-grade surfaces on which the rock, filter, bedding, or geotextile is to be placed shall be cut and graded to the lines and grades shown on technical drawings. The surface to which the rock is to be placed shall be reasonably smooth and free of mounds, dips, or windrows.

B. The rock shall be placed by equipment on the surfaces and to the depths specified. The rock shall be installed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying material. The rock shall be delivered and placed in a manner that will ensure the rock shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks. Rock shall be placed in a manner to prevent damage to existing structures. Hand placing will be required as necessary to prevent damage to any new and existing structures.

C. Side slopes should be the natural angle of repose, which approximates 1.5 ft. horizontal to 1 ft. vertical.

3.2 MAINTENANCE:

A. If, at any time before 12 months after the completion and acceptance of the work, there shall be any settlement requiring repairs to be made along the line of work, or should any defect appear in the work due to neglect, carelessness or improper construction on the part of the Contractor, the Contracting Officer will notify the Contactor to make such repairs and remedy any defects. The Contractor shall, within 5 days after such notice, begin and carry out such repairs at no additional cost to the owner.

PART 4 – MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT:

A. Work will be measured by tons of rock placed.

4.2 BASIS OF PAYMENT:

A. The amount of work completed and approved, as stated above, shall be paid for at the contract unit price.

END OF SECTION 03162

NATURAL RESOURCES CONSERVATION SERVICE

CONSTRUCTION SPECIFICATIONS

CRITICAL AREA PLANTING

1. Scope

The work shall consist of establishing vegetation on sites with existing or expected high erosion rates or degraded sites that usually cannot be stabilized by ordinary conservation treatment and/or management. This specification (including references made within to other conservation practice standards and technical notes), Form KS-ECS-4, Grass Seeding, and/or Form KS-ECS-5, Tree/Shrub Planting, shall be used to design the practice. Practice application will be documented on Forms KS-ECS-4 and/or KS-ECS-5 and in the conservation plan. See also Critical Area Planting Statement of Work (SOW) for additional information on design, installation, and certification requirements.

2. Site Preparation

Necessary shaping and smoothing shall be made before seedbed preparations are started. Where practical, the area should be shaped and graded to allow the use of conventional equipment for seedbed preparation, seeding, and mulching.

Where needed to aid with revegetation, topsoil shall be salvaged from borrow areas and re-spread onto shaped and graded areas. Topsoil may be replaced in lifts no greater than six inches. Prior to topsoil application, the re-graded area will be deep chiseled or ripped to reduce soil movement and to promote root penetration.

3. Seedbed Preparation

Seedbed preparation is to take place immediately after final shaping and grading. All tillage operations should be performed across the general slope of the land. The seedbed should be tilled to a depth of three inches. All loose soil will be smoothed and packed to a degree that results in a firm seedbed. A seedbed is considered sufficiently firm when a person walking across the field leaves a footprint no deeper than 1/8 of an inch. All debris, such as wood, stones, and other objects that will interfere with seeding and/or maintenance will be removed.

Soil fertility and pH level will be amended to meet the needs of the planned plant species and to support the intended purpose. Soil amendments when applied should be based on results of a soil test. However, at the discretion of the responsible technician, fertilizer application rates may be based on the general recommendations provided in Table 1 in lieu of using results from the soils test. If native species are to be used, nitrogen is not recommended to be applied until plants are established.

Manure may be substituted for commercial fertilizer on the basis of one ton of manure being equivalent to ten pounds of nitrogen, five pounds of phosphate, and ten pounds of potassium, or according to material analysis test results. Manure shall be incorporated within 24 hours of application to retain nutrient value and reduce potential nutrient losses.

Table 1. Fertilizer Application Rates

Seeding Zone	Pounds Per Acre			
	Nitrogen	Phosphate	Potassium	Lime
Western	20-30	*	*	
Central	30-40	40-60	*	
Eastern	40-50	60-80	*	*

* In areas of known phosphate, potassium, and lime deficiencies, apply the amount recommended locally for ag production or the amount recommended by a soils test.

On sites where suitable topsoil exists, do not apply nitrogen fertilizer in the establishment year where native plant species are to be seeded.

4. Vegetation Seeding

- **Seedbed**

Seeding of permanent vegetation may be made into the following types of seedbeds:

Standing cover – Drill or broadcast (depending on slope) a suitable, non–competitive cover crop such as sorghum or hybrid sudangrass. See Conservation Practice Standard 340, Cover Crop, for a listing of suitable species and seeding rates.

Surface mulch – Crop stubble, non-growing weeds, or other plant residue (dead litter cover) that is left on the surface through chemical or non inversion-type of tillage operations. Various mulching material may also be applied before or after the permanent seeding takes place. For mulching materials and amounts, see Conservation Practice 484, Mulching.

Clean tilled – Prior to planting, the seedbed shall be prepared by using tillage equipment which will penetrate 2 to 3 inches and leave a firm but friable seedbed. This may not be an option where erosion is a concern unless proper amounts of mulching material are applied after seeding.

- **Seeding Method**

A grass drill is preferred. The drill should be equipped with double–disk openers, depth-control device for proper seed placement, and press wheels or drag chains. The drill should be operated across slope. The seed should be planted to a depth of ¼ to ¾ of an inch. On areas too steep for equipment operation, seed mixtures may be broadcast or hydroseeded. For broadcasting, the seed will be incorporated by harrowing, packing, raking by hand, or other suitable operation. For hydroseeding, the selected seed mixture and mulching material shall be applied according to manufacturers' recommendations.

- **Seeding Dates**

Seeding periods will be as follows:

- Cool-season species: Aug 15 – Oct 1; Dec 1 – Apr 15
- Warm-season species: Dec 1 – May 15
- Bermuda grass sprigs: Mar 1 – May 15

An extension of two weeks to the cut-off seeding date may be given by the district conservationist, based on favorable moisture and temperature conditions.

When it is not practical to wait for the seeding periods as noted above and at the discretion of the responsible technical, permanent seeding may be completed as soon as construction work is completed. Where soil erosion is a concern or at the discretion of the responsible technician, mulch will be applied according to Conservation Practice 484, Mulching, immediately following completion of the permanent seeding.

- **Plant Species Selection**

For approved plant species varieties, refer to Kansas Plant Materials Technical Note KS-1 (Rev 6), Grass and Forb/Legume Varieties Approved for Use in Kansas. For seeding zone delineation, see Figure 1. Where varieties are not available or are not adapted to the site, common (native harvest) seed from a source location as near to the area being seeded as possible may be utilized. For mileage restriction, native grass seed will not be used more than 250 to 400 miles north of or 100 to 150 miles south of its point of origin. An increase of elevation of 1500 feet is equivalent to a move of roughly 150 miles to the north. Seed from a southern source will be given preference over seed from a northern source. Seed source must be identified to the state and county level in order to certify mileage and elevation adequacy.

Seed labeling, quality, and seed testing shall be in accordance with Kansas Seed Law. For Kansas Seed Law, the germination test is valid for nine months after the end of the month the test was made so long as the seed remains in Kansas. Federal Seed Law pertains to seed shipped across state lines and the germination test is valid for five months after the end of the month the test was made.

For seed purchased during the valid period of the germination test, the analysis report may be considered current for the full seeding period in effect at the time of purchase. For example, if seed is purchased March 1 and the germination test date expires March 31, the analysis report may be considered current if the seed is planted by May 15. If the seed is to be planted during a later seeding season, a new germination test shall be performed.

A cooperator who raises and/or harvests seed for personal use must have a seed analysis performed. A copy of the report must be furnished to certify that quality and mileage restrictions are met.

5. Vegetation Sprigging

Vegetation may be established through the use of sprigs. Bermuda grass is typically established in this method, although seed type varieties of Bermuda grass are currently available.

- **Seedbed**

Sprigs should be planted into a firm, moist seedbed.

- **Sprigging Method**

It is desirable to plant Bermuda grass sprigs that are still dormant. Use freshly dug sprigs from areas where the top growth has been removed. Sprigs should be planted within 24 hours after they are dug. Keep sprigs moist until planted. Plant the sprigs with a mechanical sprigger or hand plant at a rate of 16 to 24 bushels per acre in 36 to 42 inch row spacing. Sprigs should be covered with 1 to 3 inches of soil and be well packed after planting. Subsequent fertilizer application shall be based on soil test, Table 1, or local extension recommendations.

Sprigging is also used as a method to establish vegetation on upstream berms of earth dams. Prairie cordgrass and common reed are typically planted as sprigs and are used to provide vegetative wave protection to the embankment. A row of sprigs shall be planted at the normal pool elevation along with a minimum of three rows planted below and three above the normal pool elevation. Rows should parallel the centerline of the dam and be spaced no greater than three feet apart. Sprigs within the rows should be placed every foot at a depth of 2 to 4 inches. Care should be taken to place prairie cordgrass sprigs with the growing point up. Sprigs should be planted while they are still dormant. Sprigs should not be permitted to dry out.

It may be necessary to control the water level of a structure to facilitate the establishment of the sprigs on the berm. Once prairie cordgrass and common reed become well established, both can tolerate extended periods of inundation. However, during the establishment period, seedlings of both species may be damaged by extended inundation periods.

- **Sprigging Date**

Sprigging should take place when soil moisture conditions are optimum during the period March 1 to May 15.

- **Plant Species Selection**

For approved plant species varieties, refer to Kansas Plant Materials Technical Note KS-1 (Rev 6).

6. Vegetation Planting Trees/Shrubs

Refer to Kansas Forestry Technical Note KS-9, Tree/Shrub Establishment and Maintenance Guidelines, for planting information and the electronic Field Office Technical Guide (eFOTG), Section II, Windbreaks and Environmental Plantings Interpretations for species suitability. It will be more than likely necessary to

complement the woody planting with a seeding of herbaceous species to aid with erosion control during the woody establishment period.

7. Maintenance

Maintenance will be carried out during establishment to aid in survival of the plant species. To manage weed competition, mow the weeds when they reach a height of 6 to 8 inches. If chemicals are used in lieu of mowing, they must be federally and locally registered and must be applied in strict accordance with authorized registered uses, directions on label, and other federal and state polices and requirements.

Livestock grazing will be excluded from the area during establishment. Flash-grazing for weed control is permissible during plant establishment if the grazing level is closely monitored. Once the plants are established, grazing may take place within the limits of proper management.

Where introduced perennial herbaceous species are used, maintenance will require periodic soil testing to determine fertilizer needs of the species.

8. Specific Treatment for Critical Areas

- **Dunes and Blowouts**

  Blowouts will be enclosed with a permanent fence when they are larger than approximately 2 acres and the area is grazed during the growing season. The fence will be established away from the edges of the blowout.

  Fencing of the blowout is not needed where the adjacent area is not grazed by livestock or is used only during the winter, except in areas of heavy livestock concentrations. Fencing is not necessary if the grassland that contains the blowout is used only occasionally for partial summer use, such as with a planned grazing system.

  Natural recovery (no seeding) by protection is permissible where desirable species are present in sufficient amounts and the character of the blowout will permit stabilization in the desired period of time. A temporary fence is needed to prevent livestock use of the area.

  Seedbed preparation shall consist of establishing a cover crop according to Conservation Practice Standard 340, Cover Crop or in lieu of a cover crop, apply a natural mulch or manure according to Conservation Practice Standard 484, Mulching.

For species selection and seeding rates, see Table 2. For plant species varieties, refer to Kansas Plant Materials Technical Note KS-1 (Rev. 6). Adapted native forbs and/or legumes may be added in addition to the full grass seeding mixture at a rate not to exceed 1 lb. pls/ac. See Table 7 for a listing of forb/legume species.

Table 2. Dunes / Blowout Areas

SPECIES	FULL SEEDING RATE (#PLS/AC)	% OF MIXTURE	REMARKS
Native			
Big bluestem	12	0-10	Use as second choice to sand bluestem
Blue grama	3	0-10	
Indiangrass	12	0-10	
Little bluestem	8	10-20	
Prairie sandreed	8	20-30	
Sand bluestem	12	10-30	
Sand lovegrass	2	10-20	
Sideoats grama	12	0-10	
Switchgrass	6	10-30	

- **Earth Dams**

All construction areas not covered by permanent water and any related area expected to produce sediment shall be seeded to a permanent mixture.

Topsoiling - Topsoil will be placed at a minimum depth of one foot and a maximum depth of three feet on all areas designated for topsoiling. To aid with vegetation establishment, topsoil will be applied as follows:

Frontslope - Where riprap is used, topsoil will be placed from the upper elevation of the riprap to the top of the dam. Where riprap is not used, topsoil placement will begin at the lower elevation of the vegetative berm and extend to the top of the dam.

Emergency Spillway, Principal Spillway Outlet Channel, Dikes, Spoil Areas - For unconsolidated or consolidated material that is determined to be adequate for erosion control and for plant establishment, no topsoiling is needed. Where the material is questionable for plant establishment, but suitable for erosion control, topsoil will be considered when aesthetic and wildlife needs have been identified and are considered important. If the material is not suitable for either erosion control or plant establishment, topsoil will be applied.

Vegetative Treatment of Upstream Berms - Vegetative treatment of the upstream berm for embankment protection (for the flatter designed front slopes) will consist of seeding and/or sprigging. See previous Section 5b on sprigging upstream berms. Vegetative wave protection for the dam embankment will not work well where there is an extreme water level fluctuation for extended periods of time. Under these conditions, it is difficult to get the right type and amount of vegetation established to dissipate wave energy before it reaches the embankment. Procedures for determining the need for special wave protection measures including vegetated berms are included in Technical Release No. 56 and the Engineering Field Handbook. Water level fluctuation, if not too large or too prolonged, may be accommodated by dividing the berm into two different vegetative establishment zones. Each zone would be planted or seeded to species suited to those particular growing conditions. See Table 3 for species selection and seeding rates for Zones 1 and 2. For plant species varieties, refer to Kansas Plant Materials Technical Note KS-1 (Rev. 6).

- Zone 1 will typically be saturated and/or inundated for extended periods of time. This zone is usually six inches in elevation above and 1.5 foot in elevation below the normal pool elevation. The vegetation selected for this zone should be able to tolerate these moisture conditions as well as providing a dense, upright, heavy, and flexible stem that will aid in the dissipation of wave energy.
- Zone 2 typically covers the area from just above the normal pool elevation to the base of the dam embankment. This zone may be inundated for short periods of time, but will mostly be in dryer soil conditions. Species should be able to tolerate these conditions.

Seeding of Earth Dam Components - Seeding of earth dam components will be completed as shown in Table 3. However, for small farm type ponds (two acres or less total disturbance), one seed mixture developed from the Borrow, Waste, and Dam Fill Component Column may be used to seed the entire disturbed area. Adapted native forbs and/or legumes may be added in addition to the full grass seeding mixture at a rate not to exceed 1 lb. pls/ac. See Table 7 for a listing of forb/legume species.

Table 3 Earth Dam

SPECIES		MAXIMUM PERCENT IN MIXTURE			REMARKS
	FULL SEEDING RATE (#PLS/AC)	BORROW AREA WASTE AREA DAM FILL	STILLING BASIN OUTLET, SHORELINE, UPSTREAM BERM	SPILLWAY	
Native					
Big bluestem	12	10	10		Berm Zone 2 adapted
Blue grama	3	20		20	
Buffalograss	10	30	30	30	Berm Zone 2 adapted
Indiangrass	12	10	10		Berm Zone 2 adapted
Little bluestem	8	20	10	20	Berm Zone 2 adapted
Prairie cordgrass			Sprigs		Berm Zone 1, 2 adapted.
Sideoats grama	12	100	10	30	Berm Zone 2 adapted
Switchgrass (Kanlow)	6		40		Berm Zone 1, 2 adapted
Switchgrass	6	100	10		Berm Zone 2 adapted
Virginia wildrye	25		40		Berm Zone 2 adapted
Western wheatgrass	20	100	30	100	Berm Zone 2 adapted
Introduced					
Bermudagrass	5	100		100	
Common reed			Sprigs		Berm Zone 1, 2 adapted
Intermediate Wheatgrass	18	100		100	
Pubescent Wheatgrass	18	100		100	
Smooth bromegrass*	16	100		100	
Tall fescue*	12	100		10	

*Brome and fescue are limited to 50 percent if seeded in conjunction with native specie(s).
For the western seeding zone, brome is limited to 50 percent and fescue is not approved.
Native or introduced forbs/legumes may be added in addition to the grass mixture at a rate not to exceed 1 lb. pls./ac.
See Table 6 for a listing of species.

- **Grassed Waterway**

A mixture of species is preferred over a single species seeding. Native species are in general more tolerant to cropland chemicals than are cool-season introduced grasses.

When a waterway is constructed to meet design criteria for an annually vegetated waterway, the following management and planting recommendations should be taken into account:

- Close grown crops are usually planted in annually vegetated waterways.
- Planting equipment that leaves a ridge less than two inches high should be used.
- Crops may be planted either parallel or perpendicular to the flow of water.
- The bottom should be left relatively flat after all seedbed and seeding operations.

For perennially vegetated waterways, see Table 4 for species selection and seeding rates. Adapted native forbs and/or legumes may be added in addition to the full grass seeding mixture at a rate not to exceed 1 lb. pls/ac. For plant species varieties, refer to Kansas Plant Materials Technical Note KS-1 (Rev. 6).

Table 4. Grassed Waterway, Ephemeral/Classic Gully, and Other Critical Treatment Areas

SPECIES	FULL SEEDING RATE (#PLS/AC)	MAXIMUM PERCENT IN MIXTURE			REMARKS
		WESTERN ZONE	CENTRAL ZONE	EASTERN ZONE	
Native					
Big bluestem	12	10	30	30	If sandy, recommend sand bluestem.
Blue grama	3	20	10	10	
Buffalograss	8	30	10	10	
Indiangrass	12	10	30	30	
Little bluestem	8	20	20	20	
Prairie cordgrass	13		20	20	Adapted to wet sites.
Sideoats grama	12	100	100	100	
Switchgrass	6	100	100	100	Use 'Kanlow' for wet sites
Virginia Wildrye	25	10	30	30	Adapted to wet sites
Western wheatgrass	20	100	100	100	
Introduced					
Bermudagrass	5		100	100	May be sprigged at 16-24 bu /ac
Intermediate Wheatgrass	18	100	100	100	
Pubescent Wheatgrass	18	100	100	100	
Smooth brome*	16	50	100	100	
Tall fescue*	12		100	100	
Tall wheatgrass	20	100	100	100	Adapted to saline areas

* Brome and fescue limited to 50 percent if seeded in conjunction with native specie(s).
Native or introduced forbs/legumes may be added in addition to the grass mixture at a rate not to exceed 1 lb pls./ac.
See Table 6 for a listing of species.

- **Reconstructed mined land.**

Suitable annual cover crops will be established until a suitable seedbed is prepared for the permanent mix. See Conservation Practice Standard 340, Cover Crop. On acid sites, it may require cover crops to be established for a period of 1 to 3 years so that proper soil amendments may be applied. Liming rates to amend soil pH shall be based on results of soil test.

See Table 4 for species selection and seeding rates. For plant species varieties, refer to Kansas Plant Materials Technical Note KS-1 (Rev. 6).

In addition to herbaceous species, woody species may also be planted on reconstructed mined land. See Kansas Forestry Technical Note KS-9 for planting information and the electronic Field Office Technical Guide (eFOTG), Section II, Windbreaks and Environmental Plantings Interpretations for Species Suitability.

- **Urban and developing areas.**

For short, intermediate, and long-term cover crops, see Conservation Practice Standard 340, Cover Crop.

- **Ephemeral and classic gullies.**

Remove excess organic material and other trash from the area to be shaped. Fill existing gullies. All fill material shall be thoroughly compacted.

Where gullies have depths greater than three feet, it may be necessary to slope the sides of the gully prior to filling in order to obtain sufficient compaction. Gully side slopes prior to filling shall not be steeper than 1:1. Gullies deeper than three feet shall be overfilled by 10 percent.

Gully areas shall be shaped to either a trapezoidal or parabolic cross section. A parabolic cross section can be approximated by shaping a nearly level bottom width that is approximately equal to half the finished top width. Minimum construction depth shall be 0.5 foot. The standard dimensions that may be used are provided in Table 5, Kansas Form KS-ECS-20, Critical Area Planting Ephemeral Gully, shall be used for design documentation.

Table 5. Standard Dimensions for Shaping of Ephemeral Gully

CROSS SECTION DIMENSIONS * FEET			MAXIMUM CONTRIBUTING DRAINAGE AREA ACRES		
TOP WIDTH	DEPTH	BOTTOM WIDTH	WESTERN ZONE	CENTRAL ZONE	EASTERN ZONE
8	0.5	2	4	1	1
16	0.5	8	20	3	2

* Table dimensions may be adjusted by 10 percent to accomodate farm machinery.

Grass strips may be individually designed. Each strip must have the capacity to contain runoff from a 5-year, 24-hour storm assuming C retardence. Velocities shall not exceed 4 feet/sec, assuming D retardence. When strip width exceeds 20 feet, they shall be designed and constructed according to Conservation Practice Standard 412, Grassed Waterway.

See Table 4 for species selection and seeding rates. For plant species varieties information, refer to Kansas Plant Materials Technical Note KS-1 (Rev. 6).

- **Other areas needing critical treatment planting (diversions, dikes, or back slopes of push-up terraces, filter strips, field borders, contour buffer strips, wastewater treatment strips).**

See Table 4 for species selection and seeding rates. For plant species varieties information, refer to Kansas Plant Materials Technical Note KS-1(Rev. 6).

Table 6. Listing of Native, Introduced Forbs / Legumes

Native Forbs / Legumes	LEGUME	GROWTH HABIT	AREA OF ADAPTATION		
			EAST	CENTRAL	WEST
Black sampson - Echinacea angustifolia		PERENNIAL	x	x	x
Blackeyed susan - Rudbeckia hirta		PERENNIAL	x	x	
Butterfly milkweed - Asclepias tuberosa		PERENNIAL	x	x	
Clasping coneflower - Rudbeckia amplexicaulis		ANNUAL	x		
Dotted gayfeather - Liatris punctata		PERENNIAL	x	x	x
Englemann's daisy - Engelmannia pinnatifida		PERENNIAL	x	x	x
False sunflower - Heliopsis helianthoides		PERENNIAL	x	x	
Grayhead prairieconeflower - Ratibida pinnata		PERENNIAL	x		
Illinois bundleflower - Desmanthus illioensis	x	PERENNIAL	x	x	x
Indian blanket - Gaillardia pulchella		ANNUAL	x	x	x
Lance-leaf coreopsis - Coreopsis lanceolata		PERENNIAL	x		
Leadplant - Amorpha canescens	x	PERENNIAL	x	x	x
Maximilian sunflower - Helianthus maximiliani		PERENNIAL	x	x	x
Missouri primose - Oenothera missouriensis		PERENNIAL	x	x	
New England aster - Aster novae angliae		PERENNIAL	x		
Pale echinacea - Echinacea pallida		PERENNIAL	x		
Pitcher sage - Salvia azurea		PERENNIAL	x	x	x
Plains coreopsis - Coreopsis tinctoria		ANNUAL	x	x	x
Prairie aster - Aster patens		PERENNIAL	x		
Purple prairieclover - Dalea purpurea	x	PERENNIAL	x	x	x
Roundhead lespedeza - Lespedeza capitata	x	PERENNIAL	x	x	
Shellleaf beardtongue - Penstemon grandiflorus		PERENNIAL	x	x	
Showy partridge pea - Chamaecrista fasiculata	x	ANNUAL	x	x	
Thickspike gayfeather - Liatris pycnostachya		PERENNIAL	x		
Upright coneflower - Ratibida columnifera		PERENNIAL	x	x	x
White prairieclover - Dalea candidum	x	PERENNIAL	x	x	

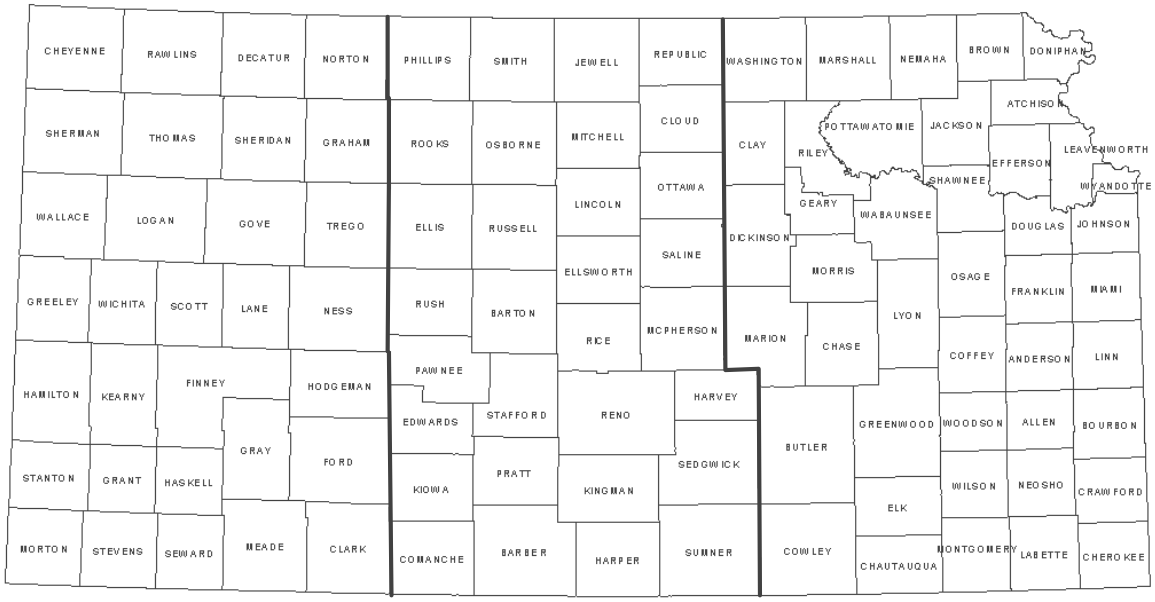
Introduced Legumes

Alfalfa	x	PERENNIAL	x	x	x
Birdsfoot trefoil	x	PERENNIAL	x		
Red Clover	x	PERENNIAL	x		

* Forb/legume species and varieties must be adapted to the site. For guidance on the suitability of species not listed, refer to eFOTG Section II, Rangeland Interpetations (Range Site Description) and Pasture Hayland Suitability Descriptions

**Adapted native forbs and/or legumes may be added in addition to the full grass seeding mixture at a rate not to exceed 1 lb. pls/ac.

Figure 1. Kansas Seeding Zone Delineation



Instructions for Using Live Cuttings for Vegetating Streambanks

INTRODUCTION

Live cuttings are leafless stem cuttings of woody plant species. These cuttings can be planted in various configurations to achieve certain vegetative and stabilization goals. The planting method(s) will be specified in the project or planting design. These methods may include: live siltation, brush layering, branch packing, brush mattress, live stakes, live poles, vegetated geo-grids, live crib-walls, joint planting, live fascines, and many others.

Willow and cottonwood cuttings are commonly used for riparian rehabilitation because they are easily established from cuttings. Although this document is primarily intended for willow species, the occasional inclusion of cottonwoods, sycamores, or other species as cuttings is acceptable. For additional species suitability, see the USDA, NRCS, publication National Engineering Handbook (NEH) Part 650. *Chapter 16: Streambank and Shoreline Protection*.

Cuttings can be obtained from commercial nurseries or cut from native stands located near project sites. When buying cuttings from commercial sources, the source and species shall be compatible with the planting area, i.e. native to the area and suitable for the local climate.

CUTTINGS FROM NATIVE STANDS

Native willow stands located near the project site are the best source of cuttings. On large stream systems, native willow stands are normally found on point bars directly across the river from project areas. Native stands of willow and cottonwood may have insect and disease infestations which can stress the plants. Extremely dry years or long periods of drought may also cause plant stress. This stress may reduce plant energy reserves resulting in decreased plant survival. When planning the number of cuttings to harvest, take stress indicators into account and harvest extra plants if needed.

Permission to harvest from the landowner, private or public, must be obtained prior to harvesting live cuttings.

CUTTINGS

Establishment success is significantly increased if cuttings are taken from live willows during the dormant season. This is the period between the fall leaf drop and the plant leaf budding in the spring.

See "Storage" section for procedures when harvesting well before the projected planting date.

Cutting Diameter

Cuttings shall be 1/2 inch diameter or larger depending upon the species. Ideal trees for cuttings should be from 3/4 inch to 3 inches in base diameter. Larger diameter cuttings have more energy and stored reserves than smaller diameter cuttings, but are often more difficult to place into the ground. Cuttings from 2 to 3 inches in diameter typically have the highest survival rates. Cuttings as large as 8 inches can be used as poles instead of live stakes. Live

poles provide more resistance to higher velocity flows and create roughness which reduces water velocity. However, larger diameter cuttings require longer cutting lengths and should be planted deeper in the soil. Deciding factors for selecting the cutting diameter are: stand density, size of the selected native species, and the selected planting method. When planting, cuttings should be large enough that they will not bend or break while being driven during installation. Smaller diameter cuttings, or limbs removed from larger cuttings are more suitable for brush mattresses, brush layering, branch packing, live fascines, or vegetated geo-grids.

Cutting Length

Cuttings shall have at least two leaf nodes, or bud scars, above the ground as illustrated on page 6. Cutting length is largely determined by the depth to the mid-summer vadose zone, or the area of moist soil at the lower bank. For ease of handling and transportation, cuttings should be harvested and stored at full length and then cut into shorter lengths prior to planting. Plantings should be placed on the lower portion of the streambank slope. Cuttings shall be long enough so the stem base reaches into the vadose zone. This zone extends slightly above the water surface elevation in most situations (See illustration on page 6).

- Several inches of the bottom of each cutting should be in the vadose zone.
- Each cutting should have a minimum of 2-4 buds above the ground.
- Observe the 2/3 or 3/4 rule: 2/3 to 3/4 of the cutting length should be placed below the soil surface.

Harvest of Cuttings

Once cutting size, source location is determined—and permission obtained—the actual cutting process can begin. Lopping shears, pruning shears, a small wood saw, brush cutters, or a chain saw are appropriate tools for harvesting cuttings. Desired cutting size will determine the appropriate tool(s).

- Make clean cuts. Ensure all equipment is sharp.
- Use live wood at least 1 year old or older. Do not use very old or dry wood.
- Larger wood is difficult to root. The best wood is 2-5 years old with smooth bark which is not deeply furrowed.
- Avoid current year's growth. It lacks the stored energy reserves necessary to consistently sprout when planted.
- When harvesting from native stands, make sure the stand will not be denuded or destroyed by your cutting activity.
- Trim off all side branches so only the main stem remains.
- The side branches can be used in live fascines, branch packing, brush layering, etc.
- Harvested plant material shall be ¾ inch to 3 inches in diameter at the base and 8 to 12 feet tall.
- A processing alternative, when cutting limbs into live stakes, is to cut the top of cutting with a horizontal cut and bottom of cutting with a 45 degree cut, (See illustration on page 6). This allows quick recognition of the cutting top (see Caring for Harvested Cuttings).

- Care should be taken to select plant materials that are free of physical damage, disease, and insect damage.

Caring for Harvested Cuttings

One of the most important steps in this process is the identification of **TOP** of cutting. If cuttings are planted upside down, mortality will occur. Leaf scars are the most reliable indicator to identify the cutting top. Buds emerging from leaf scar always point up. Another key is the stem. Usually, the smaller diameter end is the top of cutting; however this is not always obvious.

Transportation and Storage

After being harvested, the cuttings should be tied into bundles small enough to be easily carried by 1 or 2 people. Each bundle may contain 25 – 50 trees, depending on their size. Placing the same number of cuttings in each bundle makes it easier to count the number of harvested cuttings.

During harvesting, transportation, and storage, willow bundles should be kept moist and protected from sunlight and wind by covering or wrapping the bundles with wet burlap or a reflective moisture barrier to protect cuttings from becoming desiccated.

To minimize storage time, harvest cuttings in early spring within two to three weeks of the planned planting date. If this is not possible, cuttings can be harvested in late fall or winter and stored in a large cooler at 34-38°F until immediately prior to planting. Cuttings can be stored for several months in this manner. If cuttings are kept in a cooler, root cellar, garage, or shop floor, make sure the storage area is dark, moist, and cool at all times. Maintain a storage temperature slightly above freezing. Cuttings may be wrapped in a black tarp or plastic to be kept dark, if stored in an out building. Cuttings should be checked periodically for signs of frost damage and/or to insure that mold is not forming.

Pre-plant Soaking of Cuttings

Soaking plant material, prior to planting, significantly increases the survival rate. Prior to planting, all cuttings should be soaked for a minimum of 36 hours, regardless whether they are stored or harvested for immediate planting. Research shows that soaking the cuttings for 7 to 10 days can double the survival rate. Cuttings should be removed from water prior to root emergence from the bark. This normally takes 7 to 10 days. Soaking initiates the root growth processes within the inner layer of bark in willows and cottonwoods.

Only the bottom 1/3 of the cuttings needs to be soaked. However, soaking the entire cutting is not detrimental. Soaking can be accomplished in any container that will hold enough water to the required depth. Cuttings can also be soaked in streams, ponds, lakes, or other bodies of water. Avoid soaking cuttings in areas that are susceptible to flooding or where beavers are present.

Instructions for Using Live Cuttings for Vegetating Streambanks

PLANTING LIVE CUTTINGS

Spacing Considerations

Plant the cuttings about 3-4 feet apart for all live cuttings. This spacing is suitable for both within and between rows. Normally, only the lower slope should be planted with willows. Live cuttings should be planted on the first and/or second row above the edge of water. The first row is normally planted approximately 4 feet from the waters edge at low flow. Subsequent rows should be planted an additional 3 - 4 feet up slope from the previous row. Each row should be planted on an off-set pattern from the previous row (See attached design details on page 6).

When to Plant

Cuttings should be planted in early spring after frost has left the soil, but no later that June 1. Avoid planting cuttings or rooted stock in summer because of heat stress and a shortened growing period.

Planting Methods and Planting Cuttings:

One or two-person posthole power augers, hand soil augers, planting bars, shovels, soil probes, or simply pushing or driving the cutting into moist soil are appropriate tools to plant cuttings. When planting, keep several things in mind:

- Push the cutting into the soil when possible.
- If the soil is too firm to push the cutting into the soil, the cutting can be driven into the soil using a hammer. A 2-3 pound “dead blow hammer”, or shot filled mallet, works well to drive cuttings. This type of hammer reduces the chance of splitting the cutting or stake.
- If a cutting is split while driving, trim the cutting to below the split to prevent desiccation and plant mortality.
- It is essential to have firm contact between the cutting and soil. Avoid creating air pockets around the cutting that can prevent roots from developing. Holding on to the cutting with one hand while driving reduces air pocket formation.
- Avoid damaging buds when inserting the cutting into the hole or when driving the cutting.
- If the soil is too compacted to drive the cutting, a hole can be formed by driving a rebar or other metal rod into the soil first and then placing the cutting into the hole. The hole diameter shall be smaller than the cutting diameter to prevent air pocket formation.
- Holes can be created with any of the tools mentioned at the start of this section.
- The planting depth will determine the planting method. Deeper holes will be made easier by using a power auger.
- If the hole dug is larger that the cutting, additional soil will be required to form a good soil to stem contact. Preference should be given to local topsoil to encourage mycorrhizal formation and/or nodule formation by nitrogen-fixing organisms. Do not backfill with clay.
- Carefully tamp the soil around the cutting firmly several times as you fill any drilled or augered hole.
- “Water In” the back-filled soil around large cutting holes to settle soil and provide good soil to cutting contact.

Management and Maintenance

Proper management is necessary to maintain healthy, competitive plants that perform the desired function. This is as important as the initial planting to ensure rehabilitation of the riparian area. Some maintenance is expected on-site for several years after planting. For the first few years after planting, vegetation should be evaluated and monitored annually, or after any flood event. Some replanting may be needed in succeeding years in order to insure the establishment of a functioning riparian corridor.

Monitoring of the site is necessary to detect any in-stream dead organic material (i.e. old logs, dead root masses, branches, etc.). In-channel organic material may cause erosive cross currents that can erode a planted streambank. If this condition develops, the organic material should be removed or repositioned. Any trimming of cuttings should be done in the dormant season so growth will not be slowed during the growing season. During the establishment period, leave standing dead branches within the plantings to reduce stream flow velocities, thus protecting the established plantings.

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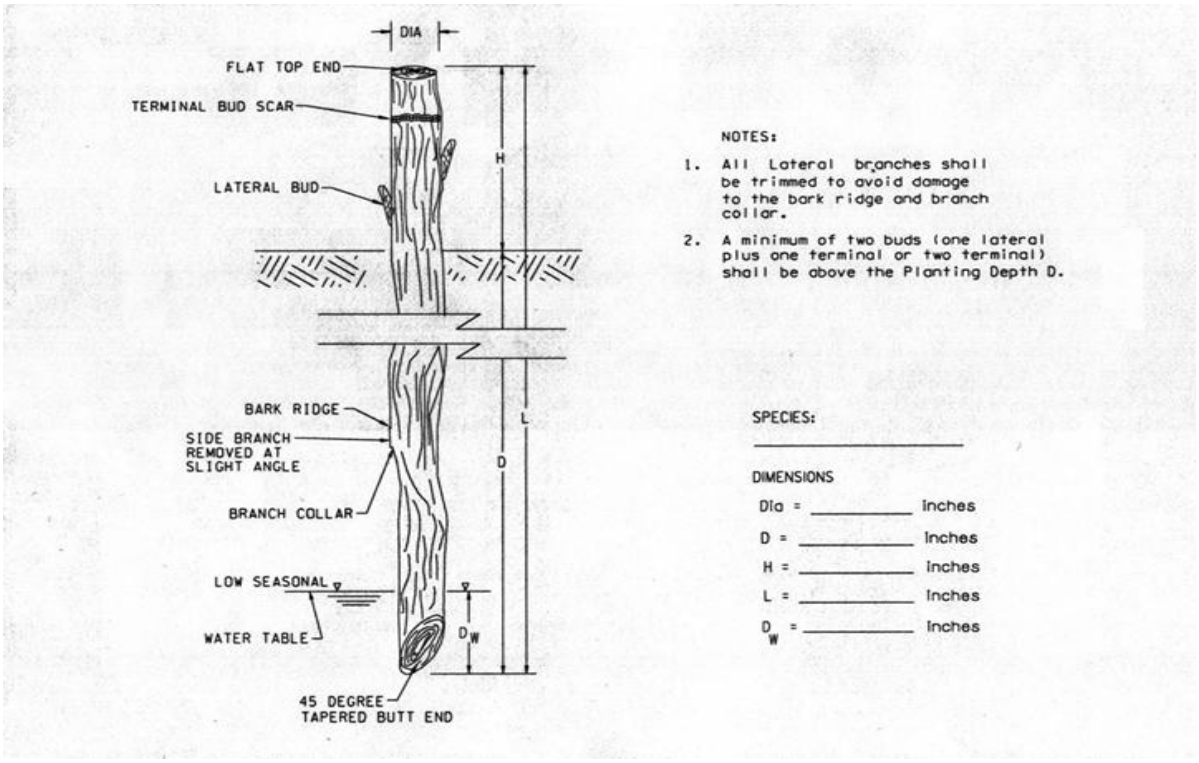
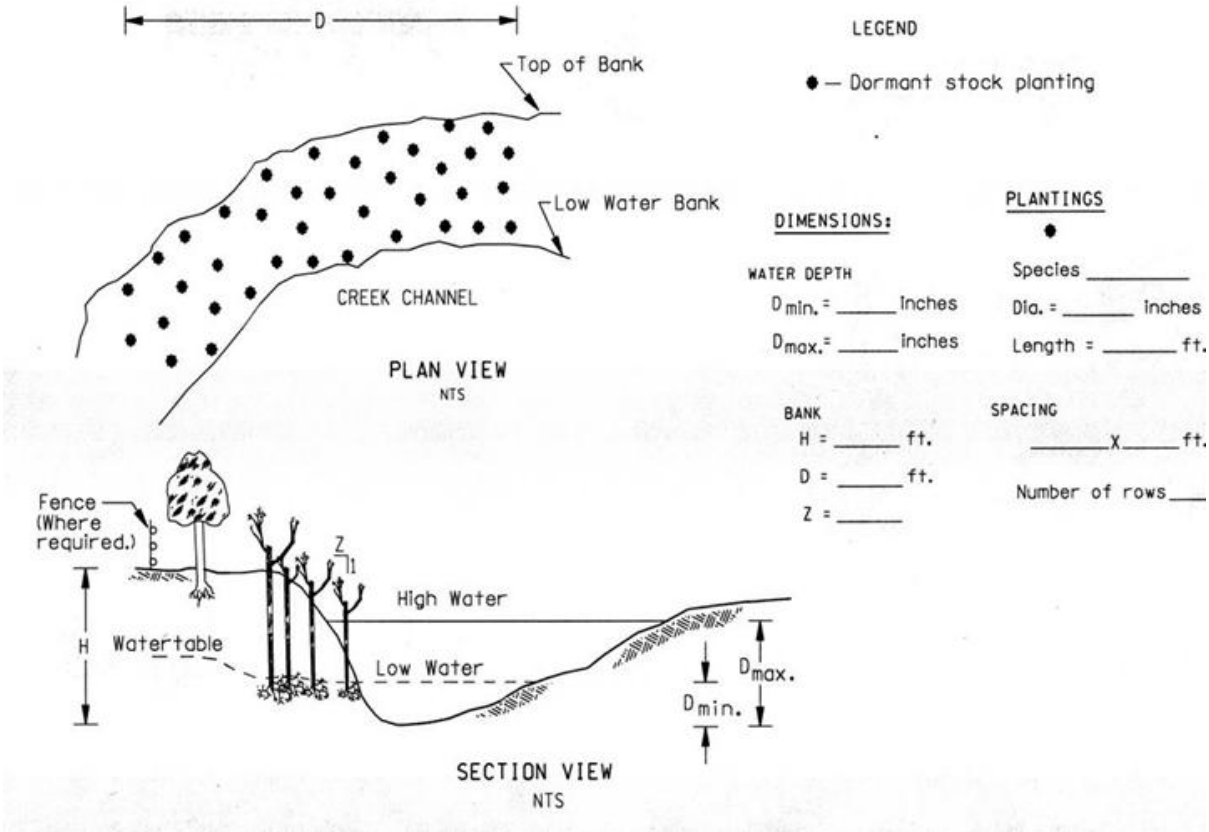
Instructions for Using Live Cuttings for Vegetating Streambanks



Source – USDA – Soil Conservation Service



Source – USDA – Soil Conservation Service

SECTION 01001 – GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 GENERAL

A. These General Requirements are incorporated herein to clarify and expand the provisions previously set forth in the Contract Documents which these specifications and drawings are a part thereof.

B. In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:

1. The Agreement
2. Addenda, with those of later date having precedence over those of earlier date
3. The Supplemental General Conditions
4. The General Conditions of the Contract for Construction
5. Drawings and Specifications
6. Latest version of the NRCS Specifications

C. In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the more stringent condition shall be provided in accordance with the Engineer's interpretation.

D. The quality of workmanship shall be an important consideration in acceptance or rejection of work. It is expected that the Contractor shall provide qualified workmen who can produce a first quality project, as defined by approved samples. Work that fails to achieve a first quality standard may be considered defective and rejected. Such work shall be removed and replaced with new work of first quality, as defined by approved samples.

E. The Contractor, being experienced in his trade, prior to submitting his bid, having made an inspection of the existing facilities and conditions; a thorough review of the Contract Documents; understanding that all systems are new; acknowledges that the installation of these systems must be complete and operational. Accordingly, all necessary parts, equipment, accessories and components must be supplied and installed, and must pass all final testing and operations. If a system component is missing in the Contract Documents, notify Engineer for clarification.

1.2 DRAWINGS AND SPECIFICATIONS

A. Do not scale drawings for dimensions. Accurately layout such work from dimensions indicated on engineering drawings or by use of field verified dimensions. Consult the Engineer for interpretations concerning locations of equipment.

B. Where drawings indicate a portion of the work and the remainder is shown in outline, the parts drawn out apply to other like portions of the work. Where detail is indicated by starting only, such detail shall continue to apply throughout the courses or parts in which it occurs and apply to similar parts of work unless otherwise indicated.

C. Unless otherwise indicated, a detail indicates the general application of work at all locations where it logically applies, and other related work incident thereto shall be provided as

required to fully complete the work in a manner consistent in the detail and other related details, and as approved by Engineer.

1.3 ENGINEER'S SELECTION AND APPROVAL OF MATERIALS

A. Where approval of Engineer for material or equipment is required, secure such approval prior to bidding in a written request.

B. The aesthetic values of every material and installation, such as shape, proportion, texture, finish and color, will be an important consideration to Engineer and his decisions concerning same shall be final, within the scope of the Contract Documents.

1.4 APPROPRIATE MATERIALS AND INSTALLATIONS

A. Furnish materials and equipment that have been properly inspected and tested in accordance with accepted industry standards. Make field laboratory test where specified herein, the cost of such being paid for by the Contractor, unless otherwise specified.

B. Before submitting any bids, the Contractor, and the Contractor's subcontractors and material suppliers shall observe the drawings and project manual and should any material and/or its installation be indicated or specified in a manner not approved by the material manufacturer, notify the Engineer and receive his instructions.

1.5 SITE ACCESS

A. Contractor shall provide adequate access to the site at the locations shown on the attached map, or other access routes that may be negotiated with individual homeowners by the contractor with approval of the Sponsor or Contracting Officer.

1.6 USE OF SITE

A. Site storage shall be confined to areas indicated on the site plan or as directed by Sponsor.

B. The Contractor shall obtain and pay for any additional storage or work areas needed for construction operations.

C. The Contractor shall be responsible for site maintenance within the construction area. Site maintenance includes trash pickup, and other actions that are required to maintain a neat and orderly site.

D. The Contractor shall be responsible for maintenance beyond the construction area for areas affected by construction operations. Maintenance includes removal of trash, mud, gravel, and other debris.

E. The Contractor is responsible for the security of the work area and for any building materials and equipment stored on the site. Maintain security of existing buildings where affected by work of this Contract.

1.7 PROTECTION OF WORK AND PROPERTY

A. The Contractor shall take charge of and assume full responsibility for proper protection of the construction areas.

B. Protect existing buildings and previously placed work by suitable coverings or other protections during installation of subsequent work. Clean off any foreign materials accidentally deposited on finish surfaces and, where such would stain, corrode or otherwise disfigure, clean it immediately with material that will not damage finished work.

C. Protect work in place requiring job finishing until such finishing has been completed. In cold weather, protect work form damage from frost and freezing. In hot weather, protect work from rapid drying.

D. Dumping on site of any liquid wastes including oils, fuels, concrete or mortar cleaning activities, paint, etc., is prohibited.

1.8 INSTALLATION

The Contractor shall:

A. Furnish, apply, install, connect, erect, clean and condition manufactured articles, materials and equipment per manufacturer's printed directions, unless otherwise indicated or specified.

B. The manufacturer's printed directions must be on job prior to and during installation of materials and equipment.

C. Make field check of actual dimensions before fabricating products.

D. Install materials only when conditions of temperature, moisture, humidity, and condition of adjacent components are conducive to achieving best installation results.

E. Handle materials in a manner to prevent scratching, abrading, distortion, chipping, breaking or other disfigurement.

F. Fabricate and install materials true to line, plumb and level, unless indicated otherwise. Leave finished surfaces smooth and flat or of smooth contour where indicated, free from wrinkles, warps, scratches, dents and other imperfections.

G. Conduct work in a manner to avoid injury to previously placed work.

1.9 CLOSING-IN WORK

A. Notify the Engineer to inspect any work when placing of subsequent work would prevent observation of previous work.

1.10 DEFECTIVE WORK

A. Unless the Engineer grants permission to repair any defective work, remove defective work from project and replace with new work in accordance with Contract Documents. If permission is granted, repair according to Engineer's direction. Permission to repair any such work shall not constitute a waiver of Engineer's right to require complete replacement of defective work if repair operation does not restore quality and appearance of member or surface to Engineer's satisfaction.

1.11 UNSUITABLE CONSTRUCTION CONDITIONS

A. During unfavorable weather, wet ground, or other unsuitable construction conditions, the Contractor shall confine operations to work which will not be affected adversely thereby. No portion of the work shall be constructed under conditions which would adversely affect the quality of efficiency thereof, unless special means of precautions are taken by the Contractor to perform the work in a proper and satisfactory manner.

1.12 PERFORMANCE

A. Where Drawings and/or Specifications designate a standard of performance, the completed installation shall perform at least to the designated standard.

1.13 TESTS OF MATERIALS

A. Furnish materials and equipment that have been properly inspected and tested in accordance with accepted industry standards. Make field or laboratory tests where specified herein, the costs of such being paid for by Contractor, unless otherwise specified.

B. Should such tests or visual observation indicate failure of materials or construction to meet requirements of the Drawings and/or Specifications, Contractor shall make and pay for additional tests, as directed by Engineer until compliance has been proven, and should such work fail to comply, Contractor shall replace it at his expense.

1.14 RECEIVING AND STORING MATERIALS

A. On receipt of materials, check for in-transit damage in ample time to replace any damaged materials prior to installation time.

B. Store materials in a manner to prevent deterioration, staining, soiling and intrusion of foreign materials. Provide waterproof, well-ventilated enclosures for materials subject to deteriorating by dampness. Adequately protect those materials subject to damage by freezing and frost.

C. Remove from premises and replace with new, any materials showing deterioration or damage.

1.15 EXISTING UNDERGROUND INSTALLATIONS

A. Existing underground installations such as water mains, gas mains, oil pipelines, sewers, telephone lines, power lines, and buried structures in the vicinity of the work to be done hereunder are indicated on the drawings only to the extent such information has been made available to or discovered by the Engineer in preparing the Drawings. There is no guarantee as to the accuracy or completeness of such information, and all responsibility for the accuracy or completeness thereof is expressly disclaimed. Generally, service connections are not indicated on the Drawings.

B. It is the Contractor’s responsibility to contact 1-800-DIG-SAFE. The Contractor shall be solely responsible for contacting all utility companies and locating all existing underground installations, including service connections, in advance of excavating or trenching, by contacting the owners thereof and prospecting. The Contractor shall use his own information

and shall not rely upon any information shown on the drawings concerning existing underground installations.

C. Any delay, additional work, or extra cost to the Contractor caused by existing underground installations shall not constitute a claim for extra work, additional payment, or damages.

1.16 PRESERVATION OF MONUMENTS AND STAKES

A. The Contractor shall carefully preserve all monuments, benchmarks, property markers, reference points, and stakes. In case of his destruction thereof, the Contractor will be charged with the expense of replacement and shall be responsible for any mistake or loss of time that may be caused. In the cases of permanent monuments or benchmarks which must be removed or disturbed, the Contractor shall furnish material and assistance for the proper replacement of such monuments or benchmarks.

1.17 APPROPRIATE MATERIALS AND INSTALLATIONS

A. Before submitting bid, Contractor, his subcontractors, and material suppliers shall observe existing conditions, Specifications, Drawings, and Addenda thereto and should any material and/or its installation be indicated or specified in a manner not approved by the material manufacturer, notify Engineer and receive his instructions. Failing to do so, Contractor shall provide other equivalent materials, suitable for the installation, as selected by Engineer or if not discovered until after installation, Contractor shall replace materials with such other equivalent suitable materials as approved by Engineer, and in either event at no added cost. If additional or other types of work are required for desired satisfactory results and specified guarantee, the additional or other work shall be included in bid amount and shall not constitute a basis of claim for “extra work” during or upon completion of this project.

1.18 CONSTRUCTION REQUIREMENTS

A. Staking: A survey with benchmarks located is included in Drawings for Contractor’s use. All other surveying and staking will be the responsibility of the Contractor at his own expense.

B. Geotechnical Reports: Subsurface data has not been obtained for design purposes. The bidder shall make his own interpretations of existing conditions and shall be expected to obtain additional data at his own expense if required to satisfy himself as to the conditions to be encountered.

C. Storage: All equipment and materials to be incorporated into the work shall be stored in a manner to prevent damage from the elements, work, or handling. No damaged or deteriorated materials will be accepted. All storage, to include Owner-provided items, will be at the expense of the Contractor.

1.19 ADMINISTRATIVE REQUIREMENTS

A. Coordination: The Contractor shall perform the activities necessary to properly coordinate the material and equipment procurement and the work provided by him and his subcontractors. The Contractor also shall coordinate his work with the Sponsor when required for the best overall coordination of the project.

B. Progress Meetings: The Contractor shall hold progress meetings on the site with the Sponsor and Engineer, to discuss job-related problems. Persons designated by the Contractor to attend and participate in the meetings shall have all required authority to commit the Contractor to solutions agreed upon in the project meeting.

C. Progress Schedule: The Contractor shall submit to the Sponsor, prior to construction, a progress schedule. The schedule shall be detailed enough to reasonably allow the Sponsor to follow the progress of the work. The schedule shall be updated periodically as required by the work and as requested by the Sponsor.

D. All materials resulting from clearing and grubbing activities shall be removed and disposed of in an acceptable manner at an acceptable facility conforming to all applicable regulations.

END OF SECTION 01001

SECTION 01002 – SPECIAL CONDITIONS

PART 1 – GENERAL

1.1 RELATIONSHIP TO GENERAL CONDITIONS

A. Should conflict occur between these Special Conditions and the General Requirements, these Special Conditions shall take precedence. When these Special Conditions modify a portion of the General Conditions, the unaltered portions of the General Conditions shall remain in effect.

1.2 LOCATIONS, LINES AND LEVELS

A. Contractor shall establish location of new work on property and establish and maintain all other grades, lines, levels, and benchmarks; check and compare all drawings, verifying grades, lines, levels, and dimensions indicated thereon, and report all inconsistencies to Engineer and receive Engineer's instructions before commencing work.

1.3 DOCUMENTS FURNISHED

A. Contractor will be responsible for obtaining all necessary Drawings and Project Manuals, including all modifications thereof, as required, including distribution to subcontractors and suppliers.

B. Contractor shall pay the actual cost of reproduction for all additional sets requested by him.

1.4 LAWS TO BE OBSERVED

A. The Contractor shall at all times observe and comply with all federal and state laws, local laws, ordinances, orders, decrees and regulations existing or enacted subsequent to the execution of the Contract, which in any manner affect the prosecution of the work. The Contractor and his Surety shall indemnify and save harmless the Sponsor, the Sponsor's Architects, Engineers, and their representatives, agents, and employees against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by himself, his employees or his subcontractors.

1.5 CONSTRUCTION OBSERVATION

A. The undertaking of periodic site visits by the Engineer or representative shall not be construed as supervision of actual construction nor make him responsible for providing a safe place for the performance of work by contractors or contractor's employees, or those of suppliers or subcontractors, or for access, visits, use, work, travel, or occupancy by any person.

1.6 CONSTRUCTION COORDINATION

A. Before starting any construction, a meeting shall be held with Sponsor, Contractor, Subcontractors, and Engineer to plan and coordinate the schedule of construction and to review intent of Contract Documents. Contractor and Subcontractor shall follow instructions received at this meeting in prosecuting the work.

END OF SECTION 01002

SECTION 01003 – SUMMARY

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Work covered by the Contract Documents
2. Type of Contract
3. Use of premises
4. Owner's occupancy requirements
5. Work restrictions
6. Specification formats and conventions

B. Related Sections include the following:

1. Division1 Section "General Requirements" for limitations and procedures governing temporary use of Sponsor's facilities.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work consists of the following:

1. The site work including addition of wooden, soil bioengineering, and rock structures, reconfiguration of existing streambank, planting of cover crop, mulching, and native plantings.

1.4 TYPE OF CONTRACT

A. Project will be constructed under a single prime contract.

1.5 USE OF PREMISES

A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings.

B. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1.6 OWNER'S OCCUPANCY REQUIREMENTS

A. Partial Owner Occupancy: Homeowners will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Homeowners during construction operations to minimize conflicts and facilitate homeowner’s usage. Perform the Work so as not to interfere with Homeowners’ operations.

1. Provide not less than 72 hours' notice to homeowner of activities that will affect Homeowner's operations.

1.7 WORK RESTRICTIONS

A. On-Site Work Hours: Contractor’s normal working hours are acceptable. Any work expected during evenings or weekends should be coordinated with Homeowner’s schedule.

1. Provide not less than 72 hours' notice to Homeowners of activities outside normal working hours.

B. Existing Utility Interruptions:

1. Notify Engineer and Sponsor not less than three days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Engineer’s written permission.

1.8 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

3. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

END OF SECTION 01003

SECTION 02102 – CLEARING AND GRUBBING

PART 1 – GENERAL

1.1 WORK INCLUDED IN THIS SECTION:

A. Clearing and grubbing required for this work includes, but is not necessarily limited to:

1 Removal of trees, stumps, debris, and brush.
2 Trimming and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal.
3 Removal and disposal of miscellaneous abandoned subsurface structures and debris that may be discovered during the work.

1.2 RELATED WORK IN OTHER SECTIONS:

A. Excavating, Filling and Grading Section B

1.3 JOB CONDITIONS:

A. Dust Control:

1. Use all means necessary to control dust on and near the work and on and near all borrow areas.

1.4 LINES AND GRADES:

A. All clearing and grubbing shall be done within the lines and grades shown on the drawings.

PART 2 – INSTALLATION

2.1 CLEARING:

A. Contractor shall only clear trees, stumps, brush, snags and other vegetation when necessary for the installation of the overall project. All other trees and vegetation shall be left standing. Trees and vegetation to be left standing shall be protected from damage during the completion of the work.

2.2 GRUBBING:

A. In areas requiring excavation, Contractor shall grub and remove material to a depth necessary to complete excavation to the limits indicated and complete required work. Material to be grubbed shall include stumps, roots larger than one inch in diameter, matted roots, and any miscellaneous subsurface structures and debris that may be encountered. Trees shall be Trees and plants to be relocated: Any tree or plants moved shall be done in a timely manner so as not to delay construction progress. The Contractor shall take extra measures to protect trees during the relocation by erecting barricades, staking, trimming, etc. as required. Trees shall be completely removed with stump ground down to a minimum depth below the grade of six (6) inches.

2.3 PROTECTION:

A. Contractor shall take precautions to protect any trees, vegetation, structures, benchmarks and survey stakes, and utilities not intended to be removed. Prior to beginning work, Contractor shall be responsible for field verifying that there are no utilities within the work area. Contractor shall be responsible for repairing and/or replacing, at no additional cost to the Sponsor, items that are damaged during construction that were not intended to be removed.

2.4 DISPOSAL OF MATERIAL:

A. All materials resulting from clearing and grubbing activities shall be removed and disposed of in an acceptable manner at an acceptable facility conforming to all applicable regulations. Materials suitable for use as aquatic habitat enhancement (stumps, logs, etc.) shall be stockpiled as directed by the Engineer.

PART 3 – MEASUREMENT AND PAYMENT

3.1 METHOD OF MEASUREMENT:

A. The quantity of Clearing and Grubbing will not be measured for payment unless the construction limits are changed. Clearing and Grubbing shall be considered subsidiary to Excavating, Filling, and Grading. No adjustment will be made for changes involving less than 0.1 acre (0.04 ha).

3.2 BASIS OF PAYMENT:

A. The amount of work completed and approved, as stated above, shall be paid for as part of the contract lump sum price. Such payment shall constitute full compensation for all labor, equipment, tools and all other items necessary and incidental to completion of the work.

B. In the event of a change in construction limits, the Contractor shall submit a unit price for Clearing and Grubbing to be approved by the Engineer.

END OF SECTION 02102

SECTION 02200 – EXCAVATING, FILLING AND GRADING

PART 1 – GENERAL

A.1 WORK INCLUDED IN THIS SECTION:

A. Excavating, filling and grading required for this work includes, but is not necessarily limited to:

1. Excavating, filling and backfilling for streambank stabilization.

2. Rough and finish grading of streambank.

3. Preparation of sub-grade for areas to be seeded, planted with trees and shrubs, and/or mulched.

1.2 RELATED WORK IN OTHER SECTIONS:

A. Clear and Grubbing: Section 02101

1.3 JOB CONDITIONS:

A. Dust Control:

1. Use all means necessary to control dust on and near the work and on and near all offsite borrow areas, if such dust is caused by the Contractor's operations during performance of the work, or if resulting from the condition in which the Contractor leaves the site.

B. Protection: Use all means necessary to protect all materials of this section before, during, and after installation, and to protect all objects designated to remain. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Sponsor. Protect tops, trunks and roots of existing trees on project site which are to remain.

C. Notification: The Contractor shall notify the Engineer prior to installation of specified portions of the work to allow the inspector sufficient time to inspect the work and shall obtain approval of all material prior to commencing construction. Any portion of the work installed without inspection may be removed to allow for inspection. Any eventual difficulty or loss of time caused by the Contractor failing to meet permit requirements shall be borne solely by the Contractor.

1.4 LINES AND GRADES:

A. All excavation, filling and backfill shall be done to the lines and grades shown on the drawings.

1.5 BENCH MARKS AND MONUMENTS:

A. Maintain carefully all bench marks and reference points, which are shown on the drawings. The Contractor shall pay for the replacement of such reference points if disturbed by the Contractor during construction.

1.6 REFERENCES:

A. The publications listed below form a part of this specification. The latest revision of the following standards shall apply to work hereunder:

Associated General Contractors of America, Inc.
"Manual of Accident Prevention in Construction"

PART 2 – PRODUCTS

2.1 FILL MATERIAL, GENERAL:

A. All fill material for embankment construction shall come from onsite unless otherwise specified by the engineer. All fill material shall be subject to approval of the Engineer.

2.2 IMPORTED FILL MATERIAL:

A. If imported fill material is required to finish embankments or sub-grade. The Contractor shall be responsible for providing a borrow area for imported fill.

2.3 TOPSOIL:

A. All areas disturbed by construction operations, which are not to be paved or rocked under this contract, shall be provided with a 12-inch uncompacted layer of topsoil approved by the Engineer. Topsoil from areas within the project limits may be stockpiled and used where such topsoil is considered satisfactory to sustain plant growth. Additional materials, if required, shall be brought to final grade, as shown on the drawings, and shall be lightly compacted.

2.4 OTHER MATERIAL:

A. All other materials not specifically described, but required for proper completion of the work of this section, shall be as selected by the Contractor, subject to the approval of the Engineer.

PART 3 – INSTALLATION

3.1 GENERAL:

A. Familiarization: Prior to all work in this section, become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this section.

B. Backfilling Prior to Approval

1. Do not allow or cause any of the work installed to be covered up or enclosed by work of this section prior to all required inspections, tests, and approval.

2. Should any of the work be so enclosed or covered up before it has been approved, uncover all such work at no additional cost to the Sponsor.

C. Site Drainage: During construction, excavation and fill shall be performed in a manner and sequence that will provide drainage at all times.

3.2 EXCAVATION AND FILLING:

A. General: Excavation, as hereinafter specified, shall comprise the satisfactory removal and disposition of all material. After topsoil removal has been done, excavation of every description and of whatever substances encountered, shall be performed to the lines and grades indicated on the drawings. After backfilling of key trenches has been completed, any surplus of excavated material shall be known as "waste" and shall be disposed of at the location approved by the Engineer. Any additional fill material required, that is not available from excavation within the immediate project area, shall be obtained from borrow area locations approved by the Engineer. During construction, excavation, key trenching, and backfilling shall be performed in a manner and sequence that will provide drainage at all times.

1. Classification of Excavation: Excavation shall be unclassified.

2. Earth and Rock Excavation shall be unclassified. Earth and Rock Excavation shall include earth, clay, silt, sand, gravel, hard pan, loose shale, loose stone masses, boulders, rock material in ledges, bedded deposits, unstratified masses, and conglomerate deposits so firmly cemented that they possess the characteristics of solid rock, which cannot be removed without systematic drilling.

B. Depressions Resulting from Removal of Obstructions: Where depressions result from, or have resulted from, the removal of surface or subsurface obstructions, open the depression to equipment working width and remove all debris and soft material, as directed by the Engineer.

C. Sloped Surfaces: Sloped ground surfaces steeper than 1 vertical to 4 horizontal, on which fill is to be placed, shall be plowed, stepped (benched) or broken up, in such manner that the fill material will bond with the existing surface.

D. Fill and Backfill: All fill or backfill material shall consist of earth or other approved material with all undesirable material removed. Unless otherwise specified, all fill shall be uniformly placed uniform layers to achieve a 3H:1V slope or as specified by the Drawings and then compacted in 9-inch lifts by equipment.

E. Over-excavation: Backfill and compact all over-excavation areas, as specified for fill, at no additional cost to the Sponsor.

F. Unfavorable Weather: Ground frozen or too wet - do not place, spread, or roll any fill material during unfavorable weather conditions. Do not resume operations until moisture content and fill density are satisfactory to the Engineer.

G. Overbank flow: To prevent erosion of finished slopes from overland flow, provide berms and rock chutes or slope drain devices along sections of disturbed bank where drainage is towards the disturbed bank.

H. Soften Sub-grade: Where soil has been softened or eroded by flooding or placement during unfavorable weather, remove all damaged areas and re-compact as specified for fill and compaction below.

I. Dewatering: Provide and maintain at all times during construction, ample means and devices with which to promptly remove and dispose of all water from every source entering the excavations or other parts of the work. Dewater by means, which will insure dry excavation and the preservation of the final lines and grades of bottoms of excavation.

3.3 BACKFILLING:

A. General Backfill: Unless otherwise specified by the Drawings, all channel slopes shall be shaped to a 3H:1V slope which smoothly transitions into the existing slope at each end of the project.

B. Responsibility of Contractor for Backfill Settlement:

1. The Contractor shall be responsible for the satisfactory compaction and maintenance of all backfill of any description required under this contract. If, prior to the final acceptance of this entire contract, any backfilled areas are found to have settled, they shall immediately be reworked by the Contractor and restored to the specified grades.

3.4 FINISH GRADING

A. The finishing of side slopes, cuts and fills shall be to reasonably smooth uniform surfaces that will merge with the adjacent terrain without noticeable break. Finishing shall be done in accordance with grades shown on the drawings, and without variations that are readily discernible.

B. Finish grading shall be performed to the lines and grades shown on the drawings. All areas disturbed by the Contractor during construction operations shall be bladed smooth, shaped, and compacted, as specified herein before. The finished grade shall provide for topsoil that is free from perennial vegetation and is loosened to depth of twelve (12) inches for areas disturbed under this contract.

C. Newly graded areas shall be protected from traffic, erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to the required elevations and slopes. Damaged areas shall be re-vegetated, if necessary.

D. Haul roads into the work sites shall be ripped to loosen compacted soils prior to removing equipment from the project site.

3.5 BORROW AND SPOIL AREAS:

A. Borrow and spoil areas shall be graded to promote positive drainage at the completion of the work. No borrow or spoil slopes shall be greater than 3 horizontal to 1 vertical.

B. Erosion controls shall be implemented to prevent erosion into waterways.

C. Borrow and spoil areas shall be seeded and mulching shall be applied at the completion of construction.

3.6 CLEANING UP:

A. Upon completion of the work of this section, immediately remove all debris and excess earth materials from the site.

PART 4 – MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT:

A. Work will be measured by bid quantity of cubic yards of soil. Contractor shall maintain weight tickets for soil trucked to the site. Material moved on site by earth moving equipment will be paid at the contract unit price and units indicated.

4.2 Basis of Payment:

A. The amount of work completed and approved, as stated above, shall be paid for at the contract unit price. Such payment shall constitute full compensation for all labor, equipment, tools and all other items necessary and incidental for the completion of the work.

END OF SECTION 02200

SECTION 02205 – GEOTEXTILE AND FILTER FABRIC

PART 1 – GENERAL

1.1 DESCRIPTION:

A. This section covers filter fabric to be used at various locations within the project area. Items include, but are not necessarily limited to:

1. Procurement, storage and protection of all filter fabric.

2. Preparation of fabric sub-grade.

3. Installation, anchoring, and covering filter fabric.

1.2 RELATED WORK IN OTHER SECTIONS:

A. Excavating, Filling and Grading: Section 02200

B. Riprap for Rock Chutes: Section 02840

C. Vegetated Geogrid: Section 02935

D. Rock Structures for Stabilization: Section 03162

1.3 REFERENCES:

A. The publications listed below form a part of this specification to the extent referenced. The latest revision of the following standards shall apply to work hereunder:

1. ASTM D 1117: Standard Test Method for Water Absorption

2. ASTM D 3786: Standard Test Method for Bursting Strength of Textile Materials

3. ASTM D 4355: Standard Test Method for Deterioration of Geotextiles for Exposure to Ultraviolet Light and Water

4. ASTM D 4632: Standard Test Method for Breaking Force and Elongation of Textile Fabrics

5. ASTM D 4751: Standard Test Method for Apparent Opening Size

6. ASTM D 4833: Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

7. ASTM D 5035: Standard Test Method for Breaking Force and Elongation of Textile Fabrics

8. ASTM D 5199: Standard Test Method Standard Test Method for Measuring the Nominal Thickness of Geosynthetics

9. ASTM D 5262: Standard Test Method for Plastics: Dynamic Mechanical Properties

10. ASTM D 6475: Standard Test Method for Measuring Mass Per Unit Area of Erosion Control Blankets

11. ASTM D 6637: Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method

1.4 LINES AND GRADES:

A. All placement of filter fabric shall conform to the lines and grades shown on the Drawings or on the plans.

PART 2 – PRODUCTS

2.1 FILTER FABRIC:

A. Geotextiles shall be manufactured from randomly oriented synthetic long chain or continuous polymeric filaments or yarns (such as polypropylene, polyethylene, polyester, polyamide or polyvinylidene-chloride) bonded together by the needle-punched process. In addition, one side may be slightly heat-bonded. The geotextile shall be formed into a stable network of filaments or yarns that retain their relative position to each other; are inert to commonly encountered chemicals; and are resistant to ultraviolet light, heat, hydrocarbons, mildew, rodents and insects. The geotextile shall be free of any chemical treatment or coating that might significantly reduce its permeability and shall have no flaws or defects that significantly alter its physical properties.

B. The filter fabric shall be Mifafi 160N or equivalent and meet the following minimum requirements:

PROPERTY	Test Method	Minimum Value
Tensile Strength	ASTM D 4632	160 lbs
Bursting Strength	ASTM D 3786	305 psi
Elongation	ASTM D 4632	> 50%
Puncture	ASTM D 4833	95 lbs
UV Resistance @ 150 hours	ASTM D 4355	70%
Apparent Opening Size	ASTM D 4751	#70 (max)

C. Geogrid shall be manufactured from high molecular weight, high tenacity polyester multifilament yarns which are woven in tension and finished with a PVC coating. The geogrid shall be formed into a stable network of filaments or yarns that retain their relative position to each other; are inert to commonly encountered chemicals; and are resistant to ultraviolet light, heat, hydrocarbons, mildew, rodents and insects. The geogrid shall be free flaws or defects that significantly alter its physical properties.

D. The geogrid material shall be Mirafi 3XT or equivalent and meet the following minimum requirements:

PROPERTY	Test Method	Minimum Value
Tensile Strength	ASTM D 6637	3500 lbs/ft.
Tensile Strength @ 5% Strain	ASTM D 6637	1056 lbs/ft.
Creep Reduced Strength	ASTM D 5262	2215 lbs/ft.
Grid Aperture Size	-	0.875 in
Grid Aperture Size – Cross	-	1.0 in.
Roll Width	-	12 ft.

E. Erosion Control Blanket (ECM) shall be N. American Green C125 or equivalent and manufactured from 100% coconut fiber matrix and have a functional longevity of approximately 36 months. The coconut fiber shall be evenly distributed over the entire area of the mat. The blanket shall be covered on top and bottom with heavy weight polypropylene netting having ultraviolet additives to delay breakdown. The ECB shall be free flaws or defects that significantly alter its physical properties.

F. The Erosion Control Blanket shall meet the following minimum requirements:

PROPERTY	Test Method	Minimum Value
MD Tensile Strength	ASTM D 5035	213.6 lbs/ft.
TD Tensile Strength	ASTM D 5035	208.80 lbs/ft.
TD Elongation	ASTM D 5035	25.50 %
Weight	ASTM D 6475	8.0 oz/yd^2.
Thickness	ASTM D 5199/ECTC	0.35 in.
Water Absorption	ASTM D 1117/ECTC	110%

G. The geotextile shall be shipped in rolls wrapped with a protective covering to keep out mud, dirt, dust, debris and direct sunlight. Each roll of geotextile shall be clearly marked to identify the brand, type and the individual production run.

2.2 STAPLES AND FASTENERS:

A. The Contractor shall provide staples, fasteners, pins, etc. that are biodegradable resin, polyethylene, or metal. Fasteners shall be a minimum of 3/16 of an inch in diameter and 12 inches in length. A flat washer shall be used with metal pins, and shall be a minimum of 1-½ inches in diameter.

PART 3 – INSTALLATION

3.1 GEOTEXTILE AND FILTER FABRIC:

A. The Contractor shall install materials as shown on the Drawings. ECB shall be installed in a directional manner as recommended by the manufacturer.

B. The Contractor shall assume a 20% scrap factor above that specified in the bid quantities (overlap and burial loss) for filter fabric. Material will be trenched at the top and bottom of the slopes and shall be installed to match the final graded contour of the riprap. A minimum lap of 24 inches is required if the fabric is installed in more than one piece or for splicing of

new rolls. The Contractor shall account for all scrap and trench-secured quantities in his/her quotation. Such quantities are considered incidental and non-payable for the project.

C. Place filter fabric over entire bedding material as shown on the Drawings. The filter fabric shall be loosely laid (not stretched) such that it will conform to any minor surface irregularities. No cuts or punctures in the fabric will be permitted.

D. The filter fabric shall be anchored to a minimum depth of 12 inches into the trench.

E. The filter fabric shall not be left exposed for more than 48 hours.

3.2 STAPLES AND FASTENERS:

A. Staples, fasteners, pins, etc. shall be installed as per the recommendations of the manufacturer.

3.3 FIELD QUALITY CONTROL:

A. Notification: The Contractor shall notify the Engineer 24 hours prior to installation of any portion of the work to allow the Engineer sufficient time to inspect the work and shall obtain approval of all material prior to commencing construction. Any portion of the work installed without inspection may be removed to uncover sufficient portions of the work to allow inspection.

PART 4 – MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT:

A. Work will be measured by square yards of material placed.

4.2 BASIS OF PAYMENT:

A. The amount of work completed and approved, as stated above, shall be paid for subsidiary to the rock chute, vegetated geogrid, or other structure requiring geotextile or filter fabric.

END OF SECTION 02205

SECTION 02840 – ROCK RIPRAP FOR ROCK CHUTES

PART 1 – GENERAL

1.1 DESCRIPTION:

A. This section covers rock riprap to be used at various locations within the project area. Items include, but are not necessarily limited to:

1. Procurement, storage and handling of riprap.

2. Preparation of subgrade for installation of riprap.

3. Installation of riprap.

1.2 RELATED WORK IN OTHER SECTIONS:

A. Excavation, Filling, and Grading: Section 02200

B. Filter Fabric: Section 02205

1.3 REFERENCES:

A. The publications listed below form a part of this specification to the extent referenced. The latest revision of the following standards shall apply to work hereunder:

1. ASTM C 88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

2. ASTM C 127-88: Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate

3. ASTM D 5312-92: Standard Test Method for Evaluation of Durability of Rock for Erosion Control under Freezing and Thawing Conditions

1.4 LINES AND GRADES:

A. All placement of riprap shall conform to the lines and grades shown on the drawings.

PART 2 – PRODUCTS

2.1 ROCK RIPRAP:

A. Material shall be free from dirt, clay, sand, rock fines and other materials not meeting the required gradation limits.

B. The rock shall be dense, sound and free from cracks, seams and other defects conducive to accelerated weathering. Except as otherwise specified, the rock shall be angular to sub rounded in shape. The least dimension of an individual rock fragment shall not less than one-third the greatest dimension of the fragment.

C. The riprap materials shall be reasonably well graded by weight within the limits stated on the Drawings:

PART 3 – INSTALLATION

3.1 INSTALLING ROCK RIPRAP:

A. The sub-grade surfaces on which the rock riprap, filter, bedding or geotextile is to be placed shall be cut and graded to the lines and grades shown on the drawings. The surface to which the riprap is to be placed shall be reasonably smooth and free of mounds, dips, or windrows.

B. The riprap shall be placed by equipment on the surfaces and to the depths specified. The riprap shall be installed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying material. The riprap shall be delivered and placed in a manner that will ensure that the riprap shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks. Riprap shall be placed in a manner to prevent damage to structures. Hand placing will be required as necessary to prevent damage to any new and existing structures.

3.2 MAINTENANCE:

A. If, at any time before 2 months after the completion and acceptance of the work, there shall be any settlement requiring repairs to be made in any property along the line of work, or should any defect appear in the work due to neglect, carelessness or improper construction on the part of the Contractor, the Contracting Officer will notify the Contactor to make such repairs and remedy any defects. The Contractor shall, within 5 days after such notice, begin and carry out such repairs at no additional cost to the Owner.

END OF SECTION 02840

SECTION 02900 – PROTECTION OF SOIL AND VEGETATION

PART 1 – GENERAL

1.1 WORK INCLUDED IN THIS SECTION:

A. This section governs measures and sets environmental protection performance, restoration, and design standards for protecting and restoring native soils and vegetation that are impacted by heavy construction equipment and other site construction activities.

1.2 RELATED WORK IN OTHER SECTIONS:

A. Excavating, Filling and Grading Section 02200

1.3 REFERENCES:

A. The following standards are referenced directly in this section. The latest version of these standards shall be used.

1. NRCS Planning and Design Manual, NRCS, 1998

2. Home Landscapes, Planting, Design and Management, E.C. Martin, Jr., and Pete Melby, Timber Press

3. American Standard for Nursery Stock

PART 2 – PRODUCTS:

2.1 STANDARDS

A. All materials used during this portion of the work shall meet or exceed applicable federal, state, county and local laws and regulations. The use of any herbicide shall follow directions given on the herbicide label. In the case of a discrepancy between these specifications and the herbicide label, the label shall prevail.

2.2 MATERIALS

A. Prior to delivery of any materials to the site, submit to the Engineer a complete list of all materials to be used during this portion of the work. Include complete data on source, amount and quality. This submittal shall in no way be construed as permitting substitution for specific items described on the plans or in these specifications unless approved in writing by the Engineer.

PART 3 – INSTALLATION

3.1 GENERAL

A. Selective Clearing is removal of undesirable trees and underbrush around specimen trees and brush as designated on the drawings and/or instructed by the Engineer.

B. Soil and specimen trees as shown on the drawings and/or instructed by the Engineer to save, shall be protected from damage incident to clearing, grubbing, and construction operations.

3.2 PLANT PRESERVATION

A. The Engineer shall mark all plant materials on the site to be saved and/or relocated. No plant material may be removed from the site prior to the Engineer's inspection. All plant material to be saved/or relocated will be protected from injury to the roots and to the branches, to a distance five feet beyond the drip-line. No grading, trenching, pruning, or storage of materials may go in this area, except as approved by the Engineer.

B. Trees and plants to be relocated: Any tree or plants moved shall be done in a timely manner so as not to delay construction progress. The CONTRACTOR shall take extra measures to protect the tree during the relocation by erecting barricades, staking, trimming, etc. as required.

3.3 FIELD QUALITY CONTROL

A. Qualifications of workmen: provide at least one person who shall be present at all times during execution of this portion of the work, who shall be thoroughly familiar with this type of work and the type of materials being used. Said person shall be competent at identification of soils and plant materials to be removed and to be preserved during the season (summer, winter) work is to be completed. Said person shall also direct all work performed under this section.

END OF SECTION 02900

SECTION 02901 – CHANNEL BANK VEGETATION – NRCS PRACTICE CODE 322

SUMMARY: The work described herein consists of furnishing, transporting, and installing seeds, trees, and other materials as required for the rehabilitation and establishment of stream side vegetation. It is the Landowner's responsibility to perform soil preparation, native grass planting, bare root seedling planting, management, and such additional extra and incidental work as may be necessary to complete the work in accordance with the specification and plans. The Landowner shall furnish required materials, equipment, tools, labor, and incidentals, unless otherwise provided in the specifications or Drawings.

PART 1 – GENERAL

1.1 DESCRIPTION:

A. Planting required—both native grass and trees—is indicated as plantings. Plantings on the Drawings and, in general, include, but are not limited to:

1. Procurement, storage and protection of listed grass seed.

2. Preparation of planting sites.

3. Planting areas.

4. Landowner maintenance of plantings installed by Landowner.

B. Related Work in Other Sections:

1. Clearing and Grubbing: Section 02102

2. Excavating, Filling and Grading Section: Section 02200

1.2 QUALITY ASSURANCE–NATIVE GRASS SEEDING

A. Qualification of Workmen: Provide at least one person who shall be present during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct work performed under this Section.

B. Standards:

1. Seeds shall meet or exceed the specification of Federal, State, and County laws requiring inspection for plant disease and insect control.

2. All seeds shall be true to species and shall be tagged with the name and percent pure live seed in accordance with accepted industry standards for grass seed.

3. Seed shall meet or exceed specifications of Federal, State and County laws requiring inspection for plant disease and insect control and shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act.

1.3 QUALITY ASSURANCE–TREE PLANTING

A Qualification of Workmen: Provide at least one person who shall be present during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct work performed under this Section.

B Standards:

1. Bare root seedlings and cuttings must be grown from locally adapted seed or cuttings of known origin and meet height and caliper standards listed in the NRCS Kansas Forestry Technical Note KS-9.

1.4 JOB CONDITIONS:

A. Time of Planting:

1. The Landowner shall complete native grass seeding immediately following construction during favorable weather conditions.

2. The Landowner shall complete tree plantings during normal and accepted planting seasons listed in the NRCS Kansas Forestry Technical Note KS-9 and during favorable weather conditions.

1.5 SUBMITTALS:

A. Materials list include, but not limited to, the following:

1. Quantities, Signed and Dated by Supplier(s).

1.6 DELIVERY, STORAGE AND HANDLING:

A. Delivery, Storage and Handling:

1. The Landowner shall deliver seed, bare root seedlings, and cuttings to the project site in good condition.

2. The Landowner shall use all means necessary to protect the seed, bare root seedlings, and cuttings before, during, and after installation and to protect the installed work and materials of other trades.

B. Replacement: In the event of damage during construction, the Landowner shall immediately make repairs and replant necessary to the approval of the Engineer and at no additional cost to the Sponsor.

1.7 SITE DISTURBANCES:

A. It is the Landowner’s responsibility to take precautions insuring that equipment and vehicles do not disturb or damage existing grading, seeding, or other site improvements.

B. The Landowner shall repair and/or return to original condition any damage at no cost to Sponsor.

PART 2 – MATERIALS

2.1 PLANT MATERIALS:

A. General: Furnish seed that is true to name and type representative of the species or variety.

B. Plant materials

1. Native grass seeding shall follow recommendations in NRCS Critical Area Planting – Practice 342.

2. Bare Root seedlings and tree cuttings shall follow recommendations in Kansas Forestry Technical Note No. KS-9.

C. Mulching: Other materials not specifically described but required for a complete and proper planting installation shall be as selected by the Landowner, subject to the approval of the Engineer

2.2 WATER:

A. Water, hose, and other watering equipment required for the work shall be furnished by the Landowner.

2.3 HERBICIDE:

A. Herbicides shall be applied according to manufactures label instructions and adhere to State, Federal, and local laws.

PART 3 – INSTALLATION

3.1 SURFACE CONDITIONS:

A. Inspection:

1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where these installations may properly commence.

2. Verify that planting, seeding and related construction work may be completed in accordance with the original design and the referenced standards.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Engineer.

2. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

3.2 SPREADING OF TOP SOIL:

A. Finish Grading: Finish grading will be performed according to Section 02002 of these Specifications, in graded areas.

3.3 PLANTING NATIVE GRASS SEED:

A. Preparation:

1. Roughly grade seed beds with equipment, leave few ridges and depressions and making areas into a continuous, firm plane that ensures proper drainage.

B. Planting:

1. Native grass seed shall be planted by hand broadcast method as approved by the Engineer. Seeding of native grass should follow recommendation in NRCS Critical Area Planting.

2. For site-specific native grass mix, reference the KS-ECS-4 form found in the design packet.

3.4 PLANTING BARE ROOT SEEDLINGS

A. Preparation

1. Roughly grade channel bank slope with equipment, leave few ridges and depressions and making areas into a continuous, firm plane that ensures proper drainage. The planting area must be free of living sod and perennial weeds before planting. Vegetation from native grass seeding is acceptable.

B. Planting

1. Cuttings and bare root seedlings should follow recommendations in Kansas Forestry Technical Note KS-9.

2. For site-specific information on cutting and bare root seedlings, reference the KS-ECS-5 form found in the design packet.

3.5 MULCHING:

A. Mulching shall immediately follow seed planting.

B. Mulch shall be an organic substance capable of eventual complete decay. The mulch shall be native prairie hay, brome hay, or straw and shall be applied at a rate of 4,000 pounds per acre. Native prairie hay is the preferred mulch.

C. Mulch shall be evenly distributed over the entire seeding area.

3.6 INSPECTION:

A. In addition to normal progress inspections, NRCS shall schedule and conduct the following formal inspections, giving the Engineer at least 24 hours prior notice of readiness for inspection:

1. Inspection of plant locations, to verify compliance with the Drawings.

2. Final inspection after completion of native grass seeding and final inspection after completion of cuttings and bare root seedling plantings; schedule these inspections sufficiently in advance, and in cooperation with the Engineer, so that final inspections may be conducted within 24 hours after completion of native grass seeding and tree planting.

3. Final inspection at the end of the maintenance period provided that previous deficiencies have been corrected. The maintenance period consists of the first three years following native grass seeding and tree planting.

3.7 CLEAN-UP:

A. During the progress of this work, and upon completion, the landowner shall thoroughly clean the project area and remove and properly dispose of resultant dirt, debris and other waste materials.

PART 4 – MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT:

A. The quantity of seeding and mulching will be measured in pounds of pure live seed and mulch applied. Seeding and Mulching shall be considered subsidiary to grass planting and the overall construction project.

4.2 BASIS OF PAYMENT:

A. The amount of work completed and approved, as stated above, shall be paid in lump sum as part of the contract unit price. Such payment shall constitute full compensation for all labor, equipment, tools and all other items necessary and incidental for the completion of the work. Two payment requests should be made based on native grass seeding and tree planting complete. The first payment request shall follow native grass seeding and mulching. A separate payment request shall be made after the cuttings and bare root seedlings are planted.

END OF SECTION 02901

SECTION 02903 – ROOTWAD REVETMENTS

SUMMARY: The work described herein consists of harvesting and installing rootwad revetments for bank toe stabilization. The Contractor shall perform all soil preparation, placement, and such additional extra and incidental work as may be necessary to complete the work in accordance with the specification and plans. The Contractor shall furnish all required materials, equipment, tools, labor, and incidentals, unless otherwise provided in the specifications or Drawings.

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Rootwad revetments are structures constructed from interlocking tree materials. These structures are continuous and resistive type methods and are designed to resist erosive flows. These structures are located along the outside bend of stream meanders. These structures are intended to mimic natural systems and improve the aquatic habitat. This method should only be considered if the natural materials are found on-site. This work shall consist of furnishing and installing the necessary materials as specified in the Drawings. This section includes but is not limited to:

Harvesting of wood

Preparation of placement sites

Installing rootwads

B. Related Work in Other Sections:

Excavating, Filling and Grading: Section 02200

1.2 QUALITY ASSURANCE:

A. Qualification of Workmen: Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct all work performed under this Section.

B. Wood Requirements:

The root fan should be of sufficient diameter to reach from the depth of the maximum scour to the annual high water elevation. If the root fan is not sufficient, then several root fans can be stacked to achieve the proper diameter. The length of rootwad fan should be four times the projected scour behind the rootwad. Typically, the fan lengths are 10 feet on small streams and over 20 feet on larger rivers. The trunk should be firmly attached to the root fan. The footer log should have a diameter of at least three-quarters the rootwad trunk.

PART 2 - MATERIALS

2.1 PLANT MATERIALS:

A. General: Existing wood materials should be located on-site. Care should be taken to select trees that are free of physical damage.

2.2 HARVESTING WOOD:

A. Trees

1. Trees should be removed by machinery so that the root mass and trunk are intact. The trunk then must be cut to the appropriate length.

B. Transportation, Storage, and Handling:

1. All wood materials are located on-site, and should be removed by machinery provided by contractor.

C. Site Disturbances:

1. Take precautions to insure that equipment and vehicles do not disturb or damage existing grading, seeding, or other site improvements.

2. Repair and/or return to original condition any damage at no cost to Sponsor.

PART 3 - INSTALLATION

3.1 SURFACE CONDITIONS:

A. Inspection:

Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where these installations may properly commence.

Verify that planting, seeding and related construction work may be completed in accordance with the Drawings and the referenced standards.

B. Discrepancies:

In the event of discrepancy, immediately notify the Engineer. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 PLACEMENT

A. Wood

1. The root fan should be oriented into oncoming flow. The rootwad should be placed at an elevation such the fan reaches the maximum scour depth. The rootwad trunk is excavated into the bank.

2. The footer log should be parallel to the streambank and extend past the root fan on both ends to protect the bank against eddying. The footer should be placed at an elevation to support the rootwad and is typically above the maximum scour depth. Rootwads are typically spaced three to four times the length of root mass. When both pieces are placed, the rootwad should be set on top of the footer log diagonally, forming and "X".

B. Rock

1. Place ballast rock in accordance with the Drawings in a manner to secure the rootwad. The ballast rock shall not exceed 5 percent fines.

3.3 SPREADING OF TOP SOIL:

A. Finish Grading: All finish grading will be performed according to Section 02002 of these Specifications, in all graded areas.

3.4 INSPECTION:

A. In addition to normal progress inspections, schedule and conduct the following formal inspections, giving the Engineer at least 24 hours prior notice of readiness for inspection:

Final inspection after completion of planting; schedule this inspection sufficiently in advance, and in cooperation with the Engineer, so that final inspection may be conducted within 24 hours after completion of placement.

Clean-up: During the progress of this work, and upon completion, thoroughly clean the project area and remove and properly dispose of all resultant dirt, debris and other waste materials.

PART 4 - MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT:

A. Work shall be subsidiary to rock vanes and longitudinal peak stone toe protection (LPSTP).

4.2 BASIS OF PAYMENT:

A. The amount of work completed and approved, as stated above, shall be paid as a lump sum subsidiary to the rock vanes and LPSTP.

END OF SECTION 02903

SECTION 02906 – MULCHING – NRCS PRACTICE CODE 484

PART 1 – GENERAL

1.1 DESCRIPTION:

A. Mulching is the application of organic material to the soil to protect it from raindrop and sheet flow erosion. Mulching shall be used on cover crop planted areas and tree plantings when so directed by the engineer. In general, mulching shall include, but is not limited to:

1. Procurement, storage and protection of all listed material

2. Maintaining plantings installed by Contractor.

B. Related Work in Other Sections:

1. Excavating, Filling and Grading Section: Section 02102

2. Channel Bank Vegetation: Section 02901

C. Purpose:

1. This practice shall be used to reduce soil erosion, aid in seed germination and establishment of plant cover, and conserve soil moisture.

1.2 QUALITY ASSURANCE:

A. Qualification of Workmen: Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct all work performed under this Section.

B. Standards:

1. All mulch materials shall be native prairie hay, brome hay, or wheat straw. All materials should be of good quality and free from mold or decay.

1.3 JOB CONDITIONS:

A. Site preparations: Soil surface shall be prepared prior to the application of mulch in order to achieve optimum contact between soil and mulch. All areas to be mulched should be reasonably free from rills and gullies.

B. Time of mulching: All mulching shall be performed during favorable weather conditions immediately following final grading.

1.4 SUBMITTALS:

A. Materials list shall include, but not limited to, the following:

1. Hay or straw quantities by weight with scale ticket, Signed and Dated by Supplier(s).

2. As-Installed Plan: During course of the installation, carefully record in red outline on a print of the planting drawings actual mulching location.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Pick up materials in accordance with any special handling instructions and deliver to project site in good condition.

B. Use all means necessary to protect plant materials before, during, and after installation and to protect the installed work and materials of all other trades.

1.6 SITE DISTURBANCES:

A. Take precautions to insure that equipment and vehicles do not disturb or damage existing grading, seeding, plantings or other site improvements.

B. Repair and/or return to original condition any damage at no cost to Owner.

PART 2 – MATERIALS

2.1 MULCH MATERIALS.

A. General: Materials shall consist of natural, biodegradable material such as plant residue to include, but not limited to, the following:

1. Native Prairie Hay

2. Brome Hay

3. Wheat Straw

B. All materials shall be free from diseased plant residue and noxious weed seed.

C. Miscellaneous Materials: All other materials not specifically described but required for a complete and proper planting installation shall be as selected by the Contractor, subject to the approval of the Engineer

PART 3 – INSTALLATION

3.1 SURFACE CONDITIONS:

A. Inspection:

1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where these installations may properly commence.

2. Verify that planting, seeding and related construction work is completed in accordance with the original design and referenced standards.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Engineer.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 GRADE SURFACE:

A. Finish Grading: All finish grading will be performed according to Section 02002 of these Specifications, in areas that are graded.

B. Fine Grading: Fine mechanical grading shall only be conducted on areas where it can be done safely without posing a danger or hazard to the equipment and operator.

3.3 APPLICATION TIMING:

A. Mulch shall be applied upon completion or within 24 hours of cover crop seeding.

3.4 APPLICATION RATE:

A. Mulch shall be applied at the rate of 4,000 pounds per surface acre.

3.5 CRIMPING:

A. If required by the engineer, mulch shall be crimped immediately after spreading with a mulch crimper or equivalent devise consisting of a series of dull flat blades with notched edges spaced approximately 8 inches apart. The mulch shall be crimped into the soil to a depth of 1 to 3 inches. Crimping shall only be performed in areas where it can be done safely, without posing a danger or hazard to the operator or equipment.

3.6 INSPECTION:

A. In addition to normal progress inspections, schedule and conduct the following formal inspections, giving the Engineer at least 24 hours prior notice of readiness for inspection:

1. Final inspection after completion of seeding, planting and mulching; schedule this inspection sufficiently in advance, and in cooperation with the Engineer, so that final inspection may be conducted within 48 hours after completion of mulching.

2. Final inspection at the end of the maintenance period provided that all previous deficiencies have been corrected.

3.7 MAINTENANCE:

A. General: The Contractor shall inspect the site within 48 hours of any precipitation event that produces 0.5 inches or more of rain in a 24 hour period. Mulch that is displaced shall be reapplied and anchored. Maintenance shall be completed as soon as possible with consideration of site conditions.

B. Maintain all seeding, planting, and mulching starting with the planting operations and continuing for 30 calendar days after all mulching is complete and approved by the Engineer.

C. Work Included:

1. Protect all planted areas against damage, including erosion, and drought by providing and maintaining proper safeguards such as periodic watering.

D. Extension of Maintenance Period: Continue the maintenance period at no additional cost to the Owner until all previously noted deficiencies have been corrected, at which time the final inspection shall be made.

3.8 CLEAN-UP:

A. During the progress of this work, and upon completion, thoroughly clean the project area and remove and properly dispose of all resultant dirt, debris and other waste materials.

END OF SECTION 02906