**Item No. 604S Seeding for Erosion Control**

## 604S.1 Description

This item shall govern the preparation of a seed bed for temporary or permanent erosion control ~~to the lines and grades indicated on the Drawings~~; sowing of seeds~~,~~; fertilizing~~,~~; mulching with straw, cellulose fiber wood chips, and recycled paper mulch; and other management practices along and across such areas as indicated in the Drawings or as directed by the Landscape Architect, Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, inch-pound units are given preference with SI units shown within parentheses.

## 604S.2 Submittals

~~The submittal requirements for this specification item shall include~~
The following submittal items are required in writing during construction:

A. Identification of the ~~type~~ seed species, source, mixture, and pure live seed (PLS) ~~and rate of application~~ of the seed as listed on the analysis tags and certification tags from all seed bags. Seed calculation worksheet per Table 9. PLS is the percentage of seed purity multiplied by the percentage of germination, plus dormant seed. The analysis tag, required on all seed sold in Texas, includes information on quality: kind and variety of seed, lot number, percent pure live seed, percent other crop seed, percent inert matter, percent weed seeds, germination percentage, and date of test. The certification tag also verifies seed quality, an assurance of seed variety and attesting to standards for germination and purity. Information provided includes class of certification, kind of crop, variety, lot number, and name and address of the owner.

~~B. type of mulch.~~

~~C. type of tacking agent.~~

B. If fertilizer is proposed, results of a recent soil test (6 months old or less) of the area to be seeded, before fertilization. Soil samples shall be collected after final grading, when topsoil has been placed. The test results must include soil lab recommended additions of Nitrogen (N), Phosphorus (P), and Potassium (K) for the type of vegetation proposed, as well as soil organic matter percentage and textural class.

C. ~~D. type and rate of application of fertilizer.~~ Fertilizer formulation and release rate based on a soil test (see B above).

D. For hydromulch applications, proposed application rate of seed, type of mulch and tacking agent, and other relevant information. An example of the required documentation is in Table 1.

E. Type of hydraulic seeding equipment and nozzles proposed for use.

F. If pesticide use is proposed, an IPM plan for pest removal including pesticide label, proposed application rate and timing, and MSDS sheets.

G. One gallon sample of proposed vegetative mulch.

The following submittal items are required before Substantial Completion:

A. For hydromulch applications, the complete hydromulch application log, including date, time and quantity of product units placed in the slurry tank. An example of an application log is provided in Table 2. This log may be requested at any time during construction by the Landscape Architect, Engineer, or designated representative.

B. Pesticide application tracking log. As of January 1, 2012, documentation of all outdoor pesticide use on city-owned properties is required to demonstrate compliance with the EPA/TCEQ mandated Municipal Stormwater Permit, the TPDES General Pesticide Permit, City Code, and the IPM program

Table 1: Example of proposed hydromulch application rates

| | | | | Hydro Slurry Unit (per acre rates) | | | | |
|---|---|---|---|---|---|---|---|---|
| Hydro Mix | Sheet No. | Seed Mix | Acres | Seed (Bags/AC) | Tackifier (Buckets/ AC) | Mulch (Bales/ AC) | Fertilizer (Bags/ AC) | Addl. Amendments (Bags/AC) |
| 1 | L2 | A | 1.0 | 1 | 100 | 1000 | 50 | 5 |
| 2 | L3 | A | 0.5 | 2 | 200 | 1500 | 50 | 5 |
| 3 | L5 | B | 3.0 | 3 | 300 | 3000 | 50 | 5 |

Table 2: Example of hydromulch application log

| | | | | | | Hydro Slurry Unit (per acre rates) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Date | Start Time | Finish Time | AC/ Tank | Water (gal) | Seed Mix | Seed (Bags/ AC) | Tackifier (Buckets/ AC) | Mulch (Bales/ AC) | Fertilizer (Bags/ AC) | Addl. Amendments (Bags/AC) |
| 4/13 | 10:30 | 11:15 | 1.0 | 3300 | A | 1 | 100 | 1000 | 50 | 5 |
| 4/17 | 2:00 | 2:30 | 0.5 | 3300 | A | 2 | 200 | 1500 | 50 | 5 |
| 5/20 | 8:30 | 10:00 | 1.2 | 3300 | B | 3 | 300 | 3000 | 50 | 5 |
| | | | | | Totals | 6 | 600 | 5500 | 127 | 15 |

**604S.3. Materials**

A. **Seed.** All seed must meet the requirements of the Texas Seed Law including the labeling

requirements for showing ~~pure live seed (~~PLS~~)~~, name and type of seed, and all other required elements of the Analysis and Certification Tags.

The seed furnished shall be of the previous season's crop and the date of analysis shown on each bag shall be within twelve (12) ~~nine~~ months of the time of delivery to the project. Each variety of seed shall be furnished and delivered in separate bags or containers, unless a specific mix is proposed for use. A sample of each variety of seed shall be furnished for analysis and testing when directed by the Landscape Architect, Engineer or designated representative.

The amount of seed planted per square yard (0.84 square meters) or acre (hectare [ha]) shall be of the type specified in Sections 604S.5 and 604S.6.

B. **Water.** Water shall be clean and free of industrial wastes and other substances harmful to the growth of ~~grass~~ plant material or the area irrigated.

C. **Topsoil.** Topsoil shall conform to ~~Standard Specification~~ Item No. 601S.3(A).

D. **Fertilizer.** The fertilizer shall conform to ~~Standard Specification~~ Item No. 606S, "Fertilizer". The type and rate of fertilizer should be based on chemical tests of recent (no older than 6 months before application) representative site soil samples. Fertilizer should be applied only when plants can take them up for growth, during: 1) seed germination and plant establishment and 2) after plant establishment. Fertilizer shall not be applied within 48 hours of a potential rain event.

E. **Straw Mulch or Hay Mulch**. Straw Mulch shall be oat, wheat or rice straw. Hay mulch shall be prairie grass, ~~Bermuda grass~~, or other hay approved by the Landscape Architect, Engineer or designated representative. The straw or hay shall be free of Johnson grass or other noxious weeds and foreign materials. It shall be kept in a dry condition and shall not be ~~molded~~ moldy or rotted.

F. **Tackifier~~Tacking Agents~~**. The tackifer ~~tacking agent~~ shall be a biodegradable tacking agent, approved by the Landscape Architect, Engineer or designated representative.

G. **Cellulose Fiber Mulch (Natural Wood).** Cellulose Fiber Mulch shall be natural cellulose fiber mulch produced from grinding clean whole wood chips. The mulch shall be designed for use in conventional mechanical planting, hydraulic planting of seed or hydraulic mulching of grass seed, either alone or with fertilizers and other additives. The mulch shall be such, that when applied, the material shall form a strong, moisture-retaining mat without the need of an asphalt binder.

H **Recycled Paper Mulch**. Recycled paper mulch shall be specifically manufactured from post-consumer paper and shall contain a minimum of 85% recycled paper content by weight, shall contain no more than 15% moisture and 1.6% ash, and shall contain no growth inhibiting material or weed seeds. The recycled paper mulch shall be mixed with grass seed and fertilizer (see "fertilizer" above) for hydro-seeding/mulching, erosion control, and a binder over straw mulch. The mulch, when applied, shall form a strong, moisture-retaining mat of a green color without the need of an asphalt binder.

I. **Mulch.** Mulches, acting as seed coverings, can enhance seed germination and seedling establishment. Characteristics of ideal mulches for seeding are those that protect seeds from wind (drying), excessive solar radiation, high evapotranspiration rates, and erosion, while allowing germination and growth. Relatively coarsely shredded, weed-free vegetative

mulch should be used on seed installations, especially in open, sunny areas. These materials shall be clean, free of foreign matter, and dry enough to spread evenly.

J. **Pesticide.** A least toxic, integrated pest management (IPM) approach shall be used to control weeds. A written request for approval of weed control products and materials shall be submitted to the City of Austin IPM program coordinator (512-974-2581) for approval. Additional information can be found at http://www.austintexas.gov/ipm.

**604S.4 Construction Methods**

**A. General**

The Contractor shall limit preparation of the seedbed to areas that will be seeded immediately. When seeding for permanent erosion control, weed species listed in Table 3 shall be managed by application of an appropriate herbicide and/or by physical removal by the roots before the seeding operation. The goal of weed management is to facilitate establishment of the permanent vegetative cover. Additionally, the Owner may require removal of any plant species that appears to be out-competing seeded or planted species during the construction period.

Table 3: Weed List

| Weed Type | Botanical Name | Common Name |
|---|---|---|
| Annual Grass | *Cenchrus spp.* | Sandbur |
| Herb | *Cnidoscolus texanus* | Bull Nettle |
| Herb | *Urtica spp.* | Stinging Nettle |
| Vine | *Toxicodendron radicans* | Poison Ivy |
| Perennial Grass | *Sorghum halapense* | Johnson Grass |
| Perennial Grass | *Arundo donax* | Giant Cane |
| Perennial Grass | *Phyllostachys aurea* | Golden Bamboo |
| Summer Annual Herb | *Ambrosia trifida* | Ragweed |
| Winter Annual Herb | *Rapistrum rugosum* | Bastard Cabbage |
| Winter Annual Herb | *Bromus arvensis* | Japanese Brome |
| Winter Annual Herb | *Lolium multiflorum* | Annual Ryegrass |

**B.** ~~**A.**~~ **Preparing Seed Bed.** After the designated areas have been rough graded to the lines, grades and typical sections indicated in the Drawings or as provided for in other items of this contract and for any other soil area disturbed by the construction, a suitable seedbed shall be prepared. The seedbed shall consist of a minimum of either 6 inches (150 millimeters) of approved topsoil or 6 inches (150 millimeters) of approved salvaged topsoil~~. cultivated and rolled sufficiently to reduce maintain the soil to a state of good tilth when the soil particles on the surface are small enough and lie closely enough together to prevent the seed from being covered too deeply for optimum germination.~~

The topsoil or growing medium must be prepared so that

compaction is appropriate for plant growth, and to achieve acceptable bulk density or hydrologic function. Rippers and subsoilers may be used to loosen compacted soil and roughen the surface. Disks, plows and excavator attachments are good for compaction reduction, roughening and incorporating amendments. A roughened soil surface of micro-ridges and valleys is an optimal seed bed with a microenvironment of increased moisture, higher humidity, wind protection, and shelter from the sun for seeds. If tracked machinery is used in seedbed preparation, cleat marks should run with the contour to prevent rills. The optimum depth for seeding shall be 1/4 inch (6 millimeters).

Water shall be gently applied as required to prepare the seedbed prior to the planting operation either by broadcast seeding or hydraulic planting. Seeding shall be performed in accordance with the requirements ~~hereinafter~~ described below.

C. **B. Watering**. All watering shall comply with ~~City Ordinances~~ City Code Chapter 6-4 (*Water Conservation*). ~~Broadcast seeded areas shall immediately be watered with a minimum of 5 gallons of water per square yard (22.5 liters of water per square meter) or as needed and in the manner and quantity as directed by the Engineer or designated representative. Hydraulic seeded areas and native grass seeded areas shall be watered commencing after the tackifier has dried with a minimum of 5 gallons of water per square yard (22.5 liters of water per square meter) or as needed~~ All seeded areas regardless of seed type and method of seeding (e.g., broadcast, hydroseed) shall be watered immediately after installation. For seed germination and establishment it is important to keep the seedbed in a ~~wet~~ moist condition favorable for the growth of ~~grass~~ plant materials.

Watering applications shall constantly maintain the seedbed in a ~~wet~~ moist condition favorable for the growth of ~~grass~~ plant materials. Watering shall continue until the ~~grass~~ plant material is ~~uniformly~~ at least 1 -1/2 inches (40 mm) in height and accepted by the Landscape Architect, Engineer or designated representative. Supplemental watering can be postponed immediately after a ~~1/2~~ half-inch (12.5 mm) or greater rainfall on the site but shall be resumed before the soil dries out.

~~Availability of water from the Austin Water Utility will be limited as stated under the Water Conservation Standard, City of Austin Land Development Code Chapter 6- 2, Article II, "Water Use Management Plan Established".~~

~~The use of potable water will be restricted as stated in City of Austin Land Development Code Sections 6-4-73, 6-4-54, 6-4-63, 6-4-64, 6-4-65, 6-4-81, 6-4- 92, 15-9-37(D) and 15-9-101(B).~~

D. **Cool Season Cover Crop**. From September 15 to March 1, non-native and native seeding shall include a cool season cover crop at the rate specified in Table 8. Cool season cover crops are not permanent erosion control. If installed separately from the permanently erosion control seed mix, the cool season cover crops shall be mowed to a height of less than one (1) inch after March 1, and the area shall be re-seeded at the specified seeding rate for non-native or native warm-season species (March 1 to September 15).

**604S.5 Non-Native Seeding**

**A.** **Method A - Broadcast Seeding**. The seed or seed mixture in the quantity specified shall be uniformly distributed over the prepared seed bed areas indicated on the Drawings or where directed by the Engineer or designated representative. If the sowing of seed is by hand, rather than by mechanical methods, the seed shall be sown in two directions at right angles to each other. If mechanical equipment is used, all varieties of seed, as well as fertilizer (if required), may be distributed at the same time, provided that each component is uniformly applied at the specified rate. After planting, the planted area shall be rolled with a corrugated roller of the "Cultipacker" type. All rolling of the slope areas shall be on the contour.

Seed Mixture and Rate of Application for Broadcast Seeding:

~~From September 15 to March 1, seeding shall be with a cool season cover crop (see Table 4) at a rate of 1.5 pounds per 1000 square feet (0.75 kilograms per 100 square meters). Cool season cover crops are not permanent erosion control. The cool season cover crops shall be mowed (scalped) to a height of less than one (1) inch after March 1, and the area shall be re-seeded in accordance with the seeding rate for March 1 to September 15, below.~~

From March 1 to September 15, seeding shall be with hulled Bermuda Grass at a rate of at least 45 lbs/AC ~~2 pounds per 1000 square feet~~ (~~1.0~~ 5.0 kilograms per hectare ~~100 square meters~~) with a minimum PLS = 0.83. Fertilizer shall be applied if warranted by a soil test, and shall conform to Item No. 606S, "Fertilizer". Bermuda grass is a warm-season grass and is therefore considered permanent erosion control once established.

**Method B - Hydraulic Planting**. The seedbed shall be prepared as specified above and hydraulic planting equipment, which is capable of placing all materials in a single operation, shall be used. Information about hydromulching for temporary and permanent vegetation stabilization is in the Environmental Criteria Manual (ECM) Section 1.4.7. Hydroseeding equipment shall be clean and free of all previous seeds, fertilizer, mulch, or any hydroseeding products used on prior jobs.

From March 1 to September 15

Hydraulic planting mixture and minimum rate of application pounds per acre or square yard ~~1000 square feet~~ (kilograms per ha~~100 square meters~~):

| Hulled Bermuda Seed (min. PLS=0.83) | Fiber Mulch | | Soil Tackifier |
|---|---|---|---|
| | Cellulose | Wood | |
| 45 lbs/AC<br>~~1 Lbs/1000 ft2~~<br>~~(0.5kgs/100 m2)~~<br>(50.44 kg/ha) | ~~45.9 Lbs/1000 ft2~~<br>2000 lbs/AC<br>~~(22.5kgs/100 m2)~~<br>(2242 kg/ha) | | ~~1.4 Lbs/1000 ft2~~<br>60.98 lbs/AC<br>~~(0.7kgs/100 m2)~~<br>(68.36 kg/ha) |
| | | ~~57.4 Lbs/1000 ft2~~<br>2500 lbs/AC<br>~~(28.0kgs/100 m2)~~<br>(2803 kg/ha) | ~~1.5 Lbs/1000 ft2~~<br>65.34 lbs/AC<br>~~(0.75kgs/100 m2)~~<br>(73.25 kg/ha) |

~~September 15 to March 1~~

~~Use 1.5 pounds per 1000 square feet (0.75 kilograms per 100 square meters) of cool season cover crop (see Table 4). Cool season cover crops are not permanent erosion control. The cool season cover crops shall be mowed to a height of less than one (1) inch after March 1, and the area shall be re-seeded in accordance with the seeding rate for March 1 to September 15, above.~~

**604S.6 Native Grass and Forb Seeding**

~~The seedbed shall be prepared as specified above. The seed mixture~~ ~~and the rate of application shall be as follows:~~

The seed mixture shall include a diversity of grasses and wildflowers. The grass mix shall be seeded at a rate of at least 131 lb/AC (146.85 lb/ha) and shall include a minimum of 8 species from Table 4 (dry, open sites) or 6 species from Table 5 (wet, open sites). The species indicated with an asterisk shall be included in all proposed mixes. No species shall constitute more than 20% of a seed mix. Any species proposed for installation and not included in Tables 4 or 5 shall be approved by a landscape architect or other qualified landscape professional, and shall be native to Central Texas as referenced by the LBJ Wildflower Center plant database (www.wildflower.org) or USDA plant database.

| **Table ~~2~~4: Native Grasses: Dry, Open Sites** | | | | |
|---|---|---|---|---|
| Common Name | Botanical Name | Exposure | Application Rates | |
| | | | Lbs/AC~~1000 feet$^2$~~ | kg/ha~~100 meter$^2$~~ |
| ~~Indiangrass~~ | ~~*Sorghastrum nutans*~~ | | ~~0.15~~ | ~~0.075~~ |
| Sideoats grama * | *Bouteloua curtipendula* | Full-pt sun | 7.0~~0.2~~ | 7.8~~0.10~~ |
| Green sprangletop* | *Leptochloa dubia* | Full sun | 6.0~~0.15~~ | 6.7~~0.075~~ |
| Buffalograss | *Buchloe dactyloides* | Full sun | 24.0~~0.25~~ | 27.0~~0.125~~ |
| ~~Little Bluestem~~ | ~~*Schizachyrium scoparium*~~ | | ~~0.2~~ | ~~0.10~~ |
| Blue Grama Grass | *Bouteloua gracilis* | Full-pt sun | 10.0~~0.15~~ | 11.2~~0.075~~ |
| Canada Wild Rye | *Elymus canadensis* | Full-pt sun | 10.0~~0.2~~ | 11.2~~0.10~~ |
| ~~Eastern gamagrass~~ | ~~*Tripsacum dactyloides*~~ | | ~~0.25~~ | ~~0.125~~ |
| Purple Three-Awn* | *Aristida purpurea* | Full sun | 4.0~~0.15~~ | 4.5~~0.075~~ |
| ~~Switchgrass~~ | ~~*Panicum virgatum*~~ | | ~~0.1~~ | ~~0.05~~ |
| ~~Bushy Bluestem~~ | ~~*Andropogon glomeratus*~~ | | ~~0.1~~ | ~~0.05~~ |
| ~~Big Bluestem~~ | ~~*Andropogon gerardii*~~ | | ~~0.1~~ | ~~0.05~~ |
| Cane Bluestem | *Bothriochloa barbinodis* | Full sun | 3.0~~0.20~~ | 3.3~~0.10~~ |
| Galleta | *Pleuraphis jamesii* | Full sun | 10.0~~0.20~~ | 11.2~~0.10~~ |
| Black Grama * | *Bouteloua eripoda* | Full sun | 10.0~~0.10~~ | 11.2~~0.05~~ |
| Sand Dropseed * | *Sporobolus cryptandrus* | Full sun | 1.0~~0.02~~ | 1.1~~0.01~~ |
| Alkali Sacaton | *Sporobolus airoides* | Full sun | 0.5~~0.02~~ | 1.7~~0.01~~ |

| | | | | |
|---|---|---|---|---|
| Curly Mesquite | *Hilaria belangeri* | Full sun | 2.0 | 2.2 |
| Sand Lovegrass | *Eragrostis trichodes* | Full sun | 2.0 | 2.2 |
| ~~Grass Seeding Rate~~ | | | ~~2.0~~ | ~~1.0~~ |
| *__These species must be included in the mix__, plus an additional three (3) species from the list or other approved species, for a total of eight (8) species__.__ | | | | |

| **Table 5: Native Grasses: Wet, Open Sites** | | | | |
|---|---|---|---|---|
| Common Name | Botanical Name | Exposure | Application Rates | |
| | | | Lbs/AC | Kg/ha |
| White Tridens | *Tridens albescens* | Full-pt sun | 0.5 | 0.56 |
| Plains Bristlegrass | *Setaria leucopila* | Full-pt sun | 6.0 | 6.7 |
| Switchgrass | *Panicum virgatum* | Full-pt sun | 4.0 | 4.5 |
| Inland Sea Oats | *Chasmanthium latifolium* | Shade | 12.0 | 13.5 |
| Canada Wild Rye | *Elymus canadensis* | Full sun - shade | 10.0 | 11.2 |
| Big Bluestem | *Andropogon gerardii* | Full sun | 4.0 | 4.5 |
| Bushy Bluestem | *Andropogon glomeratus* | Full sun | 3.0 | 3.4 |
| Green Sprangletop* | *Leptochloa dubia* | Full sun | 2.0 | 2.2 |
| Eastern Gamagrass | *Tripsacum dactyloides* | Full sun - shade | 3.0 | 3.4 |
| ***__This species must be included in the mix__**, plus an additional five (5) species from the list or other approved species, for a total of six (6) species__.__ | | | | |

The native forb mix shall be seeded at a rate of at least 65.34 lbs/AC (73.25 kg/ha) and shall include a minimum of two legumes and eight (8) other forbs from Table 6 (open, dry sites) or a minimum of two legumes and five (5) species of forbs from Table 7 (open, wet sites).

| **Table ~~3~~ 6: Native Forbs ~~Wildflowers~~: Dry, Open Sites** | | | | |
|---|---|---|---|---|
| Common Name | Botanical Name | Exposure | Application Rates | |
| | | | Lbs/AC~~1000 fe~~ | kg/ha~~100 mete~~ |
| Black-Eyed Susan | *Rudbeckia hirta* | Full-pt sun; dappled shade | 2.0~~0.05~~ | 2.2~~0.025~~ |
| Illinois Bundleflower* | *Desmanthus illinoensis* (legume) | Full-pt sun; dappled shade | 15.0~~0.05~~ | 16.8~~0.025~~ |
| Scarlet Sage | *Salvia coccinea* | Full-pt sun; dappled shade | 8.0~~0.10~~ | 9.0~~0.05~~ |
| Pink Evening Primrose | *Oenethera speciosa* | Full-pt sun; dappled shade | 1.0~~0.05~~ | 1.1~~0.025~~ |
| Drummond Phlox | *Phlox drummondii* | Full-pt sun | 8.0~~0.05~~ | 9.0~~0.025~~ |
| Plains Coreopsis | *Coreopsis tinctoria* | Full-pt sun | 2.0~~0.05~~ | 2.2~~0.025~~ |
| Greenthread | *Thelesperma filifolium* | Full sun | 6.0~~0.05~~ | 6.7~~0.025~~ |

| | | | | |
|---|---|---|---|---|
| Purple Prairie Clover* | ~~*Petalostemum*~~ *Dalea purpurea* (legume) | Full sun | 4.0~~0.05~~ | 4.5~~0.025~~ ~~0.04~~ |
| Cutleaf Daisy | *Engelmannia pinnatifida* | Full-pt sun; dappled shade | 18.0~~0.05~~ | 20.1~~0.025~~ ~~0.19~~ |
| Partridge Pea* | ~~*Cassia*~~ *Chamaecrista fasciculate* (legume) | Full-pt sun | 20.0~~0.1~~ | 22.4~~0.05~~ |
| Indian Blanket | *Gaillardia pulchella* | Full-pt sun | 10.0~~0.1~~ | 11.2~~0.05~~ |
| Bluebonnet * | *Lupinus texensis* (legume) | Full sun | 20.0~~0.15~~ | 22.4~~0.075~~ |
| Mexican Hat | *Ratibida columnaris* | Full-pt sun | 2.0~~0.05~~ | 2.2~~0.025~~ |
| Maximilian Sunflower | *Helianthus maximiliani* | Full-pt sun | 5.0~~0.1~~ | 5.6~~0.05~~ |
| Prairie Coneflower | *Ratibidia columnifera* | Full-pt sun | 2.0~~0.05~~ | 2.2~~0.02~~ |
| Clasping Coneflower | *Dracopis amplexicaulis* | Full-pt sun | 3.0~~0.07~~ | 3.4~~0.03~~ |
| Purple Coneflower | *Echinacea purpurea* | Full-pt sun; dappled shade | 10.0~~0.23~~ | 11.2~~0.10~~ |
| Lemon Mint | *Monarda citriodora* | Full-pt sun | 3.0~~0.07~~ | 3.4~~0.03~~ |
| Huisache Daisy | *Amblyolepis setigera* | Full-pt sun | 8.0~~0.18~~ | 9.0~~0.08~~ |
| Texas Yellow Star | *Lindheimera texana* | Full-pt sun | 12.0~~0.50~~ | 13.5~~0.23~~ |
| Lanceleaf Coreopsis | *Coreopsis lanceolata* | Full-pt sun; dappled shade | 10.0~~0.23~~ | 11.2~~0.10~~ |
| Bush Sunflower | *Simsia calva* | Full-pt sun | 3.0~~0.11~~ | 3.4~~0.05~~ |
| Winecup | *Callirhoe involucrata* | Full-pt sun; dappled shade | 5.0~~0.11~~ | 5.6~~0.05~~ |
| ~~Total Wildflower Seeding Rate~~ | | | ~~1.0~~ | ~~0.5~~ |
| ~~Total Warm Season Seeding Rate (Grass & Wildflowers)~~ | | | ~~3.0~~ | ~~1.5~~ |

***These species must be included in the mix.**

| **Table 7: Native Forbs: Wet, Open Sites** | | | | |
|---|---|---|---|---|
| Common Name | Botanical Name | Exposure | Application Rates | |
| | | | Lbs/AC | kg/ha |
| American Basketflower | *Centaurea americana* | Full sun | 10.0 | 11.2 |
| Antelope Horns | *Asclepias asperula* | Full sun | 7.0-12.0 | 7.8-13.4 |
| Green Antelope Horn | *Asclepias viridis* | Full sun | 7.0-12.0 | 7.8-13.4 |
| Blue Mistflower | *Conoclinium coelestinum* | Full-pt sun | 0.5 | 0.6 |
| Clasping Coneflower | *Dracopsis amplexicaulis* | Full-pt sun | 3.0 | 3.4 |
| Maximilian Sunflower | *Helianthus maximliani* | Full-pt sun | 4.0 | 4.5 |
| Prairie Blazing Star | *Liatris pycnostachya* | Full sun | 2.0 | 2.2 |
| Pink Evening Primrose | *Oenothera speciosa* | Full sun-dappled shade | 1.0 | 1.1 |
| Mexican Hat | *Ratibida columnifera* | Full-pt sun | 2.0 | 2.2 |
| Black-eyed Susan | *Rudbeckia hirta* | Full sun-dappled shade | 2.0 | 2.2 |
| Illinois Bundleflower | *Desmanthus illinoensis* (legume) | Full sun-dappled shade | 15.0 | 16.8 |
| Obedient Plant | *Physostegia virginiana* | Full sun-dappled shade | 4.0 | 4.5 |
| Partridge Pea * | *Camaecrista fasciculate* (legume) | Full-pt sun | 20.0 | 22.4 |
| Purple Prairie Clover | *Dalea purpurea* var *purpurea* (legume) | Full sun | 4.0 | 4.5 |
| Pitcher Sage | *Salvia azurea* | Full-pt sun | 3.0 | 3.4 |
| Showy Tick Trefoil | *Desmodium canadense* | Full sun | 0.5 | 0.6 |
| Winecup * | *Callirhoe involucrata* | Full- pt sun | 5.0 | 5.6 |
| ***This specie must be included in the mix.** | | | | |

| Table 4 8: Cool Season Cover Crop | | | | |
|---|---|---|---|---|
| Common Name | Botanical | Exposure | Application rates | |
| | | | Lbs/ AC ~~1000 feet~~ ~~2~~ | kg/ ha ~~100 meter~~ ~~2~~ |
| Western Wheatgrass | ~~*Triticum aestivum*~~ *Pascopyrum smithii* | Full-pt sun; dappled shade | 5.6 ~~0.5~~ | 6.28 ~~0.25~~ |
| Oats | *Avena sativa* | Full sun | 4.0 ~~0.5~~ | 4.48 ~~0.25~~ |
| Cereal Rye Grain | *Secale cereale* | Full sun | 34.0 ~~0.5~~ | 38.11 ~~0.25~~ |
| ~~Total Cool Season Cover Crop Seeding Rate~~ | | | ~~1.5~~ | ~~0.75~~ |
| ~~Total Cool Season Seedin Rate (Grass, Wildflowers, & Cover Crop)~~ | | | ~~4.5~~ | ~~2.25~~ |

One cover crop species of the listed species is required to be planted between September 15 to March 1. Contractor must ensure that any seed application requiring a cool season cover crop does not utilize annual ryegrass (*Lolium multiflorum*) or perennial ryegrass (*Lolium perenne*). Only cereal rye grain (*Secale cereale*), oats (*Avena sativa*) and western wheatgrass (*Pascopyrum smithii*) are approved as cool season cover crop.

Species substitution as necessary due to availability shall be approved by the Landscape Architect, Engineer or designated representative. Watering and fertilizer application shall follow procedures outlined above or as otherwise specified on the Drawings.

Seed shall be applied by broadcast, hydromulch, blown compost, or drill method and shall be distributed evenly over the topsoil areas. Mulching shall immediately follow seed application for broadcast and hydromulch applications.

~~September 15 to March 1Add 1.5 pounds per 1000 square feet (0.75 kilograms per 100 square meters) of cool season cover crop (see Table 4) to grass and wildflower mixture~~

**Seed Rate Calculations**

The amount of seed needed to be planted on a project shall be calculated before installation to ensure adequate seed is placed, and provided as a submittal. Table 9 is an example worksheet, followed by an example calculation. Information for calculation can be obtained from seed tags or the supplier.

**Table 9. Seed Calculation Worksheet**

| Plant Group | Desired Seeding Rate (1bs/AC) | PLS (pure live seed) | Bulk Rate (lbs/AC) | Seeding Area (AC) | Amt. of Seed to be Installed (lbs) |
|---|---|---|---|---|---|
| Grasses | | | | | |
| Forbs | | | | | |
| TOTAL | | | | | |

FORMULAS:
PLS (pure live seed) = (Purity x Germination) x 100. Can also use average PLS from seed tags.
Bulk Rate (lbs/AC) = Desired Seed Rate (lbs/AC)/PLS
Amt. of Seed to be Installed (lbs) = Bulk Rate (lbs/AC) x Seeding Area (AC)

Example:

| Plant Group | Desired Seeding Rate (1bs/AC) | PLS [pure live seed] (% decimal) | Bulk Rate (lbs/AC) | Seeding Area (AC) | Amt. of Seed to be Installed (lbs) |
|---|---|---|---|---|---|
| Grasses | 131.00 | 0.81 | 161.73 | 1.50* | 242.60 |
| Forbs | 65.34 | 0.87 | 75.10 | 1.50* | 112.70 |
| TOTAL | 196.34 | 0.84 (ave.) | 236.83 | 1.50 | 355.30 |

*applied over the same 1.5 AC area

**604S.7 Mulch**

Mulches may be used to help prevent soil erosion until final stabilization is achieved. Mulch shall be used to cover broadcasted seeds, especially in sunny, open areas, to protect them from drying out during germination.

**A. Straw Mulch.**

Straw mulch shall be spread uniformly over the area indicated or as designated by the Engineer or designated representative at the rate of 2 to 2 1/2 tons of straw per acre (4.5 to 5.6 megagrams of straw per hectare). The actual rate of application will be designated by the Landscape Architect, Engineer or designated representative. Straw may be hand or machine placed and adequately secured.

**B. Hydromulch**

Refer to ECM Section 1.4.7 for hydromulching applications.

~~**B. Fiber Mulch.**~~

~~Cellulose and wood fiber mulch shall be spread uniformly over the area indicated or as designated by the Engineer or designated representative at the rate of 45 to 80 lbs. per 1000 square feet (22.5 to 40 kilograms per 100 square meters).~~

~~**C. Recycled Paper Mulch.**~~

~~Recycled paper mulch shall be spread over the area indicated on the Drawings or as designated by the Engineer or designated representative at a rate that will provide 100% coverage.~~

**C.** ~~**D.**~~ **Shredded Brush Mulch.**

Small brush or tree limbs ~~except Juniper~~, which have been shredded, may be used for mulching Native Grass seeding.

**604S.8 Management Practices**

Management Practices include (1) weed management (pesticide application or mechanical removal) to so than 90 percent of the revegetation area is free of weeds listed in Table 3, and (2) reseeding areas of poor germination to achieve coverage and height per 604S.9, with no bare areas greater than 16 s.f.

Ninety (90) percent of a permanent revegetation area must be free of weeds listed in Table 3. Weeds shall be controlled in the most efficient manner possible. Management of weed species should begin early in the project, before seeding for permanent control, and extend into plant establishment, especially for perennial weeds. Manual removal or application of an appropriate herbicide may be required after the initial seeding if emergence of an annual weed species threatens establishment of sufficient preferred plant cover. Disturbance due to weed management after the initial seeding may necessitate re-seeding of the area to establish sufficient preferred plant coverage. Care should be taken to temporarily stabilize areas where physical removal of weeds has been performed to prevent erosion and sediment runoff.

The entire root system of perennial weeds shall be removed to prevent re-sprouting. Weeds may be controlled with an approved contact, systemic herbicide, provided the product is used with appropriate care and is applied in accordance with label instructions and the following guidelines:

1. Herbicide shall not be applied when the wind is greater than 8 mph (12.9 kph),
2. Herbicide shall not be applied when rainfall is expected within 24 hours,
3. Herbicide shall not contact surface water, i.e. creeks, rivers, and lakes,
4. Herbicide shall not contact desirable vegetation (a wicking method shall be used, if necessary, to accurately contact target weed only during application).

The Landscape Architect, Engineer or designated representative shall be consulted to determine appropriate weed control management when weeds are located in an

environmentally sensitive location (e.g. near water or adjacent to a critical environmental feature).

At locations that fail to show an acceptable stand of planting for any reason during the initial seeding, repair and/or reseed locations as determined by the Landscape Architect, Engineer or designated representative. A successful stand of grasses and forbs for erosion control should exhibit the following:

- Seedlings with vigorous green foliage;
- Green leaves remaining throughout the summer, at least at the plant bases;
- Uniform density, with grasses and/or forbs well intermixed;
- Minimum of 95% cover; and
- No exposed soil greater than 16 s.f. in aerial extent.

The Contractor shall meet the requirements of the initial seeding, including seeding method, seed mix, and application rates, unless otherwise agreed to in writing by the Owner. Corrected deficiencies will be re-inspected and approved by the Owner, and final acceptance will be granted upon satisfactory completion.

**604S.~~8~~9 Measurement**

Work and acceptable material for "Seeding for Erosion Control" will be measured by the square yard (meter: 1 meter equals 1.196 square yards) or by the acre (hectare: 1 hectare equals 2.471 acres), complete in place, with a minimum of 95 percent total coverage for the non-native mix, and 95 percent coverage for the native mix. Bare areas shall not exceed 16 square feet (1.5 square meters), and the average height of vegetation shall stand at a minimum of 1-1/2 inch (40 millimeters). Ninety (90) percent of the revegetated area must be free of weeds listed in Table 3. Bare areas greater than 16 s.f. shall be re-prepared and reseeded as required to develop an acceptable stand of ~~grass~~ plant material.

**604S.~~9~~10 Payment**

The work performed and materials furnished and measured will be paid for at the unit bid price for "Seeding for Erosion Control" of the method specified on the Drawings and type of mulch. The unit bid price shall include full compensation for furnishing all materials, including all topsoil, water, seed, tackifier, fertilizer or mulch and for performing all operations necessary to complete the work.

All fertilizer will be measured and paid for conforming to Item No. 606S, "Fertilizer".

Payment will be made under one of the following:

**Pay Item No. 604S-A:** Non-Native Seeding for Erosion Control Method, Hydraulic Planting ~~Mulch~~ Per Square Yard

**Pay Item No. 604S-B:** Non-Native Seeding for Erosion Control, Broadcast Seeding, Per Square Yard

**Pay Item No. 604S-~~B~~C:** Non-Native Seeding for Erosion Control Method, Hydraulic Planting ~~Mulch~~ Per Acre

**Pay Item No. 604S-~~C~~D:** Native Seeding for Erosion Control Method, Hydraulic Planting ~~Mulch~~ Per Square Yard

**Pay Item No. 604S-E:** Native Seeding for Erosion Control, Broadcast Seeding, Per Square Yard

**Pay Item No. 604S-~~D~~F:** Native Seeding for Erosion Control Method, Hydraulic Planting ~~Mulch~~ Per Acre

**Pay Item No. 604S-~~E~~G:** Mulch, _____Per Square Yard

**Pay Item No. 604S-~~F~~G:** Mulch, _____Per Acre

**Pay Item No. 604S-I:** Topsoil and Seedbed Preparation, Per Square Yard

**Pay Item No. 604S-J:** Topsoil and Seedbed Preparation, Per Acre

**Pay Item No. 604S-K:** Watering, Per 1000 gal (Kgal)

**Pay Item No. 604S-L:** Management Practices, Per Square Yard

**Pay Item No. 604S-M:** Management Practices, Per Acre

**End**

| ***SPECIFIC*** CROSS REFERENCE MATERIALS |
|---|
| Specification Item 604S "Seeding for Erosion Control" |

**City of Austin Technical Specifications**

| Designation | Description |
|---|---|
| Item No. 130S | Borrow |
| Item No. 601S | Salvaging and Placing Topsoil |
| Item No. 606S | Fertilizer |

**City of Austin Land Development Code**

| Designation | Description |
|---|---|
| Section 6-4 | Water Conservation |
| ~~Section 6-4-52~~ | ~~Water Use Management Plan Established~~ |
| ~~Section 6-4-53~~ | ~~Applicability~~ |
| ~~Section 6-4-54~~ | ~~Compliance Required~~ |
| ~~Section 6-4-63~~ | ~~Permanent Water Use Restrictions~~ |
| ~~Section 6-4-64~~ | ~~Water Conservation Stage One Regulations~~ |
| ~~Section 6-4-65~~ | ~~Water Conservation Stage Two Regulations~~ |
| ~~Section 6-4-81~~ | ~~Variance~~ |
| ~~Section 6-4-92~~ | ~~Penalty~~ |
| ~~Section 15-9-37(D)~~ | ~~Customer's Responsibilities Section 15-9-101(B) Basis for Termination of Service~~ |

| ***RELATED*** CROSS REFERENCE MATERIALS |
|---|
| Specification Item 604S "Seeding for Erosion Control" |

**City of Austin Technical Specifications**

| **Designation** | **Description** |
|---|---|
| Item No. 601S | Salvaging and Placing Topsoil |
| Item No. 602S | Sodding for Erosion Control |
| Item No. 605S | Soil Retention Blanket |
| Item No. 607S | Slope Stabilization |
| Item No. 608S | Planting |

**City of Austin Standards (Details)**

| **Designation** | **Description** |
|---|---|
| 627S-1 | Grass Lined Swale |
| 633S-1 | Landgrading |

**Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges**

| **Designation** | **Description** |
|---|---|
| Item No. 160 | ~~Furnishing and Placing~~ Topsoil |
| Item No. 162 | Sodding for Erosion Control |
| Item No. 164 | Seeding for Erosion Control |
| Item No. 166 | Fertilizer |
| Item No. 168 | Vegetative Watering |
| Item No. 169 | Soil Retention Blanket |
| Item No. 180 | Wildflower Seeding |
| Item No. 192 | ~~Roadside Planting and Establishment~~ Landscape Planting |

**Item No. 605S**
**Soil Retention Blanket**

## 605S.3 Materials

A. **Soil Retention Blankets**

All soil retention blankets must be listed on TxDoT Approved Products List or approved by the Engineer or designated representative.

The soil retention blanket shall be one (1) of the following classes and types as shown on the Drawings:

1. Class 1. ~~"~~Slope Protection~~"~~
   - (a) Type A. Slopes ~~1:3~~ 3:1or flatter - Clay soils
   - (b) Type B. Slopes ~~1:3~~ 3:1or flatter - Sandy soils
   - (c) Type C Slopes steeper than ~~1:3~~3:1 - Clay soils
   - (d) Type D Slopes steeper than ~~1:3~~3:1 - Sandy soils

2. Class 2. ~~"~~Flexible Channel Liner~~"~~
   - (a) Type E Short-term duration (Up to 2 years)
     Shear Stress ($t_d$) < ~~1~~2.0 pound per square foot [psf] ~~(48 Pa)~~
   - (b) Type F Short-term duration (Up to 2 years)
     Shear Stress ($t_d$) ~~1 to 2~~≤ 4.0 psf ~~(48 to 96 Pa)~~
   - (c) Type G Long-term duration (Longer than 2 years)
     Shear Stress ($t_d$) ~~>2 to <5~~ ≤ 6.0 psf ~~(>96 to <239 Pa)~~
   - (d) Type H Long-term duration (Longer than 2 years)
     Shear Stress ($t_d$) ~~5~~ ≤ 8.0 psf ~~( 239 Pa)~~

B. **Fasteners**

The fasteners shall conform to the recommendations of the manufacturer for the selected soil retention blanket.

**Item No. 606S**
**Fertilizer**

## 606S.1 Description

This item shall govern the provision and ~~distribution~~ incorporation of fertilizer ~~over the areas~~ into the soil on areas of proposed seeding, sodding, or other planting areas indicated on the Drawings and in accordance with these specifications.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, inch-pound units are given preference with SI units shown within parentheses.

## 606S.2 Submittals

The following submittals are required~~ments~~ for this specification item during construction ~~shall include~~:

A. ~~Type of soil(s) at the site~~. Analysis of native soil or introduced soil, including nutrient (N-P-K) content, textural class and soil organic matter percentage.
B. Type(s) of re-vegetation (seeding, sodding, etc.) proposed.
C. Fertilizer labels, for all t~~T~~ype(s) of fertilizer proposed, including chemical analysis.
D. Proposed r~~R~~ate(s) of application of fertilizer.
~~E. Chemical analysis of the fertilizer(s)~~
E. Schedule of proposed fertilizer applications.

## 606S.3 Materials

All fertilizer used on site shall be delivered in bags or containers ~~which~~ that are clearly labeled according to the Association of American Plant Food Control Officials (AAPFCO) protocol. Five required components must appear on a fertilizer's label, including the brand, the grade, guaranteed analysis, net weight, and name and address of the registrant or licensee. ~~and show the analysis~~. ~~The figures in the analysis shall represent the percent of nitrogen, phosphoric acid and potash nutrients, respectively, as determined by the methods of the Association of Official Agricultural Chemists.~~ The fertilizer may be subject to testing by the Texas State Chemist in accordance with the ~~Texas Fertilizer Law~~ Texas Commercial Fertilizer Rules or Texas Fertilizer Control Act.

The fertilizer type and rate of application should be based on chemical tests of representative soil samples taken after completion of construction and ground work, but before installation of plant materials.

A pelleted or granulated fertilizer shall be used. Fifty percent or greater of the Nitrogen required shall be in the form of Nitrate Nitrogen ($N0_3$). The remaining Nitrogen required may be in the form of Urea Nitrogen [$CO(NH_2)_2$].

The total amount of nutrients furnished and applied per acre (hectare: 1 hectare equals 2.471 acres) shall equal or exceed that specified for each nutrient.

Chemical fertilizer shall not be applied within the Critical Water Quality Zone (CWQZ).

**606S.4 Construction Methods**

General requirements and criterion for vegetative activities, including fertilizing~~, for the City of Austin~~ are presented in Environmental Criteria Manual Section 1.4.~~4.~~7, "*Vegetative Practices.*"~~, and Section 1.5.4, "Revegetation Criteria" of the City of Austin Environmental Criteria Manual~~.

~~The fertilizer type and rate of application should be based on chemical tests of representative soil samples taken after completion of construction and ground work. Appropriate initial fertilizer application rates for the Austin area (in lieu of recommendations from soil testing) are provided in the sections of the City of Austin Environmental Criteria Manual identified below:~~

~~A. Permanent seeding. - [Section 1.4.4.B.4].~~

~~B. Restoring Climax Grasses - [Section 1.5.5.E].~~

~~C. Sod. -. [Section 1.4.4.E.5].~~

~~D. Maintenance of Mulch Sod. - [Section 1.4.4.C.4].~~

Pelleted or granulated fertilizer shall be applied uniformly into the soil at time of seedbed preparation to a depth of 4 inches (100 mm) over the area ~~specified on the Drawings~~ to be fertilized and in the manner directed for the particular item of work. The fertilizer shall be applied at the rate recommended by soil tests. The fertilizer shall be dry and in good physical condition. Fertilizer that is powdered or caked will be rejected. Distribution of the fertilizer for the particular item of work shall meet the approval of the Landscape Architect, Engineer or Designated Representative.

Fertilizer should be applied (1) during seed germination and plant establishment and (2) after plant establishment. To minimize potential nutrient leaching to groundwater, fertilizer shall not be applied during plant dormancy or within 48 hours of a potential rain event. If needed, m~~M~~aintenance fertilizing shall be applied every 6 months after the new sod~~, or~~ grass or seeding is placed or until the work is accepted by the City.

The fertilizer may also be applied with the hydromulch.

**606S.5 Measurement**

Work and acceptable material for "Fertilizer" will be measured by the normal ton of 2,000 pounds (megagrams: 1 megagram equals 1.1023 tons) or by the 100 pounds (50 kilograms: 1 kilogram equals 2.205 pounds) as determined by approved scales or guaranteed weight of sacks shown by the manufacturer.

**606S.6 Payment**

The work performed and materials furnished and measured as provided under "Measurement" shall be included in the unit price bid for the item of construction in which fertilizer is used, unless specified in the Drawings as a Pay Item.

When fertilizer is specified on the Drawings as a pay item or included in the contract bid form, the work performed and materials furnished and measured as provided under

"Measurement" will be paid for at the unit bid price for "Fertilizer" of the analysis specified on the Drawings. The unit bid price shall include full compensation for furnishing all materials and performing all operations necessary to complete the work.

Payment, when specified, will be made under one of the following:

| | | |
|---|---|---|
| **Pay Item No. 606S-A**: | Fertilizer | Per Ton. |
| **Pay Item No. 606S-B**: | Fertilizer | Per 100 Pounds. |

**End**

**SPECIFIC** CROSS REFERENCE MATERIALS

Specification Item 606S "Fertilizer"

City of Austin Environmental Criteria Manual

| Designation | Description |
|---|---|
| ~~Section 1.4.4.B.4~~ | ~~Design Criteria of Section B. Critical Area Stabilization (with Permanent Seeding)~~ |
| ~~Section 1.4.4.C.4~~ | ~~Design Criteria of Section C. Critical Area Stabilization (with Mulch Sod)~~ |
| ~~Section 1.4.4.E.5~~ | ~~Site Preparation of Section E. Critical Area Stabilization (with Sod)~~ |
| ~~Section 1.5.5.E~~ | ~~Fertilizer, Section E of 1.5.5, "Restoring Climax Grasses"~~ |
| Section 1.4.7.A.5 | Vegetative Practices, Temporary Vegetative Stabilization of Disturbed Areas |
| Section 1.4.7.B.6 | Vegetative Practices, Permanent Vegetative Stabilization of Disturbed Area |

**RELATED** CROSS REFERENCE MATERIALS

Specification Item 606S "Fertilizer"

City of Austin Technical Specifications

| Designation | Description |
|---|---|
| Item No. 601S | Salvaging and Placing Topsoil |
| Item No. 602S | Sodding for Erosion Control |
| Item No. 604S | Seeding for Erosion Control |
| Item No. 605S | Soil Retention Blanket |
| Item No. 607S | Slope Stabilization |
| Item No. 608S | Planting |
| Item No. 609S | Native ~~Grassland~~ Seeding and Planting for ~~Erosion Control~~ Restoration |

Item No. 610S Preservation of Trees and Other Vegetation

**Item No. 609S**

**Native ~~Grassland~~ Seeding and Planting for Restoration ~~for Erosion Control~~**

## 609S.1 Description

This item shall govern the preparation of a seeding and planting area to the lines and grades indicated on the Drawings. This may include seedbed preparation, sowing of seeds, planting of rooted plants, watering, hydromulch, compost and other management practices, as indicated in the Drawings or as directed by the Landscape Architect, Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, inch-pound units are given preference with SI units shown within parentheses.

## 609S.2 Submittals

~~The submittal requirements for this specification item shall include:~~

The following submittal items are required in writing during construction:

A. For seed, provide i~~I~~dentification of the species, source, mixture ~~and rate of application of the seeding.~~ , and pure live seed (PLS) of the seed as listed on each seed bag to be used. Copies of the analysis tags and certification tags from all seed bags shall be submitted.

B. Type of mulch or compost.

C. Watering frequency and amount as shown on an irrigation watering schedule.

D. Type of management practices (e.g., hand-weeding, pesticide application, etc.) proposed, with a proposed schedule for observation and treatment.

E. For hydromulch applications, the proposed application rate of seed, type of mulch and tacking agent, and other relevant information. An example of the required documentation is in Table 1.

F. Type of hydraulic seeding equipment and nozzles proposed for use.

G. If pesticide use is proposed, an IPM plan for pest control including pesticide label, proposed application rate and timing, and MSDS sheets.

H. One gallon sample of proposed mulch or compost.

The following submittal items are required before Substantial Completion:

A. For hydromulch applications, submit the complete hydromulch application log, including date, time and quantity of product units placed in the slurry tank. An example of an application log is in Table 2.

B. Pesticide application tracking log. As of January 1, 2012, documentation of all outdoor pesticide use on city-owned properties is required to demonstrate compliance with the EPA/TCEQ mandated Municipal Stormwater Permit, the TPDES General Pesticide Permit, City Code, and the IPM program.

Table 1: Example of proposed hydromulch application rates

| | | | | Hydro Slurry Unit (per acre rates) | | | | |
|---|---|---|---|---|---|---|---|---|
| Hydro Mix | Sheet No. | Seed Mix | Acres | Seed (Bags/AC) | Tackifier (Buckets/AC) | Mulch (Bales/AC) | Fertilizer (Bags/AC) | Addl. Amendments (Bags/AC) |
| 1 | L2 | A | 1.0 | 1 | 100 | 1000 | 50 | 5 |
| 2 | L3 | A | 0.5 | 2 | 200 | 1500 | 50 | 5 |
| 3 | L5 | B | 3.0 | 3 | 300 | 3000 | 50 | 5 |

Table 2: Example of hydromulch application log

| | | | | | | Hydro Slurry Unit (per acre rates) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Date | Start Time | Finish Time | AC/ Tank | Water (gal) | Seed Mix | Seed (Bags/AC) | Tackifier (Buckets/ AC) | Mulch (Bales/AC) | Fertilizer (Bags/AC) | Addl. Amendments (Bags/AC) |
| 4/13 | 10:30 | 11:15 | 1.0 | 3300 | A | 1 | 100 | 1000 | 50 | 5 |
| 4/17 | 2:00 | 2:30 | 0.5 | 3300 | A | 2 | 200 | 1500 | 50 | 5 |
| 5/20 | 8:30 | 10:00 | 1.2 | 3300 | B | 3 | 300 | 3000 | 50 | 5 |
| | | | | | Totals | 6 | 600 | 5500 | 127 | 15 |

## 609S.3. Materials

A. **Seed.** ~~The seed furnished shall be of the previous season's crop and the date of analysis shown on each bag shall be within twelve months of the time of delivery to the project. Each variety of seed shall be furnished and delivered in separate bags or containers. A sample of each variety of seed shall be furnished for analysis and testing when directed by the Engineer or designated representative.~~

All seed must meet the requirements of the Texas Seed Law including the labeling requirements for showing PLS, name and type of seed, and all other required elements of the Analysis and Certification Tags. The seed furnished shall be of the previous season's crop and the date of analysis shown on each bag shall be within 12 months of the time of delivery to the project. Each variety of seed shall be furnished and delivered in separate bags or containers, unless a specific mix is proposed for use. A sample of each variety of seed shall be furnished for analysis and testing when directed by the Landscape Architect, Engineer or designated representative.

The amount of seed planted per ~~1000~~ square yard ~~feet~~ (.84 ~~93~~ square meters) or acre (hectare) shall be of the type specified in Section 609S.5.

B. **Water.** Water shall be clean and free of industrial wastes and other substances harmful to the growth of ~~grass~~ plant materials in the area irrigated.

C. **Topsoil.** Topsoil ~~see~~ shall conform to Standard Specification Item No. 601S.3(A).

D. **Pesticide.** A least toxic, integrated pest management (IPM) approach shall be used to control weeds. A written request for approval of weed control product(s) and/or materials shall be submitted to the City of Austin IPM program coordinator ~~(499-2550)~~ (512-974-2581) for approval. Additional information can be found at http://www.austintexas.gov/ipm.

E. **Fertilizer.** If fertilizer used in deemed necessary, the fertilizer shall conform to Standard Specification Item No. 606S, "Fertilizer." The type and rate of fertilizer should be based on chemical tests of recent (no older than 6 months before application) representative site soil samples. Fertilizer should be applied only when plants can take them up for growth, during: 1) seed germination and plant establishment and 2) after plant establishment. Fertilizer shall not be applied within 48 hours of a potential rain event.

F. **Tackifier.** The tacking agent shall be a biodegradable material approved by the Landscape Architect, Engineer, or designated representative.

G. **Mulch.** Mulch may be used to help prevent soil erosion until preferred plant establishment, whether the mulch be hydraulically applied or shredded vegetative matter. Hydromulching for temporary and permanent vegetation stabilization shall conform to Environmental Criteria Section 1.4.7.

H. **Hydroseeding Equipment.** Hydroseeding equipment shall be clean and free of all previous seeds, fertilizer, mulch, or any hydroseeding products used on prior jobs.

I. **Rooted Plants**. When proposed, rooted plants shall conform to the requirements of Standard Specification 608S, Planting.

## 609S.4 Construction Methods

A. General.

The Contractor shall limit preparation to areas that will be ~~immediately~~ seeded immediately. All ~~noxious~~ ~~weeds~~ weedy species (Table 3) shall be ~~eliminated~~ controlled by application of an herbicide and/or by physical removal (by the roots) prior to, ~~and/or~~ during the ~~seeding~~ planting operation, and through establishment. The specified weedy species shall be maintained at ten (10) percent or less of total cover after seeding. Additionally, the Owner may require removal of any plant species that appears to be out-competing seeded or planted species during construction or the establishment period.

Seeds and fruits of non-native woody invasive species should be separated from the rest of the removed plants before mulching or hauling off the material. It must be bagged and disposed of in a landfill to prevent unintentional reintroduction to the site

or elsewhere.
~~The following list of plants are considered noxious weeds:~~

Table ~~1~~ 3: Weed List

| Weed Type | Botanical Name | Common Name |
|---|---|---|
| Summer Annual Herb | *Ambrosia spp.* | Ragweed |
| Perennial Grass | *Bothriochloa ischaemum* | K.R. Bluestem |
| ~~Grass~~ | ~~*Bromus unioloides*~~ | ~~Rescue Grass~~ |
| Annual Grass | *Cenchrus spp.* | Sandbur |
| Herb | *Cnidoscolus texanus* | Bull Nettle |
| ~~Herb~~ | ~~*Convolvulus spp.*~~ | ~~Bindweed~~ |
| ~~Grass~~ | ~~*Cynodon dactylon*~~ | ~~Bermudagrass~~ |
| ~~Herb~~ | ~~*Cyperus esculentus*~~ | ~~Yellow Nutsedge (Nut-grass)~~ |
| ~~Herb~~ | ~~*Cyperus rotundus*~~ | ~~Purple Nutsedge (Nut-grass)~~ |
| ~~Grass~~ | ~~*Digitaria spp.*~~ | ~~Crab Grass~~ |
| ~~Herb~~ | ~~*Medicago sp.*~~ | ~~Bur-Clover~~ |
| ~~Grass~~ | ~~*Paspalum dilatatum*~~ | ~~Dallis Grass~~ |
| Perennial Grass | *Sorghum halapense* | Johnson Grass |
| Perennial Grass | *Arundo donax* | Giant Cane |
| Perennial Grass | *Phllostachys aurea* | Golden Bamboo |
| ~~Herb~~ | ~~*Torilis arvensis*~~ | ~~Beggar's-tick~~ |
| Vine | *Toxicodendron radicans* | Poison Ivy |
| Herb | *Urtica spp.* | Stinging Nettle |
| Winter Annual Herb | *Rapistrum rugosum* | Bastard Cabbage |
| Winter Annual Grass | *Bromus arvensis* | Japanese Brome |
| Winter Annual Grass | *Lolium multiflorum* | Annual Ryegrass |
| Tree | *Triadica sebifera* | Chinese Tallow |
| Tree | *Ligustrum sp.* | Privet |
| Tree | *Melia azedarach* | Chinaberry |
| Tree | *Lonicera japonica* | Japanese Honeysuckle |
| Shrub | *Nandina domestica* | Heavenly Bamboo |
| Shrub | *Photinia sp.* | Photinia |

B. Seed Bed Preparation.

After the designated areas have been rough graded, a suitable seedbed shall be prepared. In areas where cut or fill is required, a minimum of 6 inches (150 mm) of topsoil (see Section 609S.3.C) shall be placed or use approved existing soil (that is not infested with weeds or weed rootstock) stockpiled over the entire planting area.

The topsoil or growing medium must be prepared so that compaction is appropriate for plant growth, and to achieve acceptable bulk density or hydrologic function. Ripper and subsoilers may be used to loosen compacted soil and roughen the surface. Disks, plows and excavator attachments are good for compaction reduction, roughening, and for incorporating amendments. A

roughened soil surface of micro-ridges and valleys is an optimal seed bed with a microenvironment of increased moisture, higher humidity, wind protection, and shelter from the sun for seeds. If tracked machinery is used in seedbed preparation, cleat marks should run with the contour to prevent rills.

In areas with no soil disturbance, the weeds shall be eliminated and a minimum of 2 inches (50 mm) of topsoil, if none currently exists, shall be placed. The~~An even~~ seedbed shall be prepared with limited irregularities, lumps or soil clods and the surface shall be raked to facilitate seed to soil contact.

Water shall be gently applied as required to prepare the seedbed before the planting operation either by broadcast seeding or hydraulic planting. Seeding shall be performed in accordance with the requirements hereinafter described.

C. Watering.

All watering shall comply with City Code Chapter 6-4 (*Water Conservation*). Water the seeded areas immediately after installation to achieve germination and a healthy stand of native plants that can ultimately survive without supplemental water.

Apply the water uniformly to the planted areas without causing displacement or erosion of the materials or soil.

~~All watering shall comply with City of Austin Land Development Code requirements. Seeded areas shall immediately be watered with a minimumof 5 gallons of water per square yard (22.5 liters of water per square meter) or as needed and in the manner and quantity as directed by the Engineer or designated representative~~.

Watering applications shall insure that the seedbed is maintained in a moist condition favorable for the growth of ~~grass~~ plant materials. Watering shall continue until minimum coverage is achieved and accepted by the Landscape Architect, Engineer or designated representative. Watering may be postponed immediately after a half-inch ~~1/2~~ inch (12.5 mm) or greater rainfall on the site but shall be resumed before the soil dries out.

~~Availability of water from the Austin Water Utility will be limited as stated under the Water Conservation Standard, City of Austin Land Development Code Chapter 62, Article II, "Water Use Management Plan Established".~~

~~The use of potable water will be restricted as stated in City of Austin Land Development Code Sections 6-4-73, 6-4-54, 6-4-63, 6-4-64, 6-4-65, 6-4-81, 6-4-92, 15-9-37(D) and 15-9-101(B).~~

D. **Cool Season Cover Crop**.

From September 15 to March 1, seeding shall include a cool season cover crop at the rate specified in Tables 4, 5, & 6. If installed separately from the proposed seed mix, the cool season cover crops shall be mowed to a height of less than one (1) inch after March 1, and the area shall be re-seeded at the specified seeding rate for native warm-season species (March 1 to September 15).

## 609S.5 Native ~~Grassland~~ Seeding and Planting

~~All areas require both seed and rooted plants~~. Seeding and planting shall be performed in accordance with the requirements ~~hereinafter~~ described below. The optimum depth for seeding shall be ~~from 1/16 inch (1 1/2 millimeters) to~~ 1/4 inch (6 millimeters). Seed shall be applied by a method that achieves consistent distribution and proper seed to soil contact (i.e. hand broadcasting, hydromulch, or drill method). Installation of rooted plants shall comply to Standard Specification 608S. Mulching is not required, but it is a good technique for protecting seeds during germination and establishment.

Species substitution, when necessary due to availability, shall be approved by the Landscape Architect, Engineer or designated representative. Only native or adapted species ~~adapted~~ suitable for the designated environmental conditions shall be allowed as substitutes. Shorter growing natives such as Buffalograss should be sodded around manholes or other structures requiring higher visibility for access.

If the plant materials are ~~native grassland~~ is being installed during the cool season (September 15 to March 1~~November 1 to February 15~~), ~~the~~ a cool season cover crop species (as listed below) shall be included in the seed mix or installed separately.

The seed and rooted plant mixtures shall be applied in accordance with appropriate ~~"~~growing environments~~"~~ (Upland Full Sun–Table 2, Upland Shade-Dappled-Table 3 and Facultative Moderate to High Moisture–Table 4). Grasses shall constitute 65 percent of the mix, with forbs comprising 35 percent. No species shall constitute more than 20% of a seed mix.

Table ~~2~~4. Upland Species, Full Sun Areas

| Common Name | ~~Comments~~ Plant Type | Botanical Name | Seed application rate ~~lbs/1000 sq. ft. (kg/100 sq. m.)~~ lbs/AC (kg/ha) | ~~Rooted Plants Size & Spacing~~ |
|---|---|---|---|---|
| ~~Buffalo Grass~~ Buffalograss | grass | *Buchloe dactyloides* | ~~0.3 (0.15)~~ 24.0 (27.0) | ~~1-16"x24" piece of sod @ 10' (3m) ctrs.~~ |
| Blue Grama | grass | *Bouteloua gracilis* | ~~0.2 (0.1)~~ 10.0 (11.2) | ~~Not required~~ |
| Green Sprangletop | grass | *Leptochloa dubia* | ~~0.4 (0.2)~~ 2.0 (2.2) | |
| ~~Indian Grass~~ Sand Dropseed | grass | ~~*Sorghastrum nutans*~~ *Sporobolus cryptandrus* | ~~0.2 (0.1)~~ 1.0 (1.1) | ~~1 gal @ 10 ft.' (3m) ctrs.~~ |

| | | | | |
|---|---|---|---|---|
| ~~Little Bluestem~~ Galleta | grass | ~~*Schizachyrium scoparium*~~ *Pleuraphis jamesii* | ~~0.2 (0.1)~~ 10.0 (11.2) | |
| ~~Prairie~~ Canada Wild Rye | grass | *Elymus canadensis* | ~~0.2 (0.1)~~ 10.0 (11.2) | ~~Not required~~ |
| Purple Threeawn | grass | *Aristida purpurea* | ~~0.2 (0.1)~~ 4.0 (4.5) | |
| Sideoats Grama | grass | *Bouteloua curtipendula* | ~~0.3 (0.15)~~ 7.0 (7.8) | |
| Bluebonnet | wildflower | *Lupinus texensis* | ~~0.4 (0.2)~~ 20.0 (22.4) | ~~Not required~~ |
| Purple Prairie Clover ~~(Purple Prairie)~~ | wildflower | ~~*Petalostemum*~~ *Dalea purpurea* | ~~0.1 (0.05)~~ 4.0 (4.5) | ~~Not required~~ |
| Plains Coreopsis ~~(Plains)~~ | wildflower | *Coreopsis tinctoria* | ~~0.05 (0.025)~~ 2.0 (2.2) | ~~Not required~~ |
| ~~Goldenrod~~ Partridge Pea | wildflower | ~~*Solidago altissima*~~ *Chamaecrista fasciculata* | ~~0.02 (0.01)~~ 20.0 (22.4) | ~~Not required~~ |
| Greenthread | wildflower | *Thelesperma filifolium* | ~~0.075 (0.037)~~ 6.0 (6.7) | ~~Not required~~ |
| Indian Blanket | wildflower | *Gaillardia pulchella* | ~~0.15 (0.075)~~ 10.0 (11.2) | ~~Not required~~ |
| Lemon Mint | wildflower | *Monarda citriodora* | ~~0.06 (0.03)~~ 3.0 (3.4) | ~~Not required~~ |
| Mexican Hat | wildflower | *Ratibida columnaris* | ~~0.05 (0.025)~~ 2.0 (2.2) | ~~Not required~~ |
| Pink Evening Primrose | wildflower | *Oenethera speciosa* | ~~0.02 (0.01)~~ 1.0 (1.1) | ~~Not required~~ |
| Sunflower (Common) | wildflower | *Helianthus annuus* | ~~0.075 (0.037)~~ 5.0 (5.6) | ~~Not required~~ |
| Cereal rye grain* | cool season cover crop | ~~Elymus~~ *Secale cereale* | ~~0.5 (0.25)~~ 34.0 (38.1) | ~~Not required~~ |
| Oats* | cool season cover crop | *Avena sativa* | ~~0.2 (0.10)~~ 4.0 (4.5) | ~~Not required~~ |
| Western Wheatgrass* | cool season cover crop | ~~Triticum aestivum~~ *Pascopyrum smithii* | ~~0.3 (0.15)~~ 5.6 (6.3) | ~~Not required~~ |

| | | | | |
|---|---|---|---|---|
| ~~TOTAL**~~ | | | ~~Winter: 4.0 (2.0)~~ ~~Summer: 3.0 (1.5)~~ | ~~Rooted species mixed equally @ 10 ft. (3 m) ctrs.~~ |

* Plant only between ~~Oct. 1 and Jan. 31~~. September 15 to March 1. Non-persistent winter cover crop for erosion control. Only one cool season species is required per installation.

** Any unavailable species can be substituted with the same quantity of another species from this list or another species approved by the Landscape Architect, Engineer or designated representative. The total pounds/acre (lbs/ac) of the proposed seed mix shall be calculated based on the desired percentage of each seed in a mix.

Table ~~3~~5. Upland Species, Shade-Dappled Light Areas

| Common Name | ~~Comments~~ Plant Type | Botanical Name | Seed Application Rate ~~lbs/1000 sq. ft. (kg/100 sq. m.)~~ lbs/AC (kg/ha) | ~~Rooted Plants Size & Spacing~~ |
|---|---|---|---|---|
| ~~Meadow Sedge*~~ | ~~sedge~~ | ~~*Carex perdentata*~~ | ~~No seed required~~ | ~~1 gal. @ 10' (3m) ctrs.~~ |
| Inland Seaoats** | grass | *Chasmanthium latifolium* | ~~0.5 (0.25)~~ 12.0 (13.5) | |
| ~~Prairie Wild Rye~~ Canada Wildrye | grass | *Elymus canadensis* | ~~0.75 (0.37)~~ 10.0 (11.2) | ~~Not required~~ |
| Sideoats Grama | grass | *Bouteloua curtipendula* | ~~0.75 (0.37)~~ 7.0 (7.8) | ~~1 gal. @ 10' (3m) ctrs.~~ |
| Purple Coneflower | wildflower | *Echinacea purpurea* | ~~0.1 (0.05)~~ 10.0 (11.2) | ~~Not required~~ |
| Lanceleaf Coreopsis ~~(Lanceleaf)~~ | wildflower | *Coreopsis lanceolata* | ~~0.1 (0.05)~~ 10.0 (11.2) | ~~Not required~~ |
| Scarlet Sage ~~(Scarlet)~~ | wildflower | *Salvia coccinea* | ~~0.1 (0.05)~~ 8.0 (9.0) | ~~Not required~~ |
| Drummond Phlox | wildflower | *Phlox drummondii* | ~~0.1 (0.05)~~ 8.0 (9.0) | ~~Not required~~ |
| Black-Eyed Susan | wildflower | *Rudbeckia hirta* | ~~0.03 (0.015)~~ 2.0 (2.2) | ~~Not required~~ |
| Cutleaf Daisy | wildflower | *Engelmannia pinnatifida* | ~~0.2 (0.10)~~ 18.0 (20.2) | ~~Not required~~ |
| Tall Aster | wildflower | *Aster praealtus* | ~~0.02 (0.01)~~ 1.0 (1.1) | ~~Not required~~ |
| Illinois bundleflower | wildflower (Legume) | *Desmanthus illinoensis* | ~~0.15 (0.075)~~ 15.0 (16.8) | ~~Not required~~ |
| Standing cypress | wildflower | *Ipomopsis rubra* | ~~0.1 (0.05)~~ 6.0 (6.7) | ~~Not required~~ |
| Winecup | wildflower | *Callirhoe involucrata* | ~~0.1 (0.05)~~ 5 (5.6) | ~~Not required~~ |

| | | | | |
|---|---|---|---|---|
| Cereal rye grain*** | cool season cover crop | *Secale cereale* | ~~0.5 (0.25)~~ 34.0 (38.1) | ~~Not required~~ |
| Oats*** | cool season cover crop | *Avena sativa* | ~~0.2 (0.1)~~ 4.0 (4.5) | ~~Not required~~ |
| Western Wheatgrass*** | cool season cover crop | ~~*Triticum aestivum*~~ *Pascopyrum smithii* | ~~0.3 (0.15)~~ 5.6 (6.3) | ~~Not required~~ |
| TOTAL**** | | | ~~Winter: 4.0 (2.0) Summer: 3.0 (1.5)~~ | ~~Rooted species mixed equally @ 10' (3m) ctrs~~ |

~~* If unavailable replace with other shade and drought-tolerant sedge species.~~

** If unavailable replace with Prairie Wild Rye.

*** Plant only between ~~Oct. 1 and Jan. 31~~ September 15 to March 1. Non-persistent winter cover crop for erosion control. Only one cool-season species is required per installation.

**** Any unavailable species can be substituted with the same quantity of another species from this list or another species approved by the Landscape Architect, Engineer or designated representative. The total pounds/acre (lbs/ac) of the proposed seed mix shall be calculated based on the desired percentage of each seed in a mix.

Table 46. Facultative Species, Moderate – High Moisture Areas

| Common Name | ~~Comments~~ Plant Type | Botanical Name | Seed application rate ~~lbs/1000 sq. ft. (kg/100 sq. m.)~~ lbs/AC (kg/ha) | ~~Rooted Plants Size & Spacing~~ |
|---|---|---|---|---|
| Big Bluestem | grass | *Andropogon gerardii* | ~~0.2 (0.1)~~ 8.0 (9.0) | ~~1 gal. @ 10' (3m) ctrs~~ |
| Big Muhly (Lindhiemers) | grass | *Muhlenbergia lindheimeri* | ~~0.2 (0.1)~~ 6.0 (6.7) | |
| Bushy Bluestem | grass | *Andropogon glomeratus* | ~~0.2 (0.1)~~ 6.0 (6.7) | |
| Eastern Gamagrass ~~Grass~~ | grass | *Tripsacum dactyloides* | ~~0.3 (0.15)~~ 12.0 (13.5) | |
| ~~Indian Grass~~ Indiangrass | grass | *Sorghastrum nutans* | ~~0.2 (0.1)~~ 6.0 (6.7) | |
| Inland Seaoats | grass | *Chasmanthium latifolium* | ~~0.3 (0.15)~~ 12.0 (13.5) | |
| ~~Prairie Wild Rye~~ Canada Wildrye | grass | *Elymus canadensis* | ~~0.3 (0.15)~~ 10.0 (11.2) | |
| Sand Lovegrass | grass | *Eragrostis trichodes* | ~~0.2 (0.1)~~ 2.0 (2.2) | |
| Switchgrass | grass | *Panicum virgatum* | ~~0.1 (0.05)~~ 4.0 (4.5) | ~~1 gal. @ 10' (3m) ctrs~~ |

| | | | | |
|---|---|---|---|---|
| Black-Eyed Susan | wildflower | *Rudbeckia hirta* | ~~0.06 (0.03)~~ 2.0 (2.2) | ~~Not required~~ |
| Illinois Bundleflower ~~(Illinois)~~ | wildflower | *Desmanthus illinoensis* | ~~0.35 (0.17)~~ 15.0 (16.8) | ~~Not required~~ |
| Purple Prairie Clover ~~(Purple Prairie)~~ | wildflower (legume) | *Dalea ~~Petalostemum~~ purpurea* | ~~0.1 (0.05)~~ 4.0 (4.5) | ~~Not required~~ |
| Clasping Coneflower ~~(Clasping)~~ | wildflower | ~~*Rudbeckia*~~ *Dracopis amplexicaulis* | ~~0.06 (0.03)~~ 3.0 (3.4) | ~~Not required~~ |
| Plains Coreopsis ~~(Plains)~~ | wildflower | *Coreopsis tinctoria* | ~~0.05 (0.025)~~ 2.0 (2.2) | ~~Not required~~ |
| Goldenrod | wildflower | *Solidago altissima* | ~~0.03 (0.015)~~ 1.0 (1.1) | ~~Not required~~ |
| Lazy Daisy | wildflower | *Aphanostephus sp.* | ~~0.03 (0.015)~~ 1.0 (1.1) | ~~Not required~~ |
| Lemon Mint | wildflower | *Monarda citriodora* | ~~0.07 (0.035)~~ 3.0 (3.4) | ~~Not required~~ |
| Sunflower (Common) | wildflower | *Helianthus annuus* | ~~0.15 (0.075)~~ 5.0 (5.6) | ~~Not required~~ |
| Sunflower (Maximilian) | wildflower | *Helianthus maximiliani* | ~~0.1 (0.05)~~ 4.0 (4.5) | ~~Not required~~ |
| Cereal rye grain* | cool season cover crop | *Secale cereale* | ~~0.5 (0.25)~~ 34.0 (38.1) | ~~Not required~~ |
| Oats* | cool season cover crop | Avena sativa | ~~0.2 (0.10)~~ 4.0 (4.5) | ~~Not required~~ |
| Western Wheatgrass* | cool season cover crop | ~~Triticum aestivum~~ Pascopyrum smithii | ~~0.3 (0.15)~~ 5.6 (6.3) | |
| TOTAL** | | | ~~winter: 4.0 (2.0) summer: 3.0 (1.5)~~ | ~~Rooted species mixed equally @ 10' (3m) ctrs.~~ |

* Plant only between ~~Oct. 1 and Jan. 31~~ September 15 to March 1. Non-persistent winter cover crop for erosion control.

** Any unavailable species can be substituted with the same quantity of another species from this list or another species approved by the Landscape Architect, Engineer or designated representative. The total pounds/acre (lbs/ac) of the proposed seed mix shall be calculated based on the desired percentage of each seed in a mix.

**Table 7. Seed Rate Calculation**

Multiple species native seed mixes require careful calculations to ensure proper planting rates. The example below is for illustrative purposes only.

| Species | Seeding Rate (lbs/AC) | Desired proportion of a species in the total mix (%) | Total quantity of seed in mix (lbs/ac) |
|---|---|---|---|
| Grass 1 | 7 | .20 | 1.40 |
| Grass 2 | 2 | .20 | 0.40 |
| Grass 3 | 24 | .20 | 4.80 |
| Forb 1 | 10 | .20 | 2.00 |
| Forb 2 | 8 | .20 | 1.60 |
| TOTALS | --- | 1.0 (100%) | 10.2 |

**Table 8. Seed Calculation Worksheet**

The amount of seed needed to be planted on a project shall be calculated before installation to ensure adequate seed is placed, and provided as a submittal. Table 8 is an example worksheet, followed by an example calculation. Information for calculation can be obtained from seed tags or the supplier.

| Plant Group | Desired Seeding Rate (1bs/AC) | PLS (pure live seed) | Bulk Rate (lbs/AC) | Seeding Area (AC) | Amt. of Seed to be Installed (lbs) |
|---|---|---|---|---|---|
| Grasses | | | | | |
| Forbs | | | | | |
| TOTAL | | | | | |

FORMULAS:

PLS (pure live seed) = (Purity x Germination) x 100. Can also use average PLS from seed tags.

Bulk Rate (lbs/AC) = Desired Seed Rate (lbs/AC)/PLS

Amt. of Seed to be Installed (lbs) = Bulk Rate (lbs/AC) x Seeding Area (AC)

Example:

| Plant Group | Desired Seeding Rate (1bs/AC) | PLS [pure live seed] (% decimal) | Bulk Rate (lbs/AC) | Seeding Area (AC) | Amt. of Seed to be Installed (lbs) |
|---|---|---|---|---|---|
| Grasses | 131.00 | 0.81 | 161.73 | 1.50* | 242.60 |
| Forbs | 65.34 | 0.87 | 75.10 | 1.50* | 112.70 |
| TOTAL | 196.34 | 0.84 (ave.) | 236.83 | 1.50 | 355.30 |

*applied over the same 1.5 AC area

**609S.6 Management Practices**

Management Practices include (1) weed management (pesticide application or mechanical removal) to so than 90 percent of the revegetation area is free of weeds listed in Table 3, and (2) reseeding areas of poor germination to achieve coverage and height per 609S.8, with no bare areas greater than 16 s.f.

Weeds, as defined in the Weed List (Table ~~1~~3), shall be controlled in the most efficient manner possible. The timing of weed control may occur prior to soil disturbance, just before the installation of seed, and/or during the period of plant ~~grassland~~ establishment. Weed control shall be introduced at one or all of these times, so that the greatest control is achieved. The preferred method of control is to remove weeds, either by physical or mechanical means, when the site is conducive (e.g. when the ground is moist) to this approach.

The entire root system of perennial weeds shall be removed to prevent re-sprouting. Table 9 provides management practices for woody invasive vegetation. Weeds may be controlled with an approved contact, systemic herbicide, provided the product is used with appropriate care and is applied in accordance with label instructions and the following guidelines:

1. Herbicide shall not be applied when the wind is greater than 8 mph (12.9 kph),
2. Herbicide shall not be applied when rainfall is expected within 24 hours,
3. Herbicide shall not contact surface water, i.e. creeks, rivers, and lakes,
4. Herbicide shall not contact desirable vegetation (a wicking method shall be used, if necessary, to accurately contact target weed only during application).

**Table 9. Management Practices for Woody Invasive Vegetation**

| **Before Seeding** | |
|---|---|
| Stems ≤ 1 inch | Pull with weed wrench |
| Stems > 1 inch | Cut at base and spray stump with appropriate herbicide within five minutes. Bag and dispose of seeds and fruit in landfill. |
| **After Seeding** | |
| Seedlings | Hand pull |
| Sprouts | Foliar application of appropriate herbicide |

The Landscape Architect, Engineer or designated representative shall be consulted to determine appropriate weed control management when weeds are located in an environmentally sensitive location (e.g. near water or adjacent to a critical environmental feature).

## 609S.7 Reseeding

At locations that fail to show an acceptable stand of planting for any reason during the initial seeding, repair and/or reseed locations as determined by the Landscape Architect, Engineer or designated representative. A successful stand of grasses and forbs should exhibit the following:

- Seedlings with vigorous green foliage;
- Green leaves remaining throughout the summer, at least at the plant bases;
- Uniform density, with grasses and/or forbs well intermixed;

- Minimum of 95% cover; and
- No exposed soil greater than 16 s.f. in aerial extent.

The Owner will inspect the seeding during April of the calendar year following the year of initial seeding and determine the necessity and extent of over seeding or reseeding required. Contractor shall complete any required reseeding before May 15 of that year. This date may be extended if, in the opinion of the Owner, the weather conditions before May 15 are not suitable for reseeding work. If the timing is bad, an annual cover crop can be over seeded in a deficient area to temporarily provide coverage until a suitable time for seeding perennials. If vegetation fails to grow, the soil must be tested to determine whether nutrient imbalances are responsible and, if so, an appropriate course of nutrient remediation (e.g., fertilizers, composts, topsoils, or other organic amendments) as recommended by a landscape professional must be implemented by the Contractor.

The Contractor shall meet the requirements for initial seeding, including seeding method, seed mix, application rates, and slope texturing as applicable, unless otherwise agreed to in writing by the Owner. Corrected deficiencies will be re-inspected and approved by the Owner, and final acceptance will be granted only upon satisfactory completion.

**609S.~~7~~8 Measurement**

Work and acceptable material for ~~"~~Native Grasslands for Erosion Control~~"~~ will be measured by the square yard (square meter: 1 square meter equals 1.196 square yards) or by the acre (hectare: 1 hectare equals 2.471 acres), complete in place, with a minimum of 95 percent total coverage (90 percent of that must be free of ~~noxious weeds~~ weedy and invasive plant species listed in Table 3) with no bare areas exceeding 16 square feet (1.5 square meters) and a 1 1/2 inch tall (40 millimeters) successful stand of plant materials. Ninety (90) percent of which must be free of weeds listed in Table 3. Bare areas shall be re-prepared and reseeded as required by the Landscape Architect, Engineer or designated representative ~~in order~~ to develop an acceptable stand of ~~grass~~ vegetation.

**609S.~~8~~9 Payment**

The work performed and materials furnished and measured will be paid for at the unit bid price for ~~"Native Grasslands For Erosion Control"~~ Native Seeding and Planting for Restoration of the method specified on the Drawings.

The unit bid price shall include full compensation for furnishing all materials, including all topsoil, water, seed, or fertilizer or mulch and for performing all operations necessary to complete the work.

Payment will be made under one or more of the following pay items:

| | | |
|---|---|---|
| **Pay Item No. 609S-A:** | Topsoil and Seedbed Preparation | Per Square Yard. |
| **Pay Item No. 609S-B:** | Topsoil and Seedbed Preparation | Per Acre. |
| **Pay Item No. 609S-C:** | Native ~~Grassland~~ Seeding | Per Square Yard. |
| **Pay Item No. 609S-D:** | Native ~~Grassland~~ Seeding | Per Acre. |

| | | |
|---|---|---|
| **Pay Item No. 609S-E:** | Watering | Per ~~Square Yard~~ 1000 Gallons (Kgal) |
| ~~**Pay Item No. 609S-F:**~~ | ~~Watering~~ | ~~Per Acre~~ |
| **Pay Item No. 609S-GF:** | Management Practices | Per Square Yard |
| **Pay Item No. 609S-HG:** | Management Practices | Per Acre |

**End**

## *SPECIFIC* CROSS REFERENCE MATERIALS

Specification Item 609S "Native Grassland Seeding and Planting for Erosion Control" City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 130S | Borrow |
| Item No. 601S | Salvaging and Placing Topsoil |
| Item No. 606S | Fertilizer |

City of Austin Land Development Code

| Designation | Description |
|---|---|
| Section 6-4 | Water Conservation |
| ~~Section 6-4-52~~ | ~~Water Use Management Plan Established~~ |
| ~~Section 6-4-53~~ | ~~Applicability~~ |
| ~~Section 6-4-54~~ | ~~Compliance Required~~ |
| ~~Section 6-4-63~~ | ~~Permanent Water Use Restrictions~~ |
| ~~Section 6-4-64~~ | ~~Water Conservation Stage One Regulations~~ |
| ~~Section 6-4-65~~ | ~~Water Conservation Stage Two Regulations~~ |
| ~~Section 6-4-81~~ | ~~Variance~~ |
| ~~Section 6-4-92~~ | ~~Penalty~~ |
| ~~Section 15-9-37(D)~~ | ~~Customer's Responsibilities~~ |
| ~~Section 15-9-101(B)~~ | ~~Basis for Termination of Service~~ |

## *RELATED* CROSS REFERENCE MATERIALS

Specification Item 609S "Native Grassland Seeding and Planting for Erosion Control"

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| ~~Item No. 601S~~ | ~~Salvaging and Placing Topsoil~~ |
| Item No. 602S | Sodding for Erosion Control |
| Item No. 604S | ~~Seeding (Non-Native) for Erosion Control~~ Seeding for Erosion Control |
| Item No. 605S | Soil Retention Blanket |

| | |
|---|---|
| Item No. 607S | Slope Stabilization |
| Item No. 608S | Planting |

City of Austin Standards (Details)

| Standard No. | Description |
|---|---|
| 627S-1 | Grass Lined Swale |
| ~~62S7-2~~ 627S-2 | Grass Lined Swale W/ Stone Center |
| 633S-1 | Landgrading |

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

| Designation | Description |
|---|---|
| Item No. 160 | ~~Furnishing and Placing~~ Topsoil |
| Item No. 162 | Sodding for Erosion Control |
| Item No. 164 | Seeding for Erosion Control |
| Item No. 166 | Fertilizer |
| Item No. 168 | Vegetative Watering |
| Item No. 169 | Soil Retention Blankets |
| Item No. 180 | Wildflower Seeding |
| Item No. 192 | ~~Roadside Planting and Establishment~~ Landscape Planting |

ITEM NO. 648S
MULCH SOCK

648S.3 Materials

A. Mulching material can be manufactured on or off the project site and may consist of:

1. Shredded bark
2. Stump grindings
3. Composted bark

B. The mulch shall have the following composition:

1. Wood chips shall be produced from a 3-inch minus screening process (equivalent to TxDOT item 161, Compost, Section 1.6.2.B Wood Chip Requirements).
2. Large portions of silts, clays, or fine sands are not acceptable.
3. The pH of the mulch shall be between 5.5 and 8.5.
4. The organic matter content shall be greater than or equal to 25% on a dry weight basis.

C. Mulch material must be free of refuse, physical contaminants, and material toxic to plant growth. It is not acceptable for the mulch material to contain ground construction debris, biosolids, manure, or recyclable material.

D. Prior to placement, a representative sample of the mulching material must be tested and certified by the project engineer or his/her designee and accepted by the city inspector.

E. "Sock" material will be 100% biodegradable, photodegradable, or recyclable such as burlap, twine, UV photodegradable plastic, polyester, or any other acceptable material. The material mesh opening should be equal to or less than 3/8 inch (10 mm) and the material tensile strength should be equal to or greater than ~~44 psi (3.09 kg/cm2)~~202 psi (14.2 kg/$cm^2$).

## 658S.1 Description

This item governs notification requirements, as well as the furnishing and installing mitigation measures, specified by the Engineer or the designated Representative, for voids and water flow features discovered in bedrock during excavation activities of a project. This item does not apply to excavations that occur below the water table or in unconsolidated earth material. It is intended to address features observed upon initial excavation or discrete discharge points that are discovered when trench backfill material is removed. The purpose of the mitigation is to preserve voids and water flow features while maintaining utility integrity and preventing pollution.

LDC Section 25-8-281(D) ~~of the City of Austin Land Development Code (LDC)~~ requires notification of a void that: (a) is at least one square foot in total area; or (b) blows air from within the substrate; (c) consistently receives water during any rain event; and/or (d) potentially transmits groundwater. Construction must stop until mitigation measures are reviewed and approved by the Watershed Protection Department.

The necessary investigation, definitions, selection methods for determining mitigation measures, and site plan correction submittal requirements are presented in Environmental Criteria Manual Section 1.12.~~0 of the City of Austin Environmental Criteria Manual~~.

Standard Details 658S-1 through S-7 shall be used in site plan correction submittals related to the implementation of this item.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text the inch-pound units are given preference followed by SI units shown within parentheses.

## 658S.2 Submittals

A. Submittals requirements of this specification include:

1. 3 x 5 hard rock: Source, type and gradation of rock.

2. Controlled Low Strength Material (CLSM): Mix design for CLSM and other submittals shall be as required by ~~Standard Specification~~ SSM Item No. 402S.

3. Low Slump Concrete: The mix design for Class I, Curb & Gutter, Hand-vibrated Concrete (3500 psi) and other submittals shall be as required by City of Austin Standard Specification Item No. 403S.7, Table 5. The concrete shall have a maximum 3 inch (75 mm) slump. 2500 psi concrete mixtures allowed or required by the Texas Commission on Environmental Quality (TCEQ) that meet Class D, Table 5 of the same specification will be accepted as an alternate on a case-by-case basis.

4. Filter Fabric: Submittals as required by ~~Standard Specification~~SSM Item No. 620S. The material to be used for this application shall be noted.

5. Permanent Turf Reinforcement Mat (PTRM): Non-degradable turf reinforcement mat that meets the specification requirements of the U.S. Department of Transportation, Federal Highway Administration (FHWA) FP-03, Section 713.18. The mat shall be made of nylon or other inert plastic and not be coated with chemical, substance or film. Maximum mesh opening shall be no greater than 2.5 mm (0.1 inch).

## 658S.3 Materials

A. 3 x 5 hard rock: Rocks shall be sound with a minimum of 3 inches (75 mm) in smallest dimension and 5 inches (125 mm) in largest dimension. Open-graded rock of the size indicated on Details and fines removed, shall be used.

B. Controlled Low Strength Material (CLSM): This material shall meet the requirements for CLSM as specified in ~~Standard Specification~~SSM Item No. 402S.

C. Filter Fabric: This material shall meet the requirements for filter fabric as specified in ~~Standard Specification~~SSM Item No. 620S.

D. Low Slump Concrete: This concrete shall meet the requirements for Class I, Curb & Gutter, Hand-vibrated Concrete as specified in ~~Standard Specification~~SSM Item No. 403S.7, Table 5. The concrete shall have a maximum 3-inch (75 mm) slump. 2500 psi concrete mixtures allowed or required by the TCEQ that meet Class D, Table 5 of the same specification will be accepted as an alternate on a case-by-case basis.

E. Polypropylene Bags filled with pea gravel. Pea gravel shall meet requirements of ~~Standard Specification~~SSM Item No. 510.2 (5).

F. Gravel Backfill: Gravel backfill shall meet requirements of ~~Standard Specification~~SSM Item No. 510.2 (2) (a) for pipe bedding stone.

G. Permanent Turf Reinforcement Mat (PTRM): Non-degradable turf reinforcement mat shall meet the specification requirements of the U.S. Department of Transportation, Federal Highway Administration (FHWA) FP-03, Section 713.18. The mat shall be made of nylon or other inert plastic and not be coated with chemical, substance or film. Maximum mesh opening shall be no greater than 2.5 mm (0.1 inch).

## 658S.4 Procedures

A. The ~~Engineer~~ Owner or designated representative shall select a Geologist or designate a Geologist representative to observe trench walls greater than 5 feet (1.5 meters) deep of projects located within the Edwards Aquifer Recharge Zone (as defined ~~by the City of Austin~~ in City Code 25-8-2), accessible tunnel shafts, wet wells or tunnel excavations or within 500 feet (152.5 meters) of a spring or seep identified during the permit review. ~~The Geologist is defined as a geoscientist licensed under the Geology discipline by the Texas Board of Professional Geoscientists (Title 22, Part 39, Chapter 850.1). The Geologist representative is defined as a person who has been trained to identify and describe the geological origin of voids in karst terrain geology by the Geologist. A Professional Engineer with geological experience in karst terrain who qualifies to practice geoscience per the Texas Board of Professional Geoscientists rules (Title 22, Part 39, Chapters 850 and 851), may serve as the Geologist.~~ Inspections must occur at least once daily during excavation operations and prior to backfilling the trench. Contractor shall be responsible to provide 24-hour prior notice of excavation activity to the designated Geologist or Geologist representative. The Contractor shall be responsible for ensuring that the Geologist or Geologist representative has the opportunity to observe the vertical face of all excavation activities (including pre-trenching operations) prior to any initial temporary back fill operations and following backfill removal for bedding, final back fill, pipe or manhole installation.

B. Each underground void or water flow feature shall be mitigated in accordance with one or more of the following procedures and methods:

1. The Geologist or designated Geologist representative will observe the trench wall for any voids larger than 1 cubic foot (0.023 cubic meters) or any ~~water flow feature~~flowing water anomalies. The Geologist or the Owner shall call the City of Austin Environmental Inspector, the Construction Inspector or Site/Subdivision Inspector, the City of Austin geologist, and/or cave biologist, as necessary, for additional observation of the anomaly. For General Permit projects, the

General Permit office shall be notified. For City of Austin-constructed projects, the location of the anomaly shall be recorded in the Construction Inspector's daily progress report. The owner must also notify the Texas Commission on Environmental Quality (TCEQ) for projects located within the jurisdictional boundaries of the Edwards Aquifer Recharge Zone or Contributing Zone, as defined in Chapter 213 of Title 30 of the Texas Administrative Code.

2. Initial observation of the anomaly shall be made from the top of the trench. The Contractor shall submit an Excavation Safety System Plan (City of Austin Standard Technical Specification Item No. 509S) for approval and shall install all necessary safety equipment to allow direct observation of the anomaly.

3. The Contractor must stop all excavation or trenching activities within ~~25~~ 50 feet (~~7.62~~ 15.24 meters) of the outer edge of the void's interior extent.

4. In certain cases, the Geologist or designated Geologist representative may determine that the void requires protection prior to any further backfill operations. Protection preventing the backfill from entering the void may consist of plywood planking or other barricade necessary to block the backfill. Areas of flowing water may require temporary mitigation measures, as well. The Contractor shall implement all appropriate mitigation measures established by the Geologist or designated Geologist representative.

5. If a void is located at the bottom of a trench, temporary void protection per Class I, Standard Detail 658S-1, shall be provided at all times that trench excavation is halted and until Owner's geologic and biologic inspection has occurred and Contractor has been given instructions on how to proceed.

6. A second void or water flow feature inspection may be required following final excavation operations. The Contractor shall stabilize the trench to allow for observation of the anomaly from within the trench. The Contractor shall provide an Excavation Safety System Plan (~~City of Austin Standard Technical Specification~~SSM Item No. 509S) and shall install all necessary safety equipment to allow direct observation of the void or water flow feature. The Contractor shall assist in the investigation by providing access to the anomaly (e.g., ladders, harness and rigging, scaffolding, etc.) and confined space safety equipment. Contractor shall install all necessary shoring and trench protection.

7. The Contractor shall provide the safety plan for allowing trench entry for anomaly inspection. The Contractor's designated safety supervisor shall ensure that all OSHA requirements are met

during anomaly observation. The Contractor shall not place pipe, pipe bedding, and backfill within ~~25~~ 50 feet (~~7.62~~ 15.24 meters) of the anomaly prior to final inspection.

8. The Engineer or designated representative shall submit a site plan correction to the City of Austin for all voids and/or anomalies that require mitigation measures; except for voids that are less than 18 cubic feet (.504 cubic meters), are dry, have no airflow and are located above the top of a utility pipe. The site plan correction shall show the surveyed location of the void (s) and/or anomaly (ies) and shall reference mitigation measures from this specification. The corresponding detail (s) are to be included in the correction. The Contractor shall not proceed with construction of the mitigation measures, excavating, pipe placement or installing pipe bedding or backfill within ~~25~~ 50feet (~~7.62~~ 15.24 meters) of the anomaly (ies) until an approved site plan correction is acquired.

9. Voids ~~Mitigation of voids~~ that are less than 18 cubic feet (.504 cubic meters), are dry, have no airflow and are located at least 1 foot (305 mm) above the top of a utility pipe ~~may proceed following a site meeting of the Engineer, the Geologist, the City of Austin Environmental Inspector, a City of Austin geologist and concurrence of a mitigation method. The Environmental Inspector will issue a punch list that will require a site plan correction approval prior to issuing a Certificate of Occupancy on any private project or prior to a final walk-through on a subdivision project and prior to the issuance of the engineer's concurrence letter. For City of Austin General Permits office projects, a member of that office must be present at the site meeting and agree with the proposed mitigation method.~~do not require a City of Austin site plan correction approval prior to mitigation. Mitigation may occur after the City of Austin geologist concurs with the Geologist's description and the Engineer's proposed mitigation. The mitigation must be documented in a site plan correction prior to the completion of the project. TCEQ approval requirements must still be followed, if the site is located within the TCEQ-defined Edwards Aquifer Recharge Zone

10. The Contractor shall construct the void and/or water flow mitigation measure (s) in accordance with the approved site plan correction. Anticipated measures shall be documented within the Contract Documents and pay items. The Contractor and Construction Inspector shall record material quantities of all completed mitigation measures in accordance with the pay items in the Construction Inspector's daily progress report for each day that a specific mitigation event is undertaken. The Contractor shall notify the Watershed Protection Department Geologist 48 hours in advance of mitigation installation.

11. Upon completion of each void and/or water flow mitigation measure, a Geologist or designated Geologist representative shall inspect the work before the Contractor resumes construction activities within ~~25~~ 50 feet (~~7.62~~ 15.24 meters) of the anomaly. The owner's Geologist or Geologist representative must observe and photograph the phases of the installation of the mitigation measures and submit an electronic report to the Watershed Protection Department.

## 658S.5 Execution

A. GENERAL

The Engineer or designated representative shall establish the appropriate permanent void and water flow mitigation measures. Void and/or water flow mitigation measures shall be constructed as herein depicted and specified for most anomalies encountered. If the Geologist or designated Geologist representative observes unusually large voids or unforeseen circumstances, other measures may be prescribed by the Engineer or designated representative once the anomaly is observed.

B. VOID AND WATER FLOW MITIGATION MEASURES

1. Class I temporary void mitigation measures for a void at the bottom of a trench or along a sidewall of a trench, as indicated in Standard Detail 658S-1, generally consist of:

a. Temporary protection of the void shall be provided by covering the void opening with filter fabric with minimum of 3 foot (915 mm) distance from edge of void to edge of filter fabric. This action will be taken prior to covering the trench or temporary backfilling operations.

b. The void opening shall be covered with plywood planking with a minimum of 1 foot (305 mm) distance from edge of the void to the edge of the planking. Planking is to be placed to prevent backfill from entering void. Rock (minimum weight of 5 pounds (2.3. kg)) or concrete block shall be placed over planking.

2. Class II permanent void mitigation measures, as indicated in Standard Detail 658S-2, generally consist of:

a. Permanent protection of the void by hand packing with 3 to 5-inch (75 to 125 mm) rock to provide stable bearing support and covering the rock at the opening with filter fabric. Low slump concrete (3500 psi) shall be placed to cover the opening area and to seal the void at the limits of excavation. Concrete shall be a minimum of 18 inches (457 mm) thick within the void opening and shall extend a minimum of 6 inches (152 mm) beyond the edge of the void. Void openings that are less than 30 inches deep shall be sealed entirely with concrete. A form shall be used to ensure proper placement of a low slump concrete-seal over the void opening. After the void is covered, the controlled low-strength bedding and backfill material shall be placed. The controlled low-strength fill material shall extend a minimum of 5 feet (1.5 meters) beyond the edge of all voids in all directions.

b. For Grade 2 voids, additional measures may be specified by the Engineer or designated representative (e.g., increase thickness of concrete and placement of rebar reinforcement in the concrete, placement of a steel plate over void opening, etc.).

3. Class III void mitigation measures, as indicated in Standard Detail 658S-3, generally consist of:

a. Permanent protection of the void by hand packing large areas with pea gravel-filled polypropylene bags to provide stable bearing support in order to protect a void from infiltration of backfill material. If a void is greater than 100 cubic feet (2.8 cubic meters) or is located within a rock strata that is structurally unstable, then 3 to 5-inch (75 to 125 mm) rock may be utilized behind the gravel-filled polypropylene bags to prevent ground collapse. A connector pipe may be required to maintain air or water flow within a void bisected by the trench. After a void is filled, low slump concrete (Class I, 3500 psi) shall be placed to seal the void opening. If needed, place a form to ensure a minimum thickness of concrete that extends at least 18 inches (457 mm) into the void.

b. Secondary containment of wastewater and stormsewer lines by outer carrier pipe or low slump concrete (Class I, 3500 psi) or CLSM encasement is required. If CLSM encasement is proposed, then the engineer must submit pipe deflection and wall crushing calculations. Low slump concrete or CLSM encasement shall be a minimum of 6 inches (152 mm) thickness on all sides of the pipe and shall extend a minimum of 5 feet (1.5 m) beyond the edge of any voids. Design of carrier pipe must be reviewed by the City ~~of Austin~~ for all City ~~of Austin~~ wastewater and stormsewer lines prior to submittal of the site plan correction. Stabilizing collars and other supports, as needed, must be provided. The engineer must modify Standard Detail 658S-3 or provide a specific detail showing the proposed carrier pipe installation and void mitigation.

4. Class IV void mitigation measures, as indicated in Standard Detail 658S-4, are RESERVED FOR FUTURE RULE REVISION.

5. Class V void mitigation measures, as indicated in Standard Detail 658S-5, generally consist of:

a. Placement of CLSM bedding material along the length of pipe as directed by the Engineer or designated representative.

b. Placement of gravel backfill material wrapped in PTRM one foot (.305 meters) beyond limits of void in all directions. PTRM shall be placed along areas between the gravel material and trench walls/earth backfill and shall overlap at top.

c. A minimum of 3 feet (.915 meters) of CLSM backfill shall be placed along the length of pipe on either side of the gravel backfill material and shall extend a minimum of 1 foot (.305 meters) above the gravel backfill material. Forms shall be used to control the placement of CLSM material.

6. For very large voids, the Engineer shall <u>conduct a cave stability analysis per Attachment B of ECM 1.10.0 and</u> define specific mitigation measures. The Contractor will implement specific mitigation measures per the direction of the Engineer or designated representative after the site plan correction is approved by the City of Austin. <u>The mitigation measures must be agreed to by the</u>

Watershed Protection Department and affected departments or utilities such as the Austin Water Utility and the Public Works Department, Street and Bridge Operations.

C. REPORTING

1. The Contractor shall provide written documentation to the Engineer, the Owner, and the City of Austin or designated representative describing the void and water flow mitigation measures taken on the Project. The information shall be included in the Construction Inspector's daily progress report. The report shall include, as a minimum, the following information:

a. Location (line stationing, distance from permanent structure, depth in trench from adjacent surface grade, geologic strata, etc.).

b. Physical dimensions of void and/or description of water flow recorded on the Contractor Void Description and Documentation Log Sheet (provided as Attachment A).

c. Photographs, field notes, maps, sketches, and measurements.

d. Mitigation action taken and status. Include a copy of the plan sheet showing the location of the void and details for mitigation measures.

For City of Austin-constructed projects, also include the following:

e. Actual agreed-upon quantities of materials used by Contractor in execution of mitigation shall be included in the Construction Inspector's daily progress report.

f. Signature from the Contractor and Construction Inspector indicating agreement with the documented quantities and any delays associated with downtime for observation of the void.

**D.** ENFORCEMENT
Failure to comply with this rule is a violation of LDC § 25-8-281 (D), *Critical Environmental Features*. Enforcement may be pursued.

## 658S.7 Payment

This section does not obligate the City ~~of Austin~~ to pay for void and water flow mitigation measures on private projects.

The work performed for "Temporary Void Protection (Plywood Planking)" and "Pea Gravel-Filled Polypropylene Bags for Void Mitigation" will be paid for at the unit price bid per each occurrence. The unit price bid items shall include full compensation for all materials and all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

The work performed for "Controlled Low Strength Material," “Low Slump Concrete,” and “3 To 5 Inch Rock for Void Mitigation” will be paid for at the unit price bid per cubic yard. These unit bid price items shall include full compensation for all concrete, rock, curing, finishing, and for all labor, tools, materials, equipment and incidentals necessary to complete the work.

The work performed for "Filter Fabric for Void Mitigation" and for “Permanent Turf Reinforcement Mat” will be paid for at the unit price bid per square yard. These unit bid price items shall include full compensation for all materials and all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

The work performed for "Special Trench Safety Associated with Observation of Voids and/or Flowing Water" will be paid for at the unit price bid per linear foot. These unit bid price items shall include full compensation for all materials, supervision, mobilization, de-mobilization, and all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

The work performed for "Downtime Associated with Observation of Voids and/or Flowing Water" will be paid for at the unit price bid per day. This unit bid price item shall include full compensation for all materials, supervision, mobilization, de-mobilization, and all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

Payment for will be made using the following bid items:

| | | |
|---|---|---|
| **Pay Item 658S-1:** | Temporary Void Protection (Plywood Planking) | Per Each |
| **Pay Item 658S-2:** | Controlled Low Strength Material for Mitigation | Per Cubic Yard |
| **Pay Item 658S-3:** | Pea Gravel-Filled Polypropylene Bags for Void Mitigation | Per Each |
| **Pay Item 658S-4:** | 3 To 5 Inch Rock for Void Mitigation | Per Cubic Foot |
| **Pay Item 658S-5:** | Filter Fabric for Void Mitigation | Per Square Yard |

| | | |
|---|---|---|
| **Pay Item 658S-6:** | Permanent Turf Reinforcement Mat for Void Mitigation | Per Square Yard |
| **Pay Item 658S-7:** | Low Slump Concrete | Per Cubic Foot |
| **Pay Item 658S-8:** | Special Trench Safety Associated with Observation of Voids and/or Flowing Water | Per Linear Foot |
| **Pay Item 658S-9:** | Downtime Associated with Observation of Voids and/or Flowing Water | Per Day |

**END**

| ***SPECIFIC*** *CROSS REFERENCE MATERIALS* | |
|---|---|
| *Specification 658S, "Void and Water Flow Mitigation"* | |
| *City of Austin Criteria Manuals* | |
| *Designation* | *Description* |
| ECM 1.12.0 | Void and Water Flow Mitigation |
| *City of Austin Standards* | |
| *Designation* | *Description* |
| 658S-1 | Class I - Temporary Protection of Void at Bottom of Trench |
| 658S-2 | Class II - Permanent Void Mitigation Measures |

| | |
|---|---|
| 658S-3 | Class III - Void Mitigation Measures |
| 658S-4 | Class IV - Water Flow Mitigation Measures Groundwater Within Bedding Material Depth |
| 658S-5 | Class V - Water Flow Mitigation Measures Groundwater Above Bedding Material Depth |
| 658S-6 | Class V - Combination Void and Potential Water Flow Mitigation Measures |
| 658S-7 | Modified Concrete Retard |

| *City of Austin Standard Specification Items* | |
|---|---|
| *Designation* | *Description* |
| Item 402S | Controlled Low Strength Material |
| Item 403S | Concrete for Structures |
| Item 509S | Excavation Safety Systems |
| Item 510.2 (2)(a) | Pipe Materials, Pipe Bedding Stone |
| Item 510.2 (5) | Pipe Materials, Pea Gravel |
| Item 620S | Filter Fabric |

| *U.S. Dept. of Transportation, Federal Highway Administration* | |
|---|---|
| *Designation* | *Description* |

| | |
|---|---|
| FP-03, Section 713.18 | Permanent Turf Reinforcement Mat specifications |

| ***RELATED*** *CROSS REFERENCE MATERIALS* | |
|---|---|
| *Specification 658S, "Void and Water Flow Mitigation"* | |
| *Designation* | *Description* |
| ECM, Appendix P-1, Note 8 | Erosion and sedimentation control note requiring notification and work stoppage for voids discovered on a project |
| LDC 25-8-281 | Work stoppage required for voids intercepted during construction. Construction may only proceed after mitigation measures are reviewed and approved by the Watershed Protection Department. |

~~ATTACHMENT A~~
~~Contractor Void Description and Documentation Log Sheet~~

~~CONTRACTIOR VOID DESCRIPTION AND DOCUMENTATION LOG SHEET~~

~~Name:__Project Name:__~~

~~Date:__Time:__COA Site Plan No.:__~~

~~Construction Supervisor's Name:__Phone Number:__~~

~~Project Engineer:__~~

~~How was void intercepted? (trenching, excavating, etc.)~~

~~Depth of void from ground surface:__~~

~~Location of void, as distance measured from two closest surveyed stations:__~~

~~GPS Coordinates of void:__~~

~~(report as UTM State Plane Coordinate System, NAD 83 or state reference system for a handheld GPS unit)~~

~~Size of void: width__Length__height__~~

~~Depth extending into rock___~~

~~Shape of void: circular__keyhole__irregular, curved shape__~~

~~vertical fracture__fracture trend:___(azimuthal degrees)~~

~~horizontal fracture___~~

~~Characteristics: water flowing out? Rate or volume?~~

~~air flow out?~~

~~Sketch a profile of the void showing both sidewalls and the floor of the trench. Include measurements such as depth of trench, size of void (width, length, height), etc.~~

~~TAKE PHOTOGRAPHS OF THE TRENCH WALLS AND THE INTERIOR OF THE VOID.~~

~~LEFT WALL~~

[redacted]

~~RIGHT WALL~~

[redacted]

[redacted]

~~TOP VIEW~~

[redacted]

ATTACHMENT A.

**CONTRACTOR VOID DESCRIPTION AND DOCUMENTATION LOG SHEET**

City of Austin Site Plan No.:_____ Project Name:_____

TCEQ EAPP ID No:_____ Feature ID:_____

Inspection Date:_____ Time:_____

Latitude:_____ OR Easting:_____

Longitude:_____ Northing:_____

Datum:_____ Datum:_____

Coordinate System & Units:_____ Coordinate System & Units:_____

Trench Station ID:_____ Depth Below Surface:_____

Intercepted By: Backhoe Trencher Dozer Drill Other_____

Shape (Circle One): Spherical Keyhole Dome Irregular Other_____

Vertical Fracture Trend_____ Horizontal Fracture_____

Size: _____ft Length _____ft Width _____ft Height _____$ft^3$ Volume

Extends into Rock: _____ft

Water Flow (Y/N): ☐ Rate:_____ Note:_____

Air Flow (Y/N): ☐ Rate:_____ Note:_____

Closest CEF or Recharge Feature:_____ Type:_____ Distance:_____

Size Category: Grade 1 ☐ ($1\ ft^3 < V < 18\ ft^3$)

Grade 2 ☐ ($18\ ft^3 \leq V < 160\ ft^3$)

Grade 3 ☐ ($\geq 160\ ft^3$)

Water Flow Category: Type A ☐ (Dry)

Type B ☐ (<1 gpm or evidence of previous flow)

Type C ☐ (≥ 1 gpm from discrete discharge point or bedrock horizon)

Biological Category: Level 1 ☐ (No evidence of macrofauna)

Level 2 ☐ (Evidence of macrofauna)

Suggested Mitigation: Class I ☐ (**Temporary** measure only; Grade 1 and 2 voids)

Class II ☐ (Grade 1 and 2 voids; floor of trench)

Class III ☐ (Grade 1/Type A and Grade 2/Type A voids on trench sidewalls)

Class V ☐ (Grade 1 or Grade 2 with water flow features/voids on sidewalls above bedding)

Custom ☐ (Site Specific Measure)

Geologist/Inspector: _____ Phone No.: _____

Construction Supervisor: _____ Phone No.: _____

Project Engineer: _____ Phone No.: _____

## ADDITIONAL NOTES AND SKETCHES