

MIT

Design Standards

DIVISION 01 — General Requirements

Issued 2022

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1. GENERAL REQUIREMENTS

1.1 MIT Standard Division 01 - General Requirements

The A/E is required to issue Division 1 - General Requirements for the project, coordinated with MIT's procurement and contracting requirements. Contact the MIT Project Manager for base text in Microsoft Word format for Division 01 Sections which are to be used for MIT projects, including but not limited to MIT Temporary Tree and Soil Protection and Commissioning.

1.2 Project-Specific Requirements

The A/E is required to review the following list of topics, and include in Division 01 as applicable to the project prior to the issue of construction documents:

1. Project specific alternates, allowances and unit prices. Use of allowances is discouraged.
2. Existing site conditions and restrictions.
3. Requirements for sequencing, scheduling and completion date.
4. Prior or concurrent work by MIT or others.
5. Prior hazardous material work by MIT or others.
6. MIT pre-purchased long-lead items.
7. MIT purchased, MIT installed items.
8. MIT purchased, Contractor-installed items.
9. MIT's early or partial occupancy.
10. Occupancy of adjacent facilities.
11. Contractor's use of new and existing facilities.
12. Scope of separate prime contracts.
13. Allowable working hours.
14. Days when construction is not allowed. MIT anticipates 10 no-work days per year based on MIT activities including commencement and exam weeks. Confirm dates with the MIT Project Manager.
15. Utility Costs: MIT will allow the use of existing utility systems and pay for cost of utility services consumed, including electricity, water and gas. The Contractor shall provide sub-metering, and provide and pay for connections for temporary utilities, and for temporary heat prior to the complete enclosure of the building and availability of suitable permanent systems as applicable.
16. Temporary Offices: A separate field office for the Architect and the MIT Project Representative is typically not required.
17. Toilet Facilities: The Contractor shall provide and maintain temporary toilets outside the building. Confirm location with the MIT Project Representative.

1.3 Sustainable Design

Refer to requirements in the Thematic Folder for Sustainability. The A/E is required to coordinate with MIT sustainability consultants for Division 01 Specifications.

2. CONSTRUCTION SPECIFICATIONS

The construction specifications which follows this page are to be used in their entirety for applicable projects. Request an electronic copy from your MIT Project Manager.

2.1 Section 013514 - MIT Specialized Root Zone and Soil Excavation

2.2 Section 013515 - MIT Imported Fill Criteria and Management

2.3 Section 015640 - MIT Temporary Tree and Soil Protection

END OF DOCUMENT

SECTION 013514

MIT SPECIALIZED ROOT ZONE AND SOIL EXCAVATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all Drawings and all Sections of the Specifications for requirements and provisions affecting the Work of this Section.

1.2 DESCRIPTION OF WORK

- A. Provide all work equipment, labor and supervision necessary to perform specialized root zone and soil excavation with a compressed air-powered tool also referred to as an air spade, within the limits indicated on the Drawings and as specified herein. Work shall include, but not be limited to, the following:
 - 1. Remove and break up soils around existing trees to conduct visual inspection and correction of specific plant health concerns.
 - 2. Remove and break up soils around existing trees to conduct diagnosis of plant diseases.
 - 3. Remove and break up soils around existing trees to facilitate application of blended soils or amended soils to promote root growth.
 - 4. Remove and break up soils around existing trees to facilitate root pruning.
 - 5. Remove and break up soils around existing trees to locate tree roots.
 - 6. Remove and break up soils around existing trees to accommodate proposed site construction.
 - 7. Root Collar (Crown) Excavation (RCX) to expose the lower trunk and buttress roots of the designated trees and shrubs.
 - 8. Soil replacement for the prevention or mitigation of soil compaction, poor drainage, soil structural issues or new landscape construction.
 - 9. Root pruning.
 - 10. Removal of all rubbish, debris, and other materials to be disposed of as a result of the work of this section.

1.3 DEFINITIONS

- A. Arborist: An individual engaged in the profession of arboriculture who, through experience, education and related training, possesses the competence to provide for, or supervise the management of, trees and other woody ornamentals.
- B. Dripline: an imaginary line defined by the branch spread.
- C. Critical Root Zone (CRZ): The minimum volume of roots necessary for maintenance of tree health and stability, typically determined by measuring the tree diameter 4.5 ft. above grade and multiplying by 12 in., a minimum radius of 10' from the trunk, or at the tree's dripline, whichever is farthest from the trunk, or as otherwise indicated on the Drawings, or established in the field. CRZ will be determined/established on a case by case basis by the Arborist and approval by the Landscape Architect.

- D. Finish Grade: Elevation of finished surfaces.
- E. Hand-Digging: Careful soil excavation using 'hand-tools' to expose roots for inspection or to determine where mechanical excavation can be done without causing significant root damage or loss.
- F. Subgrade: Surface or elevation of subgrade soil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.
- G. Topsoil: Soil that is present at the top layer of the existing soil profile at the Project site.
- H. Loam: Soil that contains a combination of particles typically almost equal in parts sand, silt and clay and including organic matter.
- I. Mulch: A material placed on the soil surface composed of 100% fine-shredded pine bark or wood chips generated by sending tree parts through a wood chipping machine of uniform size and free from rot, leaves, twigs, debris, stones, or any material harmful to plant growth. No chunks 3 in. or more in size, and thicker than 1/4 in. shall be left on site.
- J. Leaf Compost: Well-composted, stable, and weed-free organic matter, pH of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through a 1-inch (25-mm) sieve; soluble-salt content of 2 to 5 dS/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.
- K. Tree Resource Evaluation: A document or site plan describing the tree resources on the site, with information provided from an inventory or survey including: tree species, size (DBH), location, condition and likelihood of failure.

1.4 SUBMITTALS

- A. Prepare and submit a "Specialized Root Zone and Soil Excavation Plan", indicating the extent of soils to be air spaded. Show all areas of proposed staging, vehicle or equipment access, trenching, excavating, or other disturbance to soils. Include
 - 1. Proposed plan will be reviewed and approval by the Owner and Landscape Architect. No work of this Section shall commence prior to approval.
- B. Prepare and submit a "Tree Resource Evaluation", as defined herein.
- C. Proposed methods, materials, and schedule for effecting soils and root zones, in accordance with ANSI A300 (All Parts), shall be submitted by Certified Arborist for approval.
- D. Submit schedule of existing trees to be air-spaded.
- E. Submit a description of each type of proposed specialized root zone and soil excavation operation and reason for and location of each type described. Specialized root zone and soil excavation operations shall include, but not be limited to:
 - 1. Soil aeration and decompaction.
 - 2. Radial trenching.
 - 3. Vertical mulching.
 - 4. Root collar excavation.
 - 5. Root pruning.
 - 6. Bare rooting.
 - 7. Soil replacement.

8. Transplanting.
9. Root training.
10. Root trenching.
11. 1Excavation or trenching required for construction or utility work in CRZ.
12. 1Assessing tree stability.

F. Conduct a Tree Root Zone Investigation and evaluate the crown/foilage rating of each tree. Submit a health assessment for each tree to undergo specialized soil excavation operations, prepared by a Certified Arborist, indicating that each tree is healthy enough to withstand the proposed air spade operation and anticipated soil and/or root system disturbance.

1. Submit digital photos documenting tree conditions and illustrating the findings of the Tree Root Zone Investigation. Refer to Paragraph 3.05.

1.5 PROPERTY PROTECTION

A. Prevent damage to and movement, settlement or collapse of adjacent services, utilities, structures and trees. Assume liability for such damage, movement, settlement, or collapse. Promptly repair damage at no cost to the Owner.

1.6 TREE DAMAGE PENALTIES

- A. Refer also to Section 015640 - MIT TEMPORARY TREE AND SOIL PROTECTION.
- B. Trees or roots visibly damaged will cause the Owner to withhold from the Contractor an assessed amount conforming to the requirements stipulated above for a period of two years. After that period the impact of the damage to any tree will be assessed accordingly.
- C. If any trees or shrubs designated to be saved are damaged and replacement is required, a number and diameter of trees or shrubs of the same species and variety, as specified by the Owner and Architect, shall be furnished and planted by the Contractor. The total inch diameter of the replacement trees or shrubs shall equal the diameter of the tree or shrub to be replaced.

1.7 EXISTING SERVICES

A. Existing structures and utilities shall be suitably protected from damage.

1.8 QUALITY ASSURANCE

A. Work of this section shall be completed by a professional Certified Arborist with a minimum five years experience, who has successfully the Massachusetts Certified Arborist (MCA) program/examination sponsored by the Massachusetts Arborists Association, 8-D Pleasant Street, South Natick, MA 01760; (508) 653-3320; FAX: (508) 653-4112; E-mail: MaarbAssn@aol.com.

B. Arborist shall have the following minimum qualifications:

1. Certification by:
2. TCIA -- Tree Care Industry Association, Inc. accredited company
3. ISA – International Society of Arborists
4. Meet state requirements for insurance.
5. Licenses for application and use of pesticides if pesticide application will be required.

C. Equipment utilized to complete the work of this Section shall be operated by experienced technicians, trained and certified by equipment manufacturer to safely and properly operate the

compressed air-powered tool in accordance with manufacturer's Operator's Manual and the "AirSpade Technical Applications Bulletin (2016)".

- D. Air spade operations shall not be performed in heavy rain or when soil is deemed too wet or too dry by Certified Arborist.
- E. Tree trunks shall be suitably protected from damage by air spade operations during all activities specified.

1.9 SITE MONITORING

- A. While use of an air spade can significantly reduce trauma to the tree, it is important to monitor the trees health and care before, during and after the procedure. Supplemental watering is typically necessary and should be provided with direction and continued monitoring of a Certified Arborist
- B. Site monitoring shall be the responsibility of a Certified Arborist. Any damage to existing trees shall be immediately reported to the Architect. If any tree has been damaged, work shall be halted and reasons for damage assessed. No work shall commence until Contractor has submitted a plan for prevention of further tree damage and plan has been approved in writing by Landscape Architect.

1.10 PRECONSTRUCTION CONFERENCE

- A. Pre-Construction Conference: Prior to implementing specialized root zone and soil excavation measures, conduct meeting with Landscape Architect, Certified Arborist, air spade manufacturer's representative and Owner to verify and review the following:
 - 1. Project requirements for tree and soil protection measures as set out in Contract Documents.
 - 2. Air spade manufacturer's product data including application, operation and safety instructions.
 - 3. Limits where specialized root zone and soil excavation measures shall be implemented.
 - 4. Areas of proposed staging, vehicle or equipment access, trenching, excavating, or other disturbance to soils.
 - 5. Health care needs of individual trees, including specific site conditions, that may affect the project goals or construction implementation strategy.
 - 6. Tree health care implementation strategy before, during and after construction.
- B. If air is drained from the hose and air tool, the tip of the tool shall be in contact or beneath the soil surface to avoid excessive noise

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Specialized root zone and soil excavation operations shall be performed using a compressed air-powered tool also referred to as an air spade. High pressure air will come from a compressor that is matched to the design flow of the tool, producing a focused jet air stream capable of penetrating and fracturing existing soil for a fast, efficient method of excavating.
 - 1. The compressor shall be in good working condition and exhibit no signs of excessive discharge of oil in the air stream.
 - 2. Tool shall be equipped with a "dead-man trigger".

PART 3 - EXECUTION

3.1 GENERAL

- A. The site where air spading is to be performed shall have access restricted. Only personnel that are involved in the operation shall be permitted within 25 feet of the operation. A temporary screen barrier shall be set up to prevent flying rocks and debris from leaving the immediate work area during the operation.
- B. Personnel using the air tool or working in close proximity to the operation shall wear appropriate personal protective equipment which includes at a minimum:
 - 1. Hard hat with plastic face shield.
 - 2. Goggle type eye protection.
 - 3. Ear plugs.
 - 4. Ear muffs.
 - 5. Long sleeved shirt and long pants.
 - 6. Work boots and socks.
- C. If the area has active fire ant activity, personnel shall take precautions including sealing of cuffs and the use of insect repellents to avoid fire ant attack.
- D. Air hoses used in the operation shall have safety pins and whip guards installed at each hose junction.
- E. The air flow heating valve (if present on the compressor) shall be turned off when working near trees so as not to damage bark.

3.2 SOIL PREPARATION

- A. Trees proposed to undergo specialized root zone and soil excavation operations shall be adequately watered before start of operations. Amount and frequency of watering shall be determined by Certified Arborist. No operations shall commence prior to preparation approval in writing by Certified Arborist.
- B. Soil shall be moist to the point of field capacity prior to and during the operation. If dust is generated during the operation, it shall be stopped and the soil should be wetted. If turf, large rock or mulch is present in the area to be included in the excavation, it shall be removed prior to the start of the operation.

3.3 AIR TILLING

- A. Contractor shall utilize the air spade tool to aerate and de-compact to the specified depth (typically 6-8 in.) of the topsoil layer. If modification to soil content and aeration is necessary to a greater depth, then this application can be combined with others such as radial trenching or vertical mulching. (Refer to Paragraphs 3.06 and 3.07).
 - 1. Place plywood sheets over adjacent trenches to prevent refilling.
 - 2. Position the AirSpade at an angle of 30 degrees to 45 degrees (depending on target depth) and about 1 inch from the surface.
 - 3. Move the nozzle from side to side to define the desired trench width
 - 4. Do not dwell on the same spot.
 - 5. Width, depth and length of trench, and soil augmentation to be determined based on tree needs and project goals.

6. The adjustable dirt shield should be positioned close to the ground to deflect airborne material away from the operator.
7. Refer to manufacture's updated safety and operational guidelines.

3.4 SOIL AUGMENTATION

- A. Soil augmentation: Fertilizers, composts or other soil components shall be applied evenly and at rates determined by soil test results in accordance with Section 329115 - MIT PLANTING SOILS. Soil amendments shall be blended into existing soil using an air spade.

3.5 TREE ROOT ZONE INVESTIGATION

- A. At a minimum, Tree Root Zone Investigation shall include the following:
 1. Establishing the objective of the inspection, such as detecting cut or damaged roots, particularly where trees are located near to recent excavation works on building sites or where trenches for underground utilities have been dug, root disease or decay, drilling for decay, collecting samples for submission to a Lab.
 2. The location of tree roots may also need to be determined, for example during an assessment to trees in relation to building subsidence or when planning construction works near to a tree.
 3. Defining the area to be excavated – mark the soil surface of the area to be inspected and define the depth of inspection/soil removal.
 4. After inspection, define how the space is treated i.e. fill it in with the same soil, new soil or leave open; mulch, sod, or seed on surface.
 5. Define aftercare e.g. soil moisture sensors, irrigation level or frequency.
- B. The assessment should also provide any recommendations for tree protection, health care before, during, and after the completion of site work, and any additional issues or constraints that should guide project goals and/or implementation strategies based on tree and field conditions.
- C. Utilize air spade or hand dig to carry out subterranean investigations to ascertain the condition of structural roots to assess tree stability. Air spade shall be used to investigate suspected tree root decay or damage.

3.6 VERTICAL MULCHING

- A. Vertical mulching with air spade shall be used to de-compact and augment soil deep into the tree root zone.
- B. Spray paint target marks on the ground to indicate hole locations
- C. Bore holes shall be to specified depth (typically 18 to 36 in. deep) depending on individual site needs and determined health of trees. When resistance is met, slowly withdraw the air spade and then reinsert, allowing loosened soil at the bottom of the hole to exit upwards.
- D. Fill vertical holes with mature leaf compost or other augmentation material as recommended by Arborist.
- E. To avoid undesirable concentrations of augmented nutrients ("hotspots"), use amendments that are compatible or blended with existing soils. Refer to Section 329115 - MIT PLANTING SOILS. For more extensive results, it is possible to perform vertical mulching over the course of several growing seasons.

3.7 RADIAL TRENCHING

- A. Radial trenching with air spade shall be used to de-compact and augment soil into the tree root zone.
- B. Spray paint lines on the ground to indicate trench locations.
- C. Create trenches to a specific depth (typically 10 to 12 in. deep) depending on individual site needs and determined health of trees.
- D. To avoid undesirable concentrations of augmented nutrients (“hotspots”), use amendments that are compatible or blended with existing soils. Refer to Section 329115 - MIT PLANTING SOILS.

3.8 ROOT COLLAR EXCAVATION

- A. When grade is set too high against tree root flare or root collar it shall be corrected through root collar excavation with an air spade. Air spade must be kept moving back and forth. Do not dwell on same spot.
- B. Fine roots should be cut and removed if they interfere with the excavation. The excavation shall be concluded when the upper portion of a majority of buttress roots are exposed. Once uncovered, Certified Arborist shall identify roots that need to be removed. Roots less than 1/4 in. diameter may be lowered into the soil using an air spade. If the excavation depth exceeds one foot, consult with the Certified Arborist and Landscape Architect. If signs or symptoms of decay or disease are noticed, notify the Certified Arborist and Landscape Architect. If a stem girdling roots that is less than 1/3 the diameter of the trunk is discovered during the operation, or if several small stem girdling roots are discovered, they should be removed. If stem girdling roots greater than 1/3 the diameter of the trunk or many smaller stem girdling roots are discovered, the Certified Arborist and Landscape Architect shall be notified.
- C. Replace topsoil or augmented soil to cover roots to proper elevation. Refer to Section 329115 - MIT PLANTING SOILS.
- D. After the excess soil is removed, the excavated area shall be filled with mulch or wood chips as directed by the Arborist. The mulch or wood chips shall not be in contact with the tree trunk and shall not hide the buttress roots from inspection. Mulch or wood chip depth should be between 2 and 4 inches, based on the coarseness of the material and approved by the Certified Arborist and Landscape Architect.

3.9 ROOT PRUNING AND TRAINING

- A. Trees subjected to soil cuts within the root zone shall be root pruned by a Certified Arborist utilizing an air spade, removing as little of the trees root system as possible.
- B. Once existing roots have been safely exposed, a certified arborist shall determine the best places to make clean cuts using a hand pruner. Smaller roots shall be lowered down into soil horizon to help train them to follow a future path of growth.
- C. When the tree's excavated root zone will remain exposed for several days or more, protect and cover roots (for example with soil, mulch, or burlap cloth,) and provide supplemental water as required.

3.10 BARE ROOTING AND TRANSPLANTING

- A. When bare rooting is required to relocate or replace soil around existing trees, utilize an air spade to minimize damage to the tree's root system. Bare rooting operations shall expose existing tree roots as necessary to allow them to be pruned and turned down to accommodate new adjacent paving systems.
- B. Using an air spade, remove almost all of the soil from the tree root system, or leave excess soil to transplant with the tree. Once the root zone is excavated, the Arborist can prune the root mass to the desired length. It is critical to keep bare roots protected from the sun and hydrated, and to minimize the time between excavation and transplanting.

3.11 SOIL REPLACEMENT

- A. Refer to Section 329115 - MIT PLANTING SOILS.

3.12 DISPOSAL OF MATERIALS

- A. Soil moved during the air spading operations shall be collected and moved off-site or disposed of on-site if it not visually apparent.
- B. Material resulting from the specialized root zone and soil excavation work and not scheduled to be salvaged and which is unsuitable for reuse on the project, shall become the property of the Contractor and shall be legally disposed of off-site.
- C. Debris, rubbish, and other material shall be disposed of promptly and shall not be left until final cleanup of site.

END OF SECTION

SECTION 013515

MIT IMPORTED FILL CRITERIA

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all Drawings and all Sections of the Specifications for requirements and provisions affecting the Work of this Section.

1.2 DESCRIPTION OF WORK

- A. This specification section applies to all Fill materials from off-site locations that are imported to complete the work of the Project. This applies to all Fills including, but not limited to, Fill required to complete earthwork, foundations, backfilling for structures and utilities, and preparation of subgrades for the structures, surface treatments, walkways and roadways, and landscaping.
- B. MIT wants to be able to evaluate representative analytical test results for all imported Fill soils. This includes test results to be submitted by the Contractor as part of their submittal process and following the review of that submittal, additional testing may be conducted by the Engineer once the submitted Fill has been stockpiled on site. Results of this testing will determine whether the materials can be placed and used on the project.
- C. Work to be done under this Section includes, but is not limited to, providing all labor, materials, equipment, and incidentals to conduct and complete the Work specified herein and shown on the Drawings, including but not limited to the following:
 - 1. Furnish materials from approved off-site source(s) as required, including performing testing and providing data on the engineering properties and chemical characteristics representative of the materials and soils proposed for use.
 - 2. Working with MIT, Architect, and Engineer to make sure the activities meet the requirements of this Section and are performed in the correct sequence.

1.3 EXISTING INFORMATION AND PROJECT CONDITIONS

- A. Prior to submitting a bid, the Contractor shall review and understand the available subsurface information.
- B. If, during the course of construction operations, conditions differing substantially from those indicated are encountered, promptly notify the Owner in writing, and do not disturb such conditions until directed. The Architect and/or Engineer will investigate such conditions, and, if it is determined that the conditions do differ substantially from those that reasonably would have been anticipated from examination of the report and site, and that such conditions will necessitate a change in the Work, the Architect and/or Engineer will recommend any required changes and adjustments. Verbal or written communications with field personnel will not constitute acknowledgment of a differing subsurface condition.

- C. Prospective bidders shall visit the site and observe existing conditions prior to submitting a bid.

1.4 DEFINITIONS AND REFERENCE STANDARDS

- A. Owner: Massachusetts Institute of Technology (MIT).
- B. Architect: Authorized representatives of the Owner, Owner's Representative
- C. Engineer: Authorized representatives of the Owner, Owner's Representative, or Architect.
- D. Contractor: Entity responsible for completing the Work of this Section.
- E. ASTM: Specifications of the American Society for Testing and Materials
- F. AASHTO: American Association of State Highway and Transportation Officials
- G. ACI: American Concrete Institute
- H. Code: Current Edition of the Massachusetts State Building Code
- I. OSHA: Occupational Health and Safety Administration
- J. MassDEP – Massachusetts Department of Environmental Protection
- K. MCP – Massachusetts Contingency Plan 310 CMR 40.0000; latest revisions
- L. US EPA – Environmental Protection Agency
- M. Imported Fill shall include all soil materials imported to the project site including but not limited to Common Fill, Gravel, Gravel Borrow, Granular Fill, Topsoil, Loam, Planting Soils, Planting Soil Components, Compost, Playground Sand, Impervious Fill, and any soil or other soil-based materials called for in the Contract Documents.
- N. Imported Aggregate shall include all rock and processed rock-based materials imported to the project site including but not limited to Structural Fill, Sand/Sand Bedding, Drainage Fill, Crushed Stone, Dense Graded Crushed Stone, and any other rock-based materials called for in the Contract Documents.

1.5 QUALITY CONTROL

- A. Comply with all rules, regulations, laws and ordinances of the Commonwealth of Massachusetts, City of Cambridge, and all other authorities having jurisdiction. All labor, materials, equipment, and services necessary to make the work comply with such requirements shall be provided without additional cost to the Owner.
- B. The Contractor shall adhere to the applicable requirements of the Standard Specifications, OSHA Standards, and to all other applicable ordinances, codes, statutory rules, and regulations of federal, state, and local authorities having jurisdiction over the Work of this Section and other applicable Sections.
- C. The Contractor is required to conduct various testing at various times to prepare submittals and confirm compliance with the requirements of this Section. The Contractor shall cooperate with the Engineer in all respects to facilitate observations or review of that work.

- D. All Fill materials submitted by the Contractor to be imported to the site will be reviewed by the Engineer and/or Owner prior to use on the site and may be re-tested by the Owner and/or Engineer if they appear different in composition, gradation, or other physical properties from the testing provided in the submittal from the Contractor. The Contractor will bear the cost incurred by the Owner of any and all tests which are deemed necessary to confirm the material delivered to the site are suitable for use. Test results and recommendations will be made available to the Contractor on a timely basis.
- E. The presence of the Engineer shall not relieve the Contractor of its responsibility to perform the Work in accordance with the Contract Documents, nor shall it be construed to relieve the Contractor from full responsibility for the means and methods of construction, protection of site improvements against damage, and for safety on the construction site.
- F. Beyond those required by this section, the Contractor may conduct additional field and laboratory testing or screening tests for its own information at no additional cost to the Owner.

1.6 SUBMITTALS

A. General

- 1. Unless otherwise specified, the Contractor shall forward submittals to the Architect a minimum of fifteen (15) working days prior to any planned work related to the Contractor's submittals.
- 2. The time period(s) for submittals are the minimum required to review, comment, and respond to the Contractor. The Architect and/or Engineer may require resubmission(s) for various reasons. The Contractor is responsible for scheduling specified submittals and resubmittals so as to prevent delays in the work.
- 3. The Contractor's submittals shall be reviewed and accepted by the Engineer prior to conducting any work.
- 4. Acceptance of the Contractor's submittals by the Engineer does not relieve the Contractor of the responsibility for the adequacy, safety, and performance of the Work.

B. Submit the following:

- 1. Location and details of anticipated on-site or imported off-site material stockpiles.
- 2. Contractor shall not import any material to the site unless accepted in advance by the Engineer.
- 3. Imported Fill Materials: For each type of imported Fill material to be utilized, the Contractor shall deliver to the Engineer's office for review:
 - a. two representative 50-lb bag samples from each borrow source or supplier from the actual material proposed for use on the project;
 - b. laboratory analytical testing results representative of the bag samples submitted to the Engineer – see below for testing requirements; and
 - c. With each submitted sample the Contractor must provide the following documentation:
 - 1) Location of borrow source site, including name of the owner or facility name with contact phone number, street address, city, and state.
 - 2) Present and past usage of the source site and material.
 - 3) All existing report(s) associated with an assessment of the source site as relates to the presence of oil or hazardous materials.
- 4. Quality Testing of Off-Site Imported Fill Materials:

- a. Chemical testing is not required for Imported Aggregate materials from customarily utilized commercial borrow sources and hard, intact, naturally-occurring mineral materials provided as building materials (eg; Crushed Stone, Dense Graded Crushed Stone, Sand Bedding, Stone Dust).
 - b. All other materials, including Imported Fill but not limited to: Common Fill, Gravel, Gravel Borrow, Granular Fill, Topsoil, Loam, Compost, Impervious Fill, Landscaping Soils and amendments, and any other material proposed for use by the Contractor – will be required to have representative analytical test results as part of their submittal in advance of bringing the material on-site and its proposed use.
 - c. A summary of required testing is provided below in Table 1: Analytical Testing Provided by the Contractor.
 - d. The data shall be for samples obtained, transported, and tested in a manner acceptable to the Engineer shall be taken from and be representative of the actual volume of materials proposed for use on the project, and the testing shall be within the 30-days prior to making the submittal. The cost of any required sampling, testing, any retesting, and reporting shall be borne by the Contractor. The Engineer will review the data and determine its acceptability for use on site.
 - e. Samples of each material shall be submitted to a MassDEP-certified laboratory. All sampling of soils for chemical testing shall be performed by a person experienced in sample collection and either:
 - 1) A Professional Engineer or Licensed Site Professional registered in the Commonwealth of Massachusetts
 - 2) An authorized representative of the one of the persons listed above.
5. Sequence of Submittals, Testing, and Approval for Use of Imported Fill: As outlined below:
- a. The Contractor must provide representative analytical testing in accordance with this specification for all Imported Fill proposed for use.
 - b. The Engineer will review these results in comparison to MIT's Imported Fill Criteria, and will also evaluate whether the Imported Fill will may be exposed at ground surface.
 - c. If the proposed material conforms to the Imported Fill Criteria and complies with other specified criteria – the Contractor will be notified in writing that they are allowed to import and stockpile. Otherwise, materials will be rejected for use.
 - d. When the Contractor delivers and stockpiles materials at the site, the Contractor must provide a Bill-of-Lading for the material complete with date and time of loading from the supplying facility, date, and time of deliver to site, name of transporter, and weight of material delivered to the site.
 - e. The Engineer will review the materials stockpiled on-site for consistency with the physical properties and analytical testing submitted by the Contractor.
 - 1) If the materials appear consistent with the Contractors submittal, the Contractor will be informed in writing that they are authorized to proceed with the use of the imported materials.
 - 2) If the materials appear to differ from the information submitted by the Contractor, the Engineer will obtain samples from the stockpile and complete analytical or physical testing as deemed necessary by the Engineer to confirm if the materials delivered to the site meet the criteria in this Section.
 - f. If re-testing is completed, the Engineer will review these results in comparison to MIT's Imported Fill Criteria, specification requirements, and the analytical testing submitted by the Contractor for that material.

- g. If the representative analytical test results of the on-site stockpiled material are inconsistent with the Contractor-submitted test results for that material and/or do not conform to MIT's Imported Fill Criteria or any other criteria of the specifications, the materials will be rejected, and the Contractor must remove them from the site at no cost to the Owner.
- h. If the representative analytical test results of the on-site stockpiled material are consistent with the Contractor-submitted test results, other criteria of the specifications, and conform to MIT's Imported Fill Criteria, the material will be approved for on-site use.
6. Samples to be submitted and tested for the following parameters:
- Total Petroleum Hydrocarbons (EPA Method 9071/418.1) every 250 cy.
 - Extractable and Volatile Petroleum Hydrocarbons every 250 cy.
 - Volatile Organic Compounds (EPA Method 8260) every 250 cy.
 - PCB and Pesticides (EPA Method 8080) every 250 cy.
 - MCP 14 Metals (EPA Method 6000-7000 series) every 250 cy.
 - Acid-Base Neutrals (EPA Method 8270) every 250 cy.
 - TCLP (for a particular parameter) if the measured concentration for that particular parameter exceeds twenty times the RCRA Hazardous Waste TCLP Regulatory criteria.
7. Additional material samples and representative analytical test results may be requested throughout the course of the Work, in the same frequency as listed above, to evaluate and document the consistency of the source or process, at no additional cost to the Owner. If the properties of the material and/or representative analytical test results are inconsistent with the previously submitted test results for that material, inconsistent with the physical properties of the previously submitted materials, and/or do not conform to MIT's Imported Fill Criteria, they will be rejected.
8. Soil Volumes - The Contractor shall estimate and submit to the Engineer the i] total excavation volume of soil from the Work outlined on the Drawings and ii] total off-site volume of materials needed for Imported Fill to backfill excavations, provide raise in grade, backfill trenches, complete landscaping, and make the work complete based on the details shown on the Drawings.

MIT Imported Fill Criteria - In order for MIT to approve and accept Imported Fill for use, analytical test results for Imported Fill must be less than their corresponding MCP RCS-1 Reportable Concentrations, MCP Method 1 S-1/GW-2 and GW-3 numerical soil standards, and/or MassDEP background concentrations for natural soils as presented in MassDEP's Technical Update "Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil" dated May 23, 2002. These criteria are in accordance with MassDEP guidance including anti-degradation provisions outlined at 310 CMR 40.0032(3) and the Similar Soils Provision Guidance, Policy WSC #13-500. For compounds with no RCS-1 values, provided there is no reason to believe such compounds would be present in the soil, the test results must be less than the laboratory reporting limits for those analytes as established by MCP Compendium of Analytical Methods.

TABLE 1: ANALYTICAL TESTING PROVIDED BY THE CONTRACTOR

Material Description	Chemical Testing Required By Contractor As Part of Submittal	Chemical Testing <u>Not</u> Required by Contractor
Common Fill	X	
Gravel	X	
Gravel Borrow	X	
Granular Fill	X	
Topsoil, Loam, Planting Soils, and Planting	X	

Material Description	Chemical Testing Required By Contractor As Part of Submittal	Chemical Testing <u>Not</u> Required by Contractor
Soil Components		
Compost	X	
Playground Sand	X	
Impervious Fill	X	
Drainage Fill		X
Sand/Sand Bedding		X
Gravel Structural Fill		X
Crushed Stone		X
Dense Graded Crushed Stone		X
Gravel Borrow from Commercial Source		X

PART 2 - Not Applicable

PART 3 - not applicable

PART 4 - MEASUREMENT AND PAYMENT

4.1 GENERAL

- A. No separate measurement or payment will be made for excavation, on-site handling, temporary storage, reuse, segregation, screening, off-site stockpiling, returning the soil to the site for reuse, representative analytical testing, reporting, preparing submittals, backfilling, soil management, stockpiling, equipment, or other associated items or activities considered incidental to the conduct of the Work.
- B. As part of their bid, the Contractor shall estimate the total excavation volume of soil from the Work outlined on the Drawings and estimate the total off-site volume of materials needed for Imported Fill to backfill excavations, provide raise in grade, backfill trenches, complete landscaping, and make the work complete based on the details shown on the Drawings.
- C. Costs provided by the Contractor shall include all costs for submittals (including required analytical testing), transporting, handling, stockpiling, off-site disposal (if required), coordinating with the Engineer, preparing and providing required documentation (from supplying facilities), and other incidental work to excavated soils, import soils, and manage materials on the site.
- D. The Contractor shall improve or remove and replace Work not in conformance with the specified requirements, or which becomes disturbed or unsuitable. All costs related to laboratory testing of nonconforming Work or materials shall be back-charged to the Contractor.

4.2 PAYMENT

- A. Work of this Section will not be measured and will be paid for as part of the Base Contract Price and Unit Prices, and will include all labor, equipment, and incidentals required to complete all import of materials; submittals, analytical testing, recordkeeping, or other associated items or work necessary to the conduct the Work of this Section.

TABLE 4.1: ESTIMATED OVERALL QUANTITIES:

Material Type	Estimated Volume (cy)/ Weight (tons)
Total Estimated Excavation Volume ¹ (A)	
Total Estimated Excavated Materials to be Reused ² (B)	
Total Estimated to be Imported for Backfill ³ (C)	
Total Estimated Backfill ⁴ (D=B+C)	
Total Estimated Materials requiring Off-site Disposal ⁵ (E = A-D)	

Notes and Assumptions:

- Quantity A: Total quantity of material Contractor estimates to be removed within the limit of the work, including but not limited to: surface asphalt, sidewalks, curbs, soil, buried rubble, foundation walls, and utility structures.
- Quantity B: Quantity of the soil the Contractor estimates can be reused with the excavation assuming that all excavated materials are geotechnically and environmentally suitable.
- Quantity C: Total quantity Contractor estimates for importing material from off-site borrow source, including but not limited to: select backfill, bedding material, and subbase material. Note that on-site excavated material may be reused as bedding material or subbase material if the on-site material meets the gradation requirements or can be processed to meet specified gradation requirements.
- Quantity D: Total quantity Contractor estimates will be needed as backfill (includes imported and on-site material to be reused).
- Quantity E: Total quantity Contractor estimates will require off-site disposal.
- When converting from cubic yards to tons, Contractor shall assume that 1 cy equals approximately 1.7 tons.

END OF SECTION

SECTION 015640

MIT TEMPORARY TREE AND SOIL PROTECTION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all Drawings and all Sections of the Specifications for requirements and provisions affecting the Work of this Section.

1.2 DESCRIPTION OF WORK

- A. Protection of existing trees, plants, and soil from damage as a result of the Contractor's operations including, but not limited to:
 - 1. Tree and soils protection fencing.
 - 2. Critical root zone protection.
 - 3. Pre-construction root invigoration and deep root watering by certified arborist
 - 4. Fertilization of preserved trees.
- B. Contractor is directed to prevent construction activities from occurring on soil to the greatest extent possible and redirect them to paved areas. Where construction activities must take place on soils, those activities shall be constrained within the limits reviewed with the Owner and Architect.
- C. Much of the work required under this Section will be performed by a Certified Arborist. This Arborist will be approved by the Owner and paid for by the Contractor.

1.3 DEFINITIONS

- A. Certified Arborist: An individual engaged in the profession of arboriculture who, through experience, education and related training, possesses the competence to provide for, or supervise the management of, trees and other woody ornamentals, approved by the Owner, and hired by the Contractor, with a minimum five years experience, who has successfully completed a certification program equal to the Massachusetts Certified Arborist (MCA) program/examination sponsored by the Massachusetts Arborists Association, 8-D Pleasant Street, South Natick, MA 01760; (508) 653-3320; FAX: (508) 653-4112; E-mail: MaarbAssn@aol.com.
- B. Critical Root Zone (CRZ): The minimum volume of roots necessary for maintenance of tree health and stability, typically determined by measuring the tree diameter 4.5 ft. above grade and multiplying by 12 in., a minimum radius of 10' from the trunk, or at the tree's dripline, whichever is farthest from the trunk, or as otherwise indicated on the Drawings, or established in the field. CRZ will be determined/established on a case by case basis by the Arborist and approval by the Architect.
- C. Compacted Soil: A high density soil lacking structure and porosity characterized by restricted water infiltration and percolation (drainage), and limited root penetration.

- D. Dripline: An imaginary line defined by the branch spread; the farthest extension of the tree branches.
- E. Owner: An MIT Landscape Architect, and/or MIT Grounds Supervisor.

1.4 SUBMITTALS

- A. Prepare and submit a “Logistics Plan for Tree and Soil Protection”, indicating the extent of tree and soils protection fencing required, and areas where soil compaction prevention measures shall be implemented. Show all areas of proposed staging, vehicle or equipment access, trenching, excavating, or other disturbance to soils.
 - 1. Proposed plan will be reviewed and approval by the Owner. No work of this Section shall commence prior to approval.
- B. Proposed methods, materials, and schedule for effecting tree and soil protection within the limits indicated on the Logistics Plan for Tree and Soil Protection.
- C. Mitigation or preventative maintenance operations such as root pruning and tree fertilization shall be submitted by Certified Arborist for Owner’s approval.
- D. Product samples for review and approval by the Owner.
 - 1. Submit 1.0 lb. sample of wood chips.
 - 2. Submit 1.0 lb. sample of crushed stone.

1.5 MODIFICATIONS TO TREE AND SOIL PROTECTION PLAN

- A. Modifications deemed necessary by the Contractor to the approved Logistics Plan for Tree and Soil Protection shall be submitted to the Architect and Owner for review and approval prior to implementing any changes to tree and soil protection areas, materials and methods. All modifications shall be submitted by Contractor in written form, approved by the Owner and signed by all parties.

1.6 PRECONSTRUCTION CONFERENCE

- A. Pre-Construction Conference: Prior to implementing tree and soil protection measures, conduct meeting with Owner and Architect to verify and review the following:
 - 1. Project requirements for tree and soil protection measures as set out in Contract Documents.
 - 2. Manufacturer's product data including application instructions.
 - 3. Limits where tree protection measures shall be implemented.
 - 4. Limits where soil protection measures shall be implemented.
 - 5. Areas of proposed staging, vehicle or equipment access, trenching, excavating, or other disturbance to soils.

1.7 QUALITY ASSURANCE

- A. All tree work shall be performed by a professional Certified Arborist.
- B. Mitigation or preventative maintenance operations such as root pruning and tree fertilization shall be performed in accordance with ANSI A300 Tree Management standards specification writing guidelines.

1.8 DAMAGE PENALTIES

- A. Damages to trees and shrubs during construction activities will be assessed by the Architect, in accordance with the Council of Tree and Landscape Appraiser 9th Edition Guide for Plant Appraisal.
- B. If any trees or shrubs designated to be saved are damaged and replacement is required, a number and diameter of trees or shrubs of the same species and variety, as specified by the Owner and Architect, shall be furnished and planted by the Contractor. The total inch diameter of the replacement trees or shrubs shall equal the diameter of the tree or shrub to be replaced.

PART 2 - PRODUCTS

2.1 TREE AND SOIL PROTECTION FENCING AND SIGNAGE

- A. Tree and soil protection fencing shall be the following:
 - 1. Galvanized chain link fencing, 6 ft. high.
 - 2. Fabric shall be a good commercial quality of steel wire of 2 in. mesh and 11 gage.
 - 3. Fittings shall be malleable iron casting, wrought iron forgings, or pressed steel and provided with pin connections. Equipment shall be designed to carry 100% overload.
 - 4. Piping shall be steel conforming to ASTM A 120 except that pipe shall be unthreaded and untested for water pressure.
- B. Stakes for fencing shall be 9 ft. galvanized steel posts. Fence panels shall be clamped and bolted.
- C. For fencing within the drip line of trees, surface mounted post anchors may be acceptable. Review with Architect and Owner and obtain written approval prior to installing. Post installation shall not damage tree root systems.
- D. Unless otherwise indicated, warning signs will be provided by the Owner.
- E. If signs are not provided by the Owner, then provide signs conforming to the following requirements:
 - 1. A warning sign shall be displayed on the street side of the fence. The size of the sign must be no less than 8.5 x 11 inches. The sign must clearly state in bold red lettering: "Tree and Soil Protection Zone". The sign shall clearly list the name and current contact information of the project owner or authorized representative.

2.2 SOILS AND CRITICAL ROOT ZONE PROTECTION

- A. To prevent soil compaction within this protected zone, there should be no nonessential activity. Construction backfill material, construction stockpiles of material, and utility structures should not be stored (or construction equipment parked) in or around the bases of existing trees or within the protected zones.
- B. Soils and root zone protection shall include one of the following materials on an as needed basis, subject to review and approval by the Owner and Architect during the course of construction, incidental to an unforeseen need for construction access.
 - 1. Road Mats: Critical root zones shall be protected with AlturnaMats, 1/2" thick recycled polyethylene mats capable of supporting vehicles and equipment weighing up to 60 tons,

manufactured by AlturnaMats, Inc., 701 E. Spring Street, Mailbox #9, Titusville, PA 16354 • Phone: 888.544.6287 • Fax: 866-723-2903 , or approved equal.

2. Steel Plates: ½ in. thick steel plates shall be placed on top of wooden cribbing to allow for air and gass exchange in soils.
3. Crushed Stone: shall be an angular, washed, durable, dense graded ¾". crushed stone, crushed and screened through a ¾" square screen. Following the crushing and screening of the crushed stone, it shall be cleaned extensively to ensure that it is free from stone dust and other residues.
4. Aged Wood Chips: shall be a 100% wood and bark chips free from dye, debris and stones, shredded and stockpiled no less than six months and no more than two years before use.

2.3 ROOT PRUNING MATERIALS

- A. Root pruning materials will be determined and applied by a Certified Arborist.

PART 3 - EXECUTION

3.1 FIELD VERIFICATION

- A. If Logistics Plan for Tree and Soil Protection is required, conduct the following:
 1. Flag trees to be preserved in accordance with approved Logistics Plan for Tree and Soil Protection.
 2. Flag trees to be removed in accordance with approved Logistics Plan for Tree and Soil Protection.
 3. Stake out extents of construction disturbance for review and approval by Owner and Architect, in accordance with approved Logistics Plan for Tree and Soil Protection.
- B. If no Logistics Plan for Tree and Soil Protection is required, conduct field verification in accordance with methods agreed upon during Preconstruction Conference.

3.2 INSTALLATION OF FENCING AND SIGNAGE

- A. Prior to start of demolition work and clearing and grubbing operations, tree and soil protection fencing shall be installed in accordance with the following:
 1. Fencing shall be installed at the tree and soil protection areas indicated on the Drawings and approved submittals.
 2. Fencing shall be installed on a tree by tree basis, beyond the drip line of trees to be protected, unless otherwise approved by the Owner and Architect.
- B. Tree protection fencing to be installed over tunnels, vaults or other underground structures or utilities with less than 30 in. of cover shall be installed using surface anchors. No poles or stakes shall be driven into the ground at these locations.
- C. Tree and soil protection signage shall be installed on fencing at locations indicated on the Drawings or determined in the field by the Owner.

3.3 CRITICAL ROOT ZONE IMPACTS

- A. Unless otherwise directed by the Certified Arborist, trees impacted shall have a minimum of a six (6) inch layer of mulch placed and maintained over the critical root zone and the undisturbed area within the dripline.

1. Immediate pruning and fertilization shall occur per the pruning and fertilization sections of this specification.
 2. Provide water in a slow drip manner to impacted trees as approved by the Architect and Owner.
 3. Provide water to apply equivalent to 1 inch once per week to deeply soak in over the area within the dripline of the tree during periods of hot, dry weather.
 4. Spray tree crowns periodically to reduce dust accumulation on the leaves.
- B. No disturbance shall occur closer to the tree than inside the radius of the CRZ or within ten (10) feet of the tree, whichever is greater, and not without approval by the Architect and Owner.
- C. Trimming of roots shall be performed by Certified Arborist.
- 3.4 PROTECTION FOR EXISTING TREES AND SOIL TO BE PRESERVED
- A. All trees and soil to be preserved on the property shall be protected against damage from construction operations.
1. Includes associated understory.
- B. Only those trees located within the limits of improvements to be constructed as indicated, shall be removed.
1. All trees to remain shall be flagged for review after the location of improvements to be constructed are staked in the field.
 2. Any tree to be removed shall be reviewed by the Owner and Architect for approval prior to removal.
 3. Obtain approval of installation of tree barricade fencing from Owner and Architect prior to the initiation of any removal of vegetation and construction.
- C. Erect fencing prior to beginning any clearing, demolition or construction activity, and unless otherwise instructed, maintain in place until construction is completed.
1. Obtain approval of installation of tree barricade fencing from Architect and Owner prior to the initiation of any removal of vegetation and construction.
 2. Tree and soil protection barricade shall be erected at the edge of the dripline where possible; in extreme circumstances and with the approval of the Architect and Owner, fencing may be located at the edge of the critical root zone.
 - a. For trees 10 inch caliper and less, the minimum distance the barrier shall be erected is ten (10) feet from the trunk of tree or clump of trees.
 3. Trees immediately adjacent to or within 25 ft. of any construction activities shall be protected by barricade fencing; subject to approval of the Architect and Owner.
 4. The tree and soil protection barricade shall be placed before any excavating, trenching or grading is begun and maintained in repair for the duration of the construction work unless otherwise directed in writing by the Architect and Owner.
 5. No material shall be stored or construction operation shall be carried on within the tree and soil protection barricade.
 6. Tree and soil protection barricades shall remain in place until all work is completed and removal is permitted by the Architect and Owner.
- D. Protect trees that are to remain, whether within barricade fencing or not, from the following (Refer to EXCAVATING AROUND TREES paragraph for additional information):

1. Compaction of soils by equipment or material storage; construction materials shall not be stored within the CRZ.
 2. The proposed finished grade within the critical root zone of any preserved tree shall not be raised or lowered more than one and one half (1-1/2) inches. No soils within the CRZ shall be raised or lowered without prior on-site approval from the Owner. Review proposed grade with Architect prior to commencing work.
 - a. Retaining methods can be used to protect and/or provide lateral support to the area outside the critical root zone.
 3. Trunk damage by moving equipment, material storage, nailing or bolting.
 4. Girdling or abrading by tying ropes or guy wires to the tree trunk or large branches.
 5. Poisoning by pouring solvents, gas, paint, chemical solutions applied in masonry washing, etc., on or around tree soils and roots.
 6. Drought from failure to water or by cutting or changing normal drainage patterns past roots, or disconnection, breakage or shut off of existing irrigation system. Contractor shall provide means as necessary to ensure adequate watering and positive drainage.
 7. Changes of soil pH factor by disposal of lime base materials such as concrete, plaster, lime treatment at pavement subgrade, etc. When installing concrete adjacent to the root zone of a tree, use a minimum 6 mil. plastic vapor barrier behind the concrete to prohibit leaching of lime into the soil.
 8. Do not cut roots 3/4" in diameter or over without approval of the Owner. All excavation and earthwork within the CRZ of trees shall be done by hand or as directed.
 9. Protect all existing trees near areas to be stabilized from underground contaminations by placing a 6 mil. Plastic film barrier along exposed vertical cut extending a minimum 12" into undisturbed subgrade below depth of stabilization.
 10. No vehicular traffic shall occur within the drip line of any tree or in protected soil zones; including parking of vehicles.
 11. No soil shall be spread, spoiled or otherwise disposed of under any tree within the CRZ.
- E. Any damage done to existing tree crowns or root systems shall be repaired by the Certified Arborist to the satisfaction of the Owner and Architect.
1. Broken branches shall be pruned in accordance with industry standards.
 2. Roots shall be exposed and cut cleanly with an airspade or other means approved by the Architect.
- F. Damages to trees caused through negligence of Contractor or his employees will be assessed as described in Paragraph 1.10.

3.5 CAVATING AROUND TREES

- A. Excavate within the dripline of trees only where required and when absolutely necessary and with prior written approval from the Owner and Architect.
1. Any excavation within the CRZ of trees shall be under the direction of the Certified Arborist.
 2. A Certified Arborist shall be at site prior to and for periodic observation while excavation is occurring within the CRZ.
 3. Air spade operations of all removals within the CRZ are by Certified Arborist as directed by the Owner and Architect.
 4. Refer to CRITICAL ROOT ZONE (CRZ).
- B. When excavating for new construction is required within the CRZ, air spade and hand excavate to minimize damage to root systems.

1. Air spade operations shall be performed by Certified Arborist.
 2. Use narrow tine spading forks and comb soil to expose roots.
 3. Relocate roots back into backfill areas wherever possible.
 4. If large main lateral roots are encountered, expose beyond excavation limits as required to bend and relocate without breaking.
 5. If root relocation is not practical, clean cut roots using sharp hand saw approximately three (3) inches back from new construction.
- C. Where existing grade is above new finish grade, carefully excavate within the dripline to the new finish grade.
1. Carefully hand excavate an additional six (6) inches below the finish grade.
 2. Use narrow tine spading forks to comb the soil to expose the roots, and prune the exposed root structure as recommended by the Arborist.
 3. Keep the exposed roots damp.
 4. Treat the cut roots as specified and as recommended by the Certified Arborist.
 5. After pruning and treatment of the root structure is complete, backfill to finish grade with eight (8) inches of approved plant mix, or structural soil.
- D. Where noted on plan, use airspade to expose roots for required cutting to accommodate hardscape elements. Landscape Architect to verify all cuts prior to proceeding.
- E. Temporarily support and protect roots against damage until permanently relocated and covered with recommended landscape material.

3.6 ROOT PRUNING

- A. Where construction will occur within drip line of existing trees designated to remain, roots shall be pruned in accordance with ANSI A300.
- B. All root pruning shall be done by Certified Arborist only. Trenching, vibrating plow, and stump grinding are NOT suitable means for root pruning.
- C. Roots greater than 1 in. diameter shall be pruned by means of a hand saw, or other approved means.
- D. Install root protection measures as prescribed by Certified Arborist.

3.7 CROWN PRUNING

- A. Pruning of tree crowns shall not be permitted.

3.8 FERTILIZATION OF PRESERVED TREES

- A. All existing trees to be preserved, and impacted by construction activities taking place within the dripline, including but not limited to trenching and grading, shall be fertilized as determined by a soils analysis report.
- B. Subsurface deep root fertilization of the existing trees to be impacted by construction shall be accomplished in accordance with the following specifications and performed by Certified Arborist under direction from the Owner:
1. Fertilization shall be completed prior to construction of permanent improvements adjacent to all trees including site fill or paving including trenching operations.

2. Liquid tree fertilizer applied with a standard hydraulic sprayer at a pressure of 100 to 200 psi shall be injected in slightly slanted holes approximately 6 to 8 inches in depth.
3. Concentration of suspension to be forty (40) pounds of fertilizer for trees in each 100 gallons of water. Application rate: six (6) pounds of actual nitrogen per 1,000 square feet of area under drip-line.
4. Holes are to be made in concentric circles and 3' on center around the tree with the last ring located at the dripline of the foliage of the trees.
5. Area beneath the dripline of the trees is to be well watered after the fertilization is placed.

3.9 CLEANUP

- A. Wood and debris shall become property of the Contractor and shall be removed from the site. Cost of disposal shall be paid by Contractor.
- B. If acceptable to Owner, wood from tree removal and pruning activities can be double shredded/grinded and used on site as mulch at locations approved by the Owner.

3.10 REMOVAL OF PROTECTION AND SIGNAGE

- A. All protection measures shall remain in place throughout the construction period. Remove protection devices only after written permission has been granted by the Architect.
- B. Signage shall be removed and returned to the Owner.

END OF SECTION