

This information includes specifications for plant material and work to be conducted at the restoration site to restore native vegetation. Specifications should be chosen that fit specific project needs and incorporated into the vegetation plan.

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Project Administration

Bidding and Contractor Qualifications

- Contractors shall submit their qualifications for approval at least three weeks prior to bid closing.
- Contractors must have at least three years of experience planting wetland restorations of similar size to this project.
- Contractors must have completed at least three successful wetland restoration projects (i.e. good diversity of species, low occurrence of non-natives) with addresses of the projects and client contact names and phone numbers.
- The contractor (owner or foreman) conducting the work shall have training in restoration ecology (eg., a bachelors or masters degree in conservation biology, wildlife, ecology botany, landscape architecture or related field or other equivalent specialized training).
- The contractor shall be knowledgeable in identifying and differentiating native wetland and prairie plants from noxious weeds in order to conduct selective spot spraying of noxious weeds without harming the native plant seeding.
- The contractor must assign a qualified project supervisor capable of being present full time during all installation and maintenance work.
- Provide references (client contact name and phone number) and a list of pervious projects of similar size and scope (with project addresses). The project designer reserves the right to reject any contractor that does not provide a minimum of five years experience and a successful track record with projects of similar size and scope.
- The project manager is responsible for coordinating implementation activities, record keeping, meetings, compiling and furnishing accurate records of project activity to the client/project sponsor on a quarterly basis in an electronic and/or paper format.

Permit and Certification Requirements

- Permits must be obtained for _____ before construction begins.

Measurement and Payment

- _____ will be conducted on ___ acres at a rate of ____ per acre
- _____ will be conducted on ___ acres at a rate of ____ per hour

Equipment

Equipment General

- Power wash all mechanized equipment including undercarriages off-site prior to bringing it to the restoration/creation site.
- Wash or use an air compressor to blow clean entire vehicle if the vehicle may have entered areas of the project site with weed seeds.
- The contractor must have access to the equipment listed under "Equipment to be Used at the Restoration Site".

Equipment to be used at the restoration site:

- Truax type Seed Drill
- Vicon Type Broadcast Seeder
- Harrow

- Cultivator
- Disk
- Hydroseeder
- Bulldozer
- Mulch Applicator/Mulching Disk
- Cultipacker
- Roller
- Herbicide boom sprayer
- Herbicide backpack sprayers

Site Preparation Strategies

Clearing and Grubbing

- All stumps of boxelder, Siberian elm, Black locust, Tartarian Honeysuckle, and Buckthorn will be treated with herbicide within two hours of cutting.
- All cut woody plants must be removed from the project site or placed in piles as defined in the restoration plan.

Sediment Removal

- The depth of the original wetland surface must be measured and marked before excavation.
- Soil compaction should be minimized during sediment removal.
- Sediment must be moved to locations designated in the restoration plan.

Scraping

- Scraping to remove reed canary grass should be conducted to a depth that will remove all rhizomes.
- Topsoil shall be scraped to a minimum depth of ___ inches across the entire area designated on the plan and cleanly removed from the wetland surface.
- Scraped topsoil shall be removed entirely from the project site and not reused.

Crop Production

- Corn or soybeans will be grown for two years on the entire project site before seeding is conducted.
- Only approved herbicides will be used as part of crop production to prevent problems with the germination of native seed.
- Corn stalks shall be chopped and removed from the project site prior to further site preparation activities.

Perennial Vegetation Removal

- The contractor will treat the entire site with appropriate selective and non-selective herbicide using manufacturer recommended rates to eliminate all unwanted vegetation. Contractor will protect surrounding crops and all desired native vegetation in the site area during treatment.
- Only Rodeo or C-2-4D shall be used when within 50 feet of wetland sites and any certified herbicides that do not have aquatic certification shall not be used in locations where they may wash into wetlands or waterbodies.

- The use of alternative herbicides or methods of eliminating existing vegetation must be approved by the project manager.
- All personnel applying chemicals shall have a Commercial Herbicide Applicator License.
- Apply herbicide according to the following schedule and at the specified rate:
- A prescribed burn shall be conducted prior to herbicide treatment to reduce plant litter.
- Mow and rake the site to reduce plant litter before herbicide application (useful when burning is not possible).
- Allow at least seven days after herbicide application before disturbing the vegetation with other procedures.
- If seeding is delayed for any reason and weed species become established, then the entire site will be treated with glyphosate based herbicide at label-recommended rates and site preparation shall commence no sooner than 7 days after the herbicide has been applied.
- The Contractor shall be diligent and follow label recommendations while treating/removing invasive shrubs to ensure that non-target species are not damaged.
- Herbicide use logs shall be kept for all application of herbicides on this project.
- The Contractor will install warning signs to alert the public of herbicide use and include at a minimum the following on the sign: chemicals applied, date applied, how long to stay off herbicide area, other information required by the product label, other information required by local regulations. Remove signage once herbicided areas are safe to use again.

Tilling for Weed Control

- The first tilling is to follow a season of chemical control.
- If the site has been under cultivation during the previous year disk, cultivate or harrow no more than 2 inches deep as often as the weed seedlings reach about 2 inches. This will be conducted at least every two weeks until seeding.
- Following herbicide treatment cultivate or disk to 6-inches. Then disk or cultivate to break the soil into smaller chunks. Harrow to smooth any surface irregularities or ruts. The site can sit idle for about a month to allow weed seeds to germinate. Cultivate or harrow to till the ground no more than 2 inches deep as often as the weed seedlings reach 2 inches. This will be conducted until seeding.
- Fields deemed inadequately prepared for planting shall be prepared by the contractor to create a firm, smooth seed bed prior to drilling seed.

Seedbed Preparation

- Sites that are to be broadcast seeded should be tilled to a depth of 3-inches.
- Seed bed preparation prior to the use of a native seed drill will include deep tilling (3-6 inches), disking to break up dirt clumps, harrowing, and packing. Walking on the soil should cause it to compact no more than 1-inch.
- Excessive compaction will be loosened before seeding.
- All fields shall be inspected by the contractor and the project manager ,and both must agree on suitability of the seedbed for planting.

Temporary Cover Crops

- Cover crop mix___ shall be planted at a rate of ___lbs per acre.
- The temporary cover crop shall be clipped at 5-inches in early June before seed is ripened.
- The temporary cover crop shall be disked in September to act as mulch for the dormant broadcast seeding.

Materials

Seed Cleaning

- Native plant seed must be clean, new crop seed complying with the Association of Official Seed Analysts “Rules for Testing Seeds.”
- All native grass and forb seed shall be harvested from within the previous two growing seasons. Test results for germination and/or viability shall be current (within nine months) of the actual date of installation.
- All seed shall be cleaned to the bare caryopsis, or as close to the bare caryopsis as is possible, without damaging seed viability. Canada wild rye is an exception because it loses viability rapidly when it is de-awned.
- All seed shall be cleaned and processed so that it can be installed using a Truax type native seed drill or equivalent type seed drill.

Seed Germination, Purity & Testing

- All seed shall be supplied as pure-live-seed (PLS). For many species viability will be determined by combining the results of a standard 14-day germination test with a standard viability test (tetrazolium chloride or tz test). Normally seed is germinated for 14 days under optimum conditions and remaining seed is tested for viability. The combination of the two tests provides the final viability (germination) for that species. It is assumed that since seed is to be cleaned to the bare caryopsis that purity will be high. (2008 Mn/DOT Specifications).
- All seed shall conform to the latest seed law of the State, including those governing labeling and weed seed tolerances. Tolerances for Germination and Purity, as determined by the Department of Agriculture, shall only apply to seed that has been previously tested and approved by the Department of Agriculture as a seed lot. Test for percent germination shall have been completed within the 15 months prior to sale date as stated in the Department of Agriculture seed laws section 21.82 subd 5(a) and 21.86(a)(1).
- Seed testing shall be performed in accordance with applicable Association of Official Seed Analysts (AOSA) rules. Such tests shall be performed by a seed testing laboratory designated by MCIA or at a USA Accredited Seed Laboratory (ASL) as determined by the United States Department of Agriculture – Agricultural Marketing Service (USDA-AMS). The ASL shall have achieved a scope of accreditation appropriate for the species tested. (2008 Mn/DOT Specifications).
- The amount of pure live seed (PLS) of each species to be included in seed mixes shall be specified.
- All seeding rates shall be based on Pure Live Seed (PLS). Documentation shall include copies of the actual seed tests from the labs used for determining PLS of each component.
- No pre-blending of seed shall be done unless approved by the project manager. The seed shall be mixed in accordance with the specific planting plan and equipment to be used by the selected installer.
- It is generally accepted that upland warm and cool-season grasses be tested with a germination and tz test (as per

above). Most forbs, sedges, bulrushes and rushes are accepted on the basis of a tz test only. The above described testing will be accepted until there is a change or modification in the way seed of wild (ecotype) seed is tested under AOSCA rules. Seed of all native species must be tested every 14 months (excluding the test days).

- All bag labels shall be in accordance with specifications. Additionally, each bag shall contain a label listing the bulk weight in addition to the PLS of each component.

Weed Seed Tolerances

- All seed and seed mixes shall conform to state seed of Minnesota requirements for noxious weed content.

Labeling

- Seed tags for each bag must meet the Minnesota Department of Agriculture (MDA) labeling requirements described in 21.82 of the Minnesota Seed Law and Rules. The following requirements are in addition to MDA rules. Information required in state seed law for individual species that constitute greater than 5% of the total mix shall also be included for species that constitute less than 5% of the total mix. The following information is also required for each individual species: PLS percentage, county of origin, and scientific name. Labeling must also include the total PLS weight of each particular bag and the area to be seeded by that bag based on the seeding rates listed for that particular seed mix. Tags must not be hand written. If any of the above mentioned information is not included on the tag the material will be subject to Mn/dot specification 1503. When multiple bags are required for the purpose of keeping certain species or groups of species separate for seeding (see 3876.2-F) those bags may be placed inside of a larger bag as long as each bag is labeled separately and there is a packing list on the outer bag. (from 2008 Mn/DOT Specifications).

Seed Origin

- To the extent possible, seed should be acquired that is of genotypes that originate within 150 miles of the project location. When available, seed that is Source Identified (Yellow Tag) through the Minnesota Crop Improvement Association (MCIA) should be used over non-Source identified seed. When MCIA Yellow Tag seed is not available wild ecotype native seed can be used provided that the collector, county and or provide of origin are known. When seed is not available within the desired distance requirement every effort should be made to acquire Minnesota genotypes that are as close to the project as possible. If Minnesota genotype seed is not available, seed originating from southern Canada, western North Dakota, western South Dakota, northern Iowa and western Wisconsin will be acceptable, provided the project vendor has consulted with and received the approval of the project designer. Failure to abide by these requirements can be a reason to cancel the contract or with-hold payment.
- Seed sources for all native grass and forb seeds shall be submitted.
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Substitutions

- Substitutions are discouraged, however in cases where they are necessary due to supply shortages or excessive expense substitutions may be made with written approval by the project manager. All substitutions shall serve the same function or similar niches as the species being substituted.

Delivery

- The seed vendor shall be responsible to deliver all seed in properly labeled bags, mixed in accordance with the installer's specifications and to the location specified by the installer.
- Upon delivery, an invoice shall be presented to the project manager that matches the total pounds of Pure Live Seed of each mix purchased by the project manager and the total bulk weight delivered.

- Upon the delivery of seed the contractor shall provide for storage in a cool dry environment until the seed is delivered to the site on the selected day of installation. If the seeding takes more than one day, all seed shall be properly protected from the elements and stored in a secure, cool, dry location overnight. No seed shall be stored overnight in the fields.

Seed Storage

- Between purchase and installation, seed shall be stored in a dark area at a temperature no higher than sixty degrees Fahrenheit and a relative humidity between 20 and 40 percent. Seed shall be protected from mechanical, chemical, and animal damage until the contractor is ready to begin planting.

Bare-root Stock and Containerized Plants

- Bare-root stock shall be kept moist and planted within three days of purchase. Potted or balled and burlapped plants shall be planted within five days.
- Provide trees, shrubs, and plants of quantity, size genus, species, and variety shown and scheduled and complying with recommendations and requirements of the "American Standard for Nursery Stock". Provide healthy vigorous stock, grown in accordance with good horticultural practice and free of disease, insects, eggs, larvae, and defects such as knots, sun-scald, injuries, abrasions, or disfigurement.

Planting Strategies

Planting General

- Planting will be conducted according to the following schedule:
- The various planting strategies that will be used shall be conducted as defined in the vegetation plan.
- Seed mixtures shall be sown in all portions of the site as shown on the planting zone map.
- Prior to seeding, the seed zones must be located and clearly staked or flagged to ensure the seed installer properly plants the appropriate amount and types of seed in zones designated on the Planting zone map. The staking shall be done under the direction and supervision of the project designer.
- Both the upland and wetland zones shall be seeded before July 1st in the northern half of the state and June 15th in the southern part of the state. If this timeframe cannot be met, the seeding shall be delayed until a seeding can be done after October 15th in the northern half of the state and November 1st in the southern half of the state.
- Dormant seeding shall be conducted after October 15th in the northern half of the state and November 1st in the southern half of the state and before freeze-up.
- Temporary seeding shall be done on areas that need to be established with vegetative cover for temporary erosion control. Erosion control with temporary seeding shall be for a length of time greater than 30 days and up to one growing season. Unless otherwise specified, fertilizer is not needed in conjunction with temporary seeding.
- Planting shall be conducted when specified in the plans and shall not take place when the ground or overlying water is frozen, or when conditions are otherwise unsatisfactory.
- Delays due to weather related problems are the only valid reason for not completing the work.
- All seeding operations shall be performed in such a manner that the seed is uniformly applied at the specified quantities in the designated areas. The method and rate of seed application shall be as specified in the restoration plan.

- Delays due to contractor workload related to other projects are not acceptable and will be deemed just cause for termination of the contract.
- The seeding rate for broadcast seeding processed seed is ___ lb. PLS./acre.
- Unprocessed seed shall be broadcast at a rate of ___ lb./acre.
- Seeding shall occur as soon as possible after final site preparation to prevent weed germination.
- Cultipacking or rolling will be conducted immediately after seeding to ensure good seed to soil contact.
- The contractor must supply a seeding/seedling planting schedule to be approved by the project designer prior to any installation.
- If seeding is delayed it shall be the responsibility of the contractor to keep the upland and wetland seed zones in a fallow condition free of weeds.

Upland Planting

Upland Seeding General

- Upland zones shall be seeded before July 1st in the northern half of the state and June 15th in the southern part of the state. If this timeframe cannot be met, the seeding shall be delayed until a seeding can be done after October 15th in the northern half of the state and November 1st in the southern half of the state.

Broadcast Seeding Uplands

- Topsoil shall be loosened to a depth of 3 inches prior to broadcast seeding unless there is a risk of erosion. The loosened soil shall be allowed to settle prior to seeding.
- Grasses shall be raked or harrowed into the soil before forbs and sedges are broadcast.
- Following the installation of seed, the site shall be packed to ensure proper seed contact with the soil and a firm seedbed.

Seed Drills

- The seeding rate when using a Truax type seeder is ___ lb. PLS./ acre.
- All drill seeding should be done at a right angle to surface drainage.
- Split the site's seed in half and make two passes over the site during the seeding operation.
- A Truax type seeder must be used. The seed drill must accurately meter the types of seed to be planted and keep all seed uniformly mixed during the drilling. The drill should contain a minimum of two seed boxes, a fine seed box and a box for large/fluffy seeds, and it should be equipped with disc furrow openers and packer assembly to compact the soil directly over the drill rows. Maximum row spacing should be 8 inches. The interseeder drill must be out-fitted with trash rippers that will slice through the vegetative mat and make a furrow into the underlying soil approximately 1 inch wide by 0.2-1 inch deep. The furrows should be directly in line with the drill seed disc openers. Fine seed should be drop-seeded onto the ground from the fine seed box and large/fluffy seed should be placed to obtain a final planting depth of ¼ to ½ inch.

Upland Containerized Plants and Rootstock

- Containerized plants and rootstock shall be planted after seeding is completed.
- Hand plant the prescribed quantities of plugs within the area specified in the plan.
- Plugs shall be randomly planted throughout the area to provide a non-uniform appearance throughout the site.
- Insofar as practicable, transplanting of rootstock shall occur on the day of delivery at the project site. In the event this is not possible, the plants shall temporarily be stored in a well-ventilated, cool storage place and shall be protected adequately against drying.

Upland Trees and Shrubs

- Shrubs shall be planted between mid-April and the end of May and shall be clearly marked with flagging or temporary fencing to avoid destruction during grass and forb maintenance.
- Unless otherwise noted, shrubs in the form of container plants or roots will be spaced ____ feet apart.
- Planting holes shall be made large enough to accommodate roots being spread out to their approximate natural position. Sides of rootballs shall be loosened and any circling/girdling roots cut and removed. The root flare should be within one-inch of the soil surface after planting.
- Backfill used to plant trees shall be free of all vegetation and shall be in a loose friable condition.
- Bare root shade trees and shrubs shall be mulched to a depth of four inches in a circular pattern with 36-inch diameters measured from the center of the hole. The mulch shall be pulled away from the trunk of trees or shrubs.
- Wood chip mulch shall consist of hardwood chips originating from tree trunks and larger limbs. Mulch must be free of bark, leaves, twigs, sawdust, foreign and extraneous matter, debris and toxic substances.
- Tree and shrub species shall be fertilized with a time-released fertilizer.
- Qualified and trained personnel, experienced and familiar with accepted horticultural practices shall do all pruning as directed by the project designer in a manner and method that will preserve and retain the growth habit and characteristic of the various individual plants.
- Within one week after planting, all bare root shade tree trunks shall be wrapped from the ground line to a height of 3 feet with a one-half-inch square mesh, galvanized, steel wire with minimum gauge of 19 (poultry netting) at a diameter of 14 inches measured from the center of the trunk with a 4-inch overlap. The screen wire shall be secured with a minimum of four steel staples (hog rings). The mesh cylinder shall be imbedded 1-inch below the surface of the soil without disturbing the tree roots. A 1- inch by 1-inch stake will be driven into the ground and secured to the mesh cylinder.
- Seedling tree shelters should be of seamless, extruded, twin-wall, rigid and semi-translucent polypropylene tubes with a top rim flared outward to prevent abrasion to stems and branches. The shelters will be secured with nylon ratchet-locking ties attached to a 1 inch by 1-inch stake. The bottom of the tube will be inserted a minimum of 1-inch below the surface of the soil. A plastic photodegradable netting cover and sleeve shall be installed over the top of the tube to prevent entrapment of birds.

Bacterial and Mycorrhizal Inoculum

- Seed of all prairie legumes must be inoculated prior to seeding.
- Cover crop seed must be inoculated before seeding.
- Bacterial inoculums packages shall not be opened until immediately before use.
- Endomycorrhizal inoculum shall contain several species of *Glomus* that can be applied to the soil or base of a plant as a liquid, powder, or pellet. Minnesota origin of inocula is preferred. Additional endomycorrhizal species of *Gigaspora*, *Scutellospora*, *Endotrospora*, *Acaulospora*, or *Sclerocystis* may also be present. The Inoculum will not be rejected if ectomycorrhizal species of *Pisolithus* or *Rhizopogon* are present. The inoculum shall have a defined live spore count and shall be applied according to the manufacturer's recommendations for new plantings. Antagonistic pathogens shall not be present above trace levels. This material may be mixed or pre-blended with hydrophilic polymers and rooting hormones.
- Ectomycorrhizal inoculum shall contain *Rhizopogon* and or other cold tolerant species that can be applied to the soil or base of a plant as a liquid, powder, or pellet. Minnesota origin of inocula is preferred. The inoculum shall have a defined live spore count and shall be applied according to the manufacturer's recommendation for new plantings. Antagonistic pathogens shall not be present above trace levels. This material may be mixed or pre-blended with hydrophilic polymers and rooting hormones.

Stabilizing Uplands

- Mulch shall consist of clean grain straw and be certified by the Minnesota Crop Improvement Association (MCIA) to be free of noxious weed seeds, seed bearing stalks, and/or other reproductive propagules as defined by rules and regulations of the Minnesota Department of Agriculture.
- Documentation verifying that the mulch has passed MCIA field inspection shall accompany the material upon delivery to the job site. At the time of delivery, the mulch shall be in an air dried condition.
- Use a mulch crimper, or an equivalent disk type mulch-anchoring tool with cutaway straight disks. When a mulch crimper or equivalent anchoring tool is used, it shall have straight blades and be the type manufactured expressly for and capable of firmly punching the mulch into the soil. The disk spacing shall be approximately 8-inches and shall be weighted sufficiently so as to be capable of punching the mulch vertically 2 to 3 inches into the seedbed. A tool with concave disks shall not be used. Where equipment can safely be operated, it shall be operated on the contour. Hand methods of crimping shall be used where equipment cannot safely operate to perform the work required. .
- A temporary cover crop can act as mulch for the site if it is clipped and disked into the soil before seeding.
- Upland mulching shall be conducted at two tons per acre.
- Netting used for erosion control shall be rolled out flat, parallel to the direction of flow. Netting placed on cut or fill slopes shall be rolled out flat, parallel or perpendicular to the direction of water flow. The edges of adjacent strips shall overlap a minimum of 2-inches and a maximum of 4-inches with the net on the upstream side of any lateral water flow being on the top. The netting shall be secured in place by means of wire staples driven reasonably vertical into the soil. The netting shall not be stretched prior to stapling. Staples shall be placed 3-feet apart along the ends and edges of each strip. Additional rows of staples shall be placed parallel to the edge row of staples so that the distance between adjacent rows does not exceed 3-feet. Staples shall be placed 3-feet apart within these rows. Where possible, staples of adjacent rows shall be placed so as to form a sawtooth pattern.

Wetland Planting

Native Seed Bank

- The native seedbank will be tested according to guidelines in Appendix E of the Minnesota Wetland Restoration Guide.
- The appropriate depth of sediment removal to expose native seedbank will be determined before excavation and checked periodically during excavation.

Broadcast Seeding Wetlands

- Broadcast seeding shall be conducted with broadcast seeding equipment equipped with an agitator that effectively prevents seed from bridging or plugging. Seed shall be broadcast twice over each area to help ensure even distribution.
- All native seed in the wetland zones will be installed by broadcast seeding with equipment designed for broadcasting native seed mixes containing seed of varying sizes and weights (i.e.; a cyclone type broadcaster).
- Seeding shall occur before hydrology is restored to the wetland to allow for the use of mechanized equipment.
- Prior to seeding, topsoil shall be loosed to a minimum depth of 3 inches unless there is a risk of erosion and allowed to settle prior to seeding.
- Grasses should be raked or harrowed into the soil before forb and sedges are broadcast.
- Wetland zones shall be seeded before July 1st in the northern half of the state and June 15th in the southern part of the state. If this timeframe cannot be met, the seeding shall be delayed until a seeding can be done after October 15th in the northern half of the state and November 1st in the southern half of the state.
- Following the installation of seed, the site shall be lightly harrowed or raked and then packed to ensure proper seed contact with the soil and a firm seedbed.
- Wetland seed may be lightly raked but should not be buried to any degree. If the seed installer runs out of seed due to too heavy of an application the installer shall purchase and install additional seed of the same mix and seed vendor to complete the installation.
- No equipment shall run across seeded areas after seeding operations have been completed.

Hydroseeding Wetlands

- The seed shall be hydroseeded evenly over the site.
- A fan type nozzle should be used with approximately 500 gallons of water per acre (1892 liters/hectare).
- The seed shall be harrowed and packed after seeding.
- Hydroseeders must agitate continuously to keep the seed mixed in a slurry. Pump pressure must produce a continuous non-fluctuating stream.
- Seed cannot be left in the slurry for more than one hour.
- Hydroseeding should not be conducted if wind velocities exceed 15 mph or in wind gusts that affect uniform seed distribution.

- A coloring agent (tracer) shall be used to assist in obtaining a uniform material distribution as evidenced by a uniform coloration of the soil. If a non-uniform distribution results (such as skipped areas and saw-tooth patterns), the affected areas shall be reseeded at the contractors expense.

Wetland Containerized Plants and Rootstock

- Plugs shall be hand planted in the prescribed quantities within the area specified in the plan.
- Rootstock shall be planted in the appropriate plant community as shown on the plan.
- Plug installation shall occur after all seeding has been completed.
- Plugs shall be randomly planted throughout the area to provide a non-uniform appearance throughout the site.
- Sedges, grasses and herbaceous plants should generally be spaced ___ feet apart. The spacing of various species will differ due to growth habits of the plant and will be spaced according to specifications made on the planting chart.
- Insofar as practical, transplanting of rootstock shall occur on the day of delivery at the project site. In the event this is not possible, the plants shall be stored temporarily in a well-ventilated, cool storage place and shall be adequately protected against drying.
- The storage period shall not exceed 48 hours for any rootstocks.
- Rootstock of emergent plants shall not be planted under more than 1-foot of water.
- Tubers or rhizomes lacking or with limited fibrous root systems may simply be pushed into areas with soft substrates. In firmer substrates, planting holes shall be opened with dibble bars, spades or other suitable tools.
- Plants shall be planted in their natural orientation one to four inches deep or as specified by the supplier and at the depth that they would naturally occur in the field or nursery.

Wetland Trees and Shrubs

- Holes shall be made large enough to accommodate roots being spread out to their approximate natural position. Sides of rootballs shall be loosened and any circling/girdling roots cut and removed. The root flare should be within one-inch of the soil surface after planting.
- Backfill used to plant trees shall be free of all vegetation and shall be in a loose friable condition.
- Cuttings are to be collected from late fall to early spring, preferably around leaf fall or a few weeks prior to bud burst.
- Cuttings shall be 1.5 to 3 feet long and 0.5 to 1.5 inches in diameter.
- Cuttings shall be from relatively young branches.
- Cuttings must be kept cool and moist until planting.
- Cuttings shall be inserted into saturated soil and the soil should be compacted by foot around the cutting.
- Unless otherwise noted, shrub cuttings shall be spaced ___ feet apart.
- Unless otherwise noted, shrubs in the form of container plants or roots will be spaced ___ feet apart.
- Bare root shade trees and shrubs shall be mulched to a depth of four inches in a circular pattern with 36 inch diameters measured from the center of the hole. However, the mulch shall be pulled away from trunks for trees or shrubs.

- Wood chip mulch shall consist of hardwood chips originating from tree trunks and larger limbs and mulch must be free of bark, leaves, twigs, sawdust, foreign and extraneous matter, debris and toxic substances.
- Tree and shrub species shall be fertilized with a time-released fertilizer.
- Qualified and trained personnel, experienced and familiar with accepted horticultural practices shall do all pruning as directed by the project designer in a manner and method that will preserve and retain the growth habit and characteristic of the various individual plants.
- Within one week after planting, all bare root shade tree trunks shall be wrapped from the ground line to a height of 3 feet with a one-half-inch square mesh, galvanized, steel wire with minimum gauge of 19 (poultry netting) at a diameter of 14 inches measured from the center of the trunk with a 4-inch overlap. The screen wire shall be secured with a minimum of four steel staples (hog rings). The mesh cylinder shall be imbedded 1 inch below the surface of the soil without disturbing the tree roots. A 1 inch by 1 inch stake will be driven into the ground and secured to the mesh cylinder.
- Seedling tree shelters should be of seamless, extruded, twin-wall, rigid and semi-translucent polypropylene tubes with a top rim flared outward to prevent abrasion to stems and branches. The shelters will be secured with nylon ratchet-locking ties attached to a 1 inch by 1 inch stake. The bottom of the tube will be inserted a minimum of 1 inch below the surface of the soil. A plastic photodegradable netting cover and sleeve shall be installed over the top of the tube to prevent entrapment of birds.

Stabilizing Wetland Soil

- Straw mulch shall be distributed evenly over the restoration site at a rate of 1 ton per acre.
- Straw mulch must be disked so that plant material is punched 2-3 inches into the soil. After spreading, the mulch must be crimped into the soil with a straight disk with disks at a spacing of 12 inches.
- Use a mulch crimper, or an equivalent disk type mulch-anchoring tool with cutaway straight disks. When a mulch crimper or equivalent anchoring tool is used, it shall have straight blades and be the type manufactured expressly for and capable of firmly punching the mulch into the soil. The disk spacing shall be approximately 8-inches and shall be weighted sufficiently so as to be capable of punching the mulch vertically 2 to 3 inches into the seedbed. A tool with concave disks shall not be used. Where equipment can safely be operated, it shall be operated on the contour. Hand methods of crimping shall be used where equipment cannot safely operate to perform the work required.
- The Mulch shall consist of clean grain straw and be certified by the Minnesota Crop Improvement Association (MCIA) to be free of noxious weed seeds, seed bearing stalks, and/or other reproductive propagules as defined by rules and regulations of the Minnesota Department of Agriculture.
- Documentation verifying that the mulch has passed MCIA field inspection shall accompany the material upon delivery to the job site. At the time of delivery, the mulch shall be in an air dried condition.
- Any slopes greater than 5 percent and all berms and borrow areas shall be mulched and disk-anchored to prevent erosion.

Peatland Restoration

- A maximum depth of 10 centimeters of living vegetation should be collected from the donor site.
- The donor material collection should be conducted early in the spring when the ground is thawed about 10cm (4-inches) from the surface.

- Plant collection should be conducted using a rotovator. The rotovator should only pass once and only superficially on the collection zone to shred the living plants.
- A front end loader should be used to load donor material onto a bog wagon to transport the shredded plants to the restoration site.
- The shredded donor material should not be left on the borrow site as it will dry quickly.
- Manure spreaders should be used to apply harvested donor material on the restoration site.
- Shredded donor material should be scattered while the ground is still frozen.
- Shredded donor material should be spread 1 to 2 cm thick and in a manner that completely covers the bare peat.
- Straw mulch should be applied to the site with a straw blower at a rate of 2-tons per acre immediately after the spreading of shredded donor material.
- Effort should be made to avoid driving over the site after shredded donor material has been spread.

Maintenance Strategies for Vegetation Establishment

Herbivore Control

- Cages will be placed around white cedar and white pine trees. Each cage will consist of a 2" x 4" wire mesh over 4 feet tall and two stakes (wooden or rebar) and secured with four steel staples. Upon completion of cage effective use, cages will be removed from the site.
- Within one week after planting, all bare root shade tree trunks shall be wrapped from the ground line to a height of 3 feet with a one-half-inch square mesh, galvanized, steel wire with minimum gauge of 19 (poultry netting) at a diameter of 14 inches measured from the center of the trunk with a 4-inch overlap. The screen wire shall be secured with a minimum of four steel staples (hog rings). The mesh cylinder shall be imbedded 1 inch below the surface of the soil without disturbing the tree roots. A 1 inch by 1 inch stake will be driven into the ground and secured to the mesh cylinder.
- Seedling tree shelters should be of seamless, extruded, twin-wall, rigid and semi-translucent polypropylene tubes with a top rim flared outward to prevent abrasion to stems and branches. The shelters will be secured with nylon ratchet-locking ties attached to a 1 inch by 1 inch stake. The bottom of the tube will be inserted a minimum of 1 inch below the surface of the soil. A plastic photodegradable netting cover and sleeve shall be installed over the top of the tube to prevent entrapment of birds.

Mowing for Establishment

- Mowing shall commence just prior to weed species, such as foxtail and thistle, forming flowering heads (approximately 12 to 14 inches high in normal growing conditions).
- Mowing the first year of establishment will likely occur during mid-July, late July, or early August.
- Mowing height shall range from 5-inches to 10-inches based on the condition of the planting using a rotary mower. Shrub plantings shall be avoided during mowing operations.
- Care should be taken to not mow desirable species in the planting if possible. For example if the weed species are 12 to 14 inches and the native species are 7 to 8 inches high, the mowing height should be set at 9-inches.
- Wet areas should be mowed when possible, however the equipment used shall not cause ruts or compact the wet soil.

- Mowing of wetland areas will be conducted with hand held equipment due to the risk of soil disturbance and compaction in wetland areas.
- Mowing shall commence when weeds reach 12 to 14 inches or when dominate weed types are starting to flower, whichever occurs first.

Herbicide Application for Establishment

- Only Rodeo shall be used within 50 feet of wetland sites. Rodeo is specifically formulated for use in aquatic environments.
- The use of alternative herbicides or methods of eliminating existing vegetation must be approved by the project manager.
- All personnel applying chemicals must have a Commercial Pesticide Applicator License.
- Conduct a prescribed burn prior to herbicide treatment to reduce litter and stimulate the germination of weed seeds.
- Mow and rake the site to reduce litter before herbicide application (useful when burning is not possible).
- Apply herbicide according to the following schedules at the specified rate:
- Herbicide use logs shall be kept for all application of herbicides on this project.
- Backpack sprayers or ATV mounted sprayers will be used to spot treat invasive species.
- Allow at least seven days after herbicide application before disturbing the vegetation with other procedures.
- If seeding is delayed for any reason and weed species become established, then the entire site will be treated with glyphosate based herbicide at label-recommended rates and site preparation shall commence no sooner than 10 days after the herbicide has been applied.
- The contactor shall be diligent while treating/removing invasive shrubs to ensure that non-target species are not damaged.

Hand Weeding

- The planting area shall be hand weeded to control _____.
- Gloves and eye protection shall be used during hand weeding.
- Weeding should be conducted when the soil is moist because the weeds are easier to pull and cause less disruption to the surrounding soil.

Hydrology Control for Vegetation Establishment

- Control water levels according to the following schedule:
- As plants reach a height of one to two feet in saturated soil, water levels should be raised a few inches for bulrushes, broad-leaved arrowhead, plantains, smartweeds, spikerushes, pickerelweed, and arum.

Watering

- The contractor shall adequately water plantings until the area had been stabilized and established with vegetation averaging 6 inches in height. Watering shall be equal to 1-inch per week uniformly across the site, including water from rainfall.

Long-term Maintenance

Long-term Herbicide Application

- See [Herbicide Application for Establishment](#) Specifications on page 15.

Prescribed Burning

- Uplands should be first burned in year 4 or 5 depending on fuel availability.
- Periodic burning or haying of uplands shall be done every 3 to 5 years to control invasive or undesirable vegetation based on a recommendation of the project designer.
- The Contractor must formulate a prescribed burn plan covering all areas to be burned and submit to the project designer a minimum of 45 days before the intended burn. The prescribed burn plan shall at a minimum include the following:
 - A completed and signed, MN DNR Prescribed Burn Unit Plan
 - A map or maps showing all areas to be burned
 - A completed Prescribed Fire Complexity Rating System Guide Worksheet found at <http://www.dnr.state.mn.us/rxfire/forms.html>
 - Names and contact information for two contractor employees experienced in prescribed fire as emergency contacts who will be on site at all time during the Prescribed burn.
 - Traffic control plan to be implemented during burns.
- Prior to any burns after planting of trees, all grass shall be mowed to a height of 2-inches within 5 feet of the base of each tree. This shall be done until the project designer determines that the trees are of sufficient height and diameter where the ground fire will not kill or retard the growth of the trees.

Long-term Mowing

- See [Mowing for Establishment](#) specifications on page 14.

Tree and Shrub Control

- Conduct prescribed burn to remove as much woody growth as possible. Cut and treat stumps of plants not controlled through burning one month after the burn.
- Treat all woody vegetation above one inch diameter at the base shall be controlled through basal herbicide treatment.

Haying

- Haying must be conducted during times that will minimize impact to ground-nesting birds. The nesting season is between April 15th and August 1st.

- Cutting heights must be between 4-6 inches when haying is conducted.
- The site must be hayed a maximum of once a year to allow for adequate growth of plant material.
- No more than fifty percent of a field can be hayed in any given year to preserve refugia for wildlife species.

Grazing

- A grazing plan must be developed and followed to guide the timing and intensity of grazing.
- Grazing efforts must be monitored to assess if changes are needed to the grazing plan.

Biological Control

- Field collect bio-control agents from sites with established populations then distributed to the new site.
- For leafy spurge and spotted knapweed bio-control, call your county agricultural inspector (CAI) www.mda.state.mn.us/plants/weedcontrol/cailist.htm to obtain a starter bio-agent population.
- For purple loosestrife bio-control, call your DNR Aquatic Invasive Species Specialist http://files.dnr.state.mn.us/contact/eco_invasivesstaff.pdf. Consult with the CAI or DNR specialist to determine the quantity of bio-agents and number of releases for your site.
- Biological control agents shall be released according to specific guidance from the project designer.
- If the bio-agents are in containers, place the contents of a single container all in one spot and record the date, species and quantity released, and location information. Multiple releases may be needed for large sites.
- Take photos of the site to document changes at the site following bio-agent release.
- Check for bio-agent establishment two years after release. A sweep net may be a necessary for finding the bio-control agents.
- If target weeds are starting to decline, call the CAI or DNR specialist to report the progress. It is possible that your site has a collectible population of bio-agents that can be moved to new sites.
- Do not conduct prescribed burning or herbicide application while the adult form of the bio-control is present at the project site.

Water Level Management - Drawdowns

- Water levels shall be managed to accommodate the growth of wetland species. Water levels will be lowered as needed after large storms to protect wetland seedlings. As plants reach a height of 6-inches water levels will be raised slightly to aid the establishment of wet meadows and shallow marsh species.
- The wetland should be disked following drawdown of the wetland to promote vegetation establishment.
- Water levels shall be raised a few inches as emergent vegetation reaches 1-2 feet tall.

Water Level Management - Flooding

- Vegetation should be mowed before flooding to remove undesirable vegetation ensuring that even dead stems that can transport oxygen are cut.
- Flooding for vegetation removal should be conducted for an entire growing season if possible.

- Vegetation to be controlled shall be submerged for at least one continuous month.

Re-planting

- Replanting shall be conducted in areas greater than 1/2 acre in size with less than 25% cover of native species during the 3rd growing season or any area with obvious erosion control problems such as rills greater than two-inches deep or obvious sediment plumes at any time during the contract.
- Hand disperse seed over bare areas and then work seed into the soil with a rake. Larger seed should be raked in, while smaller seed can be broadcast on top of the raked soil.
- Roll hand seeded areas with a garden roller or walk over the area to create seed to soil contact.
- The interseeding drill shall contain trash rippers and at least two seed boxes, a fine seed box and a box for larger or fluffy seed. The drill shall slice through the soil making a 1-inch wide by 3/8 to 1-inch deep furrow into the underlying soil.
- Mulch the seeded area; in some cases dead stems from surrounding native vegetation can be used but should be spread in a way that will allow light to penetrate to the seeded area.
- Before interseeding remove thatch through burning, haying or herbicide treatment as necessary to decrease competition
- Mow re-seeded areas to 6-8 inches twice the first season and once during the second season of growth.

Tree and Shrub Care

- Conduct a soil test to determine if fertilizer is needed for the tree and shrub planting.
- Any cultivation done to add herbaceous species must be conducted to a depth of three inches or less and done outside the tree drip line to minimize damage to their roots.
- After the first growing season inspect the planting to determine which trees need pruning. Any multi leader trees should be pruned back to one leader. Crossing branches and branches that curve back toward the center of the tree should be removed. One side of forked branches should be removed.
- Conduct pruning during the dormant season, usually late fall to early spring before the buds swell.
- To shorten a branch or twig during pruning cut down to about 1/4 inch above a side branch or bud. Always cut above the bud that is facing to the outside of the tree so the branch is forced to grow in an outward direction.

