SECTION 32 91 13
SOIL PREPARATION

PART 1 – GENERAL

1.1 SUMMARY

A. The scope of work includes all labor, materials, tools, supplies, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with furnishing, delivery, and installation of Planting Soil and /or the modification of existing site soil for use as Planting Soil, complete as shown on the drawings and as specified herein.

B. The scope of work in this section includes, but is not limited to, the following:

1. Locate, purchase, deliver and install Imported Planting Soil and soil amendments.

2. Harvest and stockpile existing site soils suitable for Planting Soil.

3. Modify existing stockpiled site soil.

    a. Modify existing site soil in place for use as Planting Soil.

    b. Install existing or modified existing soil for use as Planting Soil.

4. Locate, purchase, deliver and install subsurface Drain Lines.

5. Fine grade Planting Soil.

6. Incorporate Compost into Planting Soil.

7. Clean up and disposal of all excess and surplus material.

1.2 CONTRACT DOCUMENTS

A. Shall consist of specifications, general conditions, and the drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.

1.3 RELATED DOCUMENTS AND REFERENCES

A. Related Documents:

1. Drawings and general provisions of contract, including general and supplementary conditions and Division I specifications, apply to work of this section.

2. Related Specification Sections

a. Section 01 56 39 – Temporary Tree & Plant Protection

b. Section 32 90 00 – Planting

c. Section 32 92 19 – Seeding

d. Section 32 92 23 – Sodding

B. References: The following specifications and standards of the organizations and documents listed in this paragraph form a part of the Specification to the extent required by the references thereto. In the event that the requirements of the following referenced standards and specification conflict with this specification section the requirements of this specification shall prevail. In the event that the requirements of any of the following referenced standards and specifications conflict with each other the more stringent requirement shall prevail.

1. ASTM: American Society of Testing Materials cited section numbers.

2. U.S. Department of Agriculture, Natural Resources Conservation Service, 2003. National Soil Survey Handbook, title 430-VI. Available Online.

3. US Composting Council www.compostingcouncil.org and http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/191/LandscapeArch_Specs.pdf.

4. *Methods of Soil Analysis*, as published by the Soil Science Society of America (http://www.soils.org/).

3. *Up by Roots: Healthy Soils and Trees in the Built Environment*. 2008. J. Urban. International Society of Arboriculture, Champaign, IL.

1.4 VERIFICATION

A. All scaled dimensions on the drawings are approximate. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and quantities, and shall immediately inform PARKWAYS of any discrepancies between the information on the drawings and the actual conditions, refraining from doing any work in said areas until given approval to do so.

1.5 PROTECTION OF WORK, PROPERTY AND PERSON

A. The Contractor shall adequately protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to the Contractor's actions.

1.6 DEFINITIONS

A. Acceptable drainage: Drainage rate is sufficient for the plants to be grown. Not too fast and not too slow. Typical rates for installed Planting Soil are between one to five inches (1" – 5")

per hour. Turf soils are often higher, but drainage rates above two to three inches (2" – 3") per hour will dry out very fast. In natural undisturbed soil a much lower drainage rate, as low as one-eighth inch (1/8") per hour can still support good plant growth. Wetland plants can grow on top of perched water layers or even within seasonal perched water layers, but could become unstable in high wind events.

B. Amendment: Material added to Topsoil to produce Planting Soil Mix. Amendments are classified as general soil amendments, fertilizers, biological, and pH amendments.

C. Biological Amendment: Amendments such as Mycorrhizal additives, compost tea or other products intended to change the soil biology.

D. Compacted soil: Soil where the density of the soil is greater than the threshold for root limiting, and further defined in this specification.

E. Compost: Well decomposed stable organic material as defined by the US Composting Council and further defined in this specification.

F. Drainage: The rate at which soil water moves through the soil transitioning the soil from saturated condition to field capacity. Most often expressed as saturated hydraulic conductivity (Ksat; units are inches per hour).

G. Existing Soil: Mineral soil existing at the locations of proposed planting after the majority of the construction within and around the planting site is completed and just prior to the start of work to prepare the planting area for soil modification and/or planting, and further defined in this specification.

H. Fertilizer: Amendment used for the purpose of adjusting soil nutrient composition and balance.

I. Fine grading: The final grading of the soil to achieve exact contours and positive drainage, often accomplished by hand rakes or drag rakes other suitable devices, and further defined in this specification.

J. Finished grade: Surface or elevation of Planting Soil after final grading and 12 months of settlement of the soil, and further defined in this specification.

K. Graded soil: Soil where the A horizon has been stripped and relocated or re-spread; cuts and fills deeper than 12 inches, and further defined in this specification.

L. Installed soil: Planting soil and existing site soil that is spread and or graded to form a planting soil, and further defined in this specification.

M. Minor disturbance: Minor grading as part of agricultural work that only adjusts the A horizon soil, minor surface compaction in the top six inches (6") of the soil, applications of fertilizers, installation of utility pipes smaller than eighteen inches (18") in diameter thru the soil zone.

N. Ped: A clump or clod of soil held together by a combination of clay, organic matter, and fungal hyphae, retaining the original structure of the harvested soil.

O. Planting Soil: Topsoil, or Planting Soil Mixes which are imported or existing at the site, or made from components that exist at the site, or are imported to the site; and further defined in this specification.

P. Poor drainage: Soil drainage that is slower than that to which the plants can adapt. This is a wide range of metrics, but generally if the soil is turning grey in color it is preferable to either to plant moisture adaptive plants at smaller sizes that are young in age with shallow root balls or look at options to improve the drainage.

Q. Scarify: Loosening and roughening the surface of soil and sub soil prior to adding additional soil on top, and further defined in this specification.

R. Soil Fracturing: Deep loosening the soil to the depths specified by using a back hoe, and further defined in this specification.

S. Soil Horizons: As defined in the USDA National Soil Survey Handbook, found online at: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

T. Soil Ripping: Loosening the soil by dragging a ripping shank or chisel thru the soil to the depths and spacing specified, and further defined in this specification.

U. Soil Tilling: Loosening the surface of the soil to the depths specified with a rotary tine tilling machine, roto tiller, or spade tiller, and further defined in this specification**.**

V. Soil trenching: Cutting narrow trenches thru the soil at the depths and spacing specified to loosen the soil profile, and further defined in this specification.

W. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing Planting Soil.

X. Substantial Completion Acceptance: The date at the end of the Planting, Planting Soil, and Irrigation installation (if applicable) where PARKWAYS accepts that all work in these sections is complete and the warranty period has begun. This date may be different than the date of substantial completion for the other sections of the project, and further defined in this specification.

Y. Topsoil: Naturally produced and harvested soil from the A horizon or upper layers or the soil as further defined in this specification.

Z. Undisturbed soil: Soils with the original A horizon intact that have not been graded or compacted. Soils that have been farmed, subjected to fire or logged but not graded, and

natural forested land will be considered as undisturbed.

1.7 SUBMITTALS

A. See the contract General Conditions for policy and procedures related to submittals.

B. Submit all product submittals four (4) weeks prior to the start of the soil work.

C. Product data and certificates: For each type of manufactured product, submit data and certificates that the product meets the specification requirements, signed by the product manufacturer, and complying with the following:

1. Submit manufacturers or supplier's product data and literature certified analysis for standard products and bulk materials, complying with testing requirements and referenced standards and specific requested testing.

a. For each Compost product submit the following analysis by a recognized laboratory:

1.) pH

2.) Salt concentration (electrical conductivity)

3.) Moisture content %, wet weight basis

4.) Particle size % passing a selected mesh size, dry weight basis

5.) Stability carbon dioxide evolution rate mg CO2-C per g OM per day

6.) Solvita maturity test

7.) Physical contaminants (inerts) %, dry weight basis

8.) US EPA Class A standard, 40CFR § 503.13, Tables 1 and 3 levels Chemical Contaminants mg/kg (ppm)

b. For Coarse Sand product, submit the following analysis by a recognized laboratory:

1.) pH

2.) Particle size distribution (percent passing the following sieve sizes):
3/8 inch (9.5 mm) (100%)
No 4 (4.75 mm) (95-100%)
No 8 (2.36 mm) (85-100%)
No 16(1.18 mm) (50-85%)
No 30 (.60 mm) (25-60%)
No 50 (.30 mm) (10-30%)

No 100 (.15 mm) (2-10%)
No 200 (.075 mm) (1-2%)

D. Samples: Submit samples of each product and material, where required by Part 2 of the specification, to PARKWAYS for approval. Label samples to indicate product, characteristics, and locations in the work. Samples will be reviewed for appearance only.

1. Submit samples a minimum of eight (8) weeks prior to the anticipated date of the start of soil installation.

2. Samples of all Topsoil, Coarse Sand, Compost and Planting Soil shall be submitted at the same time as the particle size and physical analysis of that material.

E. Soil testing for Imported and Existing Topsoil, existing site soil to be modified as Planting Soil and Planting Soil Mixes.

1. Topsoil, existing site soil and Planting Soil Mix testing: Submit soil test analysis report for each sample of Topsoil, existing site soil and Planting Soil from an approved soil-testing laboratory and where indicated in Part 2 of the specification as follows:

   a. Submit Topsoil, Planting Soil, Compost, and Coarse Sand for testing at least eight (8) weeks before scheduled installation of Planting Soil Mixes. Submit Planting Soil Mix test no more than two (2) weeks after the approval of the Topsoil, Compost and Coarse Sand. Do not submit to the testing laboratory, Planting Soil Mixes, for testing until all Topsoil, Compost and Coarse Sand have been approved.

   b. If tests fail to meet the specifications, obtain other sources of material, retest and resubmit until accepted by PARKWAYS.

   c. All soil testing will be at the expense of the Contractor.

3. Provide a particle size analysis (% dry weight) and USDA soil texture analysis. Soil testing of Planting Soil Mixes shall also include USDA gradation (percentage) of gravel, coarse sand, medium sand, and fine sand in addition to silt and clay.

4. Provide the following other soil properties:

   a. pH and buffer pH.

   b. Percent organic content by oven dried weight.

   c. Nutrient levels by parts per million including: nitrogen, phosphorus, potassium, magnesium, manganese, copper, iron, sulfur, sodium, zinc, potash, and calcium. Nutrient test shall include the testing laboratory recommendations for supplemental additions to the soil for optimum growth of the plantings specified.

d. Soluble salt by electrical conductivity of a 1:2 soil water sample measured in Milliohm per cm.

e. Cation Exchange Capacity (CEC).

a. For existing soils, the soil fertility test must evaluate available soil nutrient content and fertility status, including determination of NPK, soil pH, salinity, nitrate, ammonium, phosphate, potassium, calcium, and magnesium, and other elements necessary to determine soil fertility. Nutrient test shall include the testing laboratory recommendations for supplemental additions to the soil for optimum growth of the plantings specified.

1.8 OBSERVATION OF THE WORK

A. PARKWAYS may observe the work at any time. They may remove samples of materials for conformity to specifications. Rejected materials shall be immediately removed from the site and replaced at the Contractor's expense. The cost of testing materials not meeting specifications shall be paid by the Contractor.

1. PARKWAYS may utilize the Contractor’s penetrometer and moisture meter at any time to check soil compaction and moisture.

B. PARKWAYS shall be informed of the progress of the work so the work may be observed at the following key times in the construction process. PARKWAYS shall be afforded sufficient time to schedule visit to the site. Failure of PARKWAYS to make field observations shall not relieve the Contractor from meeting all the requirements of this specification.

1. Existing Soil Conditions Review: Prior to the start of any soil modification that will utilize or modify the existing soil.

2. Excavation Review: Observe each area of excavation prior to the installation of any Planting Soil.

3. Completion of Soil Modifications Review: Upon completion of all soil modification and installation of planting soil.

4. Completion of Fine Grading and Surface Soil Modifications Review: Upon completion of all surface soil modifications and fine grading but prior to the installation of shrubs, ground covers, or lawns.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Prior to the initiation of work, the Contractor’s installer shall provide documentation indicating the firm as having at least five (5) years of experience of a scope similar to that required for the work, including the preparation, mixing and installation of soil mixes to support planting. The installer of the work in Section: Planting, shall be the same firm

installing the work in this section.

1. Installer Field Supervision: When any Planting Soil work is in progress, installer shall maintain, on site, an experienced full-time supervisor who can communicate in English with PARKWAYS.

2. Prior to the initiation of work, the Contractor's installer shall provide documentation indicating the Installer's field supervisor has a minimum of five (5) years of experience as a field supervisor installing soil, shall be trained and proficient in the use of field surveying equipment to establish grades and can communicate in English with PARKWAYS.

3. The installer's crew shall be experienced in the installation of Planting Soil, plantings, and irrigation (where applicable) and interpretation of planting plans, soil installation plans, and irrigation plans (where applicable).

4. Contractor's installer shall submit references of past projects and employee training certifications that support that the firm meets all of the above installer qualifications and applicable licensures.

B. Soil testing laboratory qualifications: an independent laboratory, with the experience and capability to conduct the testing indicated and that specializes in USDA agricultural soil testing, Planting Soil Mixes, and the types of tests to be performed. Geotechnical engineering testing labs shall not be used.

C. All delivered and installed Planting Soil shall conform to the approved submittals sample color, texture and approved test analysis.

1. PARKWAYS may request samples of the delivered or installed soil be tested for analysis to confirm the Planting Soil conforms to the approved material.

2. All testing shall be performed by the same soil lab that performed the original Planting Soil testing.

3. Testing results shall be within ten percent (10%) plus or minus of the values measured in the approved Planting Soil Mixes.

4. Any Planting Soil that fails to meet the above criteria, if requested by PARKWAYS, shall be removed and new soil installed.

D. Soil compaction testing: following installation or modification of soil, test soil compaction with a penetrometer.

1. Maintain at the site at all times a soil cone penetrometer with pressure dial and a soil moisture meter to check soil compaction and soil moisture; the Contractor must have personnel on site at all times to correctly monitor and use this device.

a. Penetrometer shall be AgraTronix Soil Compaction Meter distributed by Ben Meadows, www.benmeadows.com or approved equal.

b. Moisture meter shall be "general digital soil moisture meter" distributed by Ben Meadows, www.benmeadows.com or approved equal.

2. Prior to testing the soil with the penetrometer check the soil moisture; penetrometer readings are impacted by soil moisture and excessively wet or dry soils will read significantly lower or higher than soils at optimum moisture.

E. Contractor must furnish PARKWAYS with documentation of source of any imported soil or soil amendments, including a copy of the delivery receipt(s), prior to application and installation.

1.10 SITE CONDITIONS

A. It is the responsibility of the Contractor to be aware of all surface and subsurface conditions, and to notify PARKWAYS, in writing, of any circumstances that would negatively impact the health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected.

1. Should subsurface drainage or soil conditions be encountered which would be detrimental to growth or survival of plant material, the Contractor shall notify PARKWAYS in writing, stating the conditions and submit a proposal covering cost of corrections. If the Contractor fails to notify PARKWAYS of such conditions, they shall remain responsible for plant material under the warrantee clause of the specifications.

2. This specification requires that all Planting Soil and Irrigation (if applicable) work be completed and accepted prior to the installation of any plants.

1.11 SOIL COMPACTION – GENERAL REQUIREMENTS

A. Except where more stringent requirements are defined in this specification, the following parameters shall define the general description of the threshold points of soil compaction in existing, modified or installed soil and subsoil.

B. The following are threshold levels of compaction as determined by each method.

1. Acceptable Compaction: Good rooting anticipated, but increasing settlement expected as compaction is reduced and/or in soil with a high organic matter content.

a. Bulk Density Method – Varies by soil type see Chart on page 32 in Up By Roots.

b. Standard Proctor Method – 75-85%; soil below 75% is unstable and will settle excessively.

c. Penetration Resistance Method – 75-250 psi, below 75 psi soil becomes increasingly

unstable and will settle excessively.

2. Root limiting Compaction: Root growth is limited with fewer, shorter and slower growing roots.

   a. Bulk Density Method – Varies by soil type see Chart on page 32 in Up By Roots.

   b. Standard Proctor Method – Above 85%.

   c. Penetration Resistance Method –300 psi.

3. Excessive Compaction: Roots not likely to grow but can penetrate soil when soil is above field capacity.

   a. Bulk Density Method – Varies by soil type see Chart on page 32 in Up By Roots.

   b. Standard Proctor Method – Above 90%.

   c. Penetration Resistance Method – Approximately above 400 psi

1.12 DELIVERY, STORAGE, AND HANDLING

A. Weather: Do not mix, deliver, place or grade soils when frozen or with moisture above field capacity.

   1. Protect soil and soil stockpiles, including the stockpiles at the soil blender's yard, from wind, rain and washing that can erode soil or separate fines and coarse material, and contamination by chemicals, dust and debris that may be detrimental to plants or soil drainage. Cover stockpiles with plastic sheeting or fabric at the end of each workday.

B. All manufactured packaged products and material shall be delivered to the site in unopened containers and stored in a dry enclosed space suitable for the material and meeting all environmental regulations. Biological additives shall be protected from extreme cold and heat. All products shall be freshly manufactured and dated for the year in which the products are to be used.

C. Deliver all chemical amendments in original, unopened containers with original labels intact and legible, which state the guaranteed chemical analysis. Store all chemicals in a weather protected enclosure.

D. Bulk material: Coordinate delivery and storage with PARKWAYS and confine materials to neat piles in areas acceptable to PARKWAYS.

1.13 EXCAVATING AND GRADING AROUND UTILITIES

A. Contractor shall carefully examine the civil, record, and survey drawings to become familiar

with the existing underground conditions before digging.

B. Determine location of underground utilities and perform work in a manner that will avoid damage. Hand excavate as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.

C. Notification: The Contractor shall be responsible for contacting Louisiana One Call at 811 (1-800-272-3020) to verify the location of underground utilities prior to location flagging or excavation. Additionally, the Contractor shall contact the Department of Public Works for traffic signal line, street light and communication line locations..

SECTION 32 91 13
SOIL PREPARATION

PART 2 - PRODUCTS

2.01 IMPORTED TOPSOIL

A. Imported Topsoil definition: Fertile, friable soil containing less than five percent (5%) total volume of the combination of subsoil, refuse, roots larger than one inch (1") diameter, heavy, sticky or stiff clay, stones larger than two inches (2") in diameter, noxious seeds, sticks, brush, litter, or any substances deleterious to plant growth. The percent (%) of the above objects shall be controlled by source selection, not by screening the soil. Topsoil shall be suitable for the germination of seeds and the support of vegetative growth.

B. Imported Topsoil shall not contain weed seeds in quantities that cause noticeable weed infestations in the final planting beds. Topsoil must also be free of viable plants or plant parts of common Bermuda grass, quack grass, Johnson grass, nutsedge, poison ivy, Canada thistle, or others as may be specified.

C. Imported Topsoil shall meet the following physical and chemical criteria:

2. Soil texture: USDA loam, loamy sand, silt loam, sandy clay loam or sandy loam with clay content between 15 and 25%. And a combined clay/silt content of no more than 55%.

3. pH value shall be between 6.0 and 7.0.

4. Percent organic matter (OM): 2.0-5.0%, by dry weight.

5. Soluble salt level: Less than 500 ppm.

6. Soil chemistry suitable for growing the plants specified.

D. Imported Topsoil shall be a harvested soil from fields or development sites. The organic content and particle size distribution shall be the result of natural soil formation. Manufactured soils where Coarse Sand, Composted organic material or chemical additives has been added to the soil to meet the requirements of this specification section shall not be acceptable.

E. Imported Topsoil for Planting Soil shall NOT have been screened and shall retain soil peds or clods larger than two inches (2") in diameter throughout the stockpile after harvesting.

F. Stockpiled Existing Topsoil at the site, meeting the above criteria, may be acceptable.

G. Provide a two gallon sample from each Imported Topsoil source with required soil testing results. The sample shall be a mixture of the random samples taken around the source stockpile or field. The soil sample shall be delivered with soil peds intact that represent the size and quantity of expected peds in the final delivered soil.

2.02 COMPOST

A. Compost: Blended and ground leaf, wood and other plant based material, composted for a minimum of nine (9) months and at temperatures sufficient to break down all woody fibers, seeds and leaf structures, free of toxic material at levels that are harmful to plants or humans. Source material shall be yard waste trimmings blended with other plant or manure based material designed to produce Compost high in fungal material.

B. Compost shall be commercially prepared Compost and meet US Compost Council STA/TMECC criteria or as modified in this section for "Compost as a Landscape Backfill Mix Component".

1. Compost shall comply with the following parameters:

a. pH: 5.5 - 7.0 (based on soil amendment needs)

b. Soil salt (electrical conductivity): maximum 5 dS/m (mmhos/cm).

c. Moisture content %, wet weight basis: 30 – 60.

d. Particle size, dry weight basis: 98% pass through 3/4 inch screen or smear.

e. Stability carbon dioxide evolution rate: mg CO_2-C/ g OM/ day < 2.

f. Solvita maturity test: > 6.

g. Physical contaminants (inerts), %, dry weight basis: <1%.

h. Chemical contaminants, mg/kg (ppm): meet or exceed US EPA Class A standard, 40CFR § 503.13, Tables 1 and 3 levels.

i. Biological contaminants select pathogens fecal coliform bacteria, or salmonella, meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) level requirements.

C. Provide a two gallon sample with manufacturer's literature and material certification that the product meets the requirements.

2.03 COARSE SAND

A. Clean, washed, sand, free of toxic materials

1. Coarse concrete sand, ASTM C-33 Fine Aggregate, with a Fines Modulus Index of 2.8 and 3.2.

2. Coarse Sands shall be clean, sharp, natural Coarse Sands free of limestone, shale and slate particles. Manufactured Coarse Sand shall not be permitted.

3. pH shall be lower than 7.0.

4. Provide Coarse Sand with the following particle size distribution:

Sieve	Percent passing
3/8 inch (9.5 mm)	100
No 4 (4.75 mm)	95-100
No 8 (2.36 mm)	80-100
No 16 (1.18 mm)	50-85
No 30 (.60 mm)	25-60
No 50 (.30 mm)	10-30
No 100 (.15 mm)	2-10
No 200 (0.75 mm	2-5

B. Provide a two (2) gallon sample with manufacturer's literature and material certification that the product meets the requirements.

C. Batture sand will not be accepted.

2.04 FERTILIZER, BIOLOGICAL AND OTHER AMENDMENTS

A. Fertilizer: Soil tests shall be made to determine the exact requirements for any amendments. Soil tests shall be conducted by a reputable laboratory and results provided to Parkways Planning & Design Division.

1. All fertilizers (either granular or liquid) shall be uniform in composition, free flowing and suitable for application with approved equipment.

2. Fertilizers shall be delivered to the site fully labeled, according to applicable fertilizer laws and shall bear the name, trade name or trademark, and warranty of the producer or manufacturer.

3. Fertilizer applications shall be determined by soil tests. If soil testing is waived where there is insufficient time for complete soil tests, fertilizer materials that supply the following levels of nutrients can be applied: nitrogen – fifteen percent (15%), phosphoric acid – five percent (5%), soluble potash – ten percent (10%).

4. Fertilizers shall be distributed uniformly over the entire planting area(s).

2.05 LIME (as applicable)

A. ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:

1. Class: Class T, with a minimum 99 percent passing through No. 8 (2.36-mm) sieve and a minimum 75 percent passing through No. 60 (0.25-mm) sieve.

2. Provide lime in form of dolomitic limestone.

B. Provide manufacturer's literature and material certification that the product meets the requirements.

2.06 EXISTING SOIL (Acceptable for planting with minimum modifications)

A. General definition of existing soil: Surface soil in the areas designated on the soils plan as existing soil, that is not altered, compacted to root limiting density, graded or contaminated before or during the construction process and considered acceptable for planting and long term health of the plants specified either as it exists or with only minor modification.

B. Contractor shall verify that the soil in the designated areas is suitable prior to the beginning of planting bed preparation work in that area. In the event that the work of this project construction has damaged the existing soil in areas designated for use as Planting Soil to the point where the soil is no longer suitable to support the plants specified, PARKWAYS may require modification of the damaged soil up to and including removal and replacement with soil of equal quality to the soil that existed prior to construction. Examples of damage include further compaction, contamination, grading, creation of hard pan or drainage problems, and loss of the O, and/or A horizon.

C. Do not begin work on additional modifications until changes to the contract price are approved by PARKWAYS.

D. Protect existing soil from compaction, contamination, and degradation during the construction process.

E. Unless otherwise instructed, remove all existing plants, root thatch, and non-soil debris from the surface of the soil using equipment that does not increase compaction of soil to root limiting levels.

F. Modifications:

1. When results of soil tests recommend chemical adjustments, till surface soil to six inches or greater after chemical adjustments have been are applied.

2. Remove existing turf thatch, ground cover plants and weeds.

3. Provide pre-emergent weed control if indicated.

4. Make chemical adjustment as recommended by the soil test.

2.07 MODIFIED EXISTING SOIL (Soil suitable for planting with indicated modification)

A. General definition: Surface soil in the areas designated on the soils plan as Modified Existing Soil has been altered and or graded before or during the construction process but is still considered acceptable for planting and long term health of the plants specified with the

proposed modifications. Modifications respond to the soil problems expected or encountered. Contractor shall verify that the soil in the designated areas is suitable for modification at the beginning of planting bed preparation work in that area.

B. Contractor shall verify that the soil in the designated areas is suitable for the specified modification at the beginning of planting bed preparation work in that area. In the event that the work of this project construction has damaged the existing soil in areas designated for modification to the point where the soil is no longer suitable to support the plants specified with the specified modification, PARKWAYS may require further modification of the damaged soil up to an including removal and replacement with soil of equal quality to the soil that would have resulted from the modification. Damage may include further compaction, contamination, grading, creation of hard pan or drainage problem, and loss of the O, and/or the A horizon.

C. General requirements for all soil modifications:

   a. Take soil samples, test for chemical properties, and make appropriate adjustments.

   b. Unless otherwise instructed, remove all existing plants, root thatch, and non-soil debris from the surface of the soil using equipment that does not add to the compaction in the soil.

   c. All soil grading, tilling and loosening must be completed at times when the soil moisture is below field capacity. Allow soil to drain for at least two days after any rain event more than one inch (1”) in 24 hours, or long enough so that the soil does not make the hand muddy when squeezed.

   d. Provide pre-emergent weed control after the soil work is complete and plants planted but prior to adding mulch to the surface, if indicated by weed type and degree of threat.

D. Modified existing soil – soil removed, stockpiled, and spread

E. Description of condition to be modified: Existing soil that is suitable for reuse as Planting Soil but is in the wrong place of elevation, or cannot be adequately protected during construction. Soil is to be harvested, stockpiled and re-spread with or without further modifications as indicated.

F. Modifications:

   e. Excavate existing soil from the areas and to depths designated on the drawings. Stockpile in zones noted on the drawings or in areas proposed by the Contractor.

      1.) Prepare a soil stock pile plan for approval.

   f. Excavate soil using equipment and methods to preserve the clumps and peds in the

soil. Generally this means using the largest piece of equipment that is practical for the project size and scope.

g. Protect stock piles from erosion by compacting or tracking the soil surface, covering with breathable fabric or planting with annual grasses as appropriate for the season, location, and length of expected time of storage.

h. Re-spread soil as required in Part 3 of this specification.

G. Modified existing soil – compacted surface soil (Tilling Option)

1. Description of condition to be modified: Surface soil compaction to a maximum of six inches (6”) deep from traffic or light grading. Original A horizon may be previously removed or graded but lower profile intact with acceptable compaction levels and limited grading. The soil organic matter, pH and chemistry in the A horizon may not be suitable for the proposed plants and may need to be modified as required.

2. Modifications:

a. Till top six inches (6”) or deeper of the soil surface, with a *roto tiller, spade tiller,* ripper or agricultural plow. Spread two to three inches (2” – 3”) of Compost on the surface of the tilled soil and make any chemical adjustment as recommended by the soil test.

b. Till or disk the Compost (if applicable) into the loosened soil. Smooth out grades with a drag rake or drag slip.

H. Modified existing soil – compacted surface soil (Radial Trenching Option)

1. Description of condition to be modified: Surface soil compaction to a maximum of twenty-four inches (24”) deep from traffic or light grading. Original A horizon may be previously removed or graded but lower profile below twenty-four inches (24”) intact with acceptable compaction levels and limited grading. The soil organic matter, pH and chemistry in the A horizon may not be suitable for the proposed plants and may need to be modified as required.

2. Modifications:

a. Using a trenching machine, dig trenches to the extent and depth shown on the plans and details.

b. Backfill the trench with the soil removed from the trench. Add additional site soil if needed to fill the trench to be flush to the existing grade after the soil settlement.

I. Modified existing soil – compacted subsoil

1. Description of condition to be modified: Deep soil compaction the result of previous

grading, filling and dynamic or static compaction forces. Original A horizon likely removed or buried. The soil organic matter, pH and chemistry in the A horizon is likely not suitable for the proposed plants and should be modified as required.

2. Soil Ripping (applicable to sites less than 7,500 square feet):

    a. Step one: After grading and removing all plants and debris from the surface, using a tracked dozer or similar large grading equipment, loosen the soil by dragging a ripping shank or chisel thru the soil to depths of 24 inches with ripping shanks spaced 18 inches or less apart in two directions. The number of shanks per pull is dependent on the degree of soil compaction and the size of the dozer.

    b. Step 2: Spread 3-4 inches of Compost over the ripped area and till into the top 6 inches of the soil surface.

3. Soil Fracturing (applicable to sites over 7,500 square feet):

    a. Step one: After grading and removing all plants and debris from the surface, spread 2 – 3 inches of Compost over the surface of the soil. Loosen the soil to depth of 18 - 24 inches, using a backhoe to dig into the soil through the Compost. Lift and then drop the loosened soil immediately back into the hole. The bucket then moves to the adjacent soil and repeats the process until the entire area indicated has been loosened.

    b. Step 2: Spread 3-4 inches of Compost over the ripped area and till into the top 6 inches of the soil surface.

4. Trenching (not applicable within the critical root zone (CRZ) of any tree):

    a. Step one: After grading and removing all plants and debris from the surface using a chain trenching machine, dig 24 inch deep trenches, 24 inches apart across the entire area. Maintain an 18-inch standoff from the edges of all curbs, paving and structures. Backfill the trenches with Compost.

    b. Step 2: Spread 3-4 inches of Compost over the trenches area and till into the top 6 inches of the soil surface. Compost tilling treatment shall extend to the edges of curbs, paving and structures.

5. Following soil ripping or fracturing the average penetration resistance should be less than 250 psi to the depth of the ripping or fracturing.

6. Do not start planting into ripped or fractured soil until soil has been settled or leave grades sufficiently high to anticipate settlement of 10 – 15% of ripped soil depth.

J. Modified existing soil – low organic matter

1. Description of condition to be modified: Low soil organic matter and/or missing A horizon but soil is not compacted except for some minor surface compaction. The soil organic matter, pH and/or chemistry are likely not suitable for the proposed plants and should be modified as required.

2. Modifications:

    a. Spread 3 - 4 inches of Compost over the surface of the soil and make chemical adjustment as recommended by the soil test.

    b. Till Compost into the top 6 inches of the soil.

K. Modified existing soil – soil within the root zone of existing established trees

1. Description of condition to be modified: Surface compaction near or above root limited levels in the upper soil horizon the result of traffic or other mechanical compaction.

2. Modifications:

    a. Remove the tops of all plants to be removed from the root zone. Remove sod with a walk behind sod cutter. Do not grub out the roots of plants to be removed.

    b. Use a pneumatic air knife to loosen the top nine to twelve inches (9” – 12”) of the soil. Surface roots may move and separate from soil during this process but the bark on roots should not be broken. Pneumatic air knife shall be as manufactured by: Concept Engineering Group, Inc., Verona, PA (412) 826-8800 or Supersonic Air Knife, Inc., Allison Park, PA (866) 328 5723 or approved equivalent.

    c. Make chemical adjustment as recommended by the soil test and add two to three inches (2” – 3”) of Compost over the soil as applicable.

    d. Using the pneumatic air knife, mix the Compost (as applicable) into the top six to eight inches (6” – 8”) of the loosened soil.

    e. Work in sections such that the entire process - including irrigation - can be completed in one day. Apply approximately one inch of water over the loosened soil at the completion of each day’s work. Apply mulch or turf as indicated on the drawings within one week of the completion of work.

2.08 PLANTING SOIL MIXES

A. General definition: Mixes of Existing Soil or Imported Topsoil, Coarse Sand, and or Compost to make a new soil that meets the project goals for the indicated planting area. These may be mixed off site or onsite, and will vary in Mix components and proportions as indicated.

B. Planting Mix - moderately slow draining soil for trees and shrub beds

1. A Mix of Imported Topsoil, Coarse Sand and Compost. The approximate Mix ratio shall be:

Mix component	% by moist volume
Imported Topsoil unscreened	45-50%
Coarse sand	40-45%
Compost	10%

2. Final tested organic matter between 2.75 and 4% (by dry weight).

3. Mix the Coarse Sand and Compost together first and then add to the Topsoil. Mix with a loader bucket to loosely incorporate the Topsoil into the Coarse Sand/Compost Mix. DO NOT OVER MIX! Do not mix with a soil blending machine. Do not screen the soil. Clumps of Soil, Compost and Coarse Sand will be permitted in the overall Mix.

4. At the time of final grading, add fertilizer if required to the Planting Soil at rates recommended by the testing results for the plants to be grown.

5. Provide a two gallon sample with testing data that includes recommendations for chemical additives for the types of plants to be grown. Samples and testing data shall be submitted at the same time.

2.09 PRE-EMERGENT HERBICIDES

A. Chemical herbicides are designed to prevent seeds of selective plants from germinating. Exact type of herbicide shall be based on the specific plants to be controlled and the most effective date of application.

B. Submit report of expected weed problems and the recommendation of the most effective control for approval by Parkways Planning & Design Division. Provide manufacturer's literature and material certification that the product meets the requirements.

PART 3 – EXECUTION

3.01 SITE EXAMINATION

A. Prior to installation of Planting Soil, examine site to confirm that existing conditions are satisfactory for the work of this section to proceed.

B. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope toward the under drain lines as shown on the drawings.

C. Confirm that surface all areas to be filled with Planting Soil are free of construction debris, refuse, compressible or biodegradable materials, stones greater than 2 inches diameter, soil crusting films of silt or clay that reduces or stops drainage from the Planting Soil into the subsoil; and/or standing water. Remove unsuitable material from the site.

D. Confirm that no adverse drainage conditions are present.

E. Confirm that no conditions are present which are detrimental to plant growth.

F. Confirm that utility work has been completed per the drawings.

G. Confirm that irrigation work, which is shown to be installed below prepared soil levels, has been completed.

H. If unsatisfactory conditions are encountered, notify PARKWAYS immediately to determine corrective action before proceeding.

3.02 COORDINATION WITH PROJECT WORK

A. The Contractor shall coordinate with all other work that may impact the completion of the work.

B. Prior to the start of work, prepare a detailed schedule of the work for coordination with other trades.

C. Coordinate the relocation of any irrigation lines, heads or the conduits of other utility lines that are in conflict with tree locations. Root balls shall not be altered to fit around lines. Notify PARKWAYS of any conflicts encountered.

3.03 GRADE AND ELEVATION CONTROL

A. Provide grade and elevation control during installation of Planting Soil. Utilize grade stakes, surveying equipment, and other means and methods to assure that grades and contours conform to the grades indicated on the plans.

3.04 SITE PREPARATION

A. Excavate to the proposed subgrade. Maintain all required angles of repose of the adjacent materials as shown on the drawings or as required by this specification. Do not over excavate compacted subgrades of adjacent pavement or structures. Maintain a supporting 1:1 side slope of compacted subgrade material along the edges of all paving and structures where the bottom of the paving or structure is above the bottom elevation of the excavated planting area.

B. Remove all construction debris and material including any construction materials from the subgrade.

C. Remove any contaminated subsoil.

D. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope approximately parallel to the finished grade and/or toward the subsurface drain lines as shown on the drawings.

E. In areas where Planting Soil is to be spread, confirm subgrade has been scarified.

F. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use one-half inch (1/2") plywood and or plastic sheeting as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work.

G. At the end of each working day, clean up any soil or dirt spilled on any paved surface.

H. Any damage to the paving or site features or work shall be repaired at the Contractor's expense.

3.05 SOIL MOISTURE

A. Volumetric soil moisture level, in both the Planting Soil and the root balls of all plants, prior to, during and after planting shall be above permanent wilt point and below field capacity for each type of soil texture within the following ranges.

Soil texture	**Permanent wilting point**	**Field capacity**
Sand, Loamy sand, Sandy loam	5-8%	12-18%
Loam, Sandy clay, Sandy clay loam	14-25%	27-36%
Clay loam, Silt loam	11-22%	31-36%
Silty clay, Silty clay loam	22-27%	38-41%

B. The Contractor shall confirm the soil moisture levels with a moisture meter (Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent). If moisture is found to be too low, the planting holes shall be filled with water and allowed to drain before starting any planting operations. If the moisture is too high, suspend planting operations until the soil moisture drains to below field capacity.

3.06 EXISTING SOIL MODIFICATION

A. Follow the requirements for modifying existing soil as indicated in Part 2 for the different types of soil modifications.

3.07 PLANTING SOIL AND PLANTING SOIL MIX INSTALLATION

A. Prior to installing any Planting Soil from stockpiles or Planting Soil Mixes blended off site, PARKWAYS shall approve the condition of the subgrade and the previously installed subgrade preparation and the installation of subsurface drainage.

B. All equipment utilized to install or grade Planting Soils shall be wide track or balloon tire machines rated with a ground pressure of four (4) psi or less. All grading and soil delivery equipment shall have buckets equipped with six inch (6”) long teeth to scarify any soil that becomes compacted.

C. In areas of soil installation above existing subsoil, scarify the subgrade material prior to installing Planting Soil.

D. Scarify the subsoil of the subgrade to a depth of three to six inches (3” – 6”) with the teeth of the back hoe or loader bucket, tiller or other suitable device.

E. Immediately install the Planting Soil. Protect the loosened area from traffic. DO NOT allow the loosened subgrade to become compacted.

F. In the event that the loosened area becomes overly compacted, loosen the area again prior to installing the Planting Soil.

G. Install the Planting Soil in twelve to eighteen inch (12” – 18”) lifts to the required depths. For sodding projects only, install the Planting Soil to a minimum depth of four inches (4”) over area to be sodded. Apply compacting forces to each lift as required to attain the required compaction. Scarify the top of each lift prior to adding more Planting Soil by dragging the teeth of a loader bucket or backhoe across the soil surface to roughen the surface.

H. Phase work such that equipment to deliver or grade soil does not have to operate over previously installed Planting Soil. Work in rows of lifts the width of the extension of the bucket on the loader. Install all lifts in one row before proceeding to the next.

I. Work out from the furthest part of each bed from the soil delivery point to the edge of the bed area.

J. Where possible place large trees first and fill Planting Soil around the root ball.

K. Installing soil with soil or mulch blowers or soil slingers shall not be permitted due to the over mixing and soil ped breakdown cause by this type of equipment.

L. Where travel over installed soil is unavoidable, limit paths of traffic to reduce the impact of compaction in Planting Soil. Each time equipment passes over the installed soil it shall reverse out of the area along the same path with the teeth of the bucket dropped to scarify the soil. Comply with the paragraph "Compaction Reduction" (section 3.09) in the event that soil becomes over compacted.

M. The depths and grades shown on the drawings are the final grades after settlement and shrinkage of the compost material. The Contractor shall install the Planting Soil at a higher level to anticipate this reduction of Planting Soil volume. A minimum settlement of approximately ten to fifteen percent (10 - 15%) of the soil depth is expected. All grade increases are assumed to be as measured prior to addition of surface Compost till layer, mulch, or sod.

3.08 COMPACTION REQUIREMENTS FOR INSTALLED OR MODIFIED PLANTING SOIL

A. Compact installed Planting Soil to the compaction rates indicated; compact each soil lift as the soil is installed.

B. Existing soil that is modified by tilling, ripping or fracturing shall have a density to the depth of the modification, after completion of the loosening, such that the penetrometer reads approximately 75 to 250 psi at soil moisture approximately the mid-point between wilting point and field capacity. This will be approximately between 75 and 82% of maximum dry density standard proctor.

C. Installed Planting Soil Mix and re-spread existing soil shall have a soil density through the required depth of the installed layers of soil, such that the penetrometer reads approximately 75 to 250 psi at soil moisture approximately the mid-point between wilt point and field capacity. This will be approximately between 75 and 82% of maximum dry density standard proctor.

D. Planting Soil compaction shall be tested at each lift using a penetrometer calibrated to the required soil compaction and moisture level. The same penetrometer and moisture meter shall be used to test installed soil throughout the work.

E. Maintain moisture conditions within the Planting Soil during installation or modification to allow for satisfactory compaction. Suspend operations if the Planting Soil becomes wet. Apply water if the soil is overly dry.

F. Provide adequate equipment to achieve consistent and uniform compaction of the Planting Soils. Use the smallest equipment that can reasonably perform the task of spreading and compaction.

G. Do not pass motorized equipment over previously installed and compacted soil except as authorized below.

1. Light weight equipment such as trenching machines or motorized wheel barrows is permitted to pass over finished soil work.

2. If work after the installation and compaction of soil compacts the soil to levels greater than the above requirements, follow the requirements of the paragraph "Over Compaction Reduction" below.

3.09 OVER COMPACTION REDUCTION

A. Any soil that becomes compacted to a density greater than the specified density shall be dug up and reinstalled. This requirement includes compaction caused by other sub-contractors after the Planting Soil is installed and approved.

B. Surface roto tilling shall not be considered adequate to reduce over compaction at levels 6 inches or greater below finished grade.

3.10 INSTALLATION OF CHEMICAL ADDITIVES

A. Following the installation of each soil and prior to fine grading and installation of the Compost till layer, apply chemical additives as recommended by the soil test, and appropriate to the soil and specific plants to be installed.

B. Apply fertilizer in accordance with manufacturer's instructions.

C. Apply after smooth raking of topsoil and prior to installation of sod.

D. Apply fertilizer no more than 48 hours before laying sod.

E. Mix thoroughly into upper four inches (4”) of topsoil.

F. Lightly water to aid the dissipation of fertilizer.

3.11 FINE GRADING

A. PARKWAYS shall approve all rough grading prior to the installation of Compost, fine grading, planting, and mulching.

B. Grade the finish surface of all planted areas to meet the grades shown on the drawings, allowing the finished grades to remain higher – ten to fifteen percent (10 – 15%) of depth of soil modification – than the grades on the grading plan, as defined in paragraph Planting Soil Installation, to anticipate settlement over the first year.

C. Utilize hand equipment, small garden tractors with rakes, or small garden tractors with buckets with teeth for fine grading to keep surface rough without further compaction. Do not use the flat bottom of a loader bucket to fine grade, as it will cause the finished grade to become overly smooth and or slightly compressed.

D. Provide for positive drainage from all areas toward the existing inlets, drainage structures and or the edges of planting beds. Adjust grades as directed to reflect actual constructed field conditions of paving, wall and inlet elevations. Notify PARKWAYS in the event that conditions make it impossible to achieve positive drainage.

E. Provide smooth, rounded transitions between slopes of different gradients and direction. Modify the grade so that the finish grade before adding mulch and after settlement is one or two inches below all paving surfaces or as directed by the drawings.

N. Fill all dips and remove any bumps in the overall plane of the slope. The tolerance for dips and bumps in shrub and ground cover planting areas shall be a two inch (2”) deviation from the plane in ten feet (10’). The tolerance for dips and bumps in lawn areas shall be a one inch (1”) deviation from the plane in ten feet (10’).

3.12 INSTALLATION OF COMPOST TILL LAYER

A. After Planting Soil Mixes are installed in planting bed areas and just prior to the installation of shrub or groundcover plantings, spread three to four inches (3” – 4”) of Compost (as required per soil testing recommendations) over the beds and roto till into the top 4 - 6 inches of the Planting Soil. This step will raise grades slightly above the grades required in paragraph “Fine Grading”. This specification anticipates that the raise in grade due to this tilling will settle within a few months after installation as Compost breaks down. Additional settlement as defined in paragraph “Planting Soil and Planting Soil Mix installation” must still be accounted for in the setting of final grades.

3.13 CLEAN-UP

A. During installation, keep the site free of trash, pavements reasonably clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.

B. Immediately clean up any spilled or tracked soil, fuel, oil, trash or debris deposited by the Contractor from all surfaces within the project or on public right of ways and neighboring property.

C. Once installation is complete, wash all soil from pavements and other structures. Ensure that mulch is confined to planting beds and that all tags and flagging tape are removed from the site. PARKWAYS seals, if present, are to remain on the trees and removed at the end of the warranty period.

D. Make all repairs to grades, ruts, and damage to the work or other work at the site.

E. Remove and dispose of all excess Planting Soil, subsoil, mulch, plants, packaging, and other material brought to the site by the Contractor.

3.14 PLANTING SOIL AND MODIFIED EXISTING SOIL PROTECTION

A. The Contractor shall protect installed and/or modified Planting Soil from damage including contamination and over compaction due to other soil installation, planting operations, and operations by other Contractors or trespassers. Maintain protection during installation until acceptance. Utilize fencing and matting as required or directed to protect the finished soil work. Treat, repair or replace damaged Planting Soil immediately.

B. Loosen compacted Planting Soil and replace Planting Soil that has become contaminated as determined by PARKWAYS. Planting Soil shall be loosened or replaced at no expense to PARKWAYS.

C. Till and restore grades to all soil that has been driven over or compacted during the installation of plants.

D. Where modified existing soil has become contaminated and needs to be replaced, provide imported soil that is of similar composition, depth and density as the soil that was removed.

3.15 PROTECTION DURING CONSTRUCTION

A. The Contractor shall protect planting and related work and other site work from damage due to planting operations, operations by other Contractors or trespassers.

B. Maintain protection during installation until the date of plant acceptance (see specifications section 01 56 39 Temporary Tree & Plant Protection). Treat, repair or replace damaged work immediately.

C. Provide temporary erosion control as needed to stop soil erosion until the site is stabilized with mulch, plantings or turf.

D. Damage done by the Contractor, or any of their sub-contractors to existing or installed plants, or any other parts of the work or existing features to remain, including large existing trees, soil, paving, utilities, lighting, irrigation, other finished work and surfaces including those on adjacent property, shall be cleaned, repaired or replaced by the Contractor at no expense to PARKWAYS. PARKWAYS shall determine when such cleaning, replacement or repair is satisfactory. Damage to existing trees shall be assessed by a certified arborist.

3.16 FINAL ACCEPTANCE / SOIL SETTLEMENT

A. At the end of the plant guarantee and maintenance period, (see Specification section 32 90 00 Planting) PARKWAYS shall observe the soil installation work and establish that all provisions of the contract are complete and the work is satisfactory.

B. Restore any soil settlement and or erosion areas to the grades shown on the drawings. When restoring soil grades remove plants and mulch and add soil before restoring the planting. Do not add soil over the root balls of plants or on top of mulch.

C. Failure to pass acceptance: If the work fails to pass final acceptance, any subsequent observations must be rescheduled as per above.

END OF SECTION