

NATURAL RESOURCES CONSERVATION SERVICE

CONSTRUCTION SPECIFICATION

00 – BIO-ENGINEERING

1. SCOPE

This work shall consist of identifying, supplying, and planting dormant live cuttings of the species indicated on the plant list at the locations and spacing shown on the Drawings. Work includes identifying, harvesting, storage, and delivery to the construction site for plantings.

2A. MATERIALS

A. Live Branches

1. Cuttings will come from shrubs and young trees and will have basal branch diameters of 0.25 to 1 inch. Each stem shall contain at least two healthy side branches; side branches shall not be trimmed off.
2. Species listed in Section 5 C (3.) Group 1 are preferred. Species from Group 2 are acceptable when insufficient quantities of the preferred species are available.

B. Live Stakes

1. Cuttings will come from willow shrubs and young trees and have basal ends 1 to 2 inches in diameter.
2. Include at least one of the species listed in Section 5 B. (Group 1).
3. Collect cuttings during the dormant season (approximately two weeks after leaf-off) and deliver to the project site as soon as possible.
4. Plant material showing desiccation, abrasion, sun-scalded injury, disfigurement, or unauthorized substitution shall be rejected.

C. In-Situ Soils

In-situ soils proposed for tilling, amending and conditioning shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other materials over a minimum 3 inch diameter. In-situ soils shall be free from viable plants and plant parts.

E. Twine

Twine used for tying live branch cuttings in fascines shall be natural jute twine or an approved equal. Twine shall be untreated and free from preservatives.

3. PRODUCT HANDLING

- A. General: Carefully pack dormant live cuttings (with all growing tips in one direction) to prevent desiccation, breaking, damage to bark and branches. Provide adequate ventilation. Protect from sun, drying wind and freezing. Do not drop cuttings from vehicles. Legibly label cuttings with correct botanical name, common name, and date collected.
- B. Transport: Transport cuttings in covered, unheated vehicles, moistened and covered with moisture retaining medium.
- C. Storage:
 - 1. If cuttings cannot be delivered to the construction site within 24 hours, store off-site in specially prepared facilities specifically constructed to store dormant live plant material. Maintain facilities at a constantly cool temperature (34 deg F to 50 deg F) and with adequate humidity levels.
 - 2. Keep cuttings moist and covered with moisture-retaining medium throughout the time in storage. Periodically water to maintain moisture levels. While at construction site, ensure plants are not left in sun to dry out; keep in shaded area and keep moist.
 - 3. Store on pallets above ground surface. Provide adequate ventilation.

4. SOURCE OF SUPPLY

Harvest cuttings during the dormant season from within the project watershed, as designated or approved by the Contracting Officer. Any necessary harvesting permits are the responsibility of the contractor.

5. DORMANT LIVE CUTTINGS

- A. Notify the Contracting Officer 72 hours prior to harvesting at the approved sites.

The Contractor shall schedule his cutting and delivery to the planting site so that the materials can be installed within 48 hours after they arrive.

- 1. Collect only specimens deemed suitable for harvesting.
- 2. Harvest cuttings during the dormant season (November 1 to March 1) only.

3. Substitutions will not be permitted without written request and approval from the Contracting Officer.

B. Live Branches

1. Brush Cultivar:

Live brush for brush layers shall be 3 to 7 feet in length, as shown on the plans, with a basal end of 0.25 to 1 inch in diameter. Each stem shall contain at least two healthy side branches; side branches shall not be trimmed off. All live brush plant materials are subject to inspection and approval by the Contracting Officer.

2. Quality:

Dormant live brush shall be cut from approved harvesting sites during the dormant season or purchased from a source approved by the Contracting Officer.

3. Species

Group 1 (Recommended)

<u>Botanical Name</u>	<u>Common Name</u>
Cornus stolonifera	Red Osier Dogwood
S. exigua	Sandbar Willow
Salix purpurea	Purpleosier Willow "Streamco"
Salix x cottetii	Dwarf Willow "Bankers"

Group 2 (Acceptable)

<u>Botanical Name</u>	<u>Common Name</u>
Viburnum acerifolium	Mapleleaf viburnum
Viburnum lentago	Nannyberry viburnum
Viburnum alnifolium	Hobblebush
Viburnum recognitum	Arrowwood viburnum
Cephalanthus occidentais	Buttonbush

6. INSTALLATION

A. General

Live branches shall be installed from September 1st to December 1st and March 15th to June 1st (unless otherwise specified). Brush layering shall be installed only during periods when beneficial results can be obtained. When drought, excessive moisture, or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the brush layering operations proposed alternative times shall be submitted for approval.

B. In-Situ Soil

It is intended that the in-situ soil material, as defined herein and approved by the Contracting Officer, be obtained from approved on-site excavation operations, and be used in constructing the brush layer bioengineering systems after fertilizer and lime have been mixed with the material. Additional required suitable fill material shall be obtained from sources selected by the Contractor and approved by the Contracting Officer and meet the requirements specified herein.

The in-situ soil material shall be natural, viable soil capable of supporting plant growth. In addition, fertilizer and lime shall be mixed into the material as needed (in accordance with soil tests). The material shall be free of any admixture of subsoil, foreign matter, objects larger than three (3) inches in any dimension, toxic substances, or any material or substance which could be harmful to plant growth. Gravel alone shall not be considered a suitable material for use around live cut plant materials. Muddy (over-saturated) soils, which otherwise meet these requirements, shall not be considered suitable material until they have been dried to a workable moisture content. Heavy clays shall be mixed with sandy and/or organic soils to increase porosity. Acceptability of materials used to prepare the select fill shall be determined on-site by the Contracting Officer.

C. Installing Brush Layers

1. Brush layers are as indicated on the drawings. A trench shall be excavated into the slope, on contour, sloping downward from the face of the bank 10 degrees below horizontal as shown on the drawings. Live branches of willow and other species as listed in this specification, shall be placed in the trench with their basal end pointed inward and no less than 5 inches or more than 18 inches of the tips extending beyond the face of the slope. Brush layers shall be from 3 to 4 feet in length at a density of 10 stems per foot of bank. Branches shall have a basal end of 0.25 to 1 inch in diameter and crisscrossed. Brush layers shall be covered with at least 4 to 5 inches of in-situ soil or topsoil immediately following placement and the material compacted firmly, so as to create good stem to soil contact throughout the brush layer. Other brush layers shall be placed, as needed, on contour intermittently upslope as indicated on the drawings. If cohesionless, disturbed, or fill soil is encountered in between brush layers, it will be necessary to cover that soil with 900 cm./sp. Meter coir fabric. The coir-covered zone in between the brush layers shall be seeded with a native grass seed mix and staked

as shown on the drawings. Coir fabric shall be overlapped at all seams a minimum of 12”.

D. Installing Live Branches

1. Live Branches are an element of the Vegetation Reinforced Soil System constructed above the top of channel lining riprap on the slopes of the flood control channel, as indicated on the drawings. Above the top of the channel lining riprap, a series of 12” soil lifts will be constructed of two 6” compacted soil lifts and completely wrapped in a layer of Coir or Burlap Fabric and then a layer of geogrid. Live branches of shrub willow and other species, as listed in this specification, shall be placed between successive soil lifts with their basal end pointed inward and no less than 8 inches or more than 12 inches of the tips extending beyond the face of the slope. Live Branches shall have a minimum embedment depth of 3 to 7 feet at a density of 10 stems per foot of bank. Branches shall have a basal end of 0.25 to 1 inch in diameter. Coir/burlap fabric shall be overlapped at all seams a minimum of 12”.

E. Installing Live Stakes

1. Live stakes for Fascine installation shall be 18”-24” in length with a basal end of 1 to 2 inches diameter. All live stakes are subject to inspection and approval by the Contracting Officer.
2. Dormant live stakes shall be cut from approved harvesting sites during the dormant season or purchased from a source approved by the Contracting Officer.
3. Only species of willow shall be used for live stakes for fascine installation.

7. MAINTENANCE DURING STORAGE

- A. If immediate delivery to the construction site is not possible, maintain cuttings throughout the storage period as specified in Section 3.
- B. Materials in storage may be viewed periodically by the Government. Provide access to the Government when desired.

8. DELIVERY

- A. Coordinate with the Contracting Officer to ensure that materials are delivered to the job site in a timely manner. Report any practices planned during construction that may prevent establishment of the cuttings.
- B. Deliver as specified in Section 3. Maintain conditions of cuttings throughout transport and delivery. Provide instructions on the proper handling and protection of cuttings prior to installation.

9. PLANTING

- A. Depth, spacing, and limits of plantings are shown on the Drawings.
1. The geometric pattern of the planting may be interrupted by the presence of mature trees within the planting area.
 - a. Resume plant spacing as soon as practicable adjacent to the mature trees.

10. MAINTENANCE OF PLANTED AREAS

Maintenance operation shall begin immediately after planting and shall continue as required until final acceptance, and for a one-year guaranty period after final acceptance. Plants shall be kept in a healthy, growing condition by watering, pruning, spraying, weeding, mulching and any other necessary operations of maintenance. The Contractor may pump water from the river for watering during construction and the one-year maintenance period.

11. MEASUREMENT AND PAYMENT

Method 1 For items of work for which specific unit prices are established in the contract, each area treated will be measured as specified in Section 12 and the area calculated to the nearest 0.1 acre. Payment for treatment will be made at the contract unit price for the designated treatment which will constitute full compensation for completion of the work.

When specified as an item of work, mesh or netting will be measured to the nearest square yard of surface area covered and accepted. Payment will be made at the contract unit price and will constitute full compensation for completion of the work.

Method 2 For items of work for which specific lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for this item will be made at the contract lump sum price for the item and will constitute full compensation for the completion of the work.

All Methods The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the item(s) to which they are made subsidiary are identified in Section 7.