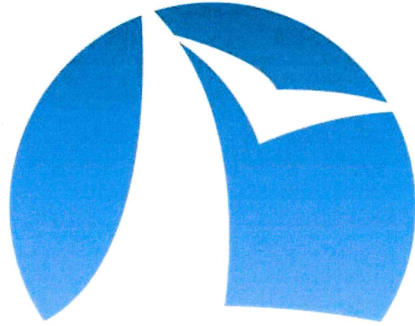




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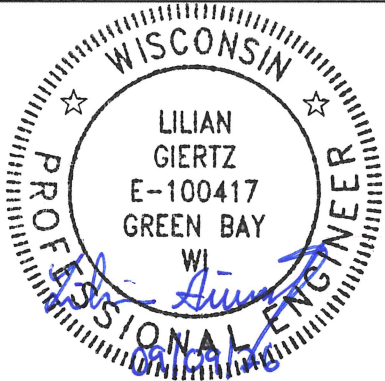
Living up to our name.

City of Superior, Wisconsin

FIBER TO THE HOME

OUTSIDE PLANT CONSTRUCTION SPECIFICATIONS

REVISION DATE: 09/09/26

	Sheet Index Pages 1-14: OSP Fiber Construction Specifications Pages 15-33: OSP Fiber Construction Typicals Pages 34-69: City of Superior/DOT Roadway Typicals
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SECTION 01 00 00 - GENERAL REQUIREMENTS

1.01 SUMMARY OF WORK

- A) The work under this Contract consists of providing all labor, materials, equipment, and supervision necessary for the complete and functional installation of a Fiber to the Home (FTTH) network within the City of Superior, including but not limited to: underground conduit systems, aerial fiber installation, handholes, pull boxes, vaults, passive cabinets, fiber optic cable placement, splicing, testing, site restoration, traffic control, and all associated civil and electrical work, as detailed in these Specifications and accompanying Plans.
- B) All work shall be performed in strict accordance with the Contract Documents, applicable codes, standards, and industry best practices.

1.02 DEFINITIONS

- A) **City:** City of Superior, Wisconsin.
- B) **Owner:** City of Superior, Wisconsin.
- C) **Project Manager:** The designated City representative responsible for day-to-day oversight, approvals, and coordination of the Project.
- D) **Engineer:** The City Engineer or authorized Professional Engineer representative responsible for technical design approvals and ultimate resolution of technical disputes.
- E) **Contractor:** The entity awarded the Contract for the execution of the Work.
- F) **Plans:** The engineering drawings, details, and schedules provided for the Project.
- G) **BMP (Best Management Practice):** Techniques or methods utilized for the control of erosion and sedimentation.
- H) **MUTCD (Manual on Uniform Traffic Control Devices):** The latest edition of the Wisconsin Manual on Uniform Traffic Control Devices.
- I) **OTDR (Optical Time Domain Reflectometer):** An optoelectronic instrument used to characterize an optical fiber.
- J) **TPZ (Tree Protection Zone):** A specified area around a tree defined by the diameter of the tree trunk (measured in inches at chest height) multiplied by 1.5 and expressed as feet, measured as a radius from the trunk, as shown in the details within the Tree Protection Zone Details.

1.03 CONTACTS

- A) For project coordination, communication, and official notifications, the following key contacts shall be utilized:

- 1) **Facility Owner**

- a) Organization: City of Superior
 - b) Contact Name: Stephanie Becken - Broadband Manager
 - c) Contact Phone: 715.395.1496
 - d) Contact Email: beckens@superiorwi.gov

- 2) **FTTH Design**

- a) Organization: Mi-Tech Services, Inc.
 - b) Contact Name: Nate Cockburn - Project Design Lead
 - c) Contact Phone: 763.402.7934
 - d) Contact Email: ncockburn@mi-tech.us
 - e) Contact Name: Jonathan Whitley - OSP Team Manager
 - f) Contact Phone: 612.719.4214
 - g) Contact Email: jwhitley@mi-tech.us

1.04 REFERENCES

- A) The latest editions of the following codes, standards, and manuals shall govern the Work unless otherwise specified herein:
- 1) WISDOT Standard Specifications for Highway and Structure Construction.
 - 2) WISDOT Facilities Development Manual (FDM) (Specifically HMM 09-15-25 Location Requirements).
 - 3) Wisconsin Manual on Uniform Traffic Control Devices (WMUTCD).
 - 4) Occupational Safety and Health Administration (OSHA) Standards.
 - 5) National Electrical Safety Code (NESC).
 - 6) National Electrical Code (NEC).
 - 7) American Society of Civil Engineers (ASCE 38-22) Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data.
 - 8) ANSI/SCTE 77-2017 (for Underground Enclosure Integrity).
 - 9) Wisconsin Department of Natural Resources (WI DNR) Technical Standards (specifically 1059 for Revegetation).
 - 10) Public Service Commission of Wisconsin Rules for Construction of Underground Electric Supply and Communication Systems.
 - 11) City of Superior Code of Ordinances (specifically Chapter 112, Section 33 - Heavy Traffic (Truck) Route).
 - 12) City of Superior construction specifications, sidewalk drawings, and design standards as applicable.
 - 13) Manufacturer's recommendations for all installed materials and equipment.
 - 14) WISDOT Construction and Materials Manual (CMM)

1.05 CONTRACTOR RESPONSIBILITIES

- A) The Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B) The Contractor shall be responsible for locating all utilities, whether public or private, prior to excavation or boring. Information shown on Plans regarding existing underground facilities is approximate; the Owner is not responsible for its accuracy or completeness.
- C) The Contractor shall have full responsibility for reviewing and checking all utility information, locating all underground facilities, coordinating with utility owners, protecting facilities, and repairing any damage resulting from the work at no additional cost to the Owner.
- D) The Contractor shall notify affected utility companies/agencies in writing at least forty eight (48) hours prior to beginning construction.
- E) The Contractor shall call 811 for locates no less than two (2) business days or no more than three (3) business days before beginning any excavation or demolition.
- F) The Contractor shall immediately notify the Project Manager of any damage or changed condition caused by construction activities that may result in a disruption of sanitary sewer service.
- G) The Contractor shall obtain all necessary permits from appropriate governing regulatory agencies (City of Superior, WISDOT, Superior Water Light & Power, WDNR, etc.) prior to commencing work.
- H) The Contractor shall comply with all applicable Federal, State, and Local laws, ordinances, and requirements governing excavation, safety, environmental protection, and all other aspects of the work.
- I) The Contractor shall take all available precautions to control dust, per WI DNR Technical Standard 1068 and as approved by the Project Manager.
- J) The Contractor shall immediately repair or replace any damage to public or private property (fences, walls, pavement, grass, trees, etc.) resulting from the work, at no additional cost to the Owner. This work shall be subsidiary to the cost of the contract unless otherwise noted.
- K) The Contractor shall re-establish any property marker, benchmark, etc., disturbed during construction to its original location and elevation (reference WISDOT CMM Section 785 and WISDOT FDM Section 9-5 for WISDOT rights of way).
- L) The Contractor is responsible for all fines, fees, or expenses resulting from failure to comply with permit conditions, failure to obtain permits, sediment or dirt discharges from the site, or the cost to restore damaged facilities or damage

to property resulting from their operations. The costs for fines, fees and restoration are to be considered incidental to the contract prices and will not be paid or reimbursed separately by the Owner.

- M) The Contractor will follow an Erosion Control Plan approved by the Project Manager.
- N) The Contractor is solely responsible for installation, implementation, maintenance, effectiveness, and removal of all erosion control devices and Best Management Practices, in accordance with approved erosion control plan.
- O) Inspections of erosion control devices, disturbed areas, and vehicle entry/exit areas shall occur weekly and after significant rain events (0.5" or more), with records maintained by the Contractor, and to be made available to the Owner upon request.
- P) Personnel performing fiber optic fusion splicing shall possess a current Fiber Optic Association (FOA) Certified Fiber Optic Technician (CFOT) certification or Owner-approved equivalent certification. Lead Fiber Splicers shall have a minimum of five (5) years of documented fiber optic splicing experience. The Owner reserves the right to request qualification documentation and reject unqualified personnel.

1.06 SUBMITTALS

- A) The Contractor shall submit the following for review and approval by the Project Manager prior to commencing relevant work:
 - 1) Traffic Control Plan: A comprehensive plan for the entire project, adhering to WMUTCD standards. No work shall commence until approved by the Project Manager.
 - 2) Erosion Control Plan: An Erosion Control Plan following Best Management Practices (BMPs) for the project. No land disturbance shall proceed until approved by the Project Manager. The Erosion Control Plan shall be maintained and updated as the project progresses.
 - 3) Product Data: Contractor shall submit copies of Product Data Sheets and Specification Sheets for all materials to be furnished on the project to the Project Manager two (2) weeks prior to the start of construction. Project Data shall clearly mark the proposed product, manufacturer and part/product numbers proposed for use on the project, and items that are not applicable shall be crossed out on the submittal. Project manager will review materials for compliance with the specifications and contract drawings and approve, request changes, or request clarification to the submitted materials. Contractor shall not incorporate any product into construction without prior written approval of the Project Manager. Products to be submitted include but are not limited to conduit, handholes, pull boxes, vaults, fiber optic cable, locate posts and passive cabinets.
- B) The Contractor shall submit the following test results prior to the Project Manager after completing installation of fiber optic systems and completing testing. Final Payment will not be made on any portion of the fiber installation until test results have been submitted showing compliance with specifications and contract documents.
 - 1) Fiber Optic Test Results: Detailed OTDR and optical source/power meter test results as specified in Section 33 60 00, Part 3.
 - 2) As-Built Drawings and GIS Locates/Coordinates: Final locations of all installed infrastructure (conduit, handholes/pull boxes/vaults, fiber runs, cabinets) upon project completion. Record drawings shall be submitted to the City in the following formats: ESRI Geodatabase, ESRI Shapefile, Geopackage, PDF.

1.07 WORK HOURS AND SITE CONDITIONS

- A) Work hours shall be Monday - Friday, 6:00 AM - 8:00 PM, unless prior written approval for extended hours or weekend work is granted by the Superior City Public Works Department. No work is allowed on holidays unless explicitly approved in advance.
- B) To minimize the risk of service interruptions, any work performed by Contractor or subcontractor personnel within the Central Office (CO) involving active fiber facilities, splice cases, fiber patch panels, splitter assemblies, or service-affecting network elements shall be performed between 10:00 PM and 5:00 AM local time unless otherwise approved in writing by the Owner. The Owner reserves the right to require on-site observation by a representative or construction inspector for the duration of such work.
- C) The Contractor shall conduct operations and cleanup to cause the least possible obstruction and inconvenience to traffic, pedestrians, cyclists, and adjacent property owners.

- D) No materials may be stored in the roadway pavement area, curb/gutter, or sidewalk so as to block drainage or create a hazard to the traveling public.
 - E) Any stockpile or equipment remaining in the road right of way at the end of the workday shall have MUTCD compliant traffic control installed until removed. No additional payment will be made for associated erosion control, roadway/boulevard cleanup, or hydroseeding.
 - F) No stockpile shall impede regular traffic in all driving lanes at any time. Vision triangles shall also be unimpeded at intersections and driveways throughout construction.
 - G) No trash, excess material, or rubbish shall be placed in manholes, handholes/pull boxes/vaults, or splice boxes. All excess material shall be removed and properly disposed of by the Contractor, in accordance with applicable rules and regulations.
 - H) The Owner will not make arrangements for contractor parking or material storage. Where parking is restricted, the Contractor shall obtain permits from the City's Police Department at their own expense.
 - I) The Contractor shall not access electric vaults; this work shall only be handled by power utility employees.
 - J) Site entry and exits shall be maintained to prevent tracking of sediment and dirt onto off-site roadways, sidewalks, or other pedestrian walkways. Any sediment/dirt deposited on roadways or sidewalk shall be removed immediately, at least once per day, and as directed by the Project Manager. Roadway/walkway shall be restored to full usable conditions at the end of each day.
 - K) All open excavations shall be protected if left unattended by the Contractor. Protection methods can include temporary fencing, barriers or other devices approved by the Project Manager.
 - L) **Winter Construction Moratorium:** Construction activities involving excavation, trenching, paving, or any ground disturbance shall generally cease when the average daily ambient air temperature falls below 25°F for three consecutive days, or when ground frost penetrates deeper than 6 inches, whichever occurs first. A construction moratorium shall typically be in effect from December 1st through April 1st, or as otherwise directed by the Project Manager, unless specific written approval for winter work is granted. Any winter work approval will require the Contractor to demonstrate adequate measures for maintaining material quality, achieving proper compaction, ensuring site safety, and preventing environmental degradation under freezing conditions. All costs associated with winter work, including specialized materials, heating, and protection, shall be borne by the Contractor unless explicitly provided for in the Contract and approved by the Project Manager.
 - M) Any removal of concrete sidewalks or concrete driveways shall not be completed if the forecast conditions call for temperatures below 50 degrees at night for the next four (4) days. All concrete sidewalks and driveways shall be replaced or temporarily replaced with asphalt prior to winter conditions to allow for full use throughout the winter months. Temporary restorations will be completed at the contractor's expense and will not be paid for separately. Under no circumstance shall sidewalks or driveways be removed and not replaced prior to winter conditions.
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SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

1.01 TRAFFIC CONTROL

- A) The Contractor shall prepare and submit a Traffic Control Plan for Project Manager approval prior to commencing construction activities.
- B) The Contractor is responsible for maintaining identified controls and implementing changes as construction progresses. No additional payment will be made for maintenance, or modification of the traffic control plan based on progress of work.
- C) All traffic control devices (signs, markings, barricades) must conform to the latest WMUTCD. If lane closures are required, the City of Superior must be notified in advance.
- D) Barricades and signs shall be placed so as not to interfere with sight distance/vision triangles for drivers entering roadways or side streets.

- E) Portable supports for barricades and signs used in lane closures or traffic staging shall conform to WMUTCD and be subject to Project Manager approval.

1.02 EROSION AND SEDIMENT CONTROL

- A) The Contractor shall comply with all local, state, and federal erosion control and water quality requirements, laws, and ordinances.
- B) National Pollutant Discharge Elimination System (NPDES) permits from the WI DNR are required for sites disturbing one acre or more, or as part of a common plan of development. The Contractor is responsible for obtaining any required NPDES permits.
- C) Erosion control devices shown on the approved Erosion Control Plan shall be installed prior to land disturbance. Land disturbance shall not proceed until a pre-construction inspection has been approved by the Project Manager.
- D) Erosion control devices shall remain in place until the protected area has been permanently stabilized with a uniform, good perennial vegetative cover of 70% (no invasive or unpermitted species).
- E) The Contractor shall observe the effectiveness of devices and make field adjustments as needed to prevent sediment from leaving the site. The Contractor shall notify the Project Manager if devices are ineffective. The Owner retains the right to add additional practices if necessary.
- F) Off-site soil borrow, spoil, and storage areas are considered part of the project site and must comply with all erosion control requirements, including Erosion Control Plan installation and permanent ground cover establishment prior to final approval of the Project Manager.
- G) Temporary seeding or other approved stabilization shall be initiated immediately on any disturbed area, unless additional construction is expected within seven (7) calendar days.
- H) The Contractor shall maintain the work area in a clean, orderly, and safe condition and shall continually remove dirt, loose material, spoil, excess excavated material, construction debris, and trash as construction progresses. Materials not required for work scheduled within the next seven (7) calendar days shall be removed from the project site or placed in a storage location approved by the Project Manager.
- I) The Contractor shall make repairs to erosion control devices within 24 hours of being instructed to make corrections or observing deficiencies during their erosion control inspection.

SECTION 31 00 00 - EARTHWORK

3.01 EXCAVATION AND BACKFILL (General)

- A) All excavation and backfill shall conform to WISDOT Standard Specifications for Highway and Structure Construction and City of Superior Construction Specifications, except as modified herein.
- B) Trench side slopes shall meet OSHA standards in effect at the time of construction. Sheet piling, shoring, and bracing shall be required when side slope standards are not met. A trench box or shoring meeting OSHA standards may be acceptable unless negated by groundwater control measures.
- C) Excavation backfill shall be placed in 12-inch or shallower, thoroughly compacted layers.
- D) Due to the heavy clay makeup of the regional soil, the top layer of the excavation backfill shall consist of "crush and run" gravel material, 1/4" and smaller, not to be finished with open graded rock larger than 1/4". This applies to all excavations where granular backfill is specified or required, including roadway crossings, bore pits, handhole/pull box/vaults, and any other locations where native clay backfill would impede drainage or stability.
- E) All cross-road bore pits shall be backfilled in layers not more than eight (8) inches in loose thickness. The base layer shall be Structural Backfill (CMM 325 & WISDOT 209.1) and eight (8) inches of 1 1/4" BAD (WISDOT 305) compacted. Further backfill layers shall match the existing section above. Each layer shall be thoroughly compacted before the next layer is placed. (Refer to WISDOT 625.2 and 651.3.1).

- F) All conduit trenches and potholes shall be backfilled completely to provide safe crossing by the end of each working day or whenever the work zone becomes inactive. The Contractor shall not open any area that cannot be backfilled in the same day/night operation.
- G) It should be noted that no test borings were made where conduit runs are to be installed by jacking or trenching. It shall be the Contractor's responsibility to examine job site conditions before submitting bid proposals.
- H) **Working in Clay Soils:** The Contractor shall anticipate and account for the presence of heavy clay soils throughout the Project area. Special attention shall be paid to:
 - 1) **Dewatering:** Implementing appropriate dewatering measures as necessary to maintain stable trench conditions and prevent mixing of excessive water with excavated material. If pumping more than 70 gpm contractor shall be required to obtain a permit from WI DNR for dewatering operations.
 - 2) **Spoil Management:** Managing excavated clay material to prevent tracking onto roadways and to ensure proper disposal or reuse in accordance with its characteristics. Excess materials shall be disposed of offsite in accordance with all applicable regulations.
 - 3) **Compaction:** Ensuring proper compaction of all backfill layers within clay-based excavations, as moisture content significantly impacts compaction effectiveness in clay. Contractor shall compact by mechanical means if vibratory compaction is ineffective as approved by Project Manager. Compaction shall be to at least 90% modified proctor outside of roadway and traffic areas, and 95% modified proctor within roadways. In the event of a dispute between the Contractor and the City on the adequacy of the compaction efforts, the City reserves the right to request compaction testing. Compaction testing will be paid for by the Contractor if test results do not pass and by the City if test results meet this specification.
 - 4) **Trench Stability:** Monitoring trench stability in clay, especially after precipitation, and taking all necessary precautions to prevent trench wall collapse.
- I) Petroleum-contaminated soil and/or Hazardous Substances may be present in soil and/or groundwater. If a petroleum odor is present during construction, stop work and notify the Project Manager. In the event that petroleum contamination is found by odor, DNR standards for reporting, testing, and clean up will need to be followed.

3.02 TOPSOIL AND RESTORATION

- A) Topsoil shall be replaced in a 4" layer and must consist of loam, sandy loam, silty clay loam, or clay loam humus-bearing soils adapted to sustain plant life, ensuring pH ranges from 6.0-7.0.
 - B) Topsoil shall be kept separate from general trench excavated material and placed on top of trench backfill. The Contractor shall remove all rock from topsoil in cultivated areas. (Refer to WISDOT 625.2 and 651.3.1).
 - C) Topsoil replacement is required in all areas where topsoil exists. (Refer to WISDOT 209.1 Granular Backfill and CMM 325 Structure Excavation).
 - D) The Contractor shall revegetate unpaved areas disturbed by construction prior to Project acceptance. Revegetation shall consist of seed sowing, ground cover (not including straw mulch), fertilizing, and watering. Revegetation shall be acceptable when vegetation achieves a uniform perennial coverage of 70%. This work is subsidiary to the Project and no additional compensation shall be allowed.
 - E) Complete revegetation work in accordance with WI DNR Technical Standards 1059. Seed mixture shall be No. 40, or as detailed in the Plans, as referenced in Section 630 of the WISDOT Standard Specifications. Seed shall be sown using hydroseed methods.
 - F) The Contractor must seed all disturbed areas upon completion of the Project, following WISDOT 107 Legal Relations and Responsibility to the Public 107.20 Erosion Control Part 4&6.
 - G) Any applicant or contractor doing work within the City's right-of-way must restore the area to its previous condition and leave it in a clean and neat condition. Any future complaints about cut or damaged tiles or poorly finished slopes or surfaces will be directed back to the Contractor for correction.
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SECTION 32 90 00 - PLANTING AND RESTORATION

3.01 TREE PLANTING, PRESERVATION, AND PROTECTION

- A) **Description:** The City of Superior acknowledges the importance of trees to the community. No trees shall be removed within the project limits without the approval of the Project Manager.
- B) **Materials:** Trees and other vegetation shall be protected and preserved during construction to maximize their survival. All workers on site shall be educated in tree preservation practices. Tree protection devices shall be placed before material deliveries, excavation, or grading begins and be maintained in good repair for the duration of the work, unless otherwise directed by the Project Manager, until landscape restoration begins.
- C) **Construction - Tree Protection:**
- 1) Protection of existing trees shall be accomplished with the establishment of the Tree Protection Zone (TPZ) for each tree and utilizing appropriate methods such as fencing, machinery selection, shoring, construction boxes, and protective ground sheeting. As an example, tree protection may include installing a snow fence with pound-in posts around trees within the current block under construction. This fencing shall be maintained for the duration of work in that immediate area and may be removed and relocated to subsequent construction blocks as the Project progresses.
 - 2) The Contractor may use additional tools or methods, approved by the Project Manager, such as hiring a commercial arborist to advise on best protection practices. If an arborist contests a damage assessment performed by the Project Manager, the Owner will consider the arborist's argument, but the Project Manager's ultimate decision shall prevail.
 - 3) Handheld operating tools, air-excavation or other non-mechanical methods are encouraged for removal or construction activities within the TPZ.
 - 4) Prior to any site work, all trees to be preserved must be protected and maintained in accordance with the TPZ Details.
 - 5) No material or construction equipment shall be stored within the TPZ.
 - 6) No protective devices, signs, utility boxes or other objects shall be nailed to trees.
 - 7) Tree protection fencing shall be erected and approved by the Project Manager at least 24 hours before construction begins in the vicinity of the tree.
- D) **Grade Changes:**
- 1) Grade cuts shall be minimized or eliminated within the TPZ.
 - 2) Areas within the TPZ disturbed by construction activity shall be mulched with a 2-3" deep layer of shredded bark mulch within 4 hours of disturbance as temporary root protection.
- E) **Trenching and Tunneling:**
- 1) Trenching shall be done outside the TPZ. Trenchless techniques (boring, tunneling) shall be employed within the TPZ. Boring through a TPZ shall be a minimum of 48" depth below existing grade.
 - 2) Pruning of branches shall be done only under the requirements and direction of the Project Manager.
- F) **Bridging Roots:**
- 1) One option for working near large roots is to bridge over them by supporting the raised section with concrete pillars or increasing the base layer over the root growth area.
 - 2) When increasing the base course material, coarse sand or pea gravel shall be used with a thin layer of foam board.
 - 3) Any bridged sections must maintain ADA allowed slopes of 1:20. Bridging roots are anticipated behind sidewalks and on side streets.
- G) **Root Grinding:**
- 1) For roots 2" diameter or larger, grinding is preferred over full severing, using a stump/root grinder, chainsaw, or debarking tool.
 - 2) Roots must maintain at least 1/3 of their original diameter when grinding.
 - 3) When possible, apply a layer of rigid foam or pipe insulation between the shaved root and the new concrete surface to allow for callus.

- 4) Work on roots greater than 2" diameter requires Project Manager approval prior to commencement.
- 5) No root grinding or cutting is permitted within 4 feet from the face of the tree.

H) **Clean Root Cutting:**

- 1) Root cutting shall be a LAST RESORT option. Where tree root systems interfere with curb and gutter, drain tile, or other utilities, the Contractor may address roots as follows:
 - a) Cleanly cut tree roots as directed by the Project Manager.
 - b) Immediately and cleanly cut damaged and exposed roots back to sound, healthy tissue.
 - c) Immediately cover root ends exposed by excavation activities with 6 inches of topsoil (measured outward from cut ends).
 - d) No cutting of roots larger than 2" will be allowed unless approved by the Project Manager. No root cutting is permitted within 4 feet from the face of the tree.

I) **Measurement:**

- 1) Tree Root Preservation and Protection will be measured by the tree, regardless of TPZ size. Measurement is complete when excavations in the TPZ are completed.

J) **Payment:**

- 1) Payment for Tree Root Preservation and Protection Type 1 (each) shall be full compensation for all labor, equipment, and materials necessary to protect trees and roots as specified, including protective construction fencing for each tree.
- 2) All protection shall be inspected by the Project Manager prior to the start of construction.

K) **Schedule of Deductions:**

- 1) Should the Contractor cause damages to trees or private landscaping, the Project Manager will maintain a running account of damage fees throughout the project. Damage fees will be assessed against the Contractor in the last application for payment. The Project Manager's running damage account will be available to the Contractor for review upon request.
- 2) Damage to trees will be measured according to the following table.

SCHEDULE OF DAMAGES (PER TREE OR PRIVATE LANDSCAPING FEATURE)			
TYPE OF DAMAGE	LEVEL OF DAMAGE		
	LOW	MODERATE	SEVERE
Trees			
Above Ground			
<i>Canopy</i>			
Branches			
Less than 2 inches diameter	Each		
Greater than 2 inches and less than 4 inches diameter.		Each	
Greater than 4 inches diameter			Each
<i>Trunk Stem Circumference Damage</i>			
\$200/sf bark loss			
Below Ground			
<i>Root Zone</i>			
Construction within TPZ			
Material storage	Each		
Equipment storage	Each		
Soil Compaction	Each		
<i>Root Cutting or Grinding</i>			
Unapproved grinding or damage to 2/3 or more of a root within 4 feet from the face of the tree.			Each
Unapproved grinding or damage to 2/3 or more of a root with a diameter of 2" or greater.			Each

- 3) Deductions from the amount due to the Contractor for the tree and private landscaping protection item will be calculated in accordance with the following table.

Level of Damage	Damage Fee ¹
Trees	
Low of all Types	\$200
Moderate of all Types	\$325
Severe of all Types	Greater of 100 times the diameter of the tree in inches expressed in dollars or \$1000

- L) **Damaged Vegetation Replacement:** Any trees, shrubs, or vegetation damaged by the Contractor shall be replaced in kind at no cost to the City.

SECTION 33 00 00 - UTILITIES

3.01 GENERAL UTILITY PLACEMENT

- A) All materials and workmanship shall conform to the WISDOT Standard Specifications for Highway and Structure Construction and City of Superior Construction Specifications, except where modified in these Plans or Specifications.
- B) The Contractor shall field locate existing utility lines to be connected to prior to commencing work. If a discrepancy exists between Plans and actual field conditions, the Contractor shall notify the Project Manager immediately.
- C) All applicable provisions of existing utility easements will be adhered to by the Contractor.
- D) The Contractor must maintain minimum vertical and horizontal clearances from existing utilities at all times and avoid crossing at highly acute angles. Potholing is required prior to crossing any City-owned utility.

3.02 UTILITIES ALONG PAVED ROADS

- A) Utilities shall be installed per approved permits and drawings, and with respect to existing utilities and locates.
- B) Utilities shall not cut or disturb any drainage tiles. The Contractor must bore under tile lines a minimum of thirty-six (36) inches.
- C) All paved roads shall have the utilities bored for crossings.
- D) All construction site restoration shall conform to City and WISDOT standards.
- E) Utilities should cross the road at a 90° angle. (Reference WISDOT HMM 09-15-25 Location Requirements).

3.03 UTILITIES ALONG GRAVEL ROADS, AND NEAR BRIDGES & CULVERTS

- A) Utilities shall be installed per approved permits and drawings, and with respect to existing utilities and locates.
- B) Utilities shall not cut or disturb any drainage tiles, culverts, or bridges. The Contractor must bore under tile and culvert a minimum of thirty-six (36) inches.
- C) Utilities may be installed around a culvert or bridge with a minimum of 15 feet maintained from all sides of the structure.
- D) All construction site restoration shall conform to City and WISDOT standards.
- E) Utilities should cross the road at a 90° angle. (Reference WISDOT HMM 09-15-25 Location Requirements).

3.04 CONDUIT

- A) The fiber optic conduit network shall be maintained at a constant horizontal and vertical location as shown in the roadway cross-sections of the Plans. (Reference WISDOT HMM 09-15-25 Location Requirements).
- B) If constant horizontal and vertical locations cannot be maintained due to existing utilities or obstacles, conduit shall maintain a minimum depth of 36 inches, maintain distances based on existing utilities identified via Contractor locates, and adhere to approved permits.
- C) Conduit runs shall not exceed 180° of bends or manufacturer recommendations between manholes or junction boxes.
- D) Conduit entering a proposed fiber optic handhole/pull box/vault shall not exceed 45-degree entry angle or manufacturer recommendations.
- E) The Contractor shall install maximum laying lengths of conduit, eliminating connections or joints between conduit runs. Prior Project Manager approval is required for any connections joined with electrofusion coupling or other manufacturer-recommended methods.
- F) If damage occurs to conduit, the Contractor shall replace the entire length between corresponding junction boxes or enclosures.
- G) If open trench installation is used, early protection warning tape shall be placed 12 inches above conduit.
- H) All HDPE conduit shall be smooth outside, with a rating of SDR-11 or thicker. All PVC conduit shall be Schedule 40 or thicker.
- I) A continuous Muletape shall be present in all installed and utilized conduits upon completion of the work and at final acceptance, including all empty and occupied conduits. Any Muletape removed, damaged, or rendered unusable

during construction shall be replaced prior to acceptance at no additional cost to the Owner. Any conduit not containing continuous Muletape between accessible structures shall be considered incomplete.

3.05 HANDHOLES/PULL BOXES/VAULTS

- A) Approximate locations of handholes/pull boxes/vaults are shown in the Plans. The number of handholes/pull boxes/vaults required may vary.
- B) Handholes/pull boxes/vaults and lids shall have a minimum ANSI/SCTE 77-2017 Tier 15 designation for handholes/pull boxes/vaults placed in grass or non-paved areas and for sidewalk applications.
- C) **Grade Requirements:** Heavier grade handholes/pull boxes/vaults, as specified on the Plans, shall be installed at locations indicated, predominantly in alleyways or other areas subject to increased vehicular loading. The Contractor shall verify specific grade requirements per Plan callouts.
- D) **Location Deviations:** While the primary design specifies handhole/pull box/vault installation between the sidewalk and the roadway, the Contractor shall identify and notify the Project Manager immediately if site conditions present significant challenges to this placement. Such conditions include, but are not limited to:
 - 1) Steep ditches between the sidewalk and roadway that would render installation or future maintenance of the handhole/pull box/vault or its contained equipment exceedingly difficult or unsafe.
 - 2) The presence of existing utilities, such as gas lines, directly beneath the sidewalk that would necessitate sidewalk replacement for installation of a drop connection to a serving premise. The Owner reserves the right to review each such case individually and grant written approval for alternative handhole/pull box/vault placement, such as on the opposite side of the sidewalk, at the Project Manager's sole discretion.
 - 3) If proposed handhole/pull box/vault placement would place the handhole/pull box/vault in a swale or other drainage way, contact the Project Manager to review location prior to placing conduit to that location to allow them to determine if the handhole/pull box/vault location will be adjusted to an alternate location.
- E) All handhole/pull box/vault installations shall be backfilled in layers not more than six (6) inches in loose thickness. The base layer shall consist of 3/4" gravel, with layers of 1/4" or lower "crush and run" gravel material above. Each layer shall be thoroughly compacted before the next layer is placed. (Refer to WISDOT 625.2 and 651.3.1).

3.06 FIBER OPTIC CABLE

- A) Fiber optic cable (fiber) installation techniques and procedures shall be as specified by the cable manufacturer and shall ensure optical and mechanical characteristics are not degraded.
- B) The central strength member and aramid yarn shall be attached directly to the pulling eye during fiber pulling. "Basket grip" or "pulling sock" type attachments to the fiber outer tensile rating shall be used on all pulls.
- C) All installation procedures shall be in accordance with manufacturer recommendations and industry standards.
- D) The Contractor shall coordinate with the Project Manager prior to disconnecting any existing fibers and for all fiber splicing at Owner sites.
- E) Only in certain circumstances, and with written approval and adherence to separation guidelines from the Owner, shall energized cable be placed in the same conduit or handhole/pull box/vault as fiber.
- F) Fiber count is specified on the Plans. Single mode all dielectric fiber shall be used. Fiber grounding is required for armored fiber. Fiber tails from patch panels, cabinets, and POP-sites shall be dielectric.
- G) Once fiber is installed into splice enclosures, follow manufacturer recommendations for proper enclosure seal.
- H) Place additional splicing trays as necessary. Only three (3) fiber drops per tray is acceptable.
- I) Provide fifty (50) feet of spare fiber for inline and end-of-line closure installs for the distribution network. If a closure serves a branch/lateral, provide one hundred (100) feet of spare fiber for the mainline cable and fifty (50) feet of spare fiber for the lateral cable being spliced to the mainline.
- J) Fiber shall be stored with snowshoe style units, consistent with aerial fiber construction figures.
- K) Conventional construction methods must be followed when pulling fiber in underground conduits, consistent with standard telecommunication industry practices.
- L) Testing, ventilating, pumping, and setting up handholes/pull boxes/vaults and conduit for fiber pulling operations are the same as for copper cable.

- M) A pulling sock/basket grip shall be attached to the outside of the fiber end for fiber pulling. Additionally, fiber strength members can be attached to the pulling eye if required by the Project Manager.
- N) Maximum pulling tensions shall not exceed 600 LBS or the manufacturer specified amount if less than 600 LBS. A tension meter or tension limiter shall be used.
- O) A swivel shall be used between the pulling line and pulling feature to relieve rope twist.
- P) Fiber shall not be subjected to a dynamic bending radius outside of manufacturer specifications during pull. Final static bending radius shall be within the manufacturer specifications.
- Q) Fiber shall be secured with tie wraps to prevent interference with future fiber installations.
- R) Identify all circuits, fiber, and equipment with approved ID tags.
- S) The tone wire shall be connected continuously through each handhole/pull box/vault with a copper split bolt for continuity testing and splicing. The tone wire shall have a minimum of five (5) feet spare in each handhole/pull box/vault. (Reference WISDOT 655 Electrical Wiring).
- T) **Grounding for Armored Fiber:** If utilizing armored fiber, ground rods shall be installed as called out on the Plans. Ground rods are required in all handholes/pull boxes/vaults containing an armored fiber splice case. Additionally, ground rods shall be installed in handholes/pull boxes/vaults along armored fiber runs such that ground rods are placed at a maximum spacing of two thousand (2,000) feet. Each armored fiber and its splice case within these handholes/pull boxes/vaults shall be directly connected to the installed ground rod. All dead-end handholes/pull boxes/vaults and handholes/pull boxes/vaults with more than two paths that contain armored fiber optic cable or splice cases shall also have a ground rod installed.
- U) Ground rods shall be 8 ft x 5/8" all copper rods and placed at the bottom of the handhole/pull box/vault or per manufacturer direction.
- V) Ground rods shall have a bonding clamp installed with a minimum of fifteen (15) feet of 12 AWG tone wire connected. The tone wire from the ground rod is not to be connected to the continuous tone wire except at dead end handholes/pull boxes/vaults. (WISDOT 655 Electrical Wiring).
- W) Upon completion, the Contractor shall demonstrate that the wire is continuous and unbroken through the entire run of conduit by providing full signal conductivity (including splices). If broken, the Contractor shall repair or replace it.
- X) If Owner authorities require, raised markers indicating fiber buried below shall be installed, subject to the following location requirements. These markers shall only be installed in rural areas, typically defined as locations along open ditches or undeveloped public rights-of-way. Markers shall not be installed in developed residential or commercial areas, typically characterized by curb, gutter, and sidewalks. In designated rural areas, markers shall be installed at intervals not to exceed 2,000 feet. A raised marker shall also be installed at all dead-end vaults and at vaults with more than two paths.

3.07 PASSIVE CABINETS

- A) Passive cabinets shall be mounted to concrete pads with an adjacent handhole/pull box/vault placed for splicing.
- B) Follow manufacturer directions for installing and mounting handholes/pull boxes/vaults.
- C) Handholes/pull boxes/vaults for passive cabinets shall follow the same typical for all other handholes/pull boxes/vaults.
- D) Passive cabinets shall be labeled according to Owner specifications.

3.08 AERIAL CONSTRUCTION

- A) All pole attachments shall follow regional communication pole attachment standards.
- B) Aerial installation of fiber shall use the same tools, equipment, material, and procedures as copper cable.
- C) Fiber shall be lashed on a separate messenger strand or an existing messenger strand with communication cable already lashed to it. Messenger strand will be installed by the Contractor when directed by the Project Plans.
- D) The installation of aerial fiber may be performed by either the back-pull or drive-off method. The method used must be discussed and approved by the Project Manager for each project phase.

- 1) **Back-Pull Method:** Requires pulling the entire fiber into position while temporarily securing it to the messenger strand with hangers (approximately every fifty (50) feet, with closer spacing over roadways, driveways, railroads, etc., for proper clearance).
 - 2) **Drive-Off Method:** Involves lashing the fiber in sections along the route. The fiber is driven past the first span and lashed, repeating until the route end.
- E) During lashing, an aerial fiber guide shall be used to protect the fiber from harmful bend radius.
- F) Fiber markers/tags, supplied by the Owner, shall be placed on the fiber at each pole.
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SECTION 33 60 00 - COMMUNICATIONS SYSTEM TESTING

3.01 FIBER OPTIC CABLE TESTING

- A) All fiber optic cables (fiber) shall be tested via OTDR after splicing is complete. The Contractor shall notify the Project Manager 48 hours prior to OTDR Testing. Testing shall be done in the presence of the Project Manager or their representative unless approved by the Project Manager.
- B) Acceptance testing shall be done by the Contractor using OTDR testing, both single and bi-directional, depending on application.
- C) dB losses and tolerances shall be determined by the Owner. Testing results shall be reviewed by the Project Manager.
- 1) **Singlemode:** 1310nm and 1550nm
 - a) MAX. IND. FIBER LOSS AT 1310 NM: 0.35 DB/KM
 - b) MAX. IND. FIBER LOSS AT 1550 NM: 0.25 DB/KM
- D) The Contractor shall summarize the results of both the OTDR and Optical Source/Power Meter tests in spreadsheet/tabular format adhering to the following requirements:
- 1) List fiber size, start point, end point.
 - 2) List all fibers by number and direction (NB, SB, EB, WB).
 - 3) List total fiber length for each fiber as documented by OTDR.
 - 4) List attenuation in dB of gain/loss for each fiber event in the OTDR.
 - 5) List fiber loss event descriptions & locations, including splices, miscellaneous events, & terminations.
 - 6) List the attenuation across the fiber in dB/KM for each fiber tested.
 - 7) List the total segment loss for each fiber as determined by the Optical Source/Power Meter Test.
 - 8) Provide bi-directional data, including event distances, event descriptions, and attenuation losses for each fiber corresponding to a common start point.
 - 9) Provide bi-directional data on separate lines, side-by-side within the same sheet.
 - 10) Provide 1310 NM and 1550 NM test results on separate sheets in identical formats.
- E) Splice results shall be supplied to the Project Manager by the Contractor for Owner approval.
- F) Fusion welding method will be utilized on all permanent splices, single and mass fusion (ribbon cable). Average optic loss to be determined via OTDR testing.
- G) Reference WISDOT 678.3.4 Communication System Testing for more information.