SECTION 01 56 39 TREE RETENTION AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contract Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Report Documentation
1. City and County of Denver - Regulated Asbestos Contaminated Soil Standard Operating Procedure (RACS SOP), Denver Department of Public Health and Environment (DDPHE) – Environmental Quality Division, May 2, 2019 (see Appendix).
2. City and County of Denver – Guidance for Reuse of Soil on City Projects, Denver Department of Environmental Health – Environmental Quality Division, October 5, 2017 (see Appendix).
3. **[City and County of Denver – Standard Materials Management Plan (MMP), Denver Department of Public Health and Environment (DDPHE) – Environmental Quality Division, November 13, 2019 (see Appendix).]**
4. **[List geotechnical, investigative trenching, MMP, PSRMP or related documentation including dates, authorship, etc. (see Appendix).]**

1.2 SUMMARY

A. This section consists of retention and protection of trees during the construction of the project.

B. Related Sections: **[REMOVE ANY OF THE SECTIONS BELOW THAT DO NOT APPLY]**
1. Division 01 Section “Erosion and Sedimentation Control”.
2. Division 02 Section “Demolition”.
3. Division 03 Section “Cast-In-Place Concrete”.
4. Division 31 Section “Clearing and Grubbing”.
5. Division 31 Section “Earth Moving”.
6. Division 31 Section “Excavating and Backfilling of Trenches”.
7. Division 31 Section “Watering”.
8. Division 32 Section "Aggregate Base Course”.
9. Division 32 Section "Asphalt Pavement".
10. Division 32 Section “Concrete Walks, Curbs, and Miscellaneous Flatwork”.
11. Division 32 Section "Crushed Stone Paving".
12. Division 32 Section “Playground Protective Surfacing”.
13. Division 32 Section “Irrigation Systems”.
14. Division 32 Section “Automatic Irrigation Controllers”
15. Division 32 Section “Soil Preparation”.
16. Division 32 Section “Topsoil”.
17. Division 32 Section “Turfgrass Seeding”.
18. Division 32 Section "Native Seeding”.
19. Division 32 Section "Sodding”.
20. Division 32 Section “Trees, Plants, and Groundcovers”.
21. Division 32 Section “Tree Transplanting”.
22. Division 32 Section “Landscape Management and Maintenance”.

1.3 DEFINITIONS AND REFERENCE STANDARDS

A. Office of the City Forester (OCF): The City division within Denver Parks and Recreation responsible for all trees in public parks, parkways, right-of-way, and other public property.

B. Caliper Inch: The diameter of a tree six (6") inches above the root flare. The root flare is where the first main roots attach to the trunk.

C. Licensed, and Insured Arborist: A person shall be licensed and insured by the City and County of Denver per the City Ordinance, Chapter 57.71 to cut, trim, prune, or remove trees.

D. Champion Tree: The largest specimen of its species as determined by American Forests measuring guidelines, and as recorded with either the Colorado Tree Coalition, or the National Register of Champion Trees. In the specification herein, Champion Tree(s) shall be referred to as Notable Tree(s).

E. Diameter at Breast Height (DBH): The diameter of a tree measured at four and a half feet (4.5') above finished grade.

F. Drip Line: The outermost edge of the tree's canopy or branch spread. The area within a tree's drip line is all the ground under the total branch spread.

G. Established Tree: Trees on public property in fair or better condition with a trunk six inches (6") in diameter or greater.

H. Exploratory Excavation: A method approved by the Office of the City Forester to determine the amount and size of tree roots under the surface. Methods may include hand excavation, a pneumatic air excavation tool, or water excavation.

I. Water Excavation: Hydrovac excavation that utilizes high-pressure water to cut and liquefy the soil, while simultaneously using a vacuum to remove the soil from the excavation and will require that import fill is brought to the site to fill trenches after excavation.

J. Impacted by Construction: Trees that are directly within or adjacent to the Limit of Work, within or adjacent to staging/storage areas, and within or adjacent to construction access areas that are affected in a negative way.

K. Invasive Tree Species: Species that are on the Colorado State List for Noxious Weed Species. Anything on the A, B, or C list needs to be evaluated by the Office of the City Forester for suitability.

L. Notable Tree: Trees on public property of species rare to the City and County of Denver, including but not limited to size, form, shape, beauty, age, color, rarity, genetic constitution, or other distinctive features; of the earliest known plantings; associated with a historic person, place, event, or period; associated with local folklore, myth, legends, or traditions; and of large diameter, height or canopy spread. In the specification herein, Notable Tree(s) will be used to describe both Champion Tree(s), and Tribute Tree(s).

M. Project Consulting Arborist: An independent consultant with a degree in forestry, horticulture, arboriculture, plant pathology, entomology or plant biology; an American Society of Consulting Arborists (ASCA) registered consulting arborist, or an International Society of Arboriculture

(ISA) Board Certified Arborist, with at least five (5) years of field experience, including tree preservation or on-site monitoring of public works or construction projects involving tree retention and protection. The Project Consulting Arborist shall be approved by the Office of the City Forester.

N. Pneumatic Air Excavation Tool: A tool specifically designed to excavate soil from around tree roots. Air Spade or Air Knife are examples of pneumatic air excavation tools.

O. Significant Tree: Trees on public property with a trunk twelve inches (12") in diameter at breast height (DBH) or greater or designated by the Office of the City Forester.

P. Suitability: The quality of a tree or trees appropriate for protection and preservation during construction projects. This quality is based on an assessment of tree health, structure, age, species factor and risk assessment, if pertinent.

Q. Tree Protection Work Plan: The tree protection plan is a plan based on the contract drawings that includes the Contractor's approach to working within and around the Tree Protection Zones.

R. Tree Protection Zone (TPZ): The Tree Protection Zone is the area above and below grade around each tree where construction activities are limited or restricted to preserve tree health and structural integrity of the protected trees.
   1. The diameter of the tree shall be measured at four and one-half feet (4.5') above grade (referred to as diameter breast height). For every-one inch (1") of tree diameter the Tree Protection Zone shall extend one foot (1.0') radially from the base of the trunk or be placed at the dripline, whichever is **greater**.
   2. Notable Tree protection shall be for every one inch (1") of tree diameter the Tree Protection Zone shall extend one- and one-half feet (1.5') radially from the base of the trunk, or as determined by the Office of the City Forester and include chain link fencing.
   3. For areas with groups or groupings of trees, if the distance between trees is less than thirty feet (30'), the Tree Protection Zone may be combined and treated as one contiguous area to create a more clearly defined and manageable Tree Protection Zone.

S. Tribute Tree: A living dedication for an occasion like a birth, wedding, anniversary, or to remember someone close to you. In the specification herein, Tribute Tree(s) shall be referred to as Notable Tree(s).

1.4 SUBMITTALS

A. All Submittals shall be approved by the Project Manager and the Office of the City Forester or the Project Consulting Arborist, prior to mobilization and any Work being conducted on site.

B. Tree Protection Work Plan: Submit a tree protection work plan based on the Contract Drawings for approval. The plan shall include the following:
   1. Existing conditions.
   2. Limit of Work.
   3. Tree caliper / diameter size, location of dripline, and City site identification number.
   4. Tree Protection Zones with Tree Protection Zone sign locations.
   5. Tree protection fencing (chain link / orange plastic safety) shall correspond to the level of construction activity adjacent to protected tree(s). Including but not limited to areas of

high traffic, material drop off/pickup, high intensity activity, and earthwork of greater intensity than grubbing. Notable trees shall include chain link fencing.

6. Plan for the Work occurring within or adjacent to Tree Protection Zones:
    a. Access routes, including designated routes for equipment and foot traffic by work crews to minimize soil compaction.
    b. Proposed exploratory excavation locations and methods to remove soil from around tree roots within Tree Protection Zones.
7. Maintenance of Tree Protection Zones and any trees affected by Construction during the Work.
8. Trees identified for regular soil moisture readings.
9. During construction, Tree Protection Plans may need to change per field conditions. The Contractor shall continue to update the Tree Protection Work Plan in the field as a redlined plan and submit for approval from the Project Manager and the Office of the City Forester.

C. Tree Protection Work Plan Updates: The Contractor shall submit a highlighted section of their Tree Protection Work Plan at the Construction Progress Meetings to discuss where they intend to work and what Tree Protection Zones may be impacted for the upcoming week.

D. Pruning: Proposed methods, materials, the Licensed and Insured Arborist, and schedule for root pruning, branch pruning, and other tree maintenance shall be submitted for approval.

E. Pneumatic Air Excavation: Type of pneumatic air excavation tool, the Licensed and Insured Arborist, and schedule for excavation shall be submitted for approval.

F. Water Excavation: Type of hydrovac excavation tool, the Licensed and Insured Arborist, and the schedule for excavation shall be submitted for approval.

G. Watering Plan and Schedule: The Contractor shall submit a watering plan and schedule prior to the start of work that details watering of all trees affected by the Project for approval. The below information shall be included:
1. Area of the project site to be watered and how watering will be phased based on construction.
2. Location, City site identification number (SID), and caliper inch of each tree to be watered.
3. Total number of trees to be watered and total caliper inches. Identify the amount of water to be applied based on total caliper inches
4. Schedule for watering during the duration of the project.
5. How the trees will be watered:
    a. On-site irrigation system.
    b. Temporary above ground irrigation system
    c. Hydrant.
    d. Water truck.
    e. Combination of on-site irrigation, hydrant, and water truck.

H. Soil Moisture and Watering Log: The Contractor shall fill out and submit the Office of the City Forester watering log, attached as an Exhibit. Information on the watering log includes:
1. Tree(s) watered, identified by the City site identification number.
2. Number of gallons of water applied to each tree during every watering period or irrigation schedule.
3. Soil moisture level readings, on a scale of one to ten (1 – 10). Refer to Part 3 - Execution for soil moisture reading requirements.

4. Dates of each watering.
5. The Soil Moisture and Watering Log shall be provided monthly via email to the Office of the City Forester and the Project Manager and reviewed at Construction Progress Meetings prior to the submittal of Pay Applications. Pay Applications will not be approved without receipt of the Soil Moisture and Watering Logs. If there appears to be an issue with on-site watering, Soil Moisture and Watering Logs may be requested at any time by the Office of the City Forester. It's expected that these are updated per the Specifications to reflect on-site watering.

1.5 QUALITY CONTROL

A. The Contractor and all their sub-contractors shall attend a Preconstruction Meeting as outlined in Division 01 "Project Meetings". When the Project requires new sub-contractors to be on-site to complete Work, the Contractor shall include the sub-contractors in the Construction Progress Meetings to review the requirements of this specification.

B. Contractor shall comply with applicable requirements and recommendations of the most current versions of the following standards and guidelines. Where these conflict with other specified requirements, the more restrictive requirements shall govern.
1. ANSI Z133.1: American National Standard for Tree Care Operations.
2. ANSI A300: Tree, Shrub, and Other Woody Plant Management – Standard Practices – Parts - 1,2,5,6 and 8.
3. Guide for Plant Appraisal – Current Edition: Authored by the Council of Tree and Landscape Appraisers; published by the International Society of Arboriculture.

C. As established by Chapter 57 of the Denver Revised Municipal Code, the City Forester, or an approved designee from the Office of the City Forester, shall be responsible for ensuring that all construction activities are in compliance with established standards for protection, removal, maintenance, and planting of trees with the goal of promoting the health, safety, welfare, and quality of life of the residents of the city through the development of a sustainable community forest and, specifically, the preservation of trees.

D. At its discretion, the City may hire a Project Consulting Arborist to conduct daily observation of the Contractor's field crews during the critical phases of the project, including, but not limited to, demolition of existing concrete, root pruning, construction of retaining walls, irrigation, and construction of new curb or sidewalk in Tree Protection Zones.

E. Motorized equipment and trailers, including but not limited to tractors, skid loaders, bulldozers, rubber-tired excavators, tracked excavators, trucks, cars, and carts shall not be allowed access within Tree Protection Zones with the exception of paved surfaces. Should access be necessary within designated Tree Protection Zones the Office of the City Forester or Project Consulting Arborist shall be notified and shall approve of the access route and driving surface prior to its use.

F. Materials, supplies, tools, and construction facilities shall not be stockpiled or stored within the Tree Protection Zones unless otherwise approved by the Office of the City Forester. Should temporary storage be approved by the Office of the City Forester within designated Tree Protection Zone(s), the existing grade shall be covered with plywood as identified in Part 3 – Execution to help distribute the weight of equipment and to minimize soil compaction and rutting. Plywood and/or mulch are not acceptable bridging materials for driving over exposed tree roots.

G. Under no circumstances shall any objects or materials be leaned against or supported by a tree's trunk, branches, or exposed roots. The attachment or installation of any sign, cable, wire, nail, swing, or any other material to trees that is not needed to help support the natural structure of the tree is prohibited. Standard arboricultural techniques such as bracing or cabling that are performed by professional arborists are acceptable upon approval of the Office of the City Forester or Project Consulting Arborist.

H. The Contractor shall notify the Office of the City Forester prior to mobilization on site with their schedule for installation of tree protection. Tree protection shall be in place and approved prior to any work being conducted on-site, this includes erosion control.

I. The Office of the City Forester is not available for inspections and approval on weekends or holidays, unless previously approved by the Project Manager and the Office of the City Forester.

J. If there is any known environmental contamination on-site, the Contractor shall coordinate with the Denver Department of Public Health and Environment (DDPHE) and follow the City and County of Denver guiding documents.

PART 2 - PRODUCTS

2.1 TREE PROTECTION FENCE

A. Orange plastic safety fencing – minimum of forty-eight inches (48") in height, heavy duty T-posts.
   1. Twelve (12) gauge wire.

B. Galvanized Chain-link – Six feet (6') in height. Steel chain link fence panels or rolls are acceptable.

C. Tree Protection Zone signs printed and laminated by the Contractor. Refer to Appendix.

2.2 EXPLORATORY EXCAVATION

A. Pneumatic Air Excavation Tool, AirSpade, Air Knife, or approved equal. The tool used shall not exceed ninety pounds per square inch (90 PSI).

B. Water Excavation Tool, Hydrovac equipment. The tool shall not exceed sixty pounds per square inch (60 PSI) and shall utilize a rotary nozzle to minimize root damage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The Contractor shall follow the approved Tree Protection Work Plans and access routes.

B. If it appears any Work may cause damage to a tree, the Contractor shall contact the Project Manager and the Office of the City Forester. The Project Manager and Office of the City Forester will make the determination as to whether such damage is likely, and the next steps.

C. Methods for working within a Tree Protection Zone shall be approved prior to the start of work and may include the following depending on project site conditions:
   1. Pneumatic air excavation tool. Maximum pressure applied shall be an amount not to damage roots and shall not exceed ninety pounds per square inch (90 PSI). Pneumatic air excavation may not be allowed when in known asbestos areas.
   2. Water excavation. Maximum pressure applied shall be an amount not to damage roots and shall not exceed sixty pounds per square inch (60 PSI). Water excavation may be required when in known asbestos areas.
   3. Directional boring.
   4. Hand digging.
   5. Other methods approved by the Office of the City Forester.

3.2 TREE PROTECTION FENCING

A. Tree protection fencing shall be installed and approved by the Office of the City Forester prior to any site activity, including installation of erosion control, and shall remain in place and maintained in the condition in which it was approved until removal is authorized by the Project Manager and the Office of the City Forester.

B. Tree protection fencing shall be installed one foot (1') offset from the existing or proposed hardscape.

C. Tree protection fencing shall be constructed as follows:
   1. Fencing shall be installed to surround the trees within the Limit(s) of Work.
   2. Orange plastic safety fencing is required as shown in the plans or as directed by the Office of the City Forester.
      a. The fencing shall be secured to metal t-posts with twelve-gauge (12) wire woven through the top of fencing along the entire length.
      b. Heavy duty t-posts shall be placed every eight feet (8') so that wire and fence are taut.
      c. Installation of the posts shall not result in injury to the tree above or below ground.

   3. Chain link fencing is required by the Office of the City Forester, particularly where heavy construction activity is adjacent to existing trees, where Notable trees are located, or as required on the plans.
      a. Chain link fence shall have posts installed no less than ten feet (10') on center, at a depth of twenty-four inches (24") minimum or utilize sandbags as shown in the Tree Retention and Protection Detail.
      b. Installation of the posts shall not result in injury to tree above or below ground.

3.3 TREE PROTECTION SIGNS

A. A standard Office of the City Forester tree protection sign shall be placed one (1) per each Tree Protection Zone, minimum, or per the direction of the Office of the City Forester.
   1. The Contractor shall print and laminate eleven by seventeen-inch (11"x17") size tree protection signs. Refer to Appendix.
      a. The Contractor shall use zip ties on all four (4) corners of the signs to attach to the tree protection fencing.
      b. The tree protection signs shall be replaced within twenty-four (24) hours if they become unreadable, destroyed, missing, or per the direction of the Project Manager and/or the Office of the City Forester.

3.4 DEMOLITION

A. Caution shall be used during removal of existing street, curb, gutter, sidewalk, drain inlets, and other concrete and asphalt demolition, to minimize injury to tree root systems. The following procedures are acceptable when removing existing concrete.
   1. Breaking of the existing concrete and asphalt for removal shall be done in a manner that will minimize ground disturbance and vibration.
   2. Curbs and sidewalks within designated Tree Protection Zones shall be removed in a manner approved by the Office of the City Forester. When removing existing sidewalks and curbs, care shall be taken to avoid injury to roots located under, over, or adjacent to paved surfaces.
   3. In instances where roots and root-trunk flares are growing over hardscape, caution shall be used to minimize damage during breaking of hardscape and removal of debris. Wood and bark tissues shall not be injured by equipment. The Contractor shall discuss methods and submit for approval from the Office of the City Forester prior to demolition.
   4. Motorized equipment and trailers, including but not limited to tractors, skid steers, bulldozers, rubber-tired excavators, tracked excavators, trucks, cars, and carts are limited to existing paved areas only and access must be approved by the Office of the City Forester prior to entrance into the Tree Protection Zones.
      a. If pre-approved by the Office of the City Forester, the Contractor shall test compaction after removal of hardscape to determine the percent of Standard Proctor. If the Standard Proctor is ninety percent (90%) or above, the Contractor may be able to utilize the tested area with equipment as approved by the Office of the City Forester. If it is determined that the compaction is adequate, but there are visible surface roots or tree roots that will be impacted, this method may not be suitable and may be denied by the Office of the City Forester.
      b. If equipment is approved by the Office of the City Forester, tracking pads shall be placed on the surface.
   5. All excavation and debris material shall be hauled off or deposited outside of the Tree Protection Zones. At no time shall material be stored, even temporarily, within the Tree Protection Zones.

3.5 CONSTRUCTION IN TREE PROTECTION ZONES

A. The Contractor shall protect all trees from injury due to construction related work. All injuries to trees shall be mitigated to the satisfaction of the Office of the City Forester, and, if appropriate in accordance with guidelines established in the "Guide for Plant Appraisal" as available upon request from the Office of the City Forester. All costs of such mitigating shall be charged to and paid by the Contractor or offending sub-contractor.

B. If access within designated Tree Protection Zones is approved by the Office of the City Forester or Project Consulting Arborist, the existing grade shall be covered with twelve inches (12") of wood mulch and overtopped by three-quarter inch (3/4") plywood with overlapping sheets, six-inches (6") minimum, or the plywood may be approved for use on the bottom of the mulch, to help distribute the weight of equipment and to minimize soil compaction and rutting. Mulch must be maintained at twelve inches (12") and plywood must be replaced when it becomes damaged and cracked to the point of being ineffective as determined by the Office of the City Forester.
   1. Ground tracking mats or steel plates may be used as an alternative to plywood and may be required in high-traffic areas. Mulch is still required in combination with ground tracking mats or steel plates. Mats or plates must be appropriately sized for the type of equipment

and shall be approved by the Project Manager of Office of the City Forester prior to installation.

C. The following procedures shall be used when constructing any hardscape or drainage improvements:
   1. All materials and equipment shall be kept on existing hardscape or within previously approved, compacted sub-base areas.
   2. Protect exposed roots from damage and contamination by stabilization materials and concrete.
   3. Locate concrete washouts outside of and away from Tree Protection Zones. Washout runoff shall be strictly contained within the washout area and shall not flow into Tree Protection Zones.
   4. When excavating, excavated soil shall be deposited in trucks and hauled off or deposited temporarily outside the Tree Protection Zones. Excavated and fill soil shall not be deposited, even temporarily, in Tree Protection Zones.
   5. If root pruning is needed, refer to section "Pruning".

D. The compaction of sub soil within Tree Protection Zones shall not exceed eighty percent (80%) proctor density, unless the Contractor can confirm by testing that the existing compaction within the Tree Protection Zones already exceeds eighty percent (80%).

E. If part of an approved plan, grading within the Tree Protection Zones shall be performed by hand or a method approved by the Office of the City Forester. Any fill material that needs to be placed in the Tree Protection Zone shall be limited to a maximum of four inches (4") of fill material over the area. Fill should consist of sandy loam topsoil. Clay soils shall not be used as fill. When using fill soil, the existing surface to receive fill should be scarified by hand, while avoiding root damage, to a maximum depth of one inch (1") from the finished grade prior to placing fill material, to ensure proper incorporation of fill material. Any filling operation should not occur during water saturated soil conditions.

F. Concrete or chemicals spilled within Tree Protection Zones shall be completely removed at the time of the spill. Contaminated soil shall be completely removed by hand and/or approved methods to minimize disturbance to root systems. Approved soil shall be added as necessary to restore the grade and the Contractor shall provide remedial tree maintenance as outlined in section "Tree Maintenance During Construction". Contact the Project Manager and the Office of the City Forester immediately in the event of a spill within a Tree Protection Zone

3.6 TRENCHING

A. When trenching is approved within the Tree Protection Zones by the Office of the City Forester, the Work shall be dug by hand, pneumatic air excavation, water excavation, or be done by directional boring in a matter to minimize root damage.

B. Whenever trenching exposes roots, as called out in section "Pruning", extending through the trench wall, the Contractor shall contact the Project Manager and the Office of the City Forester or the Project Consulting Arborist immediately for inspection and evaluation. Refer to section "Pruning".

C. Directional Boring: Bore shall be thirty-six inches (36") below grade, minimum for irrigation mainline and site utilities, unless otherwise approved by the Office of the City Forester or the Project Consulting Arborist. For irrigation lateral lines the depth shall be between eighteen inches

(18”) and twenty-four inches (24”). The bore shall have a locator to measure and maintain depth. The Contractor shall verify depth is accurate with the Project Manager and the Office of the City Forester.

3.7 IRRIGATION OR UTILITY INSTALLATION

A. All Excavation, Irrigation, or Utility installation occurring within the Tree Protection Zones as indicated on the Contract Documents shall be marked out in the field and reviewed in the field with the Office of the City Forester or Project Consulting Arborist prior to installation.

3.8 PRUNING

A. Branch Pruning: Shall be the responsibility of the Contractor for construction equipment access, specialty pruning required for the Project, and any damage caused by the Contractor during the Project and shall be done by a Licensed, and Insured Arborist. Pruning shall only be done with approval and at the direction of the Office of the City Forester or Project Consulting Arborist. Information on storm damage is found in section “Tree Maintenance During Construction”.

B. Root Pruning: Shall be done in accordance with ANSI A300 Root Management Standard latest edition and in accordance with Best Management Practices and be performed by a Licensed, and Insured Arborist.

1. The Office of the City Forester or Project Consulting Arborist shall be notified prior to any Work operation known or suspected to involve cutting of roots within the Tree Protection Zone. Tree roots shall not be pruned or cut unless their removal is unavoidable and shall be authorized by the Office of the City Forester.
    a. When contacting the Office of the City Forester, provide the following information:
        1) Tree type and/or City site identification number.
        2) Condition of the tree.
        3) Percent of disturbance anticipated within the Tree Protection Zone.
        4) Size of roots.
2. All roots needing to be pruned or removed shall be cut cleanly with sharp hand tools, with oversight by the Office of the City Forester or the Project Consulting Arborist. No wound dressings shall be used. Backfill shall promptly be installed over the exposed roots, filling all voids.
3. Recommended root pruning tools shall be free of defects and have sharp cutting edges
    a. Scissor-type lopper.
    b. Scissor-type pruner.
    c. Pruning saws designed specifically for tree work.
4. After root-pruning, cover exposed roots within thirty (30) minutes to minimize desiccation. Roots may be covered with soil, mulch, or moistened burlap, and shall be kept moist until the final grade is established or roots are buried in soil.
5. Where appropriate, and under the direction of the Office of the City Forester or the Project Consulting Arborist, root restricting barriers can be installed in accordance with manufacturer’s recommendations.
6. If root pruning is authorized within the Tree Protection Zones, the Contractor shall provide remedial tree maintenance as identified in section “Tree Maintenance During Construction”.

3.9 SURFACE AND EXPOSED ROOTS

A. When encountered, exposed roots shall be worked around in a manner that does not damage the outer layer of the root surface or bark
   1. The Office of the City Forester shall be notified should tree roots become exposed.
   2. Exposed roots must be wrapped in burlap and kept moist. At or below forty degrees (40°) F, the excavation area shall be covered in concrete blankets or as directed by the Office of the City Forester.
   3. Exposed tree roots shall not be driven over. Plywood and/or mulch are not acceptable bridging materials for driving over exposed roots.

3.10 PROJECT SITE MONITORING

A. The Contractor is responsible for monitoring and maintaining Tree Protection Zones throughout the duration of the Project until removal of the tree protection fencing is approved by the Project Manager and the Office of the City Forester.

3.11 TREE MAINTENANCE DURING CONSTRUCTION

A. Common Tree Maintenance: Practices that maintain the health and vigor of the tree, such as: watering, mulching, remedial pruning (if needed, and approved by the Office of the City Forester). The Contractor shall be responsible for all trees impacted by Construction throughout the Project.

B. Remedial Tree Maintenance: Practices such as soil remediation and soil/tissue sampling, and these practices are on an "as needed" basis, or as directed by Project Manager and the Office of the City Forester. The Contractor shall be responsible for all trees impacted by Construction throughout the Project.

C. Tree watering during Construction shall consist of the following minimum requirements for all trees within a Tree Protection Zone or otherwise impacted by Construction:
   1. Watering of trees shall occur throughout the year during Construction, including winter.
   2. Watering from May through September (growing season) shall consist of:
      a. All trees within the Limit of Work and/or impacted by Construction shall be watered.
      b. When utilizing the existing irrigation system, the Contractor shall continue to water per the current Denver Parks and Recreation watering schedule with a minimum of three (3) times per week during peak season.
   3. Watering from October through April (winter) shall consist of:
      a. Trees six inches (6”) and smaller within the Limit of Work and/or impacted by Construction shall be watered.
      b. All evergreens within the Limit of Work and/or impacted by Construction shall be watered.
      c. Frequency shall be based on soil moisture readings, visual indicators, and weather conditions.
   4. When completing winter watering or growing season watering with a hydrant or water truck, minimum watering requirements shall be twenty-five (25) gallons of water per caliper inch of every tree with an equal application of water throughout the entire Tree Protection Zone. Watering shall occur when daytime temperatures are at or above forty degrees (40°) F.
   5. Watering frequency shall be based on the criteria above, visual indications, and on the average soil moisture level.

a. The Contractor shall take soil moisture readings throughout the Project. The soil moisture shall have a measure between four (4) and eight (8) on the meter and shall be maintained during Construction.
b. Soil moisture readings shall be taken every week, at a minimum, during the Construction period and at a depth of twelve inches (12").
c. Readings shall be taken and recorded for twenty percent (20%) of the trees within the Limit of Work and impacted by Construction and shall be indicated on the Tree Protection Work Plan.
d. All readings shall be recorded and submitted as outlined in Part 1 – Submittals.

6. Depending on weather conditions, the Office of the City Forester or Project Consulting Arborist may approve less frequent watering.
7. The Office of the City Forester will look for visual indications to determine if watering is adequate during Construction. If it appears that the trees are suffering based on visual indications, the Office of the City Forester will check the soil moisture levels and determine the corrective action. Criteria includes:
   a. The surrounding soil and/or landscape is dry.
   b. The surrounding vegetation is dying or dead.
   c. The leaves on the trees are wilted.
   d. Color.
8. **[Tree watering for non-irrigated sites: During the design process, the Consultant and the Project Manager shall work with the Office of the City Forester to determine the requirement for watering for non-irrigated sites based on specific project impacts and outline the criteria that shall be included within this specification.]**
9. At the Contractor's expense, they may install a temporary irrigation system to water with the approval of the Project Manager and the Office of the City Forester.

D. Branch and Root Pruning: Refer to Section "Pruning".

E. Maintenance for Storm Damage or Emergencies: The Contractor shall coordinate trees affected by storm damage with the Office of the City Forester. Guidelines for responsibilities are identified below:
1. Non-imminent threat or immediate threat that is not a danger to the public: Considered low priority clearing and will be removed as time allows by the Office of the City Forester. If the Contractor needs access to the Limit of Work, the Contractor shall remove the damage at their expense.
2. Immediate threat that affects the public: Considered high priority clearing for the Office of the City Forester and will be removed by the Office of the City Forester inside the Limit of Work.

F. The timing duration and frequency of necessary maintenance practices shall be determined and approved by the Office of the City Forester or Project Consulting Arborist, based on factors associated with the site and affected trees.

3.12 TREE PROTECTION ZONE VIOLATION AND DAMAGE PENALTIES

A. Verbal Warning: A verbal warning with instruction may be given at the discretion of the Office of the City Forester.

B. Written Warning: A written warning may be given at the discretion of the Office of the City Forester.

C. Fines: A fine of two thousand five hundred dollars ($2,500.00) will be levied against the Contractor or any Sub-contractor for each violation of the Tree Protection Zones and/or damage. This includes but is not limited to, fencing not maintained as originally approved by the Office of the City Forester, and any encroachments within the designated Tree Protection Zones. Fines will be given for every occurrence and may exceed two thousand five hundred dollars ($2,500). This fine shall be independent of any applicable damage penalty for the appraised value of the tree(s).

D. Injuries and Damage to Existing Trees: Any plants designated as requiring retention or protection that are partially injured or lost due to Contractor neglect or unacceptable construction activities will result in a penalty as determined by the Office of the City Forester, as described in Chapter 57 of the Denver Revised Municipal Code.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT **[Consultant to select A or B]**

A. Measurement will be based on the percentage complete for the lump sum contract amount for Tree Retention and Protection.

B. Measurement will be made by the contract unit specified for Tree Retention and Protection. Measurement shall include the actual number of units of specified material(s) placed and accepted at the locations shown on the Contract Drawings, or as directed by the Project Manager, and in accordance with the Specifications.

4.2 PAYMENT

A. Payment will be made at the **[contract unit**] [**lump sum contract**] price, and shall include required materials, transportation, equipment, and labor, <**Insert additional items**> required to establish tree protection and remove the tree protection at the end of the project as required in accordance with the Contract Drawings and Specifications. Payment will also include the maintenance of the tree protection throughout the duration of the project as well as the labor, materials and equipment required to restore the site to its original condition at the completion of the project.

END OF SECTION 01 56 39