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Trees – Standard Specifications

A. Trees

PART 1 – GENERAL

1.01 SUMMARY

- A. **This Section specifies minimum requirements** for protection and maintenance of existing trees, shrubs, and other plant materials including lawn surfaces indicated to remain on the Project Site from damage as a result of the Contractor's operations.
- B. The scope of work includes all labor, materials, tools, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with protection of existing trees and other plants as shown on the drawings and as specified herein.
 - 1. Marking of clearing limits
 - 2. Protective signage
 - 3. Provide preconstruction evaluations and spec narratives
 - 4. Construction Logistics Plan
 - 5. Provide tree and plant protection fencing
 - 6. Provide protection of root zones and above ground trees and plants
 - 7. Provide pruning of existing trees and plants
 - 8. Coordinate with the requirements of Section Planting Soil for modifications to the soil within the root zone of existing trees and plants
 - 9. Provide maintenance of existing trees and plants including irrigation during the construction period as recommended by the arborist report
 - 10. Provide maintenance of existing trees and plants including irrigation during the post construction plant maintenance period.
 - 11. Remove tree protection fencing and other protection from around and under trees and plants
 - 12. Clean up and disposal of all excess and surplus material
- C. Related Sections for References:
 - 1. Pre-Design Inventory- Follow University of Washington guidelines for pre-design inventory.
 - 2. References: The following specifications and standards of the organizations and documents listed in this paragraph form a part of the specification to the extent required by the references thereto. In the event that the requirements of the following referenced standards and specification conflict with this specification section, the requirements of this specification shall prevail. In the event that the requirements of

any of the following referenced standards and specifications conflict with each other, the more stringent requirement shall prevail.

3. ANSI A 300 (Part 5) – Standard Practices for Tree, Shrub and other Woody Plant Maintenance, most current editions.
4. Pruning practices shall conform with recommendations from the most current ISA Standard.
5. Glossary of Arboricultural Terms, International Society of Arboriculture, Champaign IL, most current edition.

D. Definitions:

1. Landscape Requiring Protection and Maintenance: All existing tree, plant, and lawn located on the Project Site and not identified for Contractor's lay down or parking use, including trees with root zones extending to or within the Project Site.
2. Critical Root Zone (CRZ): The area equal to one (1) foot radius for every inch diameter from a tree measured at Diameter Standard Height (DSH).
3. Project Arborist: An arborist certified by the International Society of Arborists (ISA) and provided by the Contractor.
4. Dripline: The dripline of a tree is described as the area on the ground beneath the tree's canopy.
5. Owner's Representative: The person appointed by the Owner to represent their interest in the review and approval of the work and to serve as the contracting authority with the Contractor. The Owner's Representative may appoint other persons to review and approve any aspects of the work.
6. "Reasonable" and "reasonably": When used in this specification is intended to mean that the conditions cited will not affect the establishment or long-term stability, health, or growth of the plant. This specification recognizes that plants are not free of defects, and that plant conditions change with time. This specification also recognizes that some decisions cannot be totally based on measured findings and that professional judgment is required. In cases of differing opinion, the Owner's Representative expert shall determine when conditions within the plant are judged as reasonable.
7. Shrub: Woody plants with mature height approximately less than 25 feet.
8. Tree and Plant Protection Area: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and defined by a circle centered on the trunk with each tree with a radius equal to the crown dripline, unless otherwise indicated by the owner's representative.
9. Tree: Single and multi-stemmed plants, including palms with anticipated mature height approximately greater than 25 feet, or any plant identified on the plans as a tree.

1.02 SUBMITTALS

It is the intent of this section that the requirements apply to all sections of the project specification such that any subcontractor must comply with the restrictions on work within designated Tree and Plant Protection Areas.

- A. Specifications, General Conditions and Drawings: The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.
- B. Tree and Landscape Protection Plan: Prior to proceeding with any site disturbance, submit a plan to protect all trees, plants, and lawn indicated to remain developed by the Project Arborist, and the name and certification credentials of the proposed Contractor's Project Arborist for Owner's review and approval.
 - 1. Tree and Landscape Protection Plan to include:
 - 2. Proposed protection fence locations.
 - a. Proposed pedestrian detours to avoid desire routes through landscapes outside the construction fence.
 - b. The location of all on-site trees requiring protection identified by number, as indicated by the University of Washington, Seattle Campus Tree Inventory Tags.
 - c. Identification of the CRZ for each tree requiring protection.
 - d. Temporary irrigation and fertilization schedule.
- C. Arborist Report: Prior to the start of construction, submit, for approval by the Owner's Representative, the report of a consulting arborist who is a registered Consulting Arborist® (RCA) with American Society of Consulting Arborists, or an ISA Board Certified Master Arborist, which details the following information for all trees to remain within the area designated on the drawings as the Tree and Plant Protection Area. Prior to conducting the site visit, obtain a preliminary template from the University of Washington indicating the tree numbers, species, and approximate measurements. Use the UW tree numbers in the Arborist Report. Trees missing numbers should be given a "Letter" description and cross referenced with the University of Washington inventory to either replace the original number or create a new number. The arborist report shall include the following:
 - 1. A description of each tree to remain, indicating its tree number, genus and species, condition including any visible damage to the root system or soil within the root zone, tree diameter at standard height (dsh) and approximate height, size and any visible disease, insect infestations and/or branch and trunk structural deficiencies.
 - 2. The report shall note all trees or parts of trees which are considered a hazard or at significant or extreme risk level. Include the International Society of Arboriculture hazard evaluation sheet for each tree, which may reasonably be identified as a potential hazard tree.
 - 3. Recommendations for fertilizer treatments, if any.
 - 4. A plan of the site showing the location of all trees included in the report, highlighting any existing Trees of Distinction or Memorial Benches.
- D. Product Data: Submit manufacturer product data and literature describing all products required by this section to the Owner's Representative for approval. Provide submittal four (4) weeks before the start of any work at the site.
- E. Qualification Submittal: For each applicable person expected to work on the project, provide copies of the qualifications and experience of the Consulting arborist, proof of either the

registered Consulting Arborist® (RCA) with American Society of Consulting Arborists, or an ISA Board Certified Master Arborist, and any required Herbicide/Pesticide license to the Owner's Representative, for review prior to the start of work.

1.03 CONTRACTOR RESPONSIBILITY

- A. Damage: The Contractor shall be responsible for all damage and/or disturbance within the CRZ of landscape indicated to remain including, but not limited to, against cutting, breaking or skinning of roots, skinning or bruising of bark, compaction of root zones, and breaking of branches. The Contractor shall assume all trees, plants, and lawn within the Project Site shall be protected unless designated to be removed in the Contract Documents.
 - 1. Damage and/or disturbance which, in the Owner's sole judgment, can be remedied by corrective maintenance shall be immediately repaired by the Contractor upon written notice by Owner.
 - a. The Contractor shall employ a licensed arborist to repair damage to trees.
 - 2. Trees or shrubs which are injured or irreparably damaged in usefulness or appearance shall, at the Owner's sole discretion, be replaced by the Contractor with new trees or shrubs of the same size and type.
 - a. Trees which fail to fully foliate in the spring following completion of construction operations may be presumed to have been injured or irreparably damaged due to construction operations.
 - 3. If, in the Owner's sole opinion, replacement of damaged trees is determined not feasible or impractical, the full replacement costs shall be borne by the Contractor at values based upon the square inches of cross sectional area of trunk measured at standard height, in accordance with the following criteria:
 - a. The assessed value of the tree using the Trunk Formula Method with a minimum value of \$1000.00.
 - b. Cost is doubled for Trees of Distinction (Exceptional, Historical, Memorial, Brockman Tour, Trees of Seattle)
 - 4. Damaged trees or shrubs which require removal and/or replacement due to injury or damage by construction operations shall be removed to a depth of two (2) feet below grade and include the refilling and repair of the ground surface, with such costs to be borne by the Contractor.
 - a. The Owner is not bound to replace lost trees or shrubs in the same location.
 - 5. Protection and maintenance shall include, but not be limited to, replacement of damaged protection fencing, aeration of compacted soils, control of temporary irrigation water runoff, pruning and treatment of damaged roots, and replacement of wood chips within tree protection areas.
 - 6. Site damage and/or disturbance caused by the Contractor beyond the Project Site shall be repaired or replaced, and all costs for such repair shall be borne by the Contractor.

- a. Repairs include, but are not limited to, pruning or removing damaged vegetation, replacement of damaged vegetation, and restoration of lawn and ground to its original condition.
- B. Verification: All scaled dimensions on the drawings are approximate. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and quantities, and shall immediately inform the Owner's Representative of any discrepancies between the information on the drawings and the actual conditions, refraining from doing any work in said areas until given approval to do so by the Owner's Representative.
- C. Permits and Regulations: The Contractor shall obtain and pay for all permits related to this section of the work unless previously excluded under provision of the contract or general conditions. The Contractor shall comply with all laws and ordinances bearing on the operation or conduct of the work as drawn and specified. If the Contractor observes that a conflict exists between permit requirements and the work outlined in the contract documents, the Contractor shall promptly notify the Owner's Representative in writing including a description of any necessary changes and changes to the contract price resulting from changes in the work.
 - 1. Wherever references are made to standards or codes in accordance with which work is to be performed or tested, the edition or revision of the standards and codes current on the effective date of this contract shall apply, unless otherwise expressly set forth.
 - a. In case of conflict among any referenced standards or codes, or between any referenced standards and codes and the specifications, the more restrictive standard shall apply, or Owner's Representative shall determine which shall govern.
- D. Protection of work, Property and Person: The Contractor shall protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to his/her actions.
- E. Changes in work: The Contractor shall re-execute any work that fails to conform to the requirements of the contract and shall remedy defects due to faulty materials or workmanship upon written notice from the Owner's Representative, at the soonest possible time that can be coordinated with other work and seasonal weather demands.

1.04 PRECONSTRUCTION CONFERENCE

- A. Schedule a pre-construction meeting with the Owner's Representative at least seven (7) days before beginning work to review any questions the Contractor may have regarding the work, administrative procedures during construction, and project work schedule.
 - 1. The following Contractors shall attend the preconstruction conference:
 - a. General Contractor
 - b. Consulting Arborist
 - c. Subcontractor assigned to install Tree and Plant Protection measures
 - d. Earthwork Contractor
 - e. All site utility Contractors that may be required to dig or trench into the soil
 - f. Landscape subcontractor

- g. Irrigation subcontractor
 - h. University of Washington Arborist
 - i. University of Washington Landscape Architect
 - j. Design Landscape Architect
 - k. University of Washington Irrigation Lead
2. Prior to this meeting, mark all trees and plants to remain or be removed, as described in this specification, for review and approval by the Owner's Representative.
 3. Prior to the start of site work including the arrival of temporary facilities and equipment, on-site materials, construction parking, and the commencement of any site clearing, the Contractor shall arrange an on-site pre-installation meeting with the Owner's Representative to identify and stake out all areas of trees, plants, and lawn that are to be protected or removed.
 4. The Contractor shall be responsible for all damage to landscape features that result from the failure to schedule the pre-installation meeting.

1.05 QUALITY ASSURANCE

A. Contractor Qualifications:

1. All pruning, branch tie back, tree removal, root pruning, and fertilizing required by this section shall be performed by or under the direct supervision of ISA Certified Arborist. Submit aforementioned individual's qualifications for approval by the Owner's Representative.
2. All applications of pesticide or herbicide shall be performed by a person maintaining a current state license to apply chemical pesticides valid in the jurisdiction of the project. Submit copies of all required state licensing certificates including applicable chemical applicator licenses. Submit herbicide or pesticide product information for approval prior to application.

B. Observation of Work: Owner's Representative may inspect the work at any time.

PART 2 - PRODUCTS

2.01 TREE PROTECTION

A. Signage:

1. The Contractor shall post weather resistant 8 1/2" x 11" signs using the UW Protect Tree Template.
2. Signs: 8.5 inches x 11 inches, the signs shall be attached to the tree protection fence at 20-foot intervals.
3. Information will include UW Project Manager's phone number and tree assessed value.

B. Fencing:

1. Protection fencing shall be equal to the following:

- a. CHAIN LINK FENCE: 6 feet tall Galvanized, 11 gauge, 2 inch mesh chain link fencing, with nominal 2 1/2 inch diameter galvanized steel posts set in metal frame panels on movable core drilled concrete blocks of sufficient size to hold the fence erect in areas of existing paving to remain.
 - b. PLASTIC MESH FENCE: Heavy-duty orange plastic mesh fencing fabric 48 inches wide. Fencing shall be attached to metal "U" or "T" post driven into the ground of sufficient depth to hold the fabric solidly in place without sagging. The fabric shall be attached to the post using attachment ties of sufficient number and strength to hold up the fabric without sagging. The Owner's Representative may request, at any time, additional posts, deeper post depths, and/or additional fabric attachments if the fabric begins to sag, lean, or otherwise not present a sufficient barrier to access.
 - c. GATES: For each fence type and in each separate fenced area, provide a minimum of one (1) 3-foot-wide gate. Gates shall be lockable. The location of the gates shall be approved by the Owner's Representative.
2. Submit supplier's product data that product meets the requirements for approval.

2.02 SOIL AND COMPACTION PROTECTION

A. Wood Chips:

1. Wood chips shall be composted for a minimum of one (1) year.
2. Wood Chips from an arborist chipping operation with less than 20% by volume green leaves. Chips stockpiled from the tree removal process may be used.
3. Mulch shall be coarse, ground, from tree and woody brush sources. The minimum range of fine particles shall be 3/8 inch or less in size and a maximum size of individual pieces shall be approximately 1 to 1-1/2 inch in diameter and maximum length of approximately 4 to 8 inches. No more than 25% of the total volume shall be fine particles and no more than 20% of total volume be large pieces.
4. Submit supplier's product data that product meets the requirements and two-gallon sample for approval.

B. Matting:

1. Matting for vehicle and work protection shall be heavy-duty matting designed for vehicle loading over tree roots, Alturnamats as manufactured by Alturnamats, Inc, Franklin, PA 16323 or approved equal.
2. Submit supplier's product data that product meets the requirements for approval.

C. Geogrid:

1. Geogrid shall be woven polyester fabric with PVC coating Uni-axial or biaxial geogrid, inert to biological degradation, resistant to naturally occurring chemicals, alkalis, and acids.
2. Geogrid shall be Miragrid 2XT as manufactured by Ten Cate Nicolon, Norcross, GA. www.tencate.com or approved equal.
3. Submit suppliers product data that product meets the requirements for approval.

D. Filter Fabric:

1. Filter Fabric shall be nonwoven polypropylene fibers, inert to biological degradation and resistant of naturally occurring chemicals, alkalis, and acids.
 - a. Mirafi 135 N as manufactured by Ten Cate Nicolon, Norcross, GA. www.tencate.com or approved equal.
2. Submit suppliers product data that product meets the requirements for approval

E. Fertilizer:

1. Fertilizer shall be Osmocote Plus, 15-9-12 or approved equal.

PART 3 - EXECUTION

3.01 SITE EXAMINATION AND COORDINATION

- A. Examine the site, tree, plant, and soil conditions. Notify the Owner's Representative in writing of any conditions that may impact the successful Tree and Plant Protections that are the intent of this section.
- B. The Contractor shall coordinate with all other work that may impact the completion of the work.
 1. Prior to the start of work, prepare a detailed schedule of the work for coordination with other trades.
 2. Coordinate the relocation of any irrigation lines currently present on the irrigation plan, heads or the conduits of other utility lines or structures that are in conflict with tree locations. Root balls shall not be altered to fit around lines. Notify the Owner's Representative of any conflicts encountered. Coordinate tree planting with minimum setbacks from mainlines, electrical, fire hydrant, light posts, and other utilities.

3.02 TREE AND PLANT PROTECTION AREA

- A. The Tree and Plant Protection Area is defined as all areas indicated on the tree protection plan. Where no limit of the Tree and Plant Protection area is defined on the drawings, the limit shall be the drip line (outer edge of the branch crown) of each tree.
- B. Preparation:
 1. Prior to the preconstruction meeting, layout the limits of the Tree and Plant Protection Area, and then alignments of required Tree and Plant Protection Fencing and root pruning. Obtain the Owner's Representative's approval of the limits of the protection area and the alignment of all fencing and root pruning.
 2. Flag all trees and shrubs, and obtain the Owner Representative's approval of all trees and shrubs to be removed prior to the start of tree and shrub removal.
 3. After approval, mark all trees to be removed in orange paint in a band at the base of the tree. Mark all shrubs with orange paint.

4. The Owner's Representative will determine which trees to salvage. Mark all salvage trees with an "X" in white paint and follow Salvage Wood instruction.
5. Prior to any construction activity at the site including utility work, grading, storage of materials, or installation of temporary construction facilities, install all tree protection fencing, Filter Fabric, silt fence, tree protection signs, Geogrid, Mulch and or Wood Chips as shown on the drawings.

C. Root Pruning:

1. Root pruning is the physical cutting of tree roots to minimize root damage and promote healing. Any method which tears roots or disturbs the soil beyond the grading limit is unacceptable.
 - a. Root prune using a sharpened spade, hand pruners or loppers for all roots smaller than one inch diameter.
 - b. Root prune using an ax, sawz-all, or chainsaw for all roots greater than one inch diameter.
 - c. Do not use a backhoe bucket or any other excavating machine to root prune.
 - d. Do not allow roots to dry out. Use moistened burlap to keep roots wet until the roots are cut clean and covered with soil or wet mulch.
2. When construction is in close proximity to existing trees to remain and roots are encountered, the roots shall be pruned by the Project Arborist.
 - a. Root pruning shall be performed as early as possible before trenching or tunneling operations.
 - b. Hand-dig trenches in areas with extensive roots.
 - c. Leave intact and undamaged roots larger than two (2) inches in diameter. Do not pull roots. During the time of exposure, keep roots moist with wet mulch and burlap or equivalent.
3. Backfill trenches that require root pruning with existing soil, mixed with peat moss to a mixture of approximately 75% loam and 25% humus by volume. Tamp soil in six-inch lifts. Each lift shall be compacted to a point at which a foot print makes only a 1/16 inch impression.
4. Apply mulch to a depth of four (4) inches at a minimum ten (10) to fifteen (15) foot radius around tree to reduce compaction and increase moisture retention.

D. Installation of geogrids, filter fabric, matting, wood chips and or mulch:

1. Install Geogrids, Filter Fabric, matting, Wood Chips, and/or Mulch in areas and depths shown on the plans and details or as directed by the Owner's representative. In general it is the intent of this specification to provide the following levels of protection:
 - a. All areas within the Tree and Plant Protection area provide a minimum of five (5) inches of Wood Chips or Mulch.
 - b. Areas where foot traffic or storage of lightweight materials is anticipated to be unavoidable, provide a layer of Filter Fabric under the 5 inches of Wood Chips or Mulch.

- c. Areas where occasional light vehicle traffic is anticipated to be unavoidable, provide a layer of Geogrids under eight (8) inches of Wood Chips or Mulch.
 - d. Areas where heavy vehicle traffic is unavoidable, provide a layer of Geogrids under 8-12 inches of Wood Chips or Mulch, and a layer of matting over the Wood Chips or Mulch.
2. The Owner's Representative shall approve the appropriate level of protection.
3. In the above requirements, light vehicle is defined as a track skid steer with a ground pressure of 4 psi or lighter. A heavy vehicle is any vehicle with a tire or track pressure of greater than 4 psi. Lightweight materials are any packaged materials that can be physically moved by hand into the location. Bulk materials such as soil, or aggregate shall never be stored within the Tree and Plant Protection Area.
- E. Installation of tree protection fencing:
 1. Install posts a minimum of two (2) feet below grade and spaced ten (10) feet on center maximum.
 2. Provide diagonal bracing to posts at corners of enclosures and whenever needed to ensure rigidity of the fencing.
 3. Install chain link fencing tight to grade at the bottom edge and stretched uniformly between posts.
 4. Provide one gate into each fenced area.
 5. Attach orange flag strips 12" long at 3' on center along the fence and five (5) feet above grade.
 6. Take care not to damage roots or to compact soil inside the fence line during placement of posts. Do not use heavy equipment for this operation.
 7. Alter no grades within protective fencing except as approved by the Tree and Landscape Protection Plan, during the fine grading operations at the conclusion of site development.
- F. Protection of existing trees and shrubs:
 1. Protect the Tree and Plant Protection Area at all times from compaction of the soil; damage of any kind to trunks, bark, branches, leaves, and roots of all plants; and contamination of the soil, bark or leaves with construction materials, debris, silt, fuels, oils, and any chemicals substance. Notify the Owner's Representative of any spills, compaction or damage and take corrective action immediately using methods approved by the Owner's Representative.
 2. Trees indicated to remain within the Project Site shall have protection fencing or tree trunk boxing that shall be maintained by the Contractor in good condition until Substantial Completion.
 3. Protection fencing shall be located at the Critical Root Zone (CRZ). The area equal to one (1) foot radius for every inch diameter from a tree measured at Diameter Standard Height (DSH).
 4. When no ground vegetation exists within the CRZ of a tree indicated for protection, the ground shall be protected with a minimum of twelve (12) inches of wood chips that extends with a three (3) foot radius clear zone from each truck.

5. Buildings, retaining wall, or other appropriate hardscape may be utilized as tree protection fencing with approval from the Owner's Representative.
 6. Existing trees that are not protected with fencing and are to remain shall be protected by boxing.
 - a. Boxing shall be 4 inch x 4 inch with two – 2 inch x 4 inch rails. Box shall be approximately 8 feet x 8 feet in size centered on the tree trunk to a height of approximately 6 feet.
- G. General requirements and limitations for operations within the tree and plant protection area:
1. The Contractor shall not engage in any construction activity within the Tree and Plant Protection Area without the approval of the Owner's Representative including: operating, moving or storing equipment, storing supplies or materials, locating temporary facilities including trailers or portable toilets, and shall not permit employees to traverse the area to access adjacent areas of the project or use the area for lunch or any other work breaks. Permitted activity, if any, within the Tree and Plant Protection Area may be indicated on the drawings along with any required remedial activity as listed below.
 2. In the event that construction activity is unavoidable within the Tree and Plant Protection Area, notify the Owner's Representative and submit a detailed written plan of action for approval. The plan shall include a statement detailing the reason for the activity including why other areas are not suited, a description of the proposed activity, the time period for the activity, and a list of remedial actions that will reduce the impact on the Tree and Plant Protection Area from the activity. Remedial actions shall include but shall not be limited to the following:
 - a. In general, demolition and excavation within the CRZ of trees and shrubs shall proceed with extreme care either by the use of hand tools, directional boring and or Air Spade, vacuum truck excavation where indicated or with other low impact equipment that will not cause damage to the tree, roots, or soil.
 - b. When encountered, exposed roots 2 inches and larger in diameter shall be worked around in a manner that does not break the outer layer of the root surface (bark). These roots shall be covered in Wood Chips and shall be maintained above permanent wilt point at all times. Roots two inches and larger in diameter shall not be cut without the approval of the owners representative. Excavation shall be tunneled under these roots without cutting them. In the areas where roots are encountered, work shall be performed and scheduled to close excavations as quickly as possible over exposed roots.
 - c. Tree branches that interfere with the construction may be tied back or pruned to clear only to the point necessary to complete the work. Other branches shall only be removed when specifically indicated by the Owner's Representative. Tying back or trimming of all branches and the cutting of roots shall be in accordance with accepted arboricultural practices (ANSI A300, part 8) and be performed under supervision of the arborist.

- d. Matting: Install temporary matting over the Wood Chips or Mulch to the extent indicated. Do not permit foot traffic, scaffolding, or the storage of materials within the Tree and Plant Protection Area to occur off of the temporary matting.
- e. Air Excavation Tool: If excavation for footings or utilities is required within the Tree and Plant Protection Area, air excavation tool techniques shall be used where practical or as designed on the drawings.
 - i. Remove the Wood Chips from an area approximately 18 inches beyond the limits of the hole or trench to be excavated. Cover the Wood Chips for a distance of not less than 15 feet around the limit of the excavation area with Filter Fabric or plastic sheeting to protect the Wood Chips from silt. Mound the Wood Chips so that the plastic slopes towards the excavation.
 - ii. Using a sprinkler or soaker hose, apply water slowly to the area of the excavation for a period of at least 4 hours, approximately 12 hours prior to the work so that the ground water level is at or near field capacity at the beginning of the work. For excavations that go beyond the damp soil, rewet the soil as necessary to keep soil moisture near field capacity.
 - iii. Using an air excavation tool specifically designed and manufactured for the intended purpose, and at pressures recommended by the manufacturer of the equipment, fracture the existing soil to the shape and the depths required. Work at rates and using techniques that do not harm tree roots. Air pressure shall be a maximum of 90-100 psi.
 - (a) The air excavation tool shall be “Air-Spade” as manufactured by Concept Engineering Group, Inc., Verona, PA (412) 826-8800, or Air Knife as manufactured by Easy Use Air Tools, Inc. Allison Park, Pa (866) 328-5723 or approved equal.
- f. Using a commercial, high-powered vacuum truck if required, remove the soil from the excavation produced by the Air Knife excavation. The vacuum truck should generally operate simultaneously with the hose operator, such that the soil produced is picked up from the excavation hole, and the exposed roots can be observed and not damaged by the ongoing operation. Do not drive the vacuum truck into the Tree and Plant Protection Area unless the area is protected from compaction as approved in advance by the Owner’s Representative.
 - i. Remove all excavated soil, excavated Wood Chips, and contaminated soil at the end of the excavation.
 - ii. Schedule the work so that foundations or utility work is completed immediately after the excavation. Do not let the roots dry out. Mist the roots several times during the day. If the excavated area must remain open overnight, mist the roots and cover the excavation with black plastic.
 - iii. Dispose of all soil in a manner that meets local laws and regulations.
 - iv. Restore soil within the trench as soon as the work is completed. Utilize soil of similar texture to the removed soil and lightly compact with hand tools. Leave

soil mounded over the trench to a height of approximately 10% of the trench depth to account for settlement.

- v. Restore any Geogrids, Filter Fabric, Wood Chips or Mulch and or matting that was previously required for the area.

3.03 PRUNING

- A. All pruning shall be done in accordance with ANSI A300 (part 1), ISA BMP Tree Pruning (latest edition), and "Structural Pruning: A Guide for the Green Industry", Edward Gilman, Brian Kempf, Nelda Matheny and Jim Clark, 2013 Urban Tree Foundation, Visalia CA.
- B. Within six (6) months of the estimated date of substantial completion, prune all dead or hazardous branches larger than 1 inch in diameter from all trees to remain.
- C. Implement all pruning recommendations found in the arborist report, and all pruning of damaged trees shall be carried out under the supervision of the Project Arborist.
- D. Prune any low hanging branches and vines from existing trees and shrubs that overhang walks, streets and drives, or parking areas as follows:
 - 1. Walks - within 8 feet vertically of the proposed walk elevation.
 - 2. Parking areas - within 12 feet vertically of the proposed parking surface elevation.
 - 3. Streets and drives - within 14 feet vertically of the proposed driving surface elevation.
- E. Perform other pruning task as indicated on the drawings or requested by the Owner's Representative.
- F. Sterilize all pruning tools between work in individual trees.

3.04 TREE AND STUMP REMOVAL

- A. Tree Removal:
 - 1. Remove all trees indicated by the drawings and specifications as requiring removal, in a manner that will not damage adjacent trees or structures or compact the soil.
 - 2. Remove trees that are adjacent to trees or structures to remain, in sections, to limit the opportunity of damage to adjacent crowns, trunks, ground plane elements, and structures.
 - 3. Do not drop trees with a single cut unless the tree will fall in an area not included in the Tree and Plant Protection Area. No tree to be removed within fifty (50) feet of the Tree and Plant Protection Area shall be pushed over or up-rooted using a piece of grading equipment.
 - 4. Protect adjacent paving, soil, trees, shrubs, ground cover plantings, and understory plants to remain from damage during all tree removal operations, and from construction operations. Protection shall include the root system, trunk, limbs, and crown from breakage or scarring, and the soil from compaction.
- B. Salvage Wood:
 - 5. Salvage Trees marked with a white "X". Logs must be relatively straight with a minimum diameter of 18" and a length between 4 feet – 11ft. 6 inches. Each log must be marked

with a permanent tree tag at the cut log end indicating the tree number. Tags may be provided by the University of Washington.

C. Stump Removal:

1. Remove stumps and immediate root plate from existing trees to be removed. Grind trunk bases and large buttress roots to a depth of the largest buttress root, or at least 18 inches below the top most roots, whichever is less, and over the area of three times the diameter of the trunk (DBH).
2. For trees where the stump will fall under new paved areas, grind roots to a total depth of 18 inches below the existing grade. If the sides of the stump hole still have greater than approximately 20% wood visible, continue grinding operation deeper and/or wider until the resulting hole has less than 20% wood. Remove all wood chips produced by the grinding operation and backfill in 8 inch layers with controlled fill of a quality acceptable to the site engineer for fill material under structures, compacted to 95% of the maximum dry density standard proctor. The Owner's Representative shall approve each hole at the end of the grinding operation.
3. In areas where the tree location is to be a planting bed or lawn, remove all woodchips and backfill stump holes with planting soil as defined in Specification Section Planting Soil, in maximum of 12 inch layers and compact to 80-85% of the maximum dry density standard proctor.

3.05 FERTILIZING AND IRRIGATION DURING CONSTRUCTION/MAINTENANCE PERIOD

- A. All trees and landscape requiring protection shall be fertilized and watered by the Contractor until Substantial Completion.
 1. Fertilize and irrigate per the approved Tree and Landscape Protection Plan.
 2. Water used for irrigation shall be potable water supplied by the Contractor.
- B. Soil Moisture: Volumetric soil moisture level, in all soils within the Tree and Plant Protection Area shall be maintained above permanent wilt point to a depth of at least 8 inches. No soil work or other activity shall be permitted within the Tree and Plant Protection Area when the volumetric soil moisture is above field capacity. The permanent wilt point and field capacity for each type of soil texture shall be defined as follows (numbers indicate percentage volumetric soil moisture).

Soil type	Permanent wilt point v/v	Field capacity v/v
Sand, Loamy sand, Sandy loam	5-8%	12-18%
Loam, Sandy clay, Sandy clay loam	14-25%	27-36%
Clay loam, Silt loam	11-22%	31-36%

Silty clay, Silty clay loam	22-27%	38-41%
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- C. The Contractor shall confirm the soil moisture levels at the request of the owner. If the moisture is too high, suspend operations until the soil moisture drains to below field capacity.
- D. The Contractor shall be fully responsible to ensure that adequate water is provided to all plants to be preserved during the entire construction period. Adequate water is defined to be maintaining soil moisture above the permanent wilt point to a depth of 8 inches or greater.
- E. The Contractor shall adjust the automatic irrigation system, if available, and apply additional water, using hoses or water tanks as required.
- F. Periodically test the moisture content in the soil within the root zone to determine the water content.

3.06 GENERAL MAINTENANCE DURING CONSTRUCTION/MAINTENANCE PERIOD

A. Weed Removal:

- 1. During the construction period, control any plants that seed in and around the fenced Tree and Plant Protection area at least twice a month between November-March and weekly April-October.
- 2. At the end of the construction period provide one final weeding of the Tree and Plant Protection Area.

B. Insect and Disease Control:

- 1. Monitor all plants to remain for disease and insect infestations during the entire construction period. Provide all disease and insect control required to keep the plants in a healthy state using the principles of Integrated Plant Management (IPM). All pesticides shall be applied by a certified pesticide applicator and pre-approved by the owner's representative.

C. Clean-up:

- 1. During tree and plant protection work, keep the site free of trash, pavements reasonably clean, and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.
 - a. Immediately clean up any spilled or tracked soil, fuel, oil, trash, or debris deposited by the Contractor from all surfaces within the project or on public right of ways and neighboring property.
- 2. Once tree protection work is complete, wash all soil from pavements and other structures. Ensure that Mulch is confined to planting beds.
- 3. Make all repairs to grades, ruts, and damage to the work or other work at the site.

4. Remove and dispose of all excess Mulch, Wood Chips, packaging, and other material brought to the site by the Contractor.
5. Do not store materials potentially harmful to tree roots within twenty (20) feet of protection fencing. Potentially harmful materials include, but are not limited to, petroleum products, cement and concrete materials, cement additives, lime, paints and coatings, waterproofing products, concrete forms coatings, detergents, acids, and cleaning agents.

3.07 REMOVAL OF TREE/PLANT PROTECTION: DAMAGE OR LOSS MITIGATION

- A. At the end of the construction period or when requested by the Owner's Representative, remove all fencing, Wood Chips or Mulch, Geogrids and Filter Fabric, trunk protection and/or any other Tree and Plant Protection material.
- B. Any trees or plants designated to remain, and which are damaged by the Contractor, shall be replaced in kind by the Contractor at their own expense. Trees shall be replaced with a tree of similar species and of equal size or 6 inch caliper, whichever is less. Shrubs shall be replaced with a plant of similar species and equal size or the largest-size plants reasonably available, whichever is less. Where replacement plants are to be less than the size of the plant that is damaged, the Owner's Representative shall approve the size and quality of the replacement plant.
 1. All trees and plants shall be installed per the requirements of Specification Section Planting.
- C. Plants that are damaged shall be considered as requiring replacement or appraisal in the event that the damage affects more than 25% of the crown, 25% of the trunk circumference or root protection area, or the tree is damaged in such a manner that the tree could develop into a potential hazard. Trees and shrubs to be replaced shall be removed by the Contractor at his own expense.
 1. The Owner's Representative may engage an independent arborist to assess any tree or plant that appears to have been damaged, to determine its health or condition.
- D. Any tree that is determined to be dead, damaged, or potentially hazardous by the Owner's arborist and upon the request of the Owner's Representative shall be immediately removed by the Contractor at no additional expense to the owner. Tree removal shall include all cleanup of all wood parts and grinding of the stump to a depth sufficient to plant the replacement tree or plant, removal of all chips from the stump site, and filling the resulting hole with topsoil.
- E. Any remedial work on damaged existing plants recommended by the consulting arborist shall be completed by the Contractor at no cost to the owner. Remedial work shall include but is not limited to: soil compaction remediation and vertical mulching, pruning and or cabling, insect and disease control including injections, compensatory watering, additional mulching, and could include application tree growth regulators (TGR).
- F. Remedial work may extend up to two (2) years following the completion of construction to allow for any requirements of multiple applications, or the need to undertake applications at required seasons of the year.