Construction Specification for Growing Medium

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TS 5.10.01 SCOPE

This specification describes the requirements for the following:

1) Requirements for reuse of existing site soil as growing medium.

2) Mixing and testing of topsoil, coarse sand and compost components to create several different types of growing medium, applicable for the following applications:

   - Type 1 – Standard Mix, for seeding, sodding and trees planted in turf
   - Type 2 – Planting Bed Mix, for planting of shrubs and perennials
   - Type 3 – Boulevard Mix, for trees planted in hardscaped boulevards

3) Installation of growing medium.

4) Compacting and grading of growing medium.

5) Adding organic material to the surface layer of growing medium.

TS 5.10.02 REFERENCES

This specification refers to the following standards, specifications or publications:

City of Toronto Standard Specifications

TS 5.00	Construction Specification for Sodding
TS 5.30	Construction Specification for Planting

American Society of Testing and Materials

C33 / C33M-13	Standard Specification for Concrete Aggregates
D422-63(2007)e1	Standard Test Method for Particle-Size Analysis of Soils
D698-12e1	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3))
D2434-68(2006)	Standard Test Method for Permeability of Granular Soils (Constant Head)
F1632-03(2010)	Standard Test Method for Particle Size Analysis and Sand Shape Grading of Golf Course Putting Green and Sports Field Rootzone Mixes
F1647-11	Standard Test Methods for Organic Matter Content of Athletic Field Rootzone Mixes
F1815-11	Standard Test Methods for Saturated Hydraulic Conductivity, Water Retention, Porosity, and Bulk Density of Athletic Field Rootzones

Canadian Council of Ministers of the Environment

Guidelines for Compost Quality (PN 1340) 2005

Compost Quality Alliance

TMECC	Test Method for the Examination of Composting and Compost

Ontario Ministry of the Environment

Guideline for the Production of Compost in Ontario, Companion to the Ontario Quality Standards (July 2012)
Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act (April 2011)

TS 5.10.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

CSSS means Canadian System of Soil Classification

USDA means US Department of Agriculture

TS 5.10.04 DESIGN AND SUBMISSION REQUIREMENTS

TS 5.10.04.01 Submittals

TS 5.10.04.01.01 *Checklist*

For checklist form, see *Contractors Submittal Checklist* form, at the end of this specification section. This list is a summary of the requirements and is not intended to supplant or modify the detailed descriptions of the requirements below. Note that many of the submittals must be provided a minimum of eight weeks before the installation of growing medium.

TS 5.10.04.01.02 *Certificates*

Submit certification for approval that all growing medium components and the growing medium meet all environmental standards of the Province of Ontario and the City of Toronto. Certificate shall state that all materials are within the required maximum levels of all biological, metal and chemical contaminants.

TS 5.10.04.01.03 *Product Data*

Submit manufacturer product data and literature for approval for coarse sand, aggregate, pine bark compost and yard waste compost. Provide submittal as part of the submittal of components for the growing medium prior to the submission of the growing medium.

Submit the manufacturer's particle size analysis, pH and the manufacturer's Fines Modulus Index for coarse sand. Provide manufacturer's identification and location for each coarse sand source.

Submit the manufacturer's pine bark compost and yard waste compost analysis for approval. Chemical and physical testing shall be conducted by soil laboratories accredited by The Compost Quality Alliance (CQA) utilizing test methods specified in The Test Methods for Examination of Composting and Compost (TMECC) except as specified herein.

The compost analysis shall include:

Table 1: Compost analysis

Parameter	Testing Method
pH	TMECC 4.11A
soluble salt (mmhos/cm)	TMECC 4.10-A
% moisture	
% dry weight organic matter	TMECC 5.07-A
carbon: nitrogen	(C:N) ratio
particle size % passing 50 mm and 10 mm	TMECC 2.02-B
Solvita maturity index	Solvita
physical contaminants (% dry weight)	TMECC 3.08-A

Submit testing for chemical and biological contaminants and pathogens as required by local government regulations.

Certified reports shall be from samples taken within four months of the date of the sample submission.

TS 5.10.04.01.04 *Material source locations*

Submit locations of topsoil and growing medium material sources. The City shall have the right to reject any material source. Submit the name, address and telephone number of the source contact, and the location of the soil source including directions to the specific field location on the property. Include a list of all crops grown on the soil, and any herbicides and pesticides applied, over the previous three years.

TS 5.10.04.01.05 *Samples*

Submit samples of each product and material where required by the specification to the Contract Administrator for approval. Label samples to indicate product, specification number, characteristics, and locations in the Work. Samples shall be reviewed for appearance only. Compliance with all other requirements is the exclusive responsibility of the Contractor. Delivered materials shall closely match the samples.

Submit duplicate samples for each of: topsoil, coarse sand, aggregate, pine bark compost, yard waste compost and growing medium, as described in this clause.

Samples should be labeled to include the location of the source of the material.

Samples of each material shall be submitted at the same time as the product data and testing data of that material. Samples and analysis of topsoil, and growing medium must be submitted within 28 Days of sampling.

Each test report shall be marked with the following information:

1) Date issued.
2) Project Title and names of Contractor and material supplier.
3) Name of material and reference number from TS 5.10.05, herein, identifying the type of material.
4) Date, place, and time of sampling.
5) Location of material source.
6) Testing laboratory name, address, and telephone number, and name(s), as applicable, of each field and laboratory inspector.
7) Type(s) of test.
8) Results of tests.
9) Suggested acceptable ranges of the test data for the types of plants to be planted.
10) Recommendations for amendments to bring the growing medium to within these acceptable ranges.

Samples of growing medium shall be submitted no less than 14 Days after the approval of the mix components.

Do not submit samples of growing medium for approval until all mix component testing has been reviewed and approved by the Contract Administrator.

TS 5.10.04.01.06 *Testing Reports*

Submit soil test analysis report for approval for each sample of topsoil and growing medium from an approved soil-testing laboratory, as below:

The testing laboratory shall be approved by the City in advance. All soil andgrowing medium tests shall be conducted by soil laboratories accredited by The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), except as noted below. Current listing of accredited laboratories may be obtained on the web at www.omafra.gov.on.ca/english/crops/resource/soillabs.htm. Submit the name of the soil lab for approval prior to starting the testing process.

All tests shall be performed in accordance with the current testing standards and protocols of the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA).

Particle size distribution analysis for all topsoil and growing medium including the following gradient of mineral content:

Table 2: Particle size distribution

CSSS/USDA designation	Size (mm)
gravel	2 – 75
total sand	0.05 – 2
very coarse sand	1 – 2
coarse sand	0.5 – 1
medium sand	0.25 – 0.5
find sand	0.1 – 0.25
very fine sand	0.05 – 0.1
silt	0.002 – 0.05
clay	< 0.002

Particle size analysis for and growing medium to include sand sieve analysis, and shall be according to ASTM D422 (hydrometer test) or ASTM F1632 (pipette test).

Chemical analysis including the following:

1) pH
2) Nutrient Levels by parts per million including:
   - Phosphorus
   - Potassium
   - Magnesium
   - Calcium

   Nutrient test shall include the testing laboratory recommendations for supplemental additions to the growing medium

3) Soluble salt by electrical conductivity of a 1:2 soil water sample measured in mmhos/cm
4) Cation Exchange Capacity (CEC) measured in meq/100g
5) Percent Organic Matter by dry weight as determined by ignition (Ash Burn Test or Walkley/Black Test, ASTM F1647)
6) Carbon to Nitrogen (C:N) ration

Infiltration/Permeability/Hydraulic Conductivity testing shall be done using ASTM D2434 or ASTM F1815 at 85 per cent compaction at proctor density (ASTM D698-91).

Report suitability of topsoil or growing medium for growth of applicable planting material. Soil analysis tests shall include recommendations for normal acceptable ranges of soil chemical attributes for the type of plants included in the project in the same units as the test data.

The City may request additional growing medium test on different mix component ratios in order to attain results that more closely meet the mix requirements.

Laboratory's comments or recommendations regarding amendment requirements or procedures shall not be interpreted to prescribe or dictate procedures or quantities of soil materials for the work of this Contract. Final approval of soil amendment procedures shall be approved by the Contract Administrator.

The City reserves the right to require additional soil analysis at any time such additional samples of materials are deemed necessary for verification of conformance to specification requirements. Contractor shall furnish samples for this purpose upon request and shall perform and pay for additional testing as requested by the Contract Administrator at no extra cost to the City.

Contractor to arrange for testing at start of project. All testing shall be at the expense of the Contractor.

TS 5.10.04.01.07 *In-Situ Compaction Testing*

Submit results of all compaction testing required by the specifications to the City for approval.

1) Installed growing medium shall be tested in-situ with a cone penetrometer and a soil moisture meter.

    a) Testing shall be arranged for and paid for by the Contractor.
    b) The cone penetrometer testing can be arranged through a local arborist, using a product such as the Soil Compaction Tester as manufactured by Dickey-John, and distributed by Ben Meadows www.benmeadows.com, or approved equal.
    c) Penetration resistance shall be to the full depth of the installed soil profile or 750 mm, whichever is less.
    d) One test shall be performed once every 25 m² of growing medium surface area. The City may request additional testing locations.

2) Maintain a record log of all compaction testing for submission and approval. The record log shall include the date, location, depth and pressure reading of each test. Test location data shall be plotted on a site plan.

3) Submit the compaction log to the City at the end of installation period. The compaction log shall be kept current and available at the site for review at all times.

TS 5.10.04.02 Sequencing and Scheduling

Prepare a detailed schedule of the installation of growing medium for coordination with other trades, and submit to the City for approval prior to the start of the project.

Schedule the installation of growing medium after the area is no longer required for use by other trades and work or protect the growing medium from compaction and contamination.

Schedule all utility installations prior to beginning work in this section.

TS 5.10.04.03 Delivery, Storage and Handling

Do not mix, deliver or place growing medium in frozen, wet, or muddy weather conditions.

Where construction sequencing requires work during cold weather, protect sub grades and bulk materials from freezing using covers or as needed heated tenting. Sub grades that are sufficiently well drained to preclude the buildup of ice may be installed and built upon during freezing weather provided the surface is cleared of snow and any ice bound material.

Harvest topsoil and prepare growing medium ahead of the scheduled work during periods of warm weather. Protect stockpiles of topsoil and growing medium from freezing and saturation. Remove topsoil from within the interior of the stockpile where topsoil and growing medium are not frozen. At the end of each day cover the exposed working face of the stockpile sufficient to keep the pile from freezing.

Protect stockpiles from rain and washing that can separate fines and coarse material. Cover stockpiles with plastic sheeting at the end of each workday.

Protect growing medium stockpiles from contamination by chemicals, dust and debris that may be detrimental to plants or drainage.

Do not use delivery or installation methods that overly mix pulverize the growing medium. Soil blowing equipment and soil slinger equipment shall not be permitted to move growing medium.

TS 5.10.04.04 Site Conditions

It is the responsibility of the Contractor to be aware of all surface and sub-surface conditions, and to report any circumstances that will negatively impact drainage. Do not proceed with the work until unsatisfactory conditions have been corrected. Proceeding with work constitutes acceptance of existing or corrected conditions.

TS 5.10.04.04.01 *Utilities*

Determine location of all utilities including vaults, conduits, pipes and wires adjacent to, below or within the areas of work. Perform all work in a manner, which will avoid damage to any utility. Hand excavate near any utility.

TS 5.10.04.04.02 *Waterproofing*

Perform work in a manner, which will avoid damage to waterproofing membrane, protection board or other structural sealing materials.

TS 5.10.04.04.03 *Construction Sequencing*

Install all growing medium at the point in the project sequencing that they can be adequately protected from other work at the site.

TS 5.10.04.04.04 *Coordination*

Coordinate work with that of other trades affecting or affected by work of this section and cooperate to assure the steady progress of work.

TS 5.10.04.04.05 *Safety*

The Contactor shall be responsible for pedestrian and vehicular safety and control all movement within and around the work site. Provide the necessary barriers, warning devices and ground personnel needed to give safety, warning and protection to persons and vehicular traffic within the area of work including the Contractor's equipment and temporary storage within the public right-of-way. Provide any additional items required by the City.

TS 5.10.04.04.06 *Damage*

During site preparation, growing medium installation and protection, the Contractor shall be responsible for all damage to existing features above and below ground incurred as a result of work operations. Repairs or replacements or both shall be made to the satisfaction of the Contract Administrator.

Protect all installed material from compaction, contamination and erosion. Install fences; utilize mulch, mats and geofabrics over the surface of the soil as required. In the event that any soil becomes compacted, contaminated or eroded, repair the damage by removing and reinstalling the compacted material according to TS 5.10.07.11, herein.

TS 5.10.05 MATERIALS

TS 5.10.05.01 Topsoil Component

Topsoil shall be naturally occurring soil, harvested from the O or A horizon of the soil profile, suitable for the germination of seeds and the support of vegetative growth, and meeting the following requirements:

Soil particle size distribution	
Sand (0.05 – 2 mm)	40 – 65%
Clay (<0.002 mm)	15 – 23%
Gravel (2 – 75 mm)	< 5%
Chemical analysis	pH: 5.5 – 7.8
Nutrient levels (ppm)	
Phosphorous	10 – 60
Potassium	80 – 250
Calcium	< 5000
Magnesium	100 – 300
Soluble salt	< 0.50 mmhos/cm
Cation Exchange Capacity (CEC)	> 20 meq/100g
Percent organic matter	2.5 – 5%

Topsoil shall retain a significant portion of the soils ped structure when stockpiled at the supplier's yard. At least 25 per cent of the soil volume shall be soil peds larger than 25 mm in diameter. Peds are defined as the clumps of soil naturally aggregated during the soil building process, by clays and soil biology. Peds of any size are permissible.

Peds are to be determined by visual approximation for both size and quantity. The City shall determine when soils have sufficient peds.

Topsoil shall not be screened through sieves or screens smaller than 50 mm to avoid eliminating the required soil peds.

Topsoil shall not contain materials and contaminants at levels that would be harmful to plant growth; or impair drainage, installation or maintenance of the resulting growing medium; or adversely impact its intended use including the following:

- Refuse; roots; construction debris; wood or sticks larger than 25 mm in diameter; brush; clumps of root mats of plants and toxic materials
- Lumps of clay or subsoil larger than 50 mm
- Stones larger than 75 mm
- Deleterious substances; plant or soil pests; undesirable grasses including crabgrass or couch grass, noxious or weeds or weed seeds.

The City shall determine if the quantities of any of these materials is sufficient to cause rejection of the topsoil. The aggregate of all the above materials shall not exceed 5 per cent of the total soil volume as assessed by visual inspection.

Topsoil shall be in conformance Toronto Municipal Code Chapter 489, Grass and Weeds. The contractor shall be responsible for removing all weeds that germinate during the plant maintenance period.

Topsoil shall be harvested from approved source locations that comply with all regulations governing the removal of topsoil.

Topsoil may be purchased from a source of collected topsoil from development sites provided the sources of the topsoil stock pile is of similar textures and meets the requirements of this specification.

Topsoil shall not be a soil mix including any combination of sand, fertilizer, or organic matter or compost added to mineral soil in order to meet the texture, chemical or organic requirements for topsoil. The organic matter content of the soil shall be residue of long term, natural soil building processes and not from added organic matter or compost.

Submit source location and a list of all crops grown on the soil and any herbicides and pesticides applied over the previous three years.

Submit duplicate 4 L samples (total 8 L) from each topsoil source with soil testing results. The sample shall be a mixture of the random samples taken around the source field or stockpile. The delivered sample shall represent the soil ped content in the stockpile.

TS 5.10.05.02 Coarse Sand Component

Coarse sand shall be clean, sharp, mineral sand, washed to remove silt and clay particles, and meeting the following requirements:

Coarse concrete sand, ASTM C33 with a Fines Modulus Index between 2.8 and 3.2.

Table 3: Physical analysis

Sieve size (mm)	Per cent passing
9.5	100
4.75	95 – 100
2.36	80 – 100
1.18	50 – 85
0.60	25 – 85
0.30	5 – 30
0.15	0 – 10
0.075	≤ 3

Chemical analysis shall be as follows:

a) pH < 8.6
b) Soluble Salt < 0.5 mmhos/cm
c) Percent Organic Matter < 0.5%.

Coarse Sand shall not contain toxic substance at levels harmful to plant growth.

Submit duplicate 1 L (total 2 L) samples with manufacturer's literature and material testing certification that the product meets the above requirements.

TS 5.10.05.03 Compost Component

Compost shall be a stable, humus-like material produced from the aerobic decomposition, composted and cured until the maturity status complies with indices specified below. Except as specified herein, Compost shall be according to the requirements for Category A Compost as defined in the Guidelines for Compost Quality.

- Yard waste compost feedstock shall be yard waste trimmings or source-separated municipal solid waste or both.
- Pine bark compost feedstock shall be 98 per cent pine trees with less than 10 per cent combined pine wood fiber and sawdust content.

Compost shall not contain debris such as sharp objects, plastics, trace elements and foreign matter in excess of that defined for Category A Compost. Total of all stones, recognizable branches, wood chips and roots larger than 25 mm in diameter shall be less than 5 per cent by volume.

Compost shall have moisture content between 35 and 55 per cent when blended or applied.

Compost shall be composted long enough to exhibit a dark brown color, approximately Munsell colour 7.5 R; Value 3 or lower; Chroma 2 or lower. Color shall be determined by visual comparison of the sample to the Munsell Soil Color Chart, most current edition.

Compost shall have a strong aerobic (sweet) odor. Compost lacking a strong aerobic odor or which has an anaerobic (sour) or a strong pine or alcohol odor shall be rejected. Odor may be determined during the submittal sample review and at the time of any inspections of materials by the Contract Administrator by observation of the inspector.

Certification: provide the following documentation:

A statement that the compost meets all health and safety regulations.

Feedstock type and percentage in the final compost product.

Testing: Compost shall have one (1) composite sample tested from each 100 cubic metres of material intended for use in growing medium. The results of compost analysis shall be provided by the Compost supplier for approval. Compost shall meet the following criteria as reported by the following laboratory tests:

Physical analysis

Particle size yard waste compost	95% pass through 50 mm screen
	25% pass through 10 mm screen
Particle size pine bark compost	95% pass through 20 mm screen
	25% pass through 6 mm screen

Chemical analysis

Parameter	Range
pH yard waste compost	5.0 – 7.8
pH pine bark compost	4.0 – 5.0
soluble salt	< 3.5 mmhos/cm
% moisture	35 – 55%
% organic matter	35 – 55%
Solvita maturity index	Solvita

C:N ratio 15:1 – 25:1 (for Yard Waste only)

Physical contaminants (including man-made inerts) < 1 per cent dry weight basis

Metal content shall comply with Interim Guidelines for the Production and Use of Aerobic Compost in Ontario except for copper and zinc, which must comply with Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the *Environmental Protection Act* Table 3 (medium to fine textured soils).

Pathogen reduction shall meet Section 6.0 of Interim Guidelines for the Production and Use of Aerobic Compost in Ontario.

Submit duplicate 1 L (total 2 L) samples with manufacturer's literature and material testing certification that the product meets the requirements.

TS 5.10.05.04 Existing Site Soil as Growing Medium

Note: Specifiers should note that there are likely many sites in the city of Toronto where the soil can be reused and installed in to the soil zones being constructed. These would be places where the underlying soil is disturbed and compacted native soils of suitable texture and pH. In most cases the existing soil only requires loosening the compaction and adding yard waste compost. Soils that would not be suitable include: those with high clay or silt content, with very high or low pH, contaminated with chemicals and or salt, or which have been mixed with gravels or unshrinkable fills. Making the determination if this is feasible requires the examination of the soil conditions by a soil expert.

However, often, reasonable investigation of the soil is not possible until large areas of paving have been removed. This delay may make the decision for reuse difficult. Other considerations are project schedule and space to temporarily store soil at the site and to undertake the compost mixing operations. In tight urban sites these constraints may make reuse of soil overly expensive. The design team must evaluate all the factors in soil reuse before proceeding to assume that this concept is feasible. This decision should not be left to the Contractor to decide, although it might be left in the specification as an option provided it does not have a negative impact on the project cost.

Existing site soil for seeding, sodding and tree planting may be used as growing medium at sites where the existing soil has been analyzed by an agricultural soil scientist and determined to be suitable for its intended purpose. The City may approve the use of existing soils and may require additional amendments for the soil where recommended by the soil report.

The following are requirements for existing site soil to be used as growing medium.

Soil particle size distribution	
Sand (0.05 – 2 mm)	40 – 65%
Clay (< 0.002 mm)	15 – 23%
Gravel (2 – 75 mm)	< 8%
Chemical analysis	pH: 5.5 – 7.8
Nutrient levels (ppm)	
Phosphorous	10 – 60
Potassium	80 – 250

Calcium	< 5000
Magnesium	100 – 300
Soluble salt	< 2 mmhos/cm
Percent organic matter	2.5 – 5%
Infiltration/Permeability/Hydraulic Conductivity	50 –75 mm/hr at 85% Proctor density

Soil testing to determine the above described soil conditions shall be at sufficient intervals to accurately depict the soil quality but no less than one test per 20 cubic metres of soil.

Submit duplicate 4 L (total 8 L) samples with material testing certification that the product meets the requirements.

Submit the agricultural soil scientist report for approval. The report shall describe the extent and depth of the soil to be reused, and the soils quality relative to the required parameters. It is understood that obtaining accurate soil information in urban areas is difficult if there is paving over the soil. A preliminary soil report shall be submitted a minimum of eight weeks prior to the installation of the soil. Once the soil has been made accessible by the construction, the soil shall be reevaluated and a final report submitted. Urban Forestry may alter the approval or make additional requirements based on the final soils report.

Existing Site Soil to be reused shall be excavated to break up compaction and reinstalled at the compaction required for growing medium.

Excavation, moving, stockpiling and installation of existing site soil shall utilize means and methods that preserve soil peds. Large compacted soil peds up to 200 mm in any dimension are acceptable.

Yard waste compost shall be loosely incorporated to the soil at the time of installation at a rate of 20 per cent by volume.

Push the existing site soil into stockpiles no greater than 1.5 m tall. Cover the stockpile with yard waste compost of sufficient volume to roughly equal 20 per cent of the stockpile volume. Using the bucket of a back how, drag the pile to approximately one-third its height. Working from the bottom, turn the pile over one. Install into the soil area following the requirements for growing medium.

Fertilizer shall be added to the soil, if required to meet the chemical requirements of growing medium.

Soil shall not be contaminated with toxic chemicals harmful to humans or plants at levels regulated by provincial or federal laws.

TS 5.10.05.05 Type 1 – Standard Mix

For sodding, sodding and trees planted in turf, a mixture of topsoil, coarse sand and compost components mixed in the appropriate proportions, such that the growing medium shall meet the following parameters:

Total sand (0.05 – 2 mm)	50 – 60%
Silt	20 – 40%
Clay	6 – 10%
Chemical analysis(1)	pH: 6.0 – 7.8(1)
Nutrient levels (ppm)	
Phosphorous	10 – 60
Potassium	80 – 250
Calcium	< 5000
Magnesium	100 – 300
Soluble salt	< 1.5 mmhos/cm
Percent organic matter	2 – 5%
Infiltration/Permeability/Hydraulic Conductivity	50 –75 mm/hr at 85% Proctor density

(1) Specifiers should note that the pH maximum of 7.8 will be acceptable for most trees and other plants in the Toronto area. However, if the design team specifies pH sensitive trees or plants, the pH maximum should be lowered to an appropriate level for those plants. Note that lower pH growing medium will cost more due to the lack of availability of lower pH components. Coordinate the specification with the design team on species requirements.

Mix the growing medium with a loader bucket to preserve topsoil peds using the following method:

Mix the coarse sand and compost together separately.

Spread a layer of topsoil approximately 300 mm thick and apply the required proportions of coarse sand/compost mix over the topsoil.

Push the topsoil, coarse sand and compost into a pile and then drag out into a layer mixing the soil with the bucket. Repeat the mixing action a second time to gain an approximate mixture of the material. Do not over mix.

This method assumes that there is an additional mixing of the materials as it is moved to the final stockpile, placed into the delivery trucks, deposited at the project site, and spread into the planting space.

This method assumes that soil will not be installed using soil blower or soli slinging equipment.

Submit duplicate 4 L (total 8 L) samples with material testing certification that the product meets the requirements.

TS 5.10.05.06 Type 2 – Planting Bed Mix

For horticultural beds of shrubs and perennials, a mixture of topsoil, coarse sand and compost mixed to the following proportions, by volume:

Topsoil	50%
Coarse sand	20%
Pine bark compost	30%

The growing medium shall meet the following parameters:

Chemical analysis(1)	pH: 6.0 – 7.8(1)
Nutrient levels (ppm)	
Phosphorous	10 – 60
Potassium	80 – 250
Calcium	< 5000
Magnesium	100 – 300
Soluble salt	< 1.5 mmhos/cm
Percent organic matter	> 5%
Infiltration/Permeability/Hydraulic Conductivity	50 –75 mm/hr at 85% Proctor density

(1) Specifiers should note that the pH maximum of 7.8 will be acceptable for most trees and other plants in the Toronto area. However, if the design team specifies pH sensitive trees or plants, the pH maximum should be lowered to an appropriate level for those plants. Note that lower pH growing medium will cost more due to the lack of availability of lower pH components. Coordinate the specification with the design team on species requirements.

Submit duplicate 4L (total 8 L) samples with material testing certification that the product meets the requirements.

TS 5.10.05.07 Type 3 – Boulevard Mix

For trees planted in hardscaped boulevards, a mixture of topsoil, coarse sand and compost mixed to the following proportions, by volume:

Topsoil	40 – 45%
Coarse sand	40 – 50%
Pine bark compost	12 – 15%

The growing medium shall meet the following parameters:

Soil particle size distribution		
	Medium to coarse sand (0.25 – 2 mm) plus gravel (2 – 5 mm)	> 45%
	Total combined silt and clay	18 – 35%
Chemical analysis[1]		pH: 6.0 – 7.8[1]
Nutrient levels (ppm)		
	Phosphorous	10 – 60
	Potassium	80 – 250
	Calcium	< 5000
	Magnesium	100 – 300
Soluble salt		< 1.5 mmhos/cm
Percent organic matter		3 – 5%
Infiltration/Permeability/Hydraulic Conductivity	50 –75 mm/hr at 85% Proctor density	

(1) Specifiers should note that the pH maximum of 7.8 will be acceptable for most trees and other plants in the Toronto area. However, if the design team specifies pH sensitive trees or plants, the pH maximum should be lowered to an appropriate level for those plants. Note that lower pH growing medium will cost more due to the lack of availability of lower pH components. Coordinate the specification with the design team on species requirements.

Mix the growing medium with a loader bucket to preserve topsoil peds using the following method:

Mix the coarse sand and compost together separately.

Spread a layer of topsoil approximately 300 mm thick and apply the required proportions of coarse sand/compost mix over the topsoil.

Push the topsoil, coarse sand and compost into a pile and then drag out into a layer mixing the soil with the bucket. Repeat the mixing action a second time to gain an approximate mixture of the material. Do not over mix.

This method assumes that there is an additional mixing of the materials as it is moved to the final stockpile, placed into the delivery trucks, deposited at the project site, and spread into the planting space.

This method assumes that soil will not be installed using soil blower or soil slinging equipment.

Submit duplicate 4L (total 8 L) samples with material testing certification that the product meets the requirements.

TS 5.10.05.08 Soil Amendments

Chemicals and other materials designed to increase soil fertility as recommended in soil testing report. All products 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. All products shall be freshly manufactured and dated for the season in which the products are to be used.

Fertilizer for planting shall be organic fertilizer, as defined under the *Fertilizers Act*. Submit manufacturer's product literature.

Fertilizer selections shall be based on the recommendations of the soil test.

TS 5.10.06 EQUIPMENT – Not Used

TS 5.10.07 CONSTRUCTION

TS 5.10.07.01 Site Examination

Examine the surface grades and soil conditions for any circumstances that might be detrimental to soil drainage, such as uneven sub grades and waterproofing that may hold or pond water, deposits of construction-related waste or soil contamination, storage of material or equipment, soil compaction or poor drainage. Confirm that all utility work and installation of planter drainage has been completed and tested. Examine the grading, verify all elevations.

Confirm that all other work in the area of growing medium installation is completed. Notify the Contract Administrator in writing of any unsatisfactory conditions.

TS 5.10.07.02 Coordination with Project Work

The Contractor shall coordinate with all other work that may impact the completion of the work. Protect installed growing medium from compaction by other trades.

TS 5.10.07.03 Grade and Elevation Control

Provide grade and elevation control during installation of growing medium. Utilize grade stakes, surveying equipment and other means and methods to assure that grades and contours are as specified on the Contract Drawings.

Maintain grade stakes until the grades have been viewed by the Contract Administrator.

TS 5.10.07.04 Site Preparation

In areas not above structure, excavate to the proposed sub grade. Maintain all required angles of repose of the adjacent materials as shown on the drawings or as required to support adjacent materials or structures. Do not over excavate compacted subgrades of adjacent pavement or structures. Remove all construction debris and material.

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

Do not proceed with the installation of growing medium, until all utility work in the area has been installed.

Do not begin growing medium installation until all subsurface drainage, and irrigation main lines shown on the Contract Drawings are viewed and approved by the City.

Protect adjacent walls, walks and utilities from damage or staining by the soil. Use 12 mm plywood or plastic sheeting or both to cover existing concrete, metal and masonry work and other items as directed during the progress of the work.

1) Clean up any soil or other materials spilled on any paved surface, including at the end of each working day.

2) Any damage to the paving or architectural work shall be repaired by the Contractor at no extra cost the City.

TS 5.10.07.05 Growing Medium Installation

Prior to installing any growing medium, the Contract Administrator shall approve the condition of the subgrade and the previously installed sub grade preparation and the installation of subsurface drainage material.

In areas of soil installation above existing subsoil, till the growing medium into the bottom layer of subsoil.

1) Loosen or till the subsoil of the subgrade to a depth of 50 to 75 mm with a backhoe or other suitable device.
2) Spread a layer of the specified growing medium 50 to 75 mm deep over the subgrade. The use of soil blowing equipment or "soil slinging" equipment is not permitted to install growing medium.
3) Thoroughly till the growing medium and the subgrade together.
4) Protect the tilled area from traffic. Do not allow the tilled sub grade to become compacted.
5) In the event that the tilled area becomes overly compacted, re-till the area again prior to installing the growing medium.

Immediately install the remaining growing medium in 300 to 400 mm lifts to the required depths. Work out from the installed soil such that equipment does not have to pass over the installed soils.

The depths and grades shown on the drawings are the final grades after settlement and shrinkage of the organic material. The contractor shall install the growing medium at a higher level to anticipate this reduction of growing medium volume depending upon predicted settling properties for each type of growing medium as indicated on the drawing.

Utilize grading and earth moving equipment that uses low impact tracks that is rated to exert a static force on the ground of no more than 20 kg/m². All equipment used to install soil shall have buckets equipped with teeth to loosen soil compaction.

When any equipment passes over previously prepared subgrade or installed soil it shall reverse out of the soil area over the same path dragging the teeth of the bucket over the tracks to break surface compaction created by the equipment.

Coordinate the installation of water harvesting system and drain lines within the growing medium.

TS 5.10.07.06 Growing Medium Compaction

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

Maintain moisture conditions within the growing medium during installation to allow for satisfactory compaction. Suspend installation operations if the growing medium becomes wet. Do not place growing medium on wet or frozen sub grade.

Lightly compact each 300 to 400 mm lift to achieve the following test results.

Growing Medium compaction shall be tested at each lift using a cone penetrometer to between 70,000 and 140,000 kg/m² (100 and 200 psi) when the soil is between 12 and 20 per cent moisture.

Compact growing medium under the root balls of all trees to between 200,000 and 250,000 kg/m² (275 and 350 psi) when the soil is between 12 and 20 per cent moisture to reduce settlement and provide a stable base for the tree as indicated on the drawings.

At the end of the installation of the growing medium and prior to the installation of additional organic matter and plants, take a minimum of four undisturbed samples from locations selected by the City to determine bulk density. Submit test results for approval.

Confirm Infiltration Rate of installed growing medium is 50 to 75 mm/hr.

TS 5.10.07.07 Protection

Protect growing medium from compaction and contamination by dust, debris, and any toxic material harmful to plants or humans after placement. Any area, which becomes compacted, shall be tilled to a depth of 150 mm. Any uneven or settled areas shall be filled and re graded.

Phase the installation of the growing medium such that equipment does not have to travel over already installed growing medium.

TS 5.10.07.08 Growing Medium Fine Grading

The City shall view all rough grading prior to the installation of organic matter, fine grading, planting, and mulching.

Set grades at time of installation high enough relative to the type of growing medium and settlement anticipated so that the growing medium will be at the correct grades after the 12 month settlement period.

This specification assumes that initial settlement during the first 12 months after installation will be between 10 and 15 per cent of the installed depth. Assure that the grading is mounded sufficiently high enough to accommodate this settlement.

At the end of the planting warrantee period, if grades have settled greater than 5 per cent of the depth below the grades shown on the drawings, reset the grades to the final grades shown on the grading plan.

Adjust the finish grades to meet field conditions as directed.

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 the City in the event that conditions make it impossible to achieve positive drainage.

Provide smooth transitions between slopes of different gradients and direction. Modify the grade so that the finish grade is flush with all paving surfaces or as directed by the drawings.

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 25 mm deviation from the plane in 2000 mm.

Restore all grades after the installation of plants. Remove any excess soil removed during the planting process.

TS 5.10.07.09 Installation of Yard Waste Compost

In all areas of growing medium in open planting beds, after the specified growing medium is installed, and just prior to the installation of tree, shrub or groundcover plantings, spread 100 mm of yard waste compost and roto-till into the top 150 mm of the growing medium. Restore grades after tilling.

TS 5.10.07.10 Clean-Up

During installation, keep pavements clean and work area in an orderly condition.

Keep the site clear of trash and debris at all times. Immediately dispose of wrappings or waste materials associated with products necessary for the completion of the work.

All trash and debris shall be kept in a central collection container. Do not bury trash and debris in back-fill.

Once installation is complete, remove any excess soil from pavements or embedded fixtures.

TS 5.10.07.11 Protection During Construction

The Contractor shall protect work and materials from damage including: compaction, contamination, and erosion due to operations by other Contractors or trespassers. Maintain protection during installation until acceptance. Treat, repair or replace damaged growing medium installation work immediately.

Till compacted growing medium and replace growing medium that has become contaminated as determined by the City. Growing medium shall be tilled or replaced by the Contractor at no extra cost the City.

TS 5.10.07.12 Repair of Settled Growing Medium

At the end of 12 months after the date of substantial completion of the growing medium installation work, inspect the site and restore any areas where the grades have settled beyond the elevations shown on the drawings by an amount greater than 5 per cent of the design depth.

In shrub planting areas where the settlement is 75 mm or less, remove the mulch, top dress the area with the specified growing medium and re-mulch. All ground cover areas and shrub planting areas where the settlement is greater than 75 mm remove the mulch and plants, add the specified growing medium, re-plant and re-mulch.

TS 5.10.08 QUALITY ASSURANCE – Not Used

TS 5.10.09 MEASUREMENT FOR PAYMENT

TS 5.10.09.01 Existing Site Soil Mix

Measurement of existing site soil mix shall be measured by volume in cubic metres (m^3).

TS 5.10.09.02 Type 1 – Standard Mix, 100 mm Thick
Type 1 – Standard Mix, 200 mm Thick
Type 1 – Standard Mix, 300 mm Thick

Measurement of standard mix growing medium shall be measured by area in square metres (m^2).

TS 5.10.09.03 Type 2 – Planting Bed Mix, 100 mm Thick
Type 2 – Planting Bed Mix, 200 mm Thick
Type 2 – Planting Bed Mix, 300 mm Thick

Measurement of planting bed growing medium shall be measured by area in square metres (m^2).

TS 5.10.09.04 Type 3 – Boulevard Mix, 100 mm Thick
Type 3 – Boulevard Mix, 200 mm Thick
Type 3 – Boulevard Mix, 300 mm Thick

Measurement of boulevard mix growing medium shall be measured by area in square metres (m^2).

TS 5.10.10 BASIS OF PAYMENT

TS 5.10.10.01 Existing Site Soil Mix – Item
Type 1 – Standard Mix, 100 mm Thick – Item
Type 1 – Standard Mix, 200 mm Thick – Item
Type 1 – Standard Mix, 300 mm Thick – Item
Type 2 – Planting Bed Mix, 100 mm Thick – Item
Type 2 – Planting Bed Mix, 200 mm Thick – Item
Type 2 – Planting Bed Mix, 300 mm Thick – Item
Type 3 – Boulevard Mix, 100 mm Thick – Item
Type 3 – Boulevard Mix, 200 mm Thick – Item
Type 3 – Boulevard Mix, 300 mm Thick – Item

Payment at the Contract Price for the above tender item shall be full compensation for all labour, Equipment and Material to do the work.

Form 1: Contractors Submittal Checklist

✓	Section #	Item
		Certificates
	TS 5.10.04.01.02	Certification that all growing medium components and the growing medium meet all environmental standards
		Product Data
	TS 5.10.04.01.03	*Product data: Coarse sand*
	TS 5.10.04.01.03	Product data: Pine bark compost
	TS 5.10.04.01.03	Product data: Yard waste compost
		Material Source Locations
	TS 5.10.04.01.04	Location of all topsoil and growing medium components sources
		Samples
	TS 5.10.04.01.05	Duplicate 4L samples: Topsoil / submitted with required testing results
	TS 5.10.04.01.05	Duplicate 1L samples: Coarse sand / submitted with required testing results
	TS 5.10.04.01.05	Duplicate 1L samples: Pine bark compost / submitted with required testing results
	TS 5.10.04.01.05	Duplicate 1L samples: Yard waste compost / submitted with required testing results
	TS 5.10.04.01.05	Duplicate 4L samples: Growing medium / submitted with required testing results
		Testing Reports
	TS 5.10.04.01.06	Particle size analysis: Topsoil including sand fractions
	TS 5.10.04.01.06	Particle size analysis: Growing medium including sand fractions
	TS 5.10.04.01.06	Chemical analysis: Topsoil
	TS 5.10.04.01.06	Chemical analysis: Growing medium with lab recommendations for fertilizer applications and amendments.
	TS 5.10.04.01.07	In-Situ Compaction Testing: Installed growing medium
	TS 5.10.04.01.06	Infiltration Rate Testing: Installed growing medium
		Contractor's Qualifications
	TS 5.10.04.01.08	Documentation of contractor’s qualifications