2026

City of Duluth, Minnesota Construction Standards

Public Works & Utilities

Engineering Division

Duluth, MN

February 25, 2026

These City of Duluth Standard Construction Specifications are hereby approved for application on street, utility, and related construction contracts as referenced in the contract plans or special provisions, and they shall apply as noted and amended by those documents.

CITY APPROVALS

APPROVED	CHIEF ENGINEER OF TRANSPORTATION	DATE 2/25/2026
APPROVED	CHIEF ENGINEER OF UTILITIES	DATE 2-25-2026
APPROVED	CITY ENGINEER	DATE 2-25-2026

I hereby certify that the changes contained in these 2026 City of Duluth, Minnesota Construction Standards were prepared by me or under my general supervision and that I am a duly Licensed Professional Engineer under the laws of the state of Minnesota.

Signature

Alexander Popp
Typed or Printed Name

2/25/2026
Date

57247
Lic. No.

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CHANGES FROM THE 2019 CONSTRUCTION STANDARDS

Vertical change lines have been added to indicate text that has changed from the 2019 Edition. The change line borders the whole paragraph, even if only one line in the paragraph has been modified. These change lines are intended as a courtesy to the reader, and the City does not guarantee that all text changes are indicated by change lines.

S-1 INDEMNITY AND INSURANCE PROVISIONS

Reviewed 5/30/24

The Contractor will be required to carry insurance of the kinds and in the amounts hereinafter specified. The Contractor shall not commence work under the Contract until he has obtained all the insurance required by these specifications and until such insurance approved by the City Attorney, nor shall the Contractor allow any subcontractor to commence work on his subcontract until all similar insurance required of the subcontractor shall have been so obtained and approved. Except as superseded by the Contract, the indemnity and insurance provisions shall meet the following:

A Duties to Defend, Indemnify, and Hold Harmless

(1) To the fullest extent permitted by law, the Contractor agrees that it shall defend, indemnify, and hold harmless the City, its officers, employees, and agents, past or present, from and against any and all claims including but not limited to claims for contribution or indemnity, demands, suits, judgments, costs, and expenses (including attorneys' fees) asserted by itself or any person or persons including agents or employees of the City of Duluth or the Contractor by reason of death or injury to person or persons or the loss or damage to property arising out of, or by reason of, any act, omission, operation or work of the Contractor or its employees while engaged in the execution or performance of services under this Agreement. Said obligations to defend, indemnify, and hold harmless shall include, but not be limited to the obligation to defend, indemnify, and hold harmless the City in all matters where claims of liability against the City arise out of, relate to, are attributable to, are passive or derivative of, or vicarious to the negligent, intentional, or wrongful acts or omissions of the Contractor, including but not limited to the failure to supervise, breach of warranty, the failure to warn, the failure to prevent such act or omission by Contractor, its employees, or its agents, and any other source of liability. Said obligations to defend, indemnify, and hold harmless shall be triggered upon the assertion of a claim for damages against City. On ten days' written notice from the City of Duluth, the Contractor shall appear and defend all lawsuits against the City of Duluth growing out of such injuries or damages. Contractor shall not be required to indemnify City for amounts found by a fact finder to have arisen out of the sole negligent or intentional acts or omission of the City unless Contractor should fail to comply with its insurance obligations in this contract to the detriment of City, in which case the Contractor shall indemnify, defend, and hold harmless the City for any and all amounts except amounts attributed to intentional, willful or wanton acts of the City. This Section, in its entirety, shall survive the termination of this Agreement if any amount of work has been performed by Contractor. Nothing in this provision shall affect the limitations of liability of the City as set forth in Minnesota Statutes Chapter 466.

The Contractor understands this provision may affect its rights and may shift liability and specifically agrees to the same.

(2) The Contractor shall defend and hold and save the City, its officers, employees, representatives and agents, and the Architect, harmless from liability of any nature or kind, including costs and expenses, for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the Contract, including its use by the City, unless otherwise specifically stipulated in the Technical Specifications.

B Insurance

(1) Contractor shall provide the following minimum amounts of insurance from insurance companies authorized to do business in the state of Minnesota, which insurance shall indemnify Contractor and City from all liability described in the Indemnification paragraphs above, subject to provisions below.

(a) Workers' compensation insurance in accordance with the laws of the State of Minnesota.

(b) Commercial General and Automobile Liability Insurance with limits not less than $1,500,000 Single Limit shall be in a company approved by the city of Duluth; and shall provide for the following: Liability for Premises, Operations, Completed Operations, Independent Contractors, and Contractual Liability. Umbrella coverage with a "form following" provision may make up the difference between the commercial general and auto liability coverage amounts and the required minimum amount stated above.

(c) City of Duluth shall always be named as Additional Insured under the Commercial General, and Automobile Liability Policies. Contractor shall also provide evidence of Statutory Minnesota Workers Compensation Insurance.

(d) For any new building construction or new building addition for which the value exceeds $100,000, the Contractor shall provide proof of Builders Risk Insurance on an "All-Risk" basis, which includes theft of material not installed and glass breakage, to the full value of the new building. Contractor(s) is (are) liable for losses within deductible coverage.

(e) Contractor to provide Certificate of Insurance evidencing all coverages which shall contain an unconditional requirement that the insurer notify the City without fail not less than 30-days prior to any cancellation, or 10 days prior to any non-renewal of the policy or coverages evidenced by

said certificate, and shall further provide that failure to give such notice to City will render any such change or changes in said policy or coverages ineffective as against the City.

(3) The insurance required herein shall be maintained in full force and effect during the life of this Agreement and shall protect Contractor, its employees, agents and representatives from claims and damages including but not limited to personal injury and death and any act or failure to act by Contractor, its employees, agents and representatives in the negligent performance of work covered by this Agreement.

(4) Certificates showing that Contractor is carrying the above described insurance in the specified amounts shall be furnished to the City prior to the execution of this Contract and a certificate showing continued maintenance of such insurance shall be on file with the City during the term of this Contract.

(5) The City of Duluth does not represent or guarantee that these types or limits of coverage are adequate to protect the Contractor's interests and liabilities.

S-2 PUBLIC WORKS AND UTILITIES REGULATIONS

Prior to beginning work, the contractor shall acquaint himself with all regulations and requirements of the City of Duluth Public Works & Utilities Department that may apply to the proposed work. All work shall be open at all times to inspection by the Public Works & Utilities Department. The Contractor shall notify the Engineer not less than 2 Working Days before beginning construction. The operation of all valves on the existing distribution systems shall be performed only by the Public Works & Utilities Department. The Contractor shall give 24 hours' notice to the Public Works & Utilities Department prior to the need for the operation of any existing water valves or the need for any water main shutdowns by contacting 218-730-5200.

S-3 MATERIALS AND WORK TO BE FURNISHED BY THE PUBLIC WORKS AND UTILITIES DEPARTMENT

The Public Works & Utilities Department will furnish the following materials and work on this project at no cost to the Contractor. Contractor is to excavate and backfill in order to allow the Department to perform said work.

(1) Shut down water and gas mains and services as necessary to allow contractor to furnish and install water and gas connections.

(2) Sample and test for bacteria for new public water mains. In the case of a failed bacteria test, the City reserves the right to charge the Contractor for retests.

(3) Supply iron pipe curb box materials as shown on details W-5, W-5A, W-7, W-8, W-8A, W-8B, and W-9.

(4) Supply monument casting assembly as shown on details SUR-1 and SUR-2.

S-4 INSPECTION OF MATERIALS

All materials to be used in the construction will be inspected by the Engineer prior to installation. The Contractor shall furnish any necessary labor or equipment requested by the Engineer for the inspection. No materials shall be placed until they have been inspected and approved. Refer to section 1502 PLANS AND WORKING DRAWINGS (SHOP DRAWINGS) of these standards for shop drawing review process.

S-5 CONSTRUCTION INSPECTION

The Contractor shall provide adequate notice and coordination of planned work activities so that construction inspection can be provided by the Engineer. Any work that is performed by the Contractor (or Subcontractor) without the Engineer's inspector present will be considered unacceptable and no payment will be made. Refer to section 1511 INSPECTION OF WORK of these standards for safe access to work for inspection and record survey.

S-6 USE OF WATER FROM CITY HYDRANTS

All water taken from City hydrants, except for that water related to water main construction shall be metered and a charge will be made for the amount used. The Contractor must make arrangements with the Public Works and Utilities Department at 218-730-5200 to get the necessary permit, valve and meter, prior to using the hydrant for drawing water.

S-7 DRUG AND ALCOHOL TESTING FOR GAS WORK

This contract will require compliance with Federal regulations which require pre-employment, post-accident, and reasonable cause drug and alcohol testing of employees, contractors and other workers. Random drug testing shall also be required under this contract.

Prior to the issuance of the Notice to Proceed, contractors/vendors performing work covered by the DOT drug and alcohol testing rules as set forth in 49 CFR Part 199 and Part 40, shall provide the following documentation for review for compliance with RSPA/DOT regulations:

(1) Anti-Drug Plan and any addenda issued thereto.

(2) Alcohol Misuse Prevention Plan and any addenda issued thereto.

(3) Minnesota Office of Pipeline Safety Intrastate Anti-Drug and Alcohol Misuse Prevention Self-Assessment Form.

(4) The name and job title of the employees performing any work or functions covered by Part 199.

At the end of the calendar year, any Contractor who performed work on the City of Duluth's Natural Gas system will also be required to submit a copy of their U.S. Department of Transportation Drug and Alcohol Testing MIS Data Collection Form. As a Contractor this information is required to be submitted with the City of Duluth's annual report to PHMSA.

S-8 OPERATOR QUALIFICATION FOR GAS WORK

This contract may require contractor personnel to perform covered tasks on the City of Duluth's natural gas system. To work on the natural gas system, the Contractor's personnel must be qualified to perform any of the covered tasks identified in the City of Duluth Operator Qualification Plan. Prior to the issuance of the Notice to Proceed, contractors, subcontractors or vendors performing any of these covered tasks shall submit their Operator Qualification Plan and a list of employees' names, job titles and covered tasks to be performed under this contract to the Engineer for approval. The Contractor's Operator Qualifications for each employee should be cross referenced to the City of Duluth's Operator Qualifications requirements such that each course taken by the contractor's employee will identify the equivalent City of Duluth Operator Qualifications required course. The Operator Qualification Plan must be approved by the City before a Notice to Proceed will be issued.

S-9 CORRECTION PERIOD

The provisions of MN/DOT 1516 Acceptance are supplemented with the following:

If within one year after the effective date of Project Acceptance as specified in MN/DOT 1516.2 (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by the Engineer is found to be defective, the Contractor shall promptly, without cost to the City and in accordance with written instructions:

(1) Repair such defective land or areas; or

(2) Correct such defective work; or

(3) If the defective work has been rejected by the Engineer, remove it from the project and replace it with work that is not defective, and

(4) Satisfactorily correct or repair or remove and replace any damage to other work, to the work of others or other land or areas resulting there from.

S-10 MEETINGS

A Preconstruction Meeting will be scheduled and conducted by the Engineer and shall be attended by representatives of the City, Contractor and all subcontractors as deemed required by the Engineer. The purpose of the meeting will be to identify all project participants, review project requirements and specifications, establish the method of making pay requests and other matters that may be deemed necessary to be discussed. At this meeting, the Contractor shall submit the proposed construction schedule for review, consensus by the parties and approval. The Contractor shall also submit a schedule of values for the work to be used as the accounting format for all progress payments.

Brief weekly Construction Progress meetings, as deemed necessary by the Engineer, will be held and shall be attended by all Contractors. The purpose of the meeting will be to coordinate work schedules, review the project progress and other matters that may be deemed necessary to be

discussed. A construction progress meeting agenda shall be prepared as deemed necessary by the Engineer. All construction progress meeting attendees shall be fully prepared prior to the meeting and shall be ready to discuss issues raised as they relate to their work. This shall include, but not be limited to, providing revised schedules, milestone activities, specific requirements for subordinate construction and any proposed or completed changes required for their work.

S-11 GOVERNING SPECIFICATIONS

(1) The 2025 Edition of the Minnesota Department of Transportation 'Standard Specifications for Construction' shall govern.

(2) Latest version of Minnesota MUTCD, including the latest version of the Temporary Traffic Control Zone Layouts field manual.

(3) Appendix A – Standard Specifications for High Pressure Gas Mains, Transmission Line and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe, (Most current version). All references to Department mean the City of Duluth.

S-12 DAMAGE TO CITY UTILITIES

Section 48-224 through Section 48-229 of the Duluth City Code allows for the City to collect damages and penalties from any person that damages a City owned utility (water, sanitary sewer, storm sewer and natural gas) during excavation activities. In addition, the City may refuse to issue excavation permits or may reject bids from any contractor found to have violated this ordinance more than twice within the preceding twelve months.

Minnesota Statutes 216D.06 Damage to Facility also specifies that any excavator who knowingly damages an underground facility, and who does not notify the City as soon as reasonably possible or who backfills the excavation is guilty of a misdemeanor.

The City of Duluth will act on all cases where an excavator violates City Code or State Statutes in the course of excavating.

S-13 RESPONSIBLE CONTRACTOR

The City cannot award a construction Contract in excess of $50,000 unless the Bidder is a "Responsible Contractor" as defined in Minnesota Statutes §16C.285, subdivision 3.

A Bidder must verify it meets the minimum criteria detailed in the law. A Bidder must submit its verification electronically by completing the "Responsible Contractor" section in the "Officers and Acknowledgements" Folder within the Electronic Bid File. A company officer must certify statements in that section. Bidders only need to complete the electronic verification; DO NOT email, fax, or send paper forms to the City. The City will not accept emailed, faxed, or other paper submissions and will only accept electronic verifications.

A Bidder must obtain verification from each Subcontractor it will have a direct contractual relationship with. At the City's request, a Bidder must submit signed Subcontractor verifications. A Contractor or Subcontractor must obtain annual verification from each motor carrier with which it has a direct contractual relationship. A motor carrier must give immediate written notice if it no longer meets the minimum responsible Contractor criteria. The requirement for Subcontractor verifications does not apply to:

- Design professionals licensed under Minnesota Statutes §326.06; and
- A business or person that supplies Materials, Equipment, or supplies to a Subcontractor on the Project, including performing delivering and unloading services in connection with the supply of Materials, Equipment, and supplies. But, a business or person must submit a verification if it delivers mineral Aggregate such as sand, Gravel, or stone that will be incorporated into the Work by depositing the Material substantially in place, directly or through spreaders, from the transporting vehicle.

A Bidder or Subcontractor who does not meet the minimum criteria specified in the statute, or who fails to verify compliance with the criteria, is not a "Responsible Contractor" and is ineligible to be awarded the Contract for this Project or to Work on this Project. Submitting a false verification makes the Bidder or Subcontractor ineligible to be awarded a construction Contract for this Project. Additionally, submitting a false statement may lead to Contract termination. If only one Bidder submits a bid, the City may, but is not required to, award a Contract even if that Bidder does not meet the minimum criteria.

S-14 COMPLIANCE WITH TAX LAW REQUIREMENTS

The City cannot make final payment to the Contractor until the Contractor demonstrates that it and all its Subcontractors have complied with the Income Tax withholding requirements of Minnesota Statutes, §§ 290.92 and 270C.66 for wages paid for Work performed under the Contract. To establish compliance, the Contractor must submit a "Contractor Affidavit" either online or in paper form (IC134) to the Minnesota Department of Revenue. The contractor will receive written certification of compliance when the Department of Revenue determines that all withholding tax returns have been filed and all withholding taxes attributable to the work performed on the contract have been paid. The Contractor must then provide this written certification to the City to receive final payment.

Every subcontractor working on the Project must submit an approved "Contractor Affidavit" from the Minnesota Department of Revenue to the Contractor before the Contractor can file its own Contractor Affidavit. **The Contractor is advised to obtain the certification from each subcontractor as soon as the subcontractor completes work on the Project. Experience has shown that waiting until the project is complete to obtain the forms from all subcontractors is likely to result in significant additional work for the Contractor as it will be difficult or impossible to collect all forms.**

The Department of Revenue, in association with the Department of Employment and Economic Development, offers a free seminar to help contractors understand tax law requirements. The

Department strongly urges the Contractor and all subcontractors to attend the "Employment Taxes & Employer Responsibilities Seminar" or similarly offered classes. You can find a schedule and more information on the Department's website (www.revenue.state.mn.us/businesses/withholding/Pages/EducationandOutreach.aspx).

Complying with this requirement is considered part of the Work under this contract. The City will enforce this requirement equally with all other Contract requirements. Contractor delay in complying with this requirement will cause the City to delay final payment and Contract Acceptance. The City may also report non-compliance to the Department of Revenue, which may result in enforcement action by the Department of Revenue.

Contractor Affidavit requirements and Form IC134 can be found on the Department of Revenue website (www.revenue.state.mn.us).

1103 DEFINITIONS

The provisions of MN/DOT 1103 are supplemented and/or modified with the following:

CONTRACT
The written agreement between the Department and the Contractor setting forth their obligations, including, but not limited to, the performance of the Work, the furnishing of labor and Materials, the basis of payment, and other requirements contained in the Contract documents. Contracts include, but are not limited to, job orders or task letters issued under basic ordering agreements and orders, such as purchase orders, under which the contract becomes effective by written acceptance or performance. The Contract documents include, but are not limited to, the Advertisement for Bids, Proposal, Contract form, Contract Bonds, the MnDOT Standard Specifications, the City of Duluth Standard Construction Specifications, the Project Special Provisions, Plans, Notice to Proceed, and Change Orders that are required to complete the construction of the Work in an acceptable manner. All of the Contract documents collectively constitute one.

FINAL COMPLETION
The time and date at which, in the opinion of the Engineer, ALL of the Work is complete, in accordance with the Contract Documents, excluding turf maintenance and plant establishment activities.

SUBSTANTIAL COMPLETION
The time and date at which the Work has progressed to the point where, in the opinion of the Engineer, the Work is sufficiently complete, in accordance with the Contract Documents, so that the Work can be occupied and/or utilized for the purposes for which it is intended.

1203 ACCESS TO PROPOSAL PACKAGE

MN/DOT 1203 is hereby deleted from the MnDOT Standard Specifications and replaced with the following:

Bidders shall access the proposal package electronically through the Bid Express website (http://www.bidexpress.com). There is no charge to view proposal packages. However, Bidders must register with Bid Express® and login to the website. Bidders may search for 'City of Duluth' or the specific bid number to locate the proposal package. Bid Express may charge a nominal fee for bid submission.

1206 PREPARATION AND DELIVERY OF PROPOSAL

The provisions of MN/DOT 1206 are supplemented and/or modified with the following:

MN/DOT 1206.1 PREPARATION AND DELIVERY shall be deleted and replaced with the following

1206.1 PREPARATION AND DELIVERY

The Bidder shall use the electronic submittal process. The Bidder shall submit the electronic Proposal in accordance with the Bid Express website (http://www.bidexpress.com).

The Bidder shall submit its Proposal by the date and time for opening Proposals. Bid Express will not accept Proposals past the date and time of the opening of Proposals.

The Bidder shall submit the Proposal Guaranty electronically through Bid Express®, by email to purchasing@duluthmn.gov, or by mail or in person to the Purchasing Agent in Room 120, City Hall, 411 W. 1st Street, Duluth, MN 55802 prior to the bid opening. City spam filters may block emails. The bidder is responsible for ensuring the Proposal Guaranty is received by the City. If submitting a certified check or bank draft, it shall be delivered. Regardless of method of submission, Proposal Guaranty must be received by Purchasing by the bid deadline.

If a Bidder fails to provide a Unit Price for any Pay Item on the Bid Schedule, except for "Lump Sum" Pay Items, the City will reject the Proposal.

If a Pay Item in the Proposal requires the Bidder to choose an alternate Pay Item, the Bidder shall indicate its choice in accordance with the Specifications for that Pay Item.

MN/DOT 1206.2 ALLOWABLE SUBSTITUTIONS shall be deleted

1213 DISQUALIFICATION OF BIDDERS

The provisions of MN/DOT 1213 are supplemented and/or modified with the following:

(1) The Bidder failed to perform on a previous Contract with the City.

(2) Contractors who are debarred or suspended under Minnesota Statutes 161.315 Protection of Public Contracts will not be eligible for award of

this contract or to act as a subcontractor to any contractor under this contract.

1302 AWARD OF CONTRACT

MN/DOT 1302 is hereby deleted from the MnDOT Standard Specifications and replaced with the following:

Within **60** calendar days after opening Proposals, the City will Award the Contract to the lowest responsible Bidder provided that the lowest responsible Bidder complies with the Proposal requirements. The City may also decide not to make a Contract Award. The City will notify the lowest responsible Bidder electronically, in writing, or by other means that the City has accepted the Proposal subject to execution and approval of the Contract as required by law.

The City and the lowest responsible Bidder may mutually agree to extend the time within which the City makes the Award.

For contract values greater than or equal to $150,000, the award of Contract, if to be awarded, will be made by City Council Resolution to the lowest responsible bidder who complies with all prescribed requirements. The lowest responsible bidder will be notified of the Council meeting date, along with transmittal of the Contract and required forms.

For contract values less than $150,000, the award of Contract, if to be awarded, will be made to the lowest responsible bidder who complies with all prescribed requirements. The lowest responsible bidder will be notified that their Proposal has been accepted, along with transmittal of the Contract and required forms.

As a condition precedent to approval of a Contract, a sworn statement shall be filed with the City stating that the persons, firm, association, or corporation to whom the Contract is awarded has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the Contract. This sworn statement shall be in the form of an affidavit executed by, or on behalf of, the successful bidder and sworn to by him before a person who is authorized by the laws of this State to administer oaths. The forms for this affidavit will be furnished to the successful bidder and they shall be properly executed and returned within the period prescribed.

1303 REQUIREMENT OF CONTRACT BOND

The provisions of MN/DOT 1305 are supplemented with the following:

At the time of the execution of the Contract, the successful bidder shall furnish "Performance Bond" and a "Payment Bond" on City of Duluth forms. Both bonds shall be in amounts equal to the full amount of the contract price.

1306 EXECUTION AND APPROVAL OF CONTRACT

The provisions of MN/DOT 1306 are supplemented with the following:

The Contract shall be signed by the lowest responsible bidder and returned, together with the Performance Bond and the Payment Bond, non-collusion affidavit, EEO affidavit, and Proof of Insurance, within seven (7) calendar days after the date of Council Award, or the date of Proposal acceptance, subject to execution and approval of the Contract as required by law.

A "Notice to Proceed" letter will be issued after the Contract and Bonds are fully executed.

Contract Time shall start on the date of Notice to Proceed, or on the start date specified in the project Special Provisions, whichever is earlier.

If return of the executed forms within the specified time is impossible due to the absence of one or more of the required signers, an extension of time may be granted by the City, provided that satisfactory evidence is furnished that the forms will be executed.

An authorized representative of the Contractor shall sign the Contract. Bonds shall be signed by the principal and a surety in the presence of a notary. In the case of joint ventures, signature requirements shall apply to each firm represented.

1404 MAINTENANCE OF TRAFFIC AND LOCAL ROAD CLOSURE NOTIFICATIONS

The provisions of MN/DOT 1404 are supplemented with the following:

1404.1 GENERAL

Refer to Section **Error! Reference source not found.** of these provisions for Temporary Traffic Management.

The Contractor shall notify ALL local stakeholders of road closures with enough advance notice to allow a reasonable time to accommodate the traffic changes.

Road closure notification list is maintained on the City's website (https://duluthmn.gov/engineering/standard-construction-specifications/. Use the current list available when the notification is required.

The Contractor shall maintain the Project in a condition that accommodates mail delivery to all homes and businesses impacted by construction. In the event that the local postal authority determines that mail service cannot occur within the project or the Contractor becomes aware that mail service has been interrupted the Contractor shall coordinate with the postal patron and the local postal authority to either correct the reason for the interruption or provide a temporary mail box that is acceptable to the local postal authority. This work shall be incidental unless the Contract contains specific Unit Prices for relocating existing mail boxes or providing temporary mail boxes.

1502 PLANS AND WORKING DRAWINGS (SHOP DRAWINGS)

The provisions of MN/DOT 1502 are supplemented with the following:

The Contractor shall submit shop drawings for products supplied on the project. 'Shop drawings' shall include any product literature that identifies the materials, performance, manufacturer, type, size, and model number of products to be supplied. The list of required shop drawings will be reviewed and confirmed at the pre-construction meeting. The Contractor shall review all shop drawings for compliance with the contract documents. The Contractor shall "mark-up" shop drawings with pertinent notations to clarify the work furnished and identify any deviations. The Contractor shall include a signed certification that indicates the shop drawings are "reviewed" and all deviations shall have the reviewers "initials and date" and City standard noted on the page. The Contractor shall submit the shop drawings to the Engineer with sufficient time (not less than 14 days) to allow review and comment of the submittal.

The Engineer will review the shop drawings for compliance with the contract documents and current City standards. The Engineer will respond with comments (within 14 days of receipt of submittal) to the Contractor that the items submitted are either "reviewed" or "resubmit". The Engineer may consider work unacceptable and no payment will be made if the shop drawing review is not completed for products incorporated into the work.

In addition, the Engineer will submit "reviewed" shop drawings for **all HDPE water main and fittings** to the Chief Engineer of Utilities for review. The Engineer and Contractor will schedule a time to meet on the construction site with the Chief Engineer of Utilities to inspect the materials furnished prior to use in the work. No HDPE water main work will be considered acceptable and no payment will be made without the completed shop drawing review and inspection of the Chief Engineer of Utilities.

1504 COORDINATION OF CONTRACT DOCUMENTS

The first paragraph of MN/DOT 1504 is deleted and replaced with the following:

A requirement appearing in one of the Contract documents is as binding as though the requirement appears in all. If discrepancies exist between the Contract documents, the following order of precedence applies:

(4) Addenda

(5) Special Provisions

(6) Project Specific Plan Sheets

(7) City of Duluth Standard Construction Details

(8) City of Duluth Standard Construction Specifications

(9) MN/DOT Standard Plan Sheets and Standard Plates

(10) MN/DOT Standard Specifications

1507 UTILITY PROPERTY AND SERVICE

The provisions of MN/DOT 1507 are supplemented with the following:

1507.1 GENERAL

Bidders are advised that the following utility companies have existing facilities in the construction area that may be affected by the work under this Contract.

WATER, GAS, STORM & SANITARY
City of Duluth--Public Works & Utilities
411 West 1st Street
Duluth, MN 55802
(218) 730-4130

THERMAL ENERGY
Ever-Green Energy, LLC
One Lake Place Drive
Duluth, MN 55802
(218) 723-3601

FIBER, STREET LIGHTS & TRAFFIC SIGNALS
City of Duluth - Traffic Operations
1532 West Michigan St.
Duluth, MN 55806
(218) 730-4420

POWER
Minnesota Power
3125 Arrowhead Road
Duluth, MN 55811
(218) 355-2039

GAS (in Bayview Heights)
Minnesota Energy Resources Corp
2685 145th Street West
Rosemount, MN
(651) 402-4443

TELEPHONE
CenturyLink Lumen
4622 W. Arrowhead Road
Duluth, MN 55811
(218) 325-8206

SANITARY INTERCEPTOR SEWERS
Western Lake Superior Sanitary District
2626 Courtland St
Duluth, MN 55806
(218) 740-4782

CABLE TELEVISION
Charter Spectrum
602 Garfield Ave
Duluth, MN 55802
(218) 529-8042

The City's Contractor shall coordinate their work and cooperate with the foregoing utility owners and their forces in a manner consistent with the provisions of MN/DOT 1507 and the applicable provisions of MN/DOT 1505.

Contractors and sub-contractors shall follow the Minnesota Statutes 2025, section 216D Excavation Notice System requirements for City of Duluth projects. The City of Duluth, being a facility operator on all city projects, shall require that following the use of optional electronic white lining in the Gopher State One Call system submission process, <u>any one call ticket associated with the project that uses electronic white lining shall be accompanied with physical markings</u> as allowed by MINN. STAT. 216D.05.c (2025). The physical markings must be placed the same day or prior to submission of the ticket to avoid delays in response.

The Contractor shall provide, at its own expense, all materials, equipment, and labor necessary to protect all third-party utilities parallel to and crossing all excavated areas. This may include sheeting, shoring, supports, or other methods necessary to provide temporary support during construction and to restore all utilities to their pre-excavation state of stability. For the purposes of this section third party utilities include, but are not limited to, overhead and buried telephone, cable television, sanitary interceptor sewers, gas (in Bayview Heights), thermal energy, fiber optic, electric power, and buried fiber. City of Duluth water, gas, storm, and sanitary sewer utilities shall likewise be supported and protected at no expense to the City unless otherwise designated for removal, relocation, or replacement in the Plans.

The Contractor shall invite all utility owners to all project weekly meetings to ensure continuous and ongoing communication regarding the project status, progress, and upcoming work.

Unless otherwise directed by the utility owner, the Contractor shall bed and backfill third-party utilities and City-owned facilities not designated for replacement and intersecting the trench excavation as follows:

A Below the typical section subcut: provide aggregate bedding encasement for the pipe and granular backfill. Refer to Section 2451 EXCAVATION, BACKFILL, AND COMPACTION FOR UTILITIES of these special provisions for requirements related to granular backfill.

B Above the typical section subcut: material shall conform to the requirements of the roadway typical section.

The Contractor shall perform work in a manner that all existing utility valves, manholes, pull boxes, controls, access vaults, pedestals, and poles are accessible to the utility operator. Materials or equipment will not be allowed to be stored over, or impede access to, the facility.

No measurement or payment shall be made for the various items of Work under this section and all such work shall be considered INCIDENTAL including but not limited to all utility notice and coordination; excavating, supporting, protecting, and working around third-party utilities during the Work; bedding and backfill of third-party utilities; sequencing and staging the Work; or any other requirement to facilitate the Work on the project as it relates to utilities as described herein.

1511 INSPECTION OF WORK

The provisions of MN/DOT 1511 are supplemented and/or modified with the following:

The City will consider any Work performed or Materials used, including work required under MN/DOT 1516.2 “Project Acceptance”, without the required certification, testing, or inspection by the City as unauthorized Work in accordance with 1512.2, “Unauthorized Work.”

The Contractor shall provide access to all work for the purpose of inspection and record survey documentation. Access routes to, and including, the open excavations shall meet all OSHA safety requirements.

The following is added to the first paragraph of MN/DOT 1511:

If the Contractor or Subcontractor fails to appear on the project on the date and time when work requiring inspection was scheduled to take place, the Contractor shall be charged the following rate:

Inspector .....$150.00 per hr.

Hourly Rate shall also apply to travel time to and from the project.

1514 RESTRICTIONS ON MOVEMENT AND STORAGE OF HEAVY LOADS AND EQUIPMENT

The provisions of MN/DOT 1514 are supplemented and/or modified with the following:

The Contractor shall not operate Equipment mounted on crawler track or steel-tired wheels on or across new concrete or bituminous surfacing or existing surfaces to remain. The Contractor shall protect all new or existing surfaces to remain from damage due to equipment operation, settlement, lateral movement, undermining, washout, and other hazards created by the Contractor's operations. The use of temporary cribbing, mats, metal plates, etc. to protect new or inplace surfaces to remain shall be considered incidental. Any damage to inplace surfaces to remain shall be fully restored by the Contractor at no expense to the City.

1604 PLANT INSPECTION – COMMERCIAL FACILITY

The provisions of MN/DOT 1604 are supplemented with the following:

All costs of shop inspection at plants outside the United States shall be borne by the Contractor. Such costs shall be deducted from monies due or to become due the Contractor.

1701 LAWS TO BE OBSERVED

The provisions of MN/DOT 1701 are supplemented and/or modified with the following:

MN/DOT 1701.5 PROMPT PAYMENT AND RETAINAGE Paragraph B shall be supplemented with the following

If the City reduces the amount of retainage, the Contractor must reduce retainage for any subcontractors at the same rate.

MN/DOT 1701.5 PROMPT PAYMENT AND RETAINAGE paragraph C shall be deleted and replaced with the following

C Payment of retainage for State and Local Projects is governed by Minnesota Statutes, section 337.10 and Minnesota Statutes, section 15.72

State law does not require retainage to be withheld. The contractor may not withhold more than 5% in retainage from a subcontractor, as provided by Minnesota Statutes §337.10 subd. 4 (b). If the City reduces the amount of retainage, the Contractor must reduce retainage for any subcontractors

at the same rate. The contractor must pay any retainage no later than 10 days after the Contractor receives payment of retainage from the City, unless there is a dispute about the work under a subcontract. If there is a dispute about the work under a subcontract, the contractor must pay out retainage to any subcontractor whose work is not involved in the dispute and must provide a written statement detailing the amount and reason for the withholding to the affected subcontractor.

1717 AIR, WATER, AND LAND POLLUTION (NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT)

The provisions of MN/DOT 1717.2 are supplemented with the following:

D National Pollutant Discharge Elimination System (NPDES) Permit

The Contractor must prevent, control, and abate the pollution of natural resources of air, land and water caused by the Contractor's operations under this Contract in accordance with the rules, regulations, and standards adopted and established by the Minnesota Pollution Control Agency (MPCA), and in accordance with this Contract, the provisions of MN/DOT 1717, 2573, 2575, and these Special Provisions including the following:

By signing the NPDES Declaration and completing the electronic online NPDES CSW permit, the Contractor is a co-permittee with the City and must ensure compliance with the terms and conditions of the Construction Stormwater General Permit (MN R100001). The Contractor is responsible for those portions of the permit referencing the "operator". This Permit establishes conditions for discharging storm water to waters of the State from construction activities that disturb 1 acre or more of total land area. A copy of the permit is available on the MPCA's website (https://www.pca.state.mn.us/business-with-us/construction-stormwater) or by calling 651-296-6300.

Unless otherwise noted in the project special provisions, the Contractor shall apply and pay for the MPCA/NPDES permit application on this Project. Payment for the permit application shall be incidental to the Contract. The City will provide the Contractor with the information needed for Sections 1 thru 3 and 5 thru 14 of the application form, as part of the Contract document package. The Contractor shall complete the application process and post the Permit Coverage Card and MPCA's letter of coverage on the construction site with the Storm Water Pollution Prevention Plan (SWPPP). A copy of the MPCA/NPDES permit coverage confirmation must be returned to the Engineer.

A NPDES Permit declaration form will be sent to the Contractor with the Contract award packet. Verification of the completed permit application and a signed Permit Declaration form must be returned with the Contract and bond. Submittal of the verification of the permit application and Permit Declaration is mandatory for Contract approval. The Contractor is not authorized to perform any Project work which disturbs soil or which involves work in waters of the state until the NPDES Permit is in effect and the City has received the required documentation.

The Contractor shall be solely responsible for complying with the requirements listed in Part II.B and Part IV of the General Permit.

The Contractor shall be responsible for providing all inspections, documentation, record keeping, maintenance, remedial actions, and repairs required by the permit. All inspections, maintenance, and records required in the General Permit Paragraph IV.E, shall be the sole responsibility of the Contractor. The word “Permitee” in these referenced paragraphs shall mean “Contractor”. Standard forms for logging all required inspection and maintenance activities shall be used by the Contractor.

Contractor must provide an Erosion Control Supervisor as per MN/DOT 2573.3. The Contractor is solely responsible for all inspections, maintenance, and records required in the General Permit, Section 11. Contractor must use standard forms for logging all required inspection and maintenance activities. Contractor must submit all inspection and maintenance forms used on this Project to the Engineer weekly for retention in accordance with the permit. The Contractor must also have the forms available for on-site review. All requirements to provide the Erosion Control Supervisor shall be incidental.

Contractor must immediately notify the Engineer of any site visits by Local Permitting Authorities performed in accordance with Section 24.10 of the permit. The Contractor must obtain the Engineer’s approval before starting any work required by regulatory authorities which (1) the Contractor believes will result in additional compensation from the City; or (2) will impact the design or requirements of the Contract documents or impact traffic.

The Contractor must use Emergency Best Management Practices to help minimize turbidity of surface waters and relieve runoff from extreme weather events. The Contractor must report a stormwater sediment release from the project site to the Minnesota Duty Officer and the Resident Engineer at the time the Contractor or City discovers the release. The Contractor must also immediately contact the State Duty Officer (at 1-800-422-0798 or 1-651-649-5451) during any emergency situation involving an uncontrolled stormwater release.

Contractor must review and abide by the instructions contained in the permit package. The Contractor will indemnify and hold the City harmless for any fines or sanctions imposed by a regulatory authority and arising from the Contractor's acts or omissions in complying, or failing to comply, with the permit or erosion control provisions of this Contract.

The Contractor is advised that Section 1 of the NPDES application form refers to a Storm Water Pollution Prevention Plan (SWPPP). This Project’s SWPPP is addressed throughout MN/DOT’s Standard Specifications for Construction, as well as this Project’s Plan and these Special Provisions. The following table identifies NPDES permit requirements and cross-references where this Contract addresses each requirement. This table is for ease of reference only and may be incomplete.

NPDES Permit Requirements	Cross-Reference within this Contract
Obtain NPDES Permit; Permit Compliance; Submit Notice of Termination	MN/DOT 1701, 1702; and 1717 Construction Standards: 1717.2.D National Pollutant Discharge Elimination System (NPDES) Permit
Certified Personnel in Erosion / Sediment Control Site Management Develop a Chain of Command	MN/DOT 1506, 1717, and 2573; Construction Standards: 1717.2.D National Pollutant Discharge Elimination System (NPDES) Permit
Certified Personnel in Erosion / Sediment Control Site installation	MN/DOT Specifications 2573
Project / Weekly Schedule (for Erosion / Sediment Control) Completing Inspection / Maintenance Log / Records	MN/DOT 1717 and 2573; Construction Standards: 1717.2.D National Pollutant Discharge Elimination System (NPDES) Permit
Project Specific Construction Staging	The Plans; MN/DOT 1717; Construction Standards: 1717.2.D National Pollutant Discharge Elimination System (NPDES) Permit Special Provisions: 1806 (Determination and Extension of Contract Time)
Temporary Erosion / Sediment Control	The Plans; MN/DOT 2573, 2574 and 2575
Maintenance of Devices / Sediment removal Removal of Tracked Sediment Removal of Devices	The Plans; MN/DOT 1717.2 and 2573.3K, 2573.3.O; Construction Standards: 1717.2.D National Pollutant Discharge Elimination System (NPDES) Permit Special Provisions: 1514 (Maintenance During Construction)
Dewatering	MN/DOT 2573.3.A.6 and 3875; May also require DNR Permit
Temporary work not shown in the Plans Grading areas (unfinished acres exposed to erosion)	MN/DOT 1717, 2573, 2574 and 2575; Construction Standards: 1717.2.D National Pollutant Discharge Elimination System (NPDES) Permit

NPDES Permit Requirements	Cross-Reference within this Contract
Permanent Erosion / Sediment Control and Turf Establishment	The Plans; MN/DOT 1717, 2573, 2574, and 2575; Construction Standards: 1717.2.D National Pollutant Discharge Elimination System (NPDES) Permit

1717 AIR, WATER, AND LAND POLLUTION (EROSION AND SEDIMENT CONTROL PERMIT FOR MS4 COMPLIANCE)

The provisions of MN/DOT 1717.2 are supplemented with the following:

E Erosion and Sediment Control Permit for MS4 Compliance

For projects with a land disturbance greater than 3,000 square feet, the pollution of natural resources of air, land and water by operations under this Contract shall be prevented, controlled, and abated in accordance with the rules, regulations, and standards adopted in the Unified Development Chapter of the City of Duluth Legislative Code and in compliance with the Minnesota Pollution Control Agency (M.P.C.A.) Municipal Separate Storm Sewer System (MS4) general permit MNR040000 , these Special Provisions, and the following:

E.1 The Contractor shall obtain an Erosion and Sediment Control Permit (ESCP) for ALL projects with a land disturbance area **greater than 3,000 square feet and less than 1.0 acre.**

E.2 The Contractor shall obtain **BOTH** the Erosion and Sediment Control Permit (ESCP), and the MPCA/NPDES Permit (described above) for ALL projects with a land disturbance area **greater than or equal to 1.0 acre.**

E.3 The Erosion and Sediment Control Permit application form can be picked up at the City's Public Works & Utilities Department, Engineering Division, Room 240, City Hall, or downloaded from the City's website (http://www.duluthmn.gov/engineering/permits/).

E.4 For City public improvement projects, the City's project manager will coordinate the internal application review and processing of the ESCP application.

E.5 In accordance with goals of the City MS4 program, the Contractor shall use street sweeping to remove sediment on streets resulting from vehicle tracking or haul vehicle spillage. Equipment shall be pick-up type sweeper having adequate water and spray dust controls to meet all air quality regulations and avoid creating a nuisance to adjacent properties. All street sweeping required under this Contract shall be performed as incidental work.

E.6 In addition to the requirements of the project SWPPP incorporated into the ESCP, the Contractor shall incorporate the MPCA guidance and recommendations into their site management activities. Refer to the MPCA's website (https://www.pca.state.mn.us/business-with-us/construction-stormwater).

1801 SUBLETTING OF CONTRACT

The provisions of MN/DOT 1801 are supplemented with the following:

The City requires the Contractor to use the paper version of MnDOT's "Request to Sublet" form.

1803 PROGRESS SCHEDULES

The provisions of MN/DOT 1803 are supplemented with the following:

This Contract requires the use of a Critical Path Method (CPM) Schedule as the Project Schedule for the Project. The Contractor shall meet the requirements of 1803.2, "Critical Path Method (CPM)". The Contractor shall furnish the Engineer with the schedule at or before the preconstruction conference.

The Contractor shall notify the Engineer no later than 8:00 AM on Friday if they intend on working any part of the proximate weekend.

The Contractor shall allow for normal weather delays when developing the Bar Chart Schedule. The City will extend the Contract Time, except as limited by 1806.4, "Extension of Contract Time Due to Weather on Calendar Day and Completion Date Contracts," for delays in excess of the anticipated Working Days lost to inclement weather as specified in the table below. The days in the table below are cumulative and shall be prorated when Contract Time starts or ends mid-month. For example, if Contract Time starts May 1st and there are days lost to weather in May or June, then the Contract must lose 7 days to weather (4 days from May and 3 days from June) in addition to the anticipated days in July before a time extension would be considered due to weather days lost in July.

Table 1803-1: Weather Contingency by Time Period

Time Period	Anticipated Working Days Lost Due to Weather
January	all
February	all
March	all
April 1-15	all
April 16-30	4
May	4
June	3
July	3
August	3
September	3
October	4
November 1-14	4
November 15-30	all
December	all

1804 PROSECUTION OF WORK (LIMITATION OF OPERATIONS)

The provisions of MN/DOT 1804.2 are supplemented with the following:

No work shall be performed during the period between **9:00 PM** and **7:00 AM** Central Standard Time unless specifically specified or authorized by the Engineer.

1906 PARTIAL PAYMENTS

The provisions of MN/DOT 1906 are supplemented and/or modified with the following:

The first sentence of Paragraph Four shall be amended to read as follows: "From the total of the amounts ascertained as payable, five percent (5%) will be deducted and retained by the City for the protection of its interests as hereinafter provided. The balance, less all previous payments, will be certified for payment. The City will withhold eight percent (8%) from out of state contractors unless a waiver has been granted from the State of Minnesota, Department of Revenue by submitting Form SDE, Exemption from Surety Deposits for Non-Minnesota Contractors."

All retainage shall be released no later than 60 days after Substantial Completion, except that:

A 250 percent of the cost to correct or complete work known at the time of substantial completion may be retained; AND,

B One percent of the value of the contract or $500, whichever is greater, may be retained pending completion and submission of all final paperwork by the Contractor or subcontractor.

The Contractor must pay all remaining retainage to its subcontractors no later than ten days after receiving payment of retainage from the City, unless there is a dispute about the work under a subcontract.

All provisions for partial payments shall apply to domestic materials only. No payments shall be made to the Contractor for materials manufactured outside of the United States until such materials have been delivered to the job site.

Substantial completion shall be determined by the date when construction is sufficiently completed so that the City can occupy or use the improvement for the intended purpose. For construction, reconstruction, or improvement of streets and highways, including bridges, substantial completion means the date when construction-related traffic devices and ongoing inspections are no longer required.

1908 FINAL PAYMENTS

Final Payment shall be made in accordance with the provisions of MN/DOT 1908 and the following:

A The final estimate will show the balance due the Contractor after making all legal and specified forfeitures and deductions. This balance will then be paid by the City to the Contractor within thirty (30) days after such estimate is presented to and accepted by the Contractor or within forty-five (45) days after such estimate is presented to and not acted upon by the Contractor, less any allowed retainage of the total value of work on the final estimate. At such time, the paid final estimate shall be considered valid with no further compensation due the Contractor.

B If this Contract contains a "Disadvantage Business Enterprise or Targeted Group Business" goal, the following requirement shall apply:

"Before final payment is made, the Contractor shall also complete an affidavit showing the total dollar amounts of work performed by disadvantaged business enterprise (DBE) and targeted group business (TGB) and/or veteran-owned small business."

2015 BLAST MONITOR/SURVEY

2015.1 DESCRIPTION

The provisions for rock excavation blasting, as covered herein, are applicable to all uses of explosive materials in the fragmentation of rock for the purpose of excavation of rock materials. These provisions cover the usage of explosives, project documentation, safety, public relations, and vibration controls required for the types of rock excavation listed in the Definitions paragraph below. Construction details for these items are found elsewhere in the Plans and Specifications.

This Section includes the following:

(1) Condition surveys.

(2) Measures necessary to eliminate damage from blasting work.

(3) Vibration monitoring and control.

Blasting will create air and ground vibration that may damage adjacent buildings, retaining walls, other structures, utilities, soil and rock slopes and other natural or man-made features. The buildings, retaining walls, structures, utilities and all other improvements shall be hereafter called structures. The Contractor shall make its own assessment of damage potential, based on their planned blasting work and shall make any adjustments necessary to eliminate damage.

A Definitions

(1) (2015) Blast Monitor/Survey - refers to preparatory work and operations for rock removal, including but not limited to, those necessary for the movement of personnel, equipment, supplies and incidentals to the project site, blasting plan submittal, maintaining appropriate records, safety, public relations, vibration control and monitoring, and insurance.

(2) Peak particle displacement: The peak displacement is the maximum movement induced by the vibration.

(3) Peak particle velocity: The peak particle velocity is the maximum rate of change with respect to time of the particle displacement. The velocity amplitudes given are in units of inches per second (IPS), zero to peak amplitude.

(4) Frequency: The frequency of vibration is the number of oscillations which occur in one second. The frequency units given are in Hertz (Hz); one Hz equals one cycle per second.

(5) Air Blast: The air blast is the peak over-pressure above or below atmospheric pressure resulting from a blast. The air blast is given in units of pounds per square inch (psi) or decibels (dB) which is referenced to a sound pressure of 20 micropascals.

(6) (2106) Excavation - Rock refers to the main fragmentation blasting resulting from appropriately spaced production holes drilled throughout the rock excavation area.

(7) (2106) Controlled Excavation refers to the controlled use of explosives and blasting accessories in carefully spaced and aligned drill holes to produce a shear plane in the rock along the specified excavation

backslope. Controlled excavation techniques covered by the specification include presplitting and cushion (trim) blasting.

(8) (2411) Structure Excavation, Class R refers to removal of rock materials (bedrock, boulders, detached rock) where the excavation will be used for the placement of bridges, retaining walls, miscellaneous structure footings, etc.

(9) (2451) Rock Excavation in Trench refers to removal of rock materials (bedrock, boulders, detached rock) to create a trench for the placement of utilities.

2015.2 MATERIALS - BLANK

2015.3 CONSTRUCTION REQUIREMENTS

A Condition Surveys of Existing Buildings:

The Contractor shall perform condition survey work as necessary. It shall be the Contractor's responsibility to ensure that adequate pre-condition survey documentation for the protection of the Contractor and City is obtained prior to performing rock excavation. The City may elect to perform condition survey work for its own benefit. Should the City elect to perform condition survey work it will make those records available to the Contractor, however this shall not in any way relieve the Contractor of the full responsibility for having adequate precondition survey data including the accuracy thereof. No direct compensation will be made for condition survey work to be performed by Contractor or Contractor's representative.

B Use of Explosives

The regulatory requirements of OSHA Safety and Health Standards 29 CRF, Part 1926, Subpart U, “Blasting and Use of Explosives” shall apply. All blasting operations, including the storage and handling of explosives and blasting agents, shall be performed in accordance with the applicable provisions of the Standard Specifications and all other pertinent federal, state, and local regulations. Whenever explosives are used, they shall be of such character and in such amount as is permitted by state and local laws and ordinances and all respective agencies having jurisdiction over them. The person(s) responsible for the use of explosive materials shall be knowledgeable and experienced in their use and handling.

Blasting will be limited to a period between 8:00 a.m. and 5:00 p.m. Monday through Saturday or as otherwise approved by the Engineer. Engineer may require Contractor to coordinate specific blasting times, taking into consideration the safety and convenience of adjacent residents and building owners.

C Blasting Plan Submittal

Not less than three weeks prior to commencing drilling and blasting operations or at any time the Contractor proposes to change the drilling and blasting methods, the Contractor shall submit a "Blasting Plan" to the Engineer for review. The blasting plan shall describe in full details, the drilling and blasting patterns the Contractor proposes to use for the types of blasting required by the Contract.

The blasting plan shall include (at a minimum):

(1) Name and experience of Blaster(s).

(2) Type of explosives, primers and initiators including manufacturers' data sheets for all explosive products.

(3) General blasting configurations including hole size, spacing, loading pattern, detonation procedure, anticipated maximum pounds of explosive per delay, powder factor, number of lifts, and limits of blasting.

(4) Procedures to inform and protect the public and adjacent property (e.g., signs, horns, letters, personal visits, etc.).

(5) Flyrock control plan.

(6) Proposed "Shot Log" for individual blasts**.**

The blasting plan submittal is for quality control and record keeping purposes. Review of the blast plan by the Engineer shall not relieve the Contractor of responsibility for the accuracy and adequacy of the plan when implemented in the field.

D Shot Log

The Contractor is required to submit records (shot logs) for each individual shot on forms approved by the Engineer. The shot log shall be maintained by the Contractor and submitted to the Engineer at the end of each day. No blasting will be allowed until the shot log from the preceding day has been submitted to the Engineer. The shot log shall include the following information (at a minimum);

(1) Location of the shot by station and offset.

(2) Plan view of the drill pattern including free face, burden, hole spacing, diameters and angles.

(3) Section view showing type, amount, and number of explosives, primers, initiators, location and depth of stemming, lift height, and subdrill depth.

(4) Initiation sequence of holes including cumulative delay times and delay system.

(5) Maximum peak particle velocity measured at the closest (or most critical receptor), location of monitoring station, and scaled distance.

E Scaling and Stabilization

All rock on the excavated face that is loose, hanging, or which creates a potentially dangerous situation shall be removed or stabilized to the Engineer's satisfaction during or upon completion of the excavation in each lift. Drilling of the next lift will not be allowed until this work has been completed.

Exposed rock slopes shall be scaled throughout the span of the Contract and at such frequency as required to remove all hazardous loose rock or overhangs. The slopes shall be hand scaled using a suitable standard steel mine scaling rod. Subject to the Engineer's approval, other methods such as machine scaling, hydraulic splitters, or light blasting may be used in lieu of or to supplement hand scaling. Payment for scaling and removal of scaled rock from outside the excavation limits shall be incidental.

If in-place stabilization of backslope rock is required, due to defects inherent in the bedrock structure or weathering, as determined by the Engineer, rock bolting or other Engineer-approved stabilization techniques shall be used and paid for as extra work. Stabilization necessitated, in the opinion of the Engineer, by the Contractor`s blasting or excavation operations, shall be performed at the Contractor`s expense.

F Safety

The Contractor shall observe the entire blast area for a minimum of five minutes following a blast to guard against rock fall before commencing work in the cut. The Contractor is responsible for the safety of workers and the public in general.

The Engineer will, at all times, have the authority to prohibit or halt the Contractor's blasting operations if it is apparent that, through the methods being employed, the required slopes are not being obtained in a stable condition or the safety, convenience, or property of the public is being jeopardized.

The Contractor is advised that structures are located close to the proposed work and that noise and vibration producing activities shall be conducted so as to preclude damage to these structures and undue annoyance to their occupants. The Contractor shall be responsible for all damage caused by their activities.

G Public Relations

The Contractor is required to have both letter and personal contact with residents and owners of buildings that are adjacent to the construction area or near enough to it for ground

vibrations from construction operations (including blasting) to affect the structure, personal property, or water wells. This contact shall be made prior to the beginning of any blasting or other vibration producing activity. The Contractor shall furnish a list of those contacted to the Engineer, as part of the blasting plan.

The Contractor shall identify a contact person for complaints from the public and shall maintain a log of such complaints and any action taken by the Contractor. This log shall be available to the Engineer upon request. The Contractor shall make an initial reply to complaints within 24 hours.

H Flyrock Control

Before the firing of any blast in areas where flying rock may result in personal injury or damage to property or the work, the rock to be blasted shall be covered with approved blasting mats, soil, or other equally serviceable material to prevent flyrock.

I Fresh Concrete Vibration Controls

During the course of the work, the Contractor may desire to conduct vibration producing activities (such as blasting, vibratory compaction, pavement breaking or operation of heavy construction equipment) in the vicinity of freshly poured concrete. The following maximum* vibration levels for fresh concrete shall apply:

Table 2015-1: Maximum vibration levels for fresh concrete

Concrete Age (hours)	Maximum Peak Particle Velocity [inches per second]
0-3	No Limit
3-12	1.00
12-24	1.50
24-48	2.50
48 or greater	4.00

(The term ‘maximum’ as used herein refers to the maximum of three mutually perpendicular transducer components)

The Contractor shall provide the necessary monitoring equipment (typically a vibration seismograph) to assure that these limits are not exceeded. Any monitoring equipment supplied shall be capable of measuring a peak particle velocity of at least 4.0 inches per second. Vibrations shall be measured at a point directly between the concrete structure and the closest point of the vibration producing operation. The actual measuring point will be determined by the Engineer, and the geophone will typically be buried in the soil adjacent to the structure or placed on the structure. When located on the structure, the geophone must be grouted or mechanically fastened (bolted) to the structure.

The above vibration limits established for the protection of fresh concrete on this Project, do not relieve the Contractor from complying with any other vibration limits in force on the Project, nor do they relieve the Contractor from responsibility for damage to any existing structures (on or off the Right of Way) that may be affected by vibrations at lower levels than are allowed herein for the protection of the concrete.

The Engineer, at their discretion (or in consultation with the Geology Unit, Office of Construction Materials and Engineering), may waive the requirement for vibration monitoring (for fresh concrete controls) if the vibration producing operation is conducted at such a distance that ground vibrations cannot be readily felt by a person standing adjacent to the location where the concrete will be poured.

Payment for all work specified for monitoring vibrations in the vicinity of fresh concrete as described above, including but not limited to, furnishing monitoring equipment and maintaining appropriate records, shall be considered an incidental expense for which no direct compensation will be made.

J Vibration Control and Monitoring

J.1 Whenever vibration damage to adjacent structures is possible, the Contractor shall monitor each blast with an approved seismograph located, as approved, between the blast area and the closest (or most critical) structure subject to blast damage. The seismograph shall be capable of recording peak particle velocity for three mutually perpendicular components of vibration in the range generally found in construction blasting.

The peak particle velocity of each component shall not be allowed to exceed the safe limits, as established below, for all adjacent structures subject to vibration damage.

J.1.a Ground Vibration Control Limit

The maximum single component peak particle velocity resulting from construction activity shall not exceed the safe blasting criteria established in the Office of Surface Mining recommendations, OSM Alternative Blasting Level Criteria (Modified from Figure B-1, RI 8507 U.S. Bureau of Mines). The criteria allow a constant peak particle velocity (ppv) of 2.0 inches per second (ips) above 30 Hz. Below 30 Hz, the maximum velocity decreases at a rate equivalent to a constant peak displacement of 0.01 inch to 11Hz. Between 11 Hz and 4 Hz, the maximum velocity is 0.75 ips. Below 4 Hz, the maximum velocity decreases at a rate equivalent to a constant peak displacement of 0.03 inch.

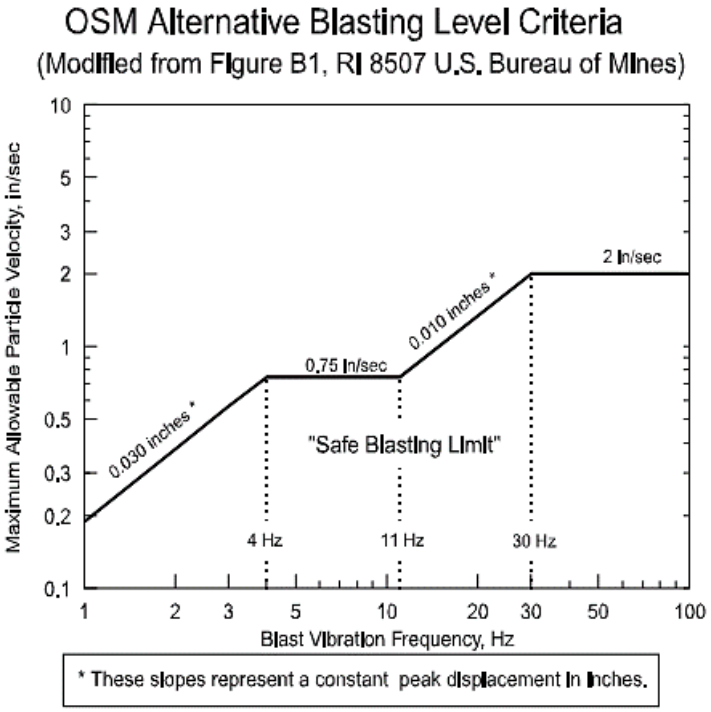

Figure 2015-1 OSM Alternative Blasting Level Criteria

J.1.b Air Blast Control Limit

The maximum air blast resulting from blasting shall not exceed 135 dB (0.015 psi) Linear- Peak weighting. The A and C weighting systems are not allowed.

J.1.c Vibration Monitors

An amplitude/frequency vibration monitor shall be supplied that is capable of measuring, recording, and producing a printed paper version of the frequency and peak particle velocity in each of three mutually perpendicular axes (“vector sum” instrumentation is not allowed). The instrument must have the appropriate sampling rate and velocity range to measure vibration levels generally found in construction blasting (must be able to measure peak particle velocity up to at least four inches per second). The instrument shall be capable of measuring Linear Scale air blast pressure (other weighting systems, such as A- or C-scale are not allowed). The instrument must also be capable of plotting the measured vibration level against the OSM criteria or be capable of reporting the frequency and displacement of each vibration event. The vibration monitoring equipment must have current calibration documentation. All vibration monitoring equipment shall be approved by the Engineer prior to usage on the Project.

When blasting near buildings, structures, or utilities which may be subject to damage from blast induced ground vibrations, the ground vibrations shall be controlled by the use of properly designed delay sequences and allowable charge weights per delay. Allowable charge weights per delay shall be based on vibration levels which will not cause damage. The allowable charge weights per delay shall be established by carrying out trial blasts and measuring vibration levels. The trial blasts shall be carried out in conformance with the blasting test sections described elsewhere in these provisions, modified as required to limit ground vibrations to a level which will not cause damage.

J.2 The City may also hire an independent testing agency (ITA) to monitor ground vibrations and air blasts resulting from rock blasting activities. If the City elects to do so the Contractor shall coordinate blasting activity work with the City hired ITA. (No blast shall be detonated without prior confirmation from the ITA that the monitoring equipment is in place and operative.) The City's hiring of an ITA shall in no way relieve the Contractor of the responsibility for performing the herein Contractor prescribed monitoring requirements.

J.3 The vibration and air blast control limits are applicable for all blasting on the Project, but the ground vibration control is also applicable to all other construction work, including but not limited to drilling, compaction, and hauling activities. Be advised that vibration attenuation is affected by the presence of groundwater.

J.4 Be advised that the ground vibration and air blast control limits defined herein restrict blasting practices. To meet the specified limits, make whatever modifications are necessary, including but not limited to the use of more delays, smaller rounds, more blast holes, shallower lifts and smaller charges.

J.5 The ground vibration and air blast controls are applicable to external locations adjacent to all structures.

J.6 No controls have been established for in-place utilities. Conduct blasting to prevent damage to utilities.

J.7 If operations result in values which exceed 80 percent of the ground vibration limit; or 2 Db less (80 percent of pressure value) than the air blast limit for any single blast, suspend that activity and submit a report. This report shall give the vibration and blast data and include the proposed corrective action to ensure that the specified limit is not exceeded for future work. This report shall be submitted to the Engineer, and their permission must be obtained before continuing blasting or engaging in other significant vibration-producing activities.

J.8 If the Contractor exceeds the ground vibration or air blast limit for any single event, the Engineer will direct that all activities related to those causing vibration

or air blast, including drilling operations, be stopped. The Contractor shall submit to the Engineer a report giving the vibration and blast data and shall include the proposed corrective action for future work. In order to proceed with any work related to vibration producing activities, written permission must be obtained from the Engineer.

J.9 Modifications to Means, Methods and Equipment: Modify the means, methods and equipment in any way necessary to eliminate damage to properties. These modifications shall include any necessary modifications of previously submitted and approved blasting plans, should field experience demonstrate that damage has occurred or may occur.

J.10 Vibration and air blast control limits will not be raised on data obtained from the test blast program. If, during the test blast program or during the course of construction, it becomes evident that the limits established are too high for safe blasting, more restrictive limits may be established.

J.11 The Engineer shall have the authority to prohibit or halt the Contractor's blasting operations at any time if the methods being employed jeopardize the safety or convenience of the City or public.

2015.4 MEASUREMENT AND BASIS OF PAYMENT

Blast Monitor/Survey will be measured and paid on a lump sum basis. On the first partial estimate that shows 10 percent or more of the original Contract amount of rock excavation has been earned, payment will be made for 50 percent of the amount bid. When the rock excavation items are completed, the remaining 50 percent of the amount bid for Blast Monitor/Survey will be paid.

The City will pay for Blast Monitor/Survey on the basis of the following schedule:

Item No.	Item	Unit
2015.601	Blast Monitor/Survey	lump sum

2051 HAUL ROAD MAINTENANCE AND RESTORATION

The provisions of MN/DOT 2051 are supplemented and/or modified with the following:

A GENERAL

The Contractor shall take reasonable care to protect and maintain ALL haul routes.

B DESIGNATED HAUL ROUTE

In coordination with any traffic restrictions detailed in the Plans, the Contractor shall designate Haul Routes for approval by the Engineer. The Contractor shall submit Haul Route Application no later than 3 Working Days prior to the Preconstruction Conference.

A copy of Contractor's Haul Route Application form is available on the City's website (https://duluthmn.gov/engineering/permits/).

The Engineer will review the haul route application and approve either the proposed hauls routes or acceptable alternative haul routes. The intent of the Engineer's review is to keep the construction traffic on those streets that have adequate capacity to support the construction traffic, minimize traffic congestion, and minimize deterioration. The Engineer anticipates that the Haul Route(s) will be approved prior to the preconstruction conference.

Once the approved haul route has been established, the Contractor will be required to perform all hauling of equipment and supplies on those approved haul routes ONLY. The Contractor will not be allowed to haul on other streets without written approval of the Engineer to revise the haul route application. These haul route restrictions shall apply to all subcontractors and suppliers as well, for which the prime contractor shall be responsible for coordinating.

C RESTORATION OF HAUL ROADS

If, in the opinion of the Engineer, roadway deterioration occurs as a result of the construction traffic and repairs are needed on the streets **designated as "approved" haul routes**, the Engineer will direct the Contractor to make repairs. Repair work on the approved haul routes will be considered Extra Work and the Contractor will be compensated in accordance with the provisions of MN/DOT 1904.

If, in the opinion of the Engineer, roadway deterioration occurs as a result of the construction traffic and repairs are needed on City streets **not permitted or not designated as the approved haul routes**, it shall be a rebuttable presumption that said damage was caused by the Contractor impermissibly using such streets or roadways. The Engineer will direct the Contractor to make repairs to restore the road to a condition that is as good as, or better than, the road conditions existing prior to construction. Repair work on the non-approved routes will be considered incidental and no compensation will be made to the contractor. If the repairs are not made by the Contractor within 30 days, the Engineer may order the work done by others and deduct the cost from monies due the Contractor.

2101 CLEARING AND GRUBBING

Clearing and grubbing shall be performed in accordance with the provisions of MN/DOT 2101 and the following:

A PLANT REMOVAL

The City Forester has reviewed this project for possible plant material salvage. All transplanting will be done by City Maintenance forces prior to the Contract starting date. All

remaining plant material necessary to be removed shall be removed and disposed of according to the Standard Specifications. Only those trees, branches, or brush necessary for proposed construction will be cut. Cutting trees, branches, or brush to clear additional area beyond proposed construction limits will not be permitted on this project.

2102 REMOVING PAVEMENT AND MISCELLANEOUS STRUCTURES

Abandoned structures and other obstructions shall be removed from the Right-of-Way and disposed of in accordance with the provisions of MN/DOT 2104, except as modified below:

A Measurement and payment for the removal and disposal of materials will be made only for those items of removal work specifically included for payment as such in the Proposal and as listed in the Contract Drawings. The removal of any unforeseen obstruction requiring, in the opinion of the Engineer, equipment or handling substantially different from that employed in excavation operations, will be paid for as Extra Work as provided in MN/DOT 1402.5.

B The Contractor shall maintain in place all existing “Stop” and “Yield” signs until the street is closed to traffic with barricades and “Road Closed” signs. The Contractor may remove and store, if necessary, “Stop” and “Yield” signs only when the street is closed to traffic. Before the street is re-opened to any traffic, the Contractor shall properly re-install the “Stop” and “Yield” signs.

C The street name signs are in place to guide emergency vehicles, deliveries, and visitors. The signs need to remain visible at all times. If necessary to relocate, the new foundation shall be completed prior to removing pole and sign in order to conduct the relocation in one move. If a temporary relocation is necessary and approved, the sign must remain visible at all times and not touch the ground during the move. Any damage to the sign or any sign installation shall be replaced or repaired at the Contractor’s expense.

D Drainage structure castings shall be removed and may be stockpiled on site. If instructed by the Engineer, the Contractor shall coordinate and deliver the castings as directed by the Engineer within the limits of the City of Duluth. It shall be the Contractor’s responsibility to unload the castings. Payment will be incidental to Item 2104.509 Remove Manhole or Catch Basin. Upon completion of the unloading, the castings will become the property of the City of Duluth. All other castings shall become the property of the Contractor to properly dispose of outside of the project limits.

E All materials removed during one Working Day that are scheduled for disposal shall be disposed of during the same Working Day. Job site stockpiling of removal items will not be permitted.

F Both the upgrade and downgrade ends of all drainage or sewer pipes leading from abandoned basements, manholes, or similar structures shall be plugged with concrete or masonry.

G Crushing or processing of pavement materials or rock on the project site shall not be permitted except as stated in the Special Provisions.

H Where not included in the Contract bid items, sawing of sidewalks, curbs, and pavements needed for removal shall be incidental.

I When removal of any existing abandoned cast iron gas main is required, the cut ends of the abandoned pipe to remain in-place shall be plugged with water-tight end cap or plug. Closed cell polyurethane foam sealant (Touch 'n Seal by Convenience Products, Polywater AFT by American Polywater Corporation, Spraytite 178 by BASF Corporation, or approved equal) will be considered an acceptable alternative to mechanical plugs, on a case-by-case basis, when authorized by the Engineer. In addition, a 1-inch PE or Type K copper "jumper" pipe shall be installed to connect the cut ends together or to a nearby catch basin as directed by the Engineer to relieve accumulated water in the pipe. Plugs and jumper pipe shall be considered incidental and no direct payment will be made.

J If the Contractor removes a portion of an existing abandoned gas service, all remaining openings shall be fitted with an appropriate waterproof cap or plug to prevent conduction of groundwater through the abandoned gas system.

2106 ROCK EXCAVATION (PRODUCTION BLASTING)

The provisions of MN/DOT 2106 are supplemented and/or modified with the following:

2106.1 DESCRIPTION

Rock excavation, as covered herein, refers to the main fragmentation blasting resulting from appropriately spaced production holes drilled and detonated in the excavation area. This includes the blasting procedures for rock channel excavation, and for general excavation areas adjacent to controlled excavation slopes or in areas where no controlled excavation is required. General rock excavation of this nature is referred to in these provisions as "production blasting".

2106.2 MATERIALS – BLANK

2106.3 CONSTRUCTION REQUIREMENTS

A Procedure

Production blast holes shall be drilled on the patterns as submitted by the Contractor in the Blasting Plan. Hole diameters shall not exceed six inches unless approved by the Engineer. Detonation of production holes shall generally be on a controlled delay sequence toward a free face to minimize environmental effects.

If controlled excavation is specified, the row of production blast holes immediately adjacent to any backslope shaped by controlled excavation shall be drilled on a plane approximately parallel to the controlled back slope. Production holes shall not be drilled closer than 6 feet to the controlled excavation slope, unless approved by the Engineer. When shooting to an intermediate working bench, the bottom of the production holes shall not be lower than the bottom of the adjacent controlled blast holes.

It is the Contractor`s responsibility to take all necessary precautions in the production blasting so as to preserve the integrity of the final rock backslope.

B Test Section(s)

Prior to commencing full-scale production blasting, the Contractor shall demonstrate the adequacy of the proposed blasting technique by drilling, blasting, and excavating short test sections of between 25 - 50 feet in length, to determine which combination of method, hole spacing, and charge works best for the rock type and existing geologic conditions. When field conditions warrant, and upon approval by the Engineer, the Contractor may be permitted to use test section lengths other than specified above. Unless otherwise ordered by the Engineer, such test sections may be incorporated as part of the planned excavation.

Requirements for controlled and production blasting operations or any ground vibration or airblast limits covered elsewhere in these construction standards shall also apply to the blasting carried out in conjunction with the test sections.

The Contractor will not be allowed to drill ahead of the test shot area until the test section has been excavated and the results evaluated by the Engineer. If the results of the test shot(s), in the opinion of the Engineer, are unsatisfactory, then, notwithstanding the Engineer's prior review of such methods, the Contractor shall adopt such revised methods as are necessary to achieve the required results. Unsatisfactory test shot results include an excessive amount of fragmentation or overbreak beyond the indicated lines and grade, excessive flyrock, or nonconformance to other requirements within these specifications (such as vibrations limits). All costs incurred by the Contractor in adopting revised blasting methods necessary to produce an acceptable test shot shall be considered incidental to the Contract unit prices for Rock Excavation.

2106.4 METHOD OF MEASUREMENT

Measurement for Rock Excavation will be made by the number of cubic yards of inplace rock acceptably removed and which is within the pay limits as detailed in the Plans and Special Provisions.

2106.5 BASIS OF PAYMENT

The Contract Unit Price for accepted quantities of rock excavation is compensation in full for Equipment, Materials and labor required to complete the Work.

The City will pay for Rock Excavation on the basis of the following schedule:

Item No.	Item	Unit
2106.507	Excavation - Rock	cubic yard
2411.507	Structure Excavation Class R	cubic yard
2451.607	Rock Excavation in Trench	cubic yard

2106 EXCAVATION AND EMBANKMENT

Roadway excavation and embankment construction shall be performed in accordance with the provisions of MN/DOT 2106, except as modified below:

A GENERAL

Unless otherwise directed in the Plans or project Special Provisions, compaction of all embankment, including culvert backfills, shall be obtained by the "Specified Density Method" described in MN/DOT 2106.3.G. The minimum sampling and testing for compaction shall be in accordance with Appendix B Schedule of Materials Testing – City of Duluth Street and Utility Projects included in these specifications. Additional testing may be performed as determined by the Engineer.

B MATERIALS

Unless specifically stated otherwise in the Plans, Select Granular Embankment and Select Granular Embankment Mod. 7% (MN/DOT 3149.2B) shall both be modified so that of the portion passing a 1-inch sieve, not more than 7 percent by weight will pass a No. 200 sieve.

C CONSTRUCTION REQUIREMENTS

The provisions of MN/DOT 2106.3F are supplemented with the following:

For Select Granular Embankment and Select Granular Embankment Mod. 7% the maximum Lift thicknesses is 8 inches.

D NOTIFICATION OF EXCAVATION NEAR GAS MAINS

The City of Duluth gas utility must be notified 2 Working Days prior to any excavation or directional drilling within 6 feet of a 6 inch or larger natural gas main. City personnel will be on site to monitor excavation and inspect any exposed main 6 inches or larger. Notify the Engineering Department at 218-730-5200 to coordinate this inspection.

The Contractor shall notify the City of Duluth gas utility immediately any time a steel natural gas main smaller than 6 inches is exposed within an excavation. Contact the Engineering Department at 218-730-5200 to coordinate an inspection of the exposed main.

E ADJUST WATER SERVICE SHUTOFF STANDPIPES

If the contract does not include a bid item for adjust water service shutoff standpipes, the Engineer will consider any work for adjustment of the water service shutoff standpipes to be incidental to Item 2106.507 Common Excavation. After finish grading and restoration has been completed, the Contractor will provide all labor and incidentals necessary to adjust curb boxes to the correct elevation. The City will provide iron pipe stand pipe, iron pipe sleeves, and iron caps as needed.

2108 GEOSYNTHETIC CONSTRUCTION MATERIALS

The provisions of MN/DOT 2108.2 are supplemented with the following:

Unless otherwise specified, geotextile shall conform to the requirements of MN/DOT 3733, Type 5, and be non-woven.

2211 AGGREGATE BASE

Aggregate base construction shall be performed in accordance with the provisions of MN/DOT 2211, except as modified below:

Aggregate for base construction shall conform to the requirements of MN/DOT 3138 and may be sampled, tested, and inspected by the City at any time prior to being incorporated permanently in the work.

The City will measure compaction of aggregate base by the “Specified Density Method” described in MN/DOT 2211.3.D.2.

Materials sampling and testing will be in accordance with Appendix B Schedule for Materials Testing – City of Duluth Street and Utility Projects included in these specifications. Additional testing may be performed as determined by the Engineer.

The provisions of MN/DOT 2211.3.B are deleted and replaced with the following:

B Contractor Quality Control (QC) Testing

Contractor QC testing is required and the Contractor shall submit results and all required forms to the Engineer within one business day.

Certify materials on Form G&B-104 and attach any required aggregate test results.

Any base material, which fails either QC or Quality Assurance (QA) testing shall be corrected by the Contractor at no expense to the City. Correct failing material, before placing the next lift.

Material placed without certifications is unauthorized Work in accordance with 1512, “Unacceptable and Unauthorized Work.”

The provisions of MN/DOT 2211.3.D.4 are deleted and replaced with the following:

D.4 Moisture Testing

Test for the moisture content in areas that appear least likely to meet specifications. Note that moisture tests during compaction are required for all compaction requirements, including quality compaction, LWD, penetration index, and specified density.

2215 RECLAMATION

The provisions of MN/DOT 2215.1 are supplemented with the following:

FDR and SFDR shall include spreading, watering, compacting, shaping, and maintaining the blended reclaim material to the specified profile and cross-section until final paving is completed.

2301 CONCRETE PAVEMENT LUGS

2301.1 DESCRIPTION

This Work consists of the construction of concrete pavement lugs underneath the concrete pavement.

2301.2 MATERIALS

Concrete Pavement Materials..... 2301

Epoxy Coated Reinforcement Bars..... 3301

Epoxy Coated Dowel Bars 3302

2301.3 CONSTRUCTION REQUIREMENTS

Construct concrete pavement lugs in accordance with the detail shown on **City Standard Detail STR-10** listed in Appendix D and the provisions of MN/DOT 2301.

2301.4 METHOD OF MEASUREMENT

Measurement will be by the length of pavement lugs constructed as specified.

2301.5 BASIS OF PAYMENT

The Contract Unit Price for Concrete Pavement Lugs is compensation in full for Equipment, Materials and labor required to complete the Work.

The City will pay for Concrete Pavement Lugs on the basis of the following schedule:

Item No.	Item	Unit
2301.603	Concrete Pavement Lugs	linear foot

2301 SLAB JACKING

2301.1 DESCRIPTION

This work is raising in place concrete pavement, driveway, and sidewalk panels by a mud-jacking/pressure grouting process in accordance with the applicable provisions of MN/DOT 2301 and this specification.

2301.2 MATERIALS

Agricultural Lime 3879

2301.3 CONSTRUCTION REQUIREMENTS

Furnish all labor, equipment, and material, including traffic control, necessary to perform the work intended. Place sufficient portable weights or other means on the panel to prevent uplift at the adjacent panel during the mud-jacking process, as directed by the Engineer.

Submit a layout of the mud-jack hole location and spacing for each proposed bridge approach panel to the Engineer for approval. The Engineer will approve each layout before drilling is started. Provide a 2-1/2 inch diameter hole size with alternate sizes approved by the Engineer.

The spacing and location of the mud-jack holes will vary depending upon the amount that the panel is to be raised and if the existing panel is cracked. The Engineer will determine the final elevation of each panel. Typical hole spacing is shown in the Plan. Hole spacing shall not exceed 6 feet center-to-center so that not more than 25 to 30 square feet of panel is raised by pumping at any one hole. The Engineer may require additional holes if the panel is cracked. The location of the holes should avoid drilling into the panel lug or shallow utility pipes as shown in the Plan. Refer to the Plan details or project Special Provisions for existing panel reinforcement. The Contractor should employ an experienced operator to make the decision on the hole spacing.

Provide an experienced individual to make the decision on the consistency of the mixture and the volume of each batch mixed. Provide a mudjack mixture consisting of the following:

Table 2301-1: Mudjack Mix Design

Ingredient	Weight (pounds)
Cement	452
Fly Ash	335
Agricultural Lime	2295
Water	Enough to attain a thick creamy texture

Drill all holes for the mud-jacking for the entire panel before jacking is started. Start mud-jacking at the lowest outboard corner of the panel and proceed towards the adjacent panel. Perform jacking in stages while carrying traffic in the adjacent lane. The Engineer may require alternate shifting of a lane closure.

Mud-jack on a continuous basis without interruption (except for a traffic shift) on each panel until the desired lift is achieved or as directed by the Engineer. Clean and fill mud-jack holes with concrete as directed by the Engineer.

Construct a temporary bituminous ramp from the in-place roadway to the newly raised panel, under flag person control, as many times as necessary during the mud-jacking process as directed by the Engineer. Maintain the temporary ramps until removal is necessary to place the permanent surfacing. Remove the ramps.

2301.4 METHOD OF MEASUREMENT

Measurement will be by the entire surface area of panel that is raised without regard to the number of holes drilled, the amount of mud-jack material used, or the distance that the panel is raised.

2301.5 BASIS OF PAYMENT

The Contract Unit Price for Slab Jacking is compensation in full for all costs, including traffic control, and all labor, materials, equipment necessary to perform the work, and place, maintain, remove temporary bituminous ramps.

The City will pay for Slab Jacking on the basis of the following schedule:

Item No.	Item	Unit
2301.604	Slab Jacking	square yard

2302 CONCRETE PAVEMENT REHABILITATION

The provisions of MN/DOT 2302 are modified and/or supplemented with the following:

A In all instances where “lineal” is written, replace with “linear”.

B The second sentence of MN/DOT 2302.1 Description is deleted and replaced with the following:

Perform all concrete pavement rehabilitation in accordance with the Concrete Pavement Rehabilitation (CPR) standard details as shown in the Contract and in Appendix F “Concrete Pavement Rehabilitation (CPR) Standard Details” of these Construction Standards.

C Delete the first sentence of MN/DOT 2302.3B.3 Type C Repairs.

D Paragraph 5 of MN/DOT 2302.3F.4 Repair is deleted and replaced with the following:

The Engineer will require corrective Work on vertical surface deviations greater than 1/8 inch within the span of the 10-foot straightedge in any direction. For corrected variations, the Engineer will accept deviations less than or equal to 1/8 inch within the span of a 10 feet straightedge in any direction.

E Delete MN/DOT 2302.3F.5 Type C Dowel Bar Anchoring Test Section in its entirety.

F Delete MN/DOT 2302.3F.6 Dowel Bar Anchoring Assurance in its entirety.

G MN/DOT 2302.4L Drill and Grout Reinforcement Bars is replaced with the following:

The Engineer will measure Drill and Grout Reinforcement Bar per each reinforcement bar, as furnished and installed as tie bars for Pavement replacement (Type CX).

2357 BITUMINOUS TACK COAT

Bituminous tack coat work shall be provided in accordance with MN/DOT 2357 except as modified as follows:

MN/DOT 2357.1 Description is supplemented with the following:

The Contractor shall coat the vertical surfaces of ALL edges abutting the asphalt pavement. When placing tack coat, the Contractor shall overspray (not more than two inches) the longitudinal joint of the adjacent road surface to seal the joint.

2360 PLANT MIXED ASPHALT PAVEMENT

The provisions of MN/DOT 2360 are modified and/or supplemented with the following:

2360.1 DESCRIPTION

Unless otherwise indicated in the Plan or project special provisions, asphalt mixtures shall be:

Type SP9.5 Wearing Course	SPWEA340C
Type SP12.5 Non-Wearing Course	SPNWB330C

2360.2 MATERIALS

A The first paragraph of MN/DOT 2360.2.G.4.b Sampling and Testing is revised with the following:

Take QC samples at random tonnage or locations, quartered from a larger sample of mixture. Sample randomly and in accordance with the Schedule of Materials Control. Determine random numbers and tonnage or locations using the Bituminous Manual; Section 720.4 or ASTM D 3665, Section 5, or an Engineer approved alternate method of random number generation. Sample either behind the paver or from the truck box at the plant site. Other sampling locations can be approved by the Engineer. The Contractor must decide and notify the Engineer where samples will be taken before production begins. The Contractor and Engineer must both agree to a change of sampling location once production has begun. Sample mixture from behind the paver. Sampling from the truck box at the plant site is not allowed unless approved by the Engineer. In addition to the QC sample, the Contractor will also bring an additional split of the

mixture sample to the plant site and store for the City for 10 calendar days. The procedure for truck box sampling is on the Bituminous Office website. The Contractor will obtain at least a 130-pound sample. Split the sample in the presence of the Inspector. The Inspector will retain possession of the Agency portion of each split sample and randomly submit a minimum of one sample, on a daily basis, to the District Laboratory for Verification testing (see 2360.2.G.3). Store compacted mixture specimens and loose mixture companion samples for 10 calendar days. Label these split companion samples with companion numbers.

B The provisions of MN/DOT 2360.2.G.8 Documentation are hereby modified with the following:

Delete "District Materials Laboratory" and replace with "City of Duluth's Project Engineer".

The City will assess monetary deductions in the amount of $250.00 each day that the Contractor fails to comply.

2360.3 CONSTRUCTION REQUIREMENTS

A MN/DOT 2360.3.B.3 Tack Coat is supplemented with the following:

The Contractor shall coat the vertical surfaces of ALL edges abutting the asphalt pavement. When placing tack coat, the Contractor shall overspray (not more than two inches) the longitudinal joint of the adjacent road surface to seal the joint.

B The provisions of MN/DOT 2360.3.D Compaction are hereby modified with the following:

B.1 The first paragraph of MN/DOT 2360.3.D.1 Maximum Density is hereby deleted and replaced with the following:

Compact the pavement to at least the minimum required maximum density values in accordance with Table 2360.3-1, "Required Minimum Lot Density (Mat)".

B.2 MN/DOT Table 2360.3-2 Longitudinal Joint Density Requirement is hereby deleted.

B.3 MN/DOT 2360.3.D.1.i Mat Density Cores is hereby deleted and replaced with the following:

Obtain four cores in each lot. Take two cores from random locations as directed by the Engineer. Take the third and fourth cores, the companion cores, within 1 foot longitudinally from the first two cores. Submit the companion cores to the Engineer immediately after coring and sawing. If the random core location falls on an unsupported joint, at the time of compaction, (the edge of the mat being placed does not butt up against another mat, pavement surface, etc.) cut the core with the outer

edge of the core barrel 1 foot [0.3 meters] away (laterally) from the edge of the top of the mat (joint). If the random core location falls on a confined joint (edge of the mat being placed butts up against another mat, pavement surface, curb and gutter, or fixed face), cut with the outer edge of the core barrel 6 inches ± 0.5 inch from the edge of the top of the mat (ex. center of 4 inch core barrel 8 ± 0.5 inches from the edge of the top of the mat). Cores will not be taken within 1 foot of any unsupported edge. The Contractor is responsible for maintaining traffic, coring, patching the core holes, and sawing the cores to the paved lift thickness before density testing.

The Engineer may require additional density lots to isolate areas affected by equipment malfunction, heavy rain, or other factors affecting normal compaction operations.

B.4 MN/DOT 2360.3.D.1.j Companion Core Testing is hereby deleted and replaced with the following:

The City will select at least one of the two companion cores per lot to test for verification.

B.5 MN/DOT 2360.3.D.1.n Longitudinal Joint Density is hereby deleted.

B.6 MN/DOT 2360.3.D.1.p Shoulders is hereby deleted.

C MN/DOT 2360.3.E Surface Requirements is hereby supplemented with the following:

Unless otherwise indicated in the Plan or project special provisions, the City will NOT evaluate Pavement Surface Smoothness (MN/DOT 2399).

2360.5 BASIS OF PAYMENT

A Table 2360.5-6 of MN/DOT 2360.5.B.13 is hereby deleted.

B Table 2360.5-7 of MN/DOT 2360.5.B.13 is hereby deleted.

C MN/DOT 2360.5.B.13.b Monetary Adjustment Factor Determination is replaced with the following:

The City will make payment based on either 1) Mat Density Pay Factor A on Table 2360.5-4 ONLY, with no adjustment for longitudinal joint density; or 2) the Payment % from Table 2360.5-5.

2360 PLANT MIXED ASPHALT PAVEMENT – STREET RESTORATION PATCHING

The provisions of MN/DOT 2360 and the City of Duluth Standard Specifications are supplemented and/or modified with the following for Street Restoration Patching Work only:

2360.1 DESCRIPTION

This work shall consist of providing plant mixed asphalt pavement to restore patches of the existing street pavement that are removed or damaged as a result of miscellaneous construction activities that do not include full-lane plant mixed asphalt pavement paving work as part of the project.

A street restoration patch will be defined generally as a small or minor area within an existing asphalt street pavement where the size or shape of the patch area precludes the use of standard asphalt street paving equipment. Any excavated area shall be restored with a temporary bituminous surface if a permanent patch cannot be placed within 5 Working Days or prior to opening to traffic, whichever comes first.

A street restoration patch may also be used to restore patches of the existing sidewalk that are removed or damaged as a result of miscellaneous construction activities as shown on the plans or as directed by the Engineer. Any excavated area shall be restored with a temporary bituminous surface if a permanent patch cannot be placed within 5 Working Days or prior to opening to pedestrians, whichever comes first.

The existing pavement shall be sawn full depth to create a neat clean edge to match the street restoration patch. Where the Contract does not include a sawing bid item, sawing shall be incidental.

Asphalt pavement street restoration patch thickness shall match the existing asphalt pavement section or unless otherwise provided in the Plan Details. Where there is no concrete base, the asphalt pavement shall be a minimum of 3.5 inches thick, placed in two layers.

For asphalt pavement on concrete base sections, the replacement concrete base shall be provided to the same thickness as the existing base section. The replacement base pavement shall be tied to the existing base panels with #5 epoxy coated rebar spaced not more than 18 inches on center. Joints shall be cut or tooled to match the original panel layout. Concrete base pavement joints shall not be sealed. Concrete base pavement surface shall not be “tined”. Concrete base pavement shall be cured for a minimum of 4 days prior to placing asphalt overlay.

Unless otherwise indicated in the Plans or special provisions, asphalt mixture for street restoration patch shall be:

SP 12.5 Wearing Course Mixture (3,C) (SPWEB340C)

2360.2 MATERIALS

A MN/DOT 2360.2 Materials is supplemented with the following:

The Contractor shall submit Mixture Design to the Engineer at least 14 calendar days prior to the asphalt paving work.

B The fourth paragraph of MN/DOT 2360.2.F is replaced with the following:

Provide a Department-reviewed Mixture Design Report for all paving.

C MN/DOT 2360.2.G Mixture Quality Management is supplemented with the following:

The Contractor shall provide copies of testing results to the Engineer upon request.

2360.3 CONSTRUCTION REQUIREMENTS

A MN/DOT 2360.3.B.2.e Rollers is supplemented with the following:

The use of mechanical tampers or skid plate compactors will only be considered acceptable with the written authorization of the Engineer prior to the work.

B MN/DOT 2360.3.B.3 Tack Coat is supplemented with the following:

The Contractor shall coat the vertical surfaces of all edges abutting the asphalt pavement street restoration patch.

C MN/DOT 2360.3.D Compaction is supplemented with the following:

Unless otherwise noted, the density of asphalt pavement for street restoration patch will be evaluated by "Ordinary Compaction" method.

D MN/DOT 2360.3.E Surface Requirements apply to the work of asphalt pavement for street restoration patch.

E MN/DOT 2360.3.E.1 Lift Thickness is supplemented with the following:

Unless otherwise noted in the Plan details, the work shall be constructed with a maximum lift thickness of three inches.

F MN/DOT 2360.3.G Small Quantity Paving is hereby deleted.

2360.4 METHOD OF MEASUREMENT

Where the actual total thickness of asphalt pavement for street restoration patch varies from the Contract bid items, the Engineer will prorate the quantities measured based on an adjustment factor determined by the ratio of actual thickness to bid item thickness.

2360.5 BASIS OF PAYMENT

The accepted quantities of asphalt pavement mixture for street restoration patch used in each course at the Contract prices per unit of material shall be compensation in full for all costs of constructing the asphalt surfacing and providing or incorporating asphalt binder, tack coat, mineral filler, hydrated lime, and anti-stripping additives that may be permitted or required.

The City will pay for asphalt pavement for street restoration patch on the basis of the following schedule:

Item No.	Item	Unit
2360.504	Type SP 12.5 Wearing Course Mixture (3,C) Street Restoration Patch (x)" Thick	square yard

Note: (x) Total Thickness of asphalt pavement for street restoration patch. Thicknesses greater than three inches SHALL be placed in multiple lifts as directed by the Engineer.

2399 PAVEMENT SURFACE SMOOTHNESS

MN/DOT 2399 is hereby deleted and the pavement surface smoothness requirements will not apply.

However, the provisions of 2360.3.E Surface Requirements **will** apply.

2402 PIPE RAILING

The provisions of MN/DOT 2402 are supplemented with the following:

Paint color for pipe railings shall be BLACK.

All metals shall be cleaned to SSPC-SP-6, commercial grade blast. Primer shall be one coat of Polyamidoamine Epoxy, Sherman Williams Macropoxy 646 or equal, to a DFT of not less than 4.0 mils. Final coat shall be one coat of Polyamidoamine Epoxy, Sherman Williams Macropoxy 646 or equal, to an average DFT of 2 to 3 mils.

Recoat as needed in field to cover metal exposed during installation.

2411 MINOR CONCRETE STRUCTURES

The provisions of MN/DOT 2411 are supplemented with the following:

A MN/DOT 2411.3 Construction Requirements is supplemented with the following:

(1) Concrete Steps shall be constructed as shown in **City Standard Detail STR-7** listed in Appendix D.

(2) Concrete retaining wall shall be constructed as shown in **City Standard Detail STR-6** listed in Appendix D.

B MN/DOT 2411.4 Method of Measurement is supplemented with the following:

Concrete steps and concrete retaining wall will be measured by volume of concrete placed and accepted with no deductions for reinforcement bar.

C MN/DOT 2411.5 Basis of Payment is supplemented with the following:

Payment for the items below will be made at the Contract bid price per unit, which shall be compensation in full for all labor, equipment, and material costs necessary to complete the work including, but not limited to, excavation, removals, aggregate bedding, reinforcement bar, structural concrete, backfill, and surface finishing.

The City will pay for Concrete Steps and Concrete Retaining Wall, Type L on the basis of the following schedule:

Item No.	Item	Unit
2411.607	Concrete Steps	cubic yard
2411.607	Concrete Retaining Wall, Type L	cubic yard

2451 EXCAVATION, BACKFILL, AND COMPACTION FOR UTILITIES

This work shall consist of furnishing all materials, labor, equipment, and other services as are necessary for preparing the site for work, the excavating, preparing the trench for the utility pipeline to be altered or installed, the backfilling and compaction. The excavation and backfill aspects of the work required for sewer, water, and gas utilities shall meet MN/DOT 2451 except as supplemented and/or modified with the following:

2451.1 DESCRIPTION

MN/DOT 2451.1 Description is supplemented with the following:

The City of Duluth considers sanitary, storm, water, and gas utility pipe, manholes, catch basins, hydrants, and valves to be 'prefabricated'.

2451.2 MATERIALS

MN/DOT 2451.2 Materials is supplemented with the following:

A Use of Onsite Materials

Where acceptable (suitable) select grading material **is available** within the project site, the select grading materials shall be utilized for backfilling pipe trench from the top of pipe encasement zone up to the subgrade (bottom of road section or bottom of topsoil) at the direction of the Engineer.

Suitable materials shall be defined as a mineral soil reasonably free of foreign materials (rubbish, debris, etc.), frozen clumps, aggregate larger than three inches, rock, concrete or asphalt chunks, and other unsuitable materials, that may damage the pipe installation, prevent thorough compaction, or increase the risks of after settlement unnecessarily. Except as modified herein, suitable backfill shall meet the provisions of MN/DOT 2106.2.B.1 Common Embankment. Suitable backfill shall not include recycled asphalt or concrete materials. The Engineer shall determine if any material is suitable.

B Imported Granular Materials for Pipe Bedding and Encasement

Granular materials furnished for foundation, bedding, pipe encasement, or other purposes as may be specified shall consist of any natural mineral aggregate such as sand, gravel, crushed rock, crushed stone, that shall meet the gradation requirements specified on the City Standard Details listed in Appendix D, the Contract Drawings and the Special Provisions. Granular material used for pipe bedding and encasement shall be comprised of Virgin Materials (3149.2.A.1) only. Recycled Materials (3149.2.A.2) will NOT be acceptable for utility backfill.

C Imported Granular Materials for Manholes and Catch Basins

Granular materials furnished for foundation and bedding shall consist of granular materials as specified on the City Standard Details listed in Appendix D, the Contract Drawings and the Special Provisions. Structure backfill for manholes and catch basins shall meet MN/DOT 3149.2.D.1 Granular Backfill. Granular material used for foundation, bedding, and backfill of utilities structures shall be comprised of Virgin Materials (3149.2.A.1) only. Recycled Materials (3149.2.A.2) will NOT be acceptable for utility backfill.

D Imported Materials for Backfill

Where acceptable select grading material is not available within the project site, the Contractor shall furnish granular backfill meeting MN/DOT 3149.2.D.1 Granular Backfill or common backfill meeting MN/DOT 21052106.1.BB.1 Common Borrow Embankment which shall be utilized for backfilling from the top of pipe encasement zone up to the subgrade (bottom of road section or bottom of topsoil) at the direction of the Engineer. Granular material used for backfill of utilities pipes and structures shall be comprised of Virgin Materials (3149.2.A.1) only. Recycled Materials (3149.2.A.2) will NOT be acceptable for utility backfill.

Where the backfill materials are not specified in the Plans or Special Provisions, it shall be Granular Backfill meeting MN/DOT 3149.2.D.1. (<20% passing No.200 sieve/1 inch).

2451.3 CONSTRUCTION REQUIREMENTS

A General Requirements

A.1 Protection of Surface Structures

All surface structures and features located outside the permissible excavation limits for underground installations, together with those within the construction areas which are indicated in the Contract Drawings as being saved, shall be properly protected against damage and shall not be disturbed or removed without approval of the Engineer. Within the construction limits, as required, the removal of improvements such as paving,

curbing, walks, turf, etc., shall be subject to acceptable replacement of underground work, with the expense of removal and replacement being borne by the Contractor to the extent that separate compensation is not specifically provided for in the Contract.

Obstructions such as street signs, traffic control signs, guard posts, small culverts, and other items of prefabricated construction may be temporarily removed during construction provided that essential service is maintained in a relocated setting as approved by the Engineer and that nonessential items are properly stored for the duration of construction. Upon completion of the underground work, all such items shall be reinstalled or replaced in their proper setting at the sole expense of the Contractor. Items or components that are worn, damaged, or otherwise not salvageable for reinstallation shall be fully replaced with new items or components at the sole expense of the Contractor.

A.2 Interference of Underground Structures

When any underground structure interferes with the planned placement of the pipeline or appurtenances to such an extent that alterations in the work are necessary to eliminate the conflict or avoid endangering effects on either the existing or proposed facilities, the Contractor shall immediately notify the Engineer and the owner of the affected structure. When any existing facilities are endangered by the Contractor's operations, he shall cease his operations at the site and take such precautions as may be necessary to protect the in-place structures until a decision is made as to how the conflict will be resolved.

The City of Duluth gas utility must be notified 2 Working Days prior to any excavation or directional drilling within 6 feet of a 6 inch or larger natural gas main. City personnel will be on site to monitor excavation and inspect any exposed steel main 6 inches or larger. Notify the Engineering Department at 218-730-5200 to coordinate this inspection.

The Contractor shall notify the Engineer immediately any time a steel natural gas main smaller than 6 inches is exposed within an excavation. Contact the Engineering Department at 218-730-5200 to coordinate an inspection of the exposed main.

Without specific authorization from the Engineer, no essential utility service shall be disrupted, nor shall any change be made in either the existing structures or the planned installations to overcome the interference. Alterations in existing facilities will be allowed only to the extent that service will not be curtailed unavoidably and then only when the encroachment or relocation will satisfy all applicable regulations and conditions.

Whenever alterations are required as a result of unforeseen underground interferences not due to any fault or negligence of the Contractor, the Engineer will issue a written order covering any additional or extra work involved and specifying the revised basis of payment, if any. Any alterations made strictly for the convenience of the Contractor shall be subject to prior approval. If an alteration diminishes the Contractor's responsibilities under the Contract in providing services or materials, a deduction will be made from the Contractor's final payment by a change order. No extra compensation will be allowed for delays caused by the interference of underground structures.

A.3 Temporary Surface Measures

While any open excavations are maintained, the Contractor shall have available a supply of steel plates suitable for temporary bridging of open trench sections where either vehicular or pedestrian traffic must be maintained. Use of the plates shall be as directed or approved by the Engineer and where installed they shall be secured against possible displacement and be replaced with the permanent structure as soon as possible.

B Excavation and Repair of Trench

B.1 Operational Limitations and Requirements

Excavating operations shall proceed only so far in advance of pipe installation as will satisfy the need for coordination of work and permit advance verification of unobstructed line and grade as planned. At no time shall over 400 lineal feet of excavated trench be open at one time. Where interference with existing structures is possible or in any way indicated, and where necessary to establish elevation or direction for connection to in-place structures, the excavating shall be done at those locations in advance of the main operation so actual conditions will be exposed in sufficient time to make adjustments without resorting to extra work or unnecessary delay.

All installations shall be accomplished by open trench construction except for short tunnel sections approved by the Engineer and with the exception that boring, directional drilling, jacking, insertion in existing pipe or tunnel construction methods shall be employed where so specifically required by the Contract Drawings or Special Provisions. Installation of pipe through tunnel excavations will be allowed only where the surface structure can be properly supported and the backfill restored to the satisfaction of the Engineer.

The excavating operations shall be conducted so as to carefully expose all in-place underground structures without damage. Wherever the excavation extends under or approaches so close to an existing structure as to endanger it in any way, precautions and protective measures shall be taken as necessary to preserve the structure and provide temporary support. Hand, vacuum, or other non-evasive methods of excavating

shall be utilized to probe for and expose such critical or hazardous installations as gas pipe and power or telephone cables.

The Engineer shall be notified of any need for blasting to remove materials which cannot be broken up mechanically, and there shall be no blasting operations conducted until the Engineer's approval has been secured. The description, construction requirements, method of measurement, and basis of payment of 2106 ROCK EXCAVATION (PRODUCTION BLASTING) shall apply to all production blasting required under this section.

B.2 Classification and Disposition of Materials

Rock will be paid for separately from other unclassified materials, either as a separate Contract Item or as an Extra Work Item when no bid price is applicable. All other materials encountered in the excavations, with the exception of items classified for payment as structure removals, will be considered as Unclassified Excavation. Unclassified materials shall include muck, rubble, wood debris, and boulder stone, masonry, or concrete fragments less than one quarter cubic yard in volume, together with other miscellaneous matter that can be removed effectively with power operated excavators without resorting to drilling and blasting.

For water, sanitary sewer and storm sewer, Rock Excavation shall be defined to include all hard, solid rock in ledge formation, bedded deposits and unstratified masses; all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock; and any boulder, stone, masonry or concrete fragments exceeding one cubic yard in volume. Materials such as shale, hard pan, soft or disintegrated rock which can be dislodged with a hand pick or removed with a power operated excavator will not be classified as Rock Excavation.

For natural gas pipe, Rock Excavation shall be defined to include all hard, solid rock in ledge formation, bedded deposits and unstratified masses; all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock. Boulder Excavation shall be defined to include any boulder, stone, masonry or concrete fragments exceeding one-quarter cubic yard in volume. Materials such as shale, hard pan, soft or disintegrated rock which can be dislodged with a hand pick or removed with a power operated excavator will not be classified as Rock Excavation or Boulder Excavation.

Excavated materials will be classified for reuse as being either suitable or unsuitable for other specified use as determined by the Engineer. All suitable materials shall be reserved for backfill where allowed and to the extent needed as called for on the Contract Drawings or in the Special Provisions, and any surplus remaining shall be utilized for other construction on the project as may be specified or ordered by the

Engineer. To the extent practicable, granular materials and topsoil shall be segregated from other materials during the excavating and stockpiling operations so as to permit best use of the available materials at the time of backfilling.

All excavated materials reserved for backfill or other use on the project shall be stored at locations approved by the Engineer that will cause a minimum of inconvenience to public travel, adjacent properties, and other special interests. The material shall not be deposited so close to the edges of the excavations as would create hazardous conditions, nor shall any material be placed so as to block access to emergency services. All materials considered unsuitable by the Engineer, for any use on the project, shall be immediately removed from the project and disposed of as arranged for by the Contractor.

B.3 Excavation Limitations and Requirements—Open Trench

Trench excavating shall be to a depth that will permit preparation of the trench bottom as shown on the Contract Drawings and installation of the pipeline and appurtenances at the prescribed line and grade, except where alterations are specifically authorized. Trench widths shall be as shown on the City Standard Details listed in Appendix D and Contract Drawings and shall be sufficient to permit the pipe to be laid and joined properly and the backfill to be placed and compacted as specified. Extra width shall be provided as necessary to permit convenient placement of sheathing and shoring, to accommodate placement of appurtenances, or to make connections. No payment will be made for extra width required for the contractors shoring. The contractor shall notify the engineer prior to excavating any additional material outside the standard trench width.

Excavations shall be extended below the bottom of structure grade only if necessary to accommodate any required bedding material. When rock or unstable foundation materials are encountered at the established grade, additional materials shall be removed as specified or ordered by the Engineer to produce an acceptable foundation. Unless otherwise indicated or directed, rock shall be removed to an elevation at least six inches below the bottom surface of the pipe barrel.

Minimum and maximum width of utility trenches shall be as shown on the City Standard Details listed in Appendix D or Contract Drawings.

Maximum allowable trench width for combined utilities shall be the maximum required separation between pipelines plus the outside diameters of each pipe plus 24 inches.

The maximum allowable trench widths shown on the City Standard Details listed in Appendix D or Contract Drawings shall be used to establish maximum payment volume for granular backfill and rock excavation. Where the trench width was exceeded

due to conditions which the Contractor could have controlled using reasonable methods to secure a trench, no additional payments for granular backfill will be made.

When no other grade controls are indicated or established for the pipeline, the excavation and foundation preparations shall be such as to provide a minimum cover over the top of the pipe as specified. Trench widths shall allow for at least six inches of clearance on each side of the joint hubs. The width of the trench at the ground surface shall be held to a minimum to prevent unnecessary destruction of the surface structures.

B.4 Sheathing and Braced Excavations

All excavations shall be sheathed, shored and braced as will meet all requirements of OSHA; shall comply with any specific requirements of the Contract; and prevent disturbance or settlement of adjacent surfaces, foundations, structures, utilities, and other properties. Any damages to the work under contract or to adjacent structures or property caused by settlement, water or earth pressures, slides, cave-ins, or other causes due to failure or lack of sheathing, shoring or bracing or through negligence or fault of the Contractor in any manner shall be repaired by the Contractor at his expense and without delay.

Where conditions warrant extreme care, the Contract may require special precautions to protect life or property, or the Engineer may order the installation of sheet piling of the interlocking type or direct that other safety measures be taken as he deems necessary. Failure of the Engineer to order correction of improper or inadequate sheathing, shoring, or bracing shall not relieve the Contractor of his responsibilities for protection of life, property, and the work. The contractor shall assume full responsibility for proper and adequate placement of sheathing, shoring, and bracing, wherever and to such depths that soil stability may dictate the need for support to prevent displacement. Bracing shall be so arranged as to provide ample working space and so as not to place stress or strain on the in-place structures to any extent that may cause damage.

Sheathing, shoring and bracing materials shall be removed only when and in such a manner as will assure adequate protection of the in-place structures and prevent displacement of supported grounds. Sheathing and bracing shall be left in place only as required by the Contract or ordered by the Engineer. Otherwise, sheathing and bracing may be removed as the backfilling reaches the level of respective support. Wherever sheathing and bracing is left in place, the upper portions shall be cut and removed to an elevation of three feet or more below the established surface grade as the Engineer may direct.

All costs of furnishing, placing and removing sheathing, shoring and bracing materials, including the value of materials left in place as required by the Contract, shall

be included in the prices bid for pipe installation and will not be compensated for separately. When any sheathing, shoring or bracing materials are left in place by written order of the Engineer, in the absence of specific requirements of the Contract to do so, payment will be made for these materials as an Extra Work Item, including waste material resulting from upper cut-off requirements.

B.5 Preparation and Maintenance of Foundations and Bedding

Foundation preparations shall be conducted as necessary to produce a stable foundation and provide continuous and uniform pipe bearing between bell holes. Over excavation shall be performed as necessary to allow installation of bedding where called for on the City Standard Details listed in Appendix D, Contract Drawings or Special Provisions. The initial excavation or bedding operations shall produce a subgrade level slightly above finished grade as will permit hand shaping to finished grade by trimming of high spots and without the need for filling of low spots to grade. Bell hole excavations shall be made at each joint as will permit proper joining of pipe and fittings.

Where the foundation soil is found to consist of materials that the Engineer considers to be so unstable as to preclude removal and replacement to a reasonable depth to achieve solid support, a suitable foundation shall be constructed as the Engineer directs in the absence of special requirements therefore in the Contract. The Contractor may be required to furnish and drive piling and construct concrete or timber bearing supports or other work as may be provided for in an Extra Work order.

Care shall be taken during the final subgrade shaping to prevent any over-excavation. Should any low spots develop, they shall only be filled with approved material, which shall have optimum moisture content and be compacted thoroughly. The finished subgrade shall be maintained free of water and shall not be disturbed once established. Where pipe lowering operations are to occur, excavation may be required as necessary to remove pipe slings.

All costs of excavating below grade and placing foundation or bedding materials as required shall be included in the unit price bid for the related utility. Any excavation below grade and any foundation or bedding aggregates required by order of the Engineer in the absence of Contract requirements therefore will be compensated for separately as Extra Work items.

B.6 Dewatering

All excavation for utility pipe or structures shall be dry and free from water as necessary to provide a stable foundation. The Contractor shall provide all necessary dewatering equipment and all necessary equipment or materials for water quality treatment when necessary. Discharge from dewatering operations shall meet all federal, state and city standards prior to entering any water course or storm sewer.

MN/DOT 2451.3.D "Backfilling and Compacting Excavations" is supplemented with the following:

D Backfilling Operations

D.1 General Requirements

Sequence of operations necessary prior to commencing final backfilling may be governed by the City Standard Details listed in Appendix D, Contract Drawings, Special Provision, or the Specifications. Backfilling prior to completing other requirements will, at the option of the Engineer, result in removal of backfill as necessary at no extra cost to the City. Elevations and measurements of existing or new exposed utilities are of primary importance prior to backfilling.

All pipeline excavations shall be backfilled as will restore pre-existing conditions as the minimum requirement, and fulfill all supplementary requirements indicated in the City Standard Details listed in Appendix D, Contact Drawings and Specifications. The backfilling operations shall be started as soon as conditions will permit on each section of pipeline, so as to provide continuity in subsequent operations and restore normal public service as soon as practicable on a section-by-section basis.

D.2 Temporary Aggregate Base Surface

Trench surfaces which are to be restored with concrete or bituminous pavements constructed by others shall have the top 18 inches backfilled to match the elevation of the existing surface with MN/DOT 3138 Class 5 aggregates. The temporary surface shall be opened to traffic where necessary and maintained by the Contractor until immediately prior to paving. At such time, the surface shall be excavated to provide for the depth of the permanent pavement.

D.3 Placement Procedure and Compaction

Initial backfill and pipe encasement materials shall be installed immediately following pipe installation. The pipe encasement area shall include all backfill up to 12 inches above the top of pipe for water and sewer and six inches for natural gas lines. The pipe shall be secured in place with backfill materials to the mid-point prior to covering the pipe or compacting. Utility trench compaction will be measured by MN/DOT 2106.3.G.1 Specified Density method as follows:

- Compaction of materials placed within the pipe bedding and encasement zones shall be accomplished with portable or hand equipment methods, so as to achieve thorough consolidation under and around the pipe and avoid damage to the pipe. The materials at this level shall be thoroughly compacted with a mechanical compactor to meet **95% of maximum standard proctor density.**

- Above the pipe encasement zone (and below subgrade), backfill materials shall be carefully placed in relatively uniform depth layers spread over the full width and length of the trench section and as will provide simultaneous support on both sides of the excavation. Compaction of backfill for utility pipe trench shall be meet **100% of maximum** standard proctor density for the **upper 3 feet below subgrade**; and **95% of maximum** standard proctor density **below the upper 3 feet.**

- Compaction of backfill for manholes and catch basin structures shall meet **100% of maximum** standard proctor density for **full depth** from bedding up to subgrade.

These compaction requirements apply to both mainline and service pipes with no differentiation made for pipe or structures located "outside" the roadway.

The minimum sampling and testing for compaction shall be in accordance with Appendix B Schedule of Materials Testing – City of Duluth Street and Utility Projects included in these specifications. Additional testing may be performed as determined by the Engineer.

Compaction of the in-place layer shall be acceptably completed before placing material for a succeeding layer thereon. The manner of placement, layer thickness, compaction equipment, and procedure effectiveness shall be subject to approval of the Engineer. The use of heavy roller type compaction equipment shall be limited to safe pipe loading.

The maximum loose thickness of each backfill layer shall be 8 inches with the provision that, by authority of the Engineer in consideration of the demonstrated capability of special type vibratory compactors, these maximums may be increased at the Engineer's discretion.

Until final acceptance of the project, the Contractor shall assume full responsibility and expense for all backfill settlement and shall refill and restore the work as directed to maintain an acceptable surface condition. All additional materials required shall be furnished without additional cost to the City.

D.4 Surplus and Waste Material

All surplus or waste materials remaining after completion of the backfilling operations shall be disposed of in an acceptable manner within 24 hours after completing the backfill work on each particular pipeline section. Disposal at any location within the project limits shall be as specified, or as approved by the Engineer; otherwise, disposal shall be accomplished outside the project limits at the Contractor's discretion. The backfilling and surplus or waste disposal operations shall be a part of the work

required under the pipeline installation items, not as work that may be delayed until final cleanup. No additional payments will be made for disposal of surplus or waste material.

2451.4 METHOD OF MEASUREMENTS

MN/DOT 2451.4.A.2 "Prefabricated Structures" is hereby deleted and replaced with the following:

A.2 Excavation for Prefabricated Structures

No measurement will be made for excavation of prefabricated structures (utility pipes and structures), except where rock excavation is required. The Engineer will measure rock excavation for prefabricated structures by volume in accordance with the limits shown in the City Standard Details listed in Appendix D.

MN/DOT 2451.4.B "Granular Materials" is hereby deleted and replaced with the following:

B Granular Materials

B.1 Granular Materials for Bedding and Encasement

No measurement will be made for granular materials utilized to construct foundation bedding and backfill within the pipe encasement zone.

B.2 Granular Materials for Manholes and Catch Basins

No measurement will be made for granular materials utilized to construct foundation bedding and structure backfill of manholes and catch basins.

MN/DOT 2451.4 "Method of Measurement" is supplemented with the following:

C Backfill Materials

C.1 On-Site Materials for Backfill

No measurement will be made for select grading materials utilized for backfill of prefabricated structures.

C.2 Imported Materials for Backfill

The Engineer will measure imported materials for backfill above the encasement zone and below subgrade by volume in accordance with the limits shown in the City Standard Details listed in Appendix D, when required in the Plans, or at the direction of the Engineer.

D Imported Materials for Foundation Stabilization

Where additional foundation material is required by the engineer, it will be measured by weight or volume within the limits defined by the Engineer. Unless otherwise specified, volume will be determined by vehicular measure (loose volume) at the point of delivery. Load ticket must be given to inspector upon delivery which indicates either volume (loose) or weight.

E Boulder Excavation in Trench

The Engineer will measure the cumulative actual measured volume of any boulder(s) removed from a utility trench which individually exceed ¼ CY in volume. Boulder volume will be determined by measuring the maximum dimension of the x, y, and z axis of the boulder for the calculation.

2451.5 BASIS OF PAYMENT

MN/DOT 2451.5 "Basis of Payment" is hereby supplemented with the following:

All costs of excavating to foundation grade, dewatering, preparing the foundation, furnishing and installing bedding and encasement materials, placing and compacting backfill materials, and other work necessary for prosecution and completion of the work as specified, shall be included for payment as part of the specified utility and utility appurtenance Contract bid items without any direct compensation being made therefore.

No payment will be made for structure excavation or trench excavation of prefabricated structures. All costs for excavation, foundation preparation, dewatering, and separating unacceptable materials shall be considered incidental to relevant Contract bid items.

No payment will be made for granular bedding and pipe encasement materials. All costs for furnishing, placing, and compaction of bedding and encasement zone backfill materials within the pipe encasement zone shall be considered incidental to relevant Contract bid items.

No payment will be made for granular bedding and structure backfill materials for manholes or catch basins. All costs for furnishing, placing, and compaction of bedding and structure backfill materials shall be considered incidental to relevant Contract bid items.

No payment will be made for backfill with suitable on-site select grading materials; all costs for handling, placing, compaction, and disposal of unacceptable materials shall be considered incidental to relevant Contract bid items.

Payment for furnishing backfill for prefabricated structures (excluding manholes and catch basins) shall be compensation in full for all labor, equipment, and materials necessary to furnish backfill materials to the site and disposal of waste excavation.

All costs for placing and compacting backfill (regardless of type: select grading material, common or granular) shall be considered incidental to relevant Contract bid items.

Payment for boulder excavation in trench shall be compensation in full for all labor, equipment, and materials necessary to excavate, remove, and dispose of boulders from a utility trench outside of the project limits.

The City will pay for structure backfill on the basis of the following schedule:

Item No.	Item	Unit
2451.507	Boulder Excavation in Trench	cubic yard
2451.607	Furnish Granular Backfill (CV)	cubic yard
2451.607	Furnish Common Backfill (CV)	cubic yard

2461 STRUCTURAL CONCRETE (VIBRATION CONTROL)

The provisions of MN/DOT 2461 are supplemented with the following:

The Contractor shall protect all freshly placed concrete from vibration in accordance with the provisions of section I (Fresh Concrete Vibration Controls) of 2015 BLAST MONITOR/SURVEY of these specifications and section G.7 (Protection of New Concrete against Vibration) of MN/DOT 2401.3.

2502 SUBSURFACE DRAINS

Subsurface drain construction shall be performed in accordance with the provisions of MN/DOT 2502, **City Standard Details STR-1 and STR-2** listed in Appendix D, and the following:

4-inch or 6-inch perforated Poly-Vinyl Chloride (PVC) Sewer Pipe, SDR 35, ASTM D 3034 shall be used. Type I geotextile conforming to MN/DOT 3733 shall be used.

Payment for drain pipe will be made under the bid items listed in MN/DOT 2502 at the Contract unit price per foot, which shall be compensation in full for all costs of furnishing and installing the pipe complete in place as specified including excavation, bedding, granular backfill, geotextile, fittings, adapters, connection to existing pipe, and connection to storm structures.

2503 CONNECT TO EXISTING SEWERS

The provisions of MN/DOT 2503 are supplemented with the following:

This work consists of constructing connections into existing sanitary sewer and storm sewer in accordance with the applicable MN/DOT Standard Specifications.

Measurement will be made by the number of connections constructed as specified.

The Contract Unit Price for Connect to Existing Sewers is to be compensation in full for all costs incidental thereto, including but not limited to, all materials and labor necessary to connect the proposed drainage structure to the existing sewer pipe. Any damage caused to the existing sewer pipe shall be repaired at no expense to the City and to the satisfaction of the Engineer.

The City will pay for Connect to Existing Sewers on the basis of the following schedule:

Item No.	Item	Unit
2503.602	Connect to Existing Sanitary Sewer	each
2503.602	Connect to Existing Storm Sewer	each

2503 PIPE SEWERS – GRAVITY

Gravity sanitary sewer and storm sewer construction and reconstruction shall be performed in accordance with the provisions of MN/DOT 2503, except as supplemented and/or modified below:

2503.1 DESCRIPTION

This work shall consist of the construction of gravity sanitary and storm sewer main and building services utilizing plant fabricated pipe and other appurtenant materials, installed for conveyance of wastewater and storm water. The work includes the relocation or adjustment of existing facilities as may be specified in the Contract.

All references to Specifications of MN/DOT, AASHTO, ASTM, ANSI, AWWA, etc. shall mean the latest published edition or supplement available on the date of advertisement for bids.

2503.2 MATERIALS

A General Requirements

All materials required for this work shall be new material conforming to requirements of the referenced specifications for the class, kind, type, size, grade and other details indicated in the Contract. Unless otherwise indicated, all required material shall be furnished by the Contractor. If any options are provided for, as to type, grade or design of the material, the choice shall be limited as may be stipulated in the Contract Drawings or Specifications.

All manufactured products shall conform in detail to such standard design drawings as may be referenced or furnished in the Contract Drawings. Otherwise, the City may require advance approval of material suppliers, product design, or other unspecified details as it deems desirable for maintaining adopted standards.

B Reinforced Concrete Pipe and Fittings

Reinforced concrete pipe, fittings, and specials shall conform to the requirements of MN/DOT 3236 and Standard Plate 3000 for the type, size and strength class specified. Rubber O-ring gasket joints conforming to Standard Plate 3006 shall be used.

C Poly-Vinyl Chloride Pipe and Fittings

Smooth-walled poly-vinyl chloride pipe and fittings shall conform to the requirements of ASTM D-3034 for the size, standard dimension ratio (SDR), and strength requirements indicated

on the Contract Drawings, Specifications, and Special Provisions. Unless otherwise specified, all pipe and fittings shall be SDR 35 and connections shall be push-on with elastomeric gasketed joints which are bonded to the inner wall of the gasket recess of the bell socket. Schedule 40 pipe with glued joints shall not be used.

D Corrugated Polyethylene Pipe

This work shall consist of furnishing and installing 12-inch to 60-inch diameter dual-wall corrugated polyethylene pipe and fittings in accordance with the Contract Drawings, MN/DOT 3247, AASHTO M294 Type S, Section 12 of the AASHTO LRFD Bridge Design Specifications and the following:

Corrugated polyethylene pipe and fittings shall be manufactured from high density polyethylene (HDPE) virgin compounds. Clean reworked HDPE materials from the manufacturer's own production may be used by the manufacturer of HDPE pipe, provided that the pipe and fittings produced meet all requirements of these Special Provisions and in AASHTO M294, Type S and Section 12 of the AASHTO LRFD Bridge Design Specifications. The polyethylene compounds shall conform to the requirements of ASTM D 3350 Cell Class 435400C. Pipe shall be new or stored for a period of time that does not exceed the manufacturer’s recommended maximum period of exposure, regardless of the method of storage.

Pipe couplings shall meet the watertight performance requirements of ASTM 2306. Watertight couplings must be capable of meeting a 10.8 psi laboratory test per ASTM 3212 and utilize a bell and spigot design with a gasket meeting the requirements of ASTM F 477.

Wall thickness shall be the thickness of the inner liner measured between corrugation valleys of the outer rib wall. The wall thickness shall equal or exceed the minimum wall thickness values in Table 2503-1.

The pipe stiffness shall be determined in accordance with AASHTO M294 at 5 percent deflection. The average pipe stiffness shall equal or exceed the minimum pipe stiffness value for each size of pipe listed in Table 2503-1.

Table 2503-1: Dual Wall Corrugated Polyethylene Pipe

Properties	12	15	18	24	30	36
Min. I.D. (in.)	11.8	14.8	17.7	23.6	29.5	35.5
Max. O.D. (in.)	14.7	18.0	21.5	28.7	36.4	42.5
Min. Wall Area ($in.^2/ft.$)	1.50	1.91	2.34	3.14	3.92	4.50
Min. C (in.)	0.35	0.45	0.50	0.65	0.75	0.90
Min. I ($in.^4/in.$)	.024	.053	.062	.116	.163	.222
Min. Pipe Stiffness (psi)	46	42	40	34	28	22
Min. Wall Thickness (in.)	.035	.035	.050	.050	.080	.100

Table 2503-1 Notes:
Pipe shall be on the current MN/DOT Approved/Qualified Products List.
Pipe sizes are nominal diameter in inches

E Service Lateral Connections to Sewer Main

Service lateral connections to gravity sewer main shall be with watertight fittings manufactured for the intended purpose. For tap service connections, the diameter of the service lateral pipe shall be not more the two-thirds of the diameter of the sewer main, except that a 6” service lateral pipe may be tapped and connected to an 8” sewer main.

Refer to Table 2503-2 Service Lateral Connections below for summary of acceptable connection types. The following is a current list of acceptable products:

- New PVC Wye – Manufactured wye fittings meeting the requirements of Section A.3 Poly-Vinyl Chloride Pipe and Fittings listed above.
- Epoxy Saddle – PVC sewer tap saddles inserted into the core drill hole (tap) and attached on the sewer main with two-part exothermic epoxy. Predco by Innovative Sewer Connections or approved equal.
- Compression Insert – A PVC stub/hub with compression gasket inserted into a core drill hole (tap) in the sewer main wall. Inserta Tee by ADS, Inc., QwikSeal by Fernco, Inc., or approved equal. Flexible tap saddles are NOT acceptable.
- New HDPE Wye – Manufactured wye fittings meeting the requirements of Section A.4 Corrugated Polyethylene Pipe listed above. ADS, Inc., Prinsco, Inc., or approved equal.
- Water Stop – Rubber gasket placed on pipe exterior and embedded in the non-shrink grout fill in between the pipe and the manhole or catch basin structure. ADS, Inc., Press-Seal, Inc. or approved equal.

- Watertight Boot – A rubber boot insert is either cast into the concrete structure or field installed in a core drill hole held in place by stainless steel compression band. Refer to Section 2506 Manholes and Catch basins found elsewhere is this standard. A-Lok Products, Inc., Kor-N-Seal by NPC, Inc., Direct Drive by Press-Seal, Inc. or approved equal.

Table 2503-2: Service Lateral Connections

Service Lateral	Sewer Main Type	Connection Type
New or Replacement	New PVC	New PVC Wye
New	Existing PVC	Core Drill w/Epoxy Saddle or New PVC Wye
Replacement	Existing PVC	Existing Wye (1) or New PVC Wye
New	Existing Vitrified Clay	Core Drill w/Epoxy Saddle or New PVC Wye
Replacement	Existing Vitrified Clay	Existing Wye (1) or Core Drill w/Epoxy Saddle or New PVC Wye
New	Concrete Pipe	Core Drill w/Compression Insert or Core Drill w/Epoxy Saddle
Replacement	Concrete Pipe	Existing Wye (1) or Core Drill w/Compression Insert or Core Drill w/Epoxy Saddle
New	Existing Brick	Core Drill w/Compression Insert or Core Drill w/Epoxy Saddle
Replacement	Existing Brick	Existing Wye (1) or Core Drill w/Compression Insert or Core Drill w/Epoxy Saddle
New	Existing CIPP lined	Epoxy Saddle directly to CIPP Liner (2)
New	Dual Wall Corrugated HDPE	Core Drill w/Compression Insert or New HDPE Wye
Replacement	Dual Wall Corrugated HDPE	Existing Wye (1) or Core Drill w/Compression Insert or New HDPE Wye
Replacement	Existing CIPP lined	Epoxy Saddle directly to CIPP Liner (2)(3)
Replacement	Brick or Concrete MH/CB	Core Drill w/Watertight Boot per Section 2506 or Non-shrink grout w/Water Stop pipe collar
New	Brick or Concrete MH/CB	Core Drill w/Watertight Boot per Section 2506

Table 2503-2 Notes:

(1) The existing wye will not be acceptable if a water-tight connection cannot be provided.

(2) Remove portion of the host pipe to allow tap saddle to connect directly to CIPP liner.

(3) If the existing service opening in the CIPP liner exceeds epoxy saddle tap dimensions, patch the existing service opening with CIPP liner, cure the CIPP patch, and cut new service opening for epoxy saddle tap to manufacturer's recommendations.

F Flexible Couplings

Flexible couplings and adapters shall be made from elastomeric polyvinyl chloride. Couplings shall be resistant to chemicals, ultraviolet rays, fungus growth, normal sewer gases and

unaffected by soil conditions. Couplings shall be watertight. Couplings shall be attached to pipe utilizing stainless steel bands.

2503.3 CONSTRUCTION REQUIREMENTS

A General Provisions

Requirements for excavation, preparing trench, backfilling and restoration are contained in 2451 EXCAVATION, BACKFILL, AND COMPACTION FOR UTILITIES of these specifications and State of Minnesota Department of Transportation "Standard Specifications for Construction", and shall govern the execution of work where the specifications therein are not in conflict with more specific requirements contained in this section, the Contract Drawings or the Special Provisions.

B Handling and Inspection

Proper and adequate implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. Unloading, distribution and storage of pipe and appurtenant materials on the job site shall be as approved by the Engineer. All materials shall be handled carefully, as to prevent damage and avoid jolting contact, dropping, or dumping.

Before being lowered into laying position, the Contractor shall make a thorough visual inspection of each pipe section and appurtenant units to detect damage or unsound conditions that may need corrective action or be cause for rejection. Inspection procedure shall be as approved by the Engineer, with special methods being required as he deems necessary to investigate suspected defects more definitely. The Contractor shall inform the Engineer of any defects discovered and the Engineer will prescribe the required corrective actions or order rejection.

Immediately before placement, the joint surfaces of each pipe section and fitting shall be inspected for the presence of foreign matter, rough edges or projections, and any imperfections so detected shall be corrected by cleaning, trimming, or repair as needed.

Store pipe on level surface. Pipe may be placed in pyramidal stacks provided the number of courses recommended by manufacturer is followed and pipe is chocked on each side to prevent roll out of the layers.

Do not dump pipe from conveyance. Unload pipe with ropes and skids or with mobile unloading equipment. Use wide slings for hoisting large pipe with boom trucks, cranes or lifts. Reinforced web slings are acceptable; chains, wire ropes or fiber ropes are not acceptable slings. Use of hooks for unloading is also unacceptable.

C Pipe Laying Operations

Trench excavation and bedding preparations shall proceed ahead of pipe placement as will permit proper laying and joining of the units at the prescribed line and grade.

The bedding shall provide uniform and continuous support for the pipe between bell holes. Bell holes shall be excavated as necessary to make the joint connections, but they shall be no larger than would be adequate. Unless otherwise permitted by the Engineer, bell and spigot pipe shall be laid with the bell ends facing upgrade and the laying shall start at the downgrade end and proceed upgrade.

As each length of pipe is placed in laying position, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. All pipe and fitting joints shall fit tightly and be fully closed. The pipe shall be secured in place with backfill material to mid-point of pipe and backfilled to 1 foot over the top of the pipe as specified in 2451 EXCAVATION, BACKFILL, AND COMPACTION FOR UTILITIES and as shown on the City Standard Details listed in Appendix D and the contract drawings.

D Pipes to be Cleaned

The interior of all pipes shall be carefully freed from all dirt, stones, sand silt, mud, concrete and superfluous material of every description as the work progresses. If, in the opinion of the Engineer, the pipe contains an excess of material, the pipe shall be cleaned by the Contractor at no additional expense to the City.

E Locating Wire

Locating wire shall be installed in accordance with 2503 LOCATING WIRE FOR SEWER of these Construction Standards, the City Standard Details listed in Appendix D, and the Special Provisions.

F Inside Drops

Where a sanitary sewer main line connects to a manhole more than 2 feet above the invert of the outgoing sewer, the connection shall be made by means of an Inside Drop Connection installed per the City Standard Details listed in Appendix D. Outside drops shall not be used except where approved by the City Engineer.

G PVC Sewer Service Pipe

Sewer service connections shall be installed as provided for in the contract and as may be directed by the Engineer. The sewer service connections and pipelines shall be installed in conformance with all applicable requirements of the main sewer installation. The Engineer, with the assistance of the Contractor, shall keep accurate records of all service installations as to the type, location, and elevation at the point of connection (wye), property line and termination, etc. The service installation shall not be backfilled until all required information has been obtained

and recorded. Unless otherwise specified, service pipe shall be installed at right angles to the main sewer and at a straight line and grade to the property line. The standard and minimum grade shall be a uniform rise of 1 inch in 4 feet (2%) for sanitary service lines. Pipe bends shall be provided as necessary to bring the service lines to the proper location and grade. Pipe bends shall not exceed 22-½ degrees without approval of the Engineer.

All wyes, tees or the end of lateral service lines shall be closed with a stopper until all testing has been completed. Plugs/caps shall be tested against with the maximum air pressure to be used in testing.

All sanitary sewer service pipes must be insulated if the depth of cover is 6'-0" or less.

PVC sewer service pipe for existing private building services shall match the size of the existing sewer service, typically 6". In no case shall the sewer pipe reduce in size between the building and the sewer main. Six-inch service pipe shall be used in new developments with new sewer main and new sewer services for residential homes. All service pipe installation shall meet the requirements of the State of Minnesota Plumbing Code.

H Continuous Sewer Service

The Contractor shall provide adequate equipment and facilities to provide bypass pumping for all elements of work requiring interruption to flow in the sanitary sewer. Provide backup or standby capabilities satisfactory to the City. The Contractor shall coordinate work activities so that bypass pumping will not be necessary during or immediately after rain events. The Contractor shall be responsible for damages to private or public property due to sewer backup while controlling sewage flow.

Under no circumstances will bypassing of untreated wastewater to any storm drainage facility or surface water course be allowed.

All costs for flow control, temporary pumping, etc. shall be inclusive to the unit price bid for sanitary sewer.

I Dewatering of Trench

Dewatering of the trench shall be considered incidental work for which no separate payment will be authorized.

J Flexible Couplings

Flexible couplings and adapters shall be used to connect new pipe to existing PVC or clay pipes.

K Bulkheads

All pipe and fitting ends left open for future connection shall be bulk-headed with prefabricated caps of the same material as the pipe material. They shall be installed with watertight seals as required for the pipeline joints. Plugs/caps shall be tested against with the maximum air pressure to be used in testing.

L Infiltration

The infiltration shall not exceed 50 gallons per inch diameter of pipe per mile per day.

M Television Inspection

After the sewer is completed, the City may inspect all or any portion of the sewer with closed-circuit television. The Contractor shall be responsible for leaving the sewer in a clean condition for televising.

N Air Test

All sanitary sewer lines, including service connections, shall be watertight and shall be tested for excessive leakage upon completion and before connections are made to the service by others. Each test section of the sewer shall be subjected to exfiltration testing by air test method as described below and at the Contractor's option. The requirements set forth for maximum leakage shall be met as a condition for acceptance of the sewer section represented by the test. The sewer pipe section under test shall be clean at the time of testing but the pipe may be wetted. Pneumatic balls shall be used to plug the pipe ends at manholes. Low pressure air shall be introduced into the plugged line until the internal air pressure reaches 27.58 kPa (4.0 psi) greater than the average back pressure of any ground water pressure that may submerge the pipe. For the purpose of air testing, the back pressure (psi) attributed to ground water shall be determined based on the difference in height (feet) of the average pipe invert elevation and the anticipated ground water elevation, times a factor of **0.4335 psi per foot**. At least two minutes shall be allowed for the air temperature to stabilize before readings are taken and the timing started. During this time the Contractor shall check all plugs with soap solution to detect plug leakage. If plugs are found to leak, air shall be bled off, the plugs shall be re-tightened, and the air shall be reintroduced into the line.

The sewer section under test will be accepted as having passed the air leakage test if it does not lose air at a rate to cause the pressure to drop from 24.82 to 20.68 kPa (3.6 to 3.0 psi) in less time than one-half minute per one inch in diameter of the pipe tested.

All testing shall be performed by the Contractor without any direct compensation being made therefore, and the Contractor shall furnish all necessary equipment and materials, including plugs and standpipes as required.

O Deflection Testing

Deflection testing shall be performed by the Contractor using a nine-point mandrel approved by the Engineer. The ball or mandrel shall have a minimum diameter equal to 95% of the actual inside diameter of the pipe.

Mandrel testing shall be done no less than thirty (30) days after installation or upon completion of construction of the roadway to the finished subgrade, whichever occurs first. The mandrel must be pulled through the pipe by non-mechanical means. Pipe through which the mandrel does not pass will be considered unacceptable. New pipe or deformed pipe which is not damaged shall be re-laid. The re-laid pipe shall be retested for deflection after no less than five (5) calendar days.

Table 2503-3: Sanitary Sewer Pipe and Mandrel Diameter

Pipe Diameter, Nominal (inches)	Pipe Diameter, Actual, SDR 35 (inches)	Mandrel Diameter (inches)
4	3.895	3.60
6	5.742	5.45
8	7.665	7.28
10	9.563	9.08
12	11.361	10.79
15	13.898	13.20
18	16.976	16.13
21	20.004	19.00
24	22.48	21.36
27	25.327	24.06
30	29.132	27.68
36	34.869	33.13

P Electrical Continuity Test

The Contractor shall perform a continuity test on all tracer wire after installation of pipe. If the test shows no continuity, the Contractor shall find and repair the broken tracer wire. Pipe that fails to meet continuity requirements above will be considered unacceptable and no payment will be made.

2503.4 METHOD OF MEASUREMENT

A Sanitary Sewer or Storm Sewer

Measurement for Pipe Sewers – Gravity shall be per lineal foot of the specified diameter and material installed.

B PVC Wye

Measurement will be made by the number of each size PVC wye furnished and installed as specified.

C Connect Sewer Service

This work shall consist of furnishing and installing a connection to a Pipe Sewer complete in place including all fitting, elbows, adapters, etc. from the center line of the pipe sewer to 4 feet beyond the main in accordance with the applicable provisions of MN/DOT 2503.

Measurement will be made by the number of each sanitary or storm sewer service connections furnished and installed as specified.

D PVC Sewer Service Pipe

This work shall consist of furnishing and installing PVC Sewer Pipe (SDR 35) complete in place including fittings, adapters, and construction joints from 4 feet beyond the wall of the pipe sewer to a termination point or connection to an existing service as the Inspector designates in accordance with the applicable provisions of MN/DOT 2503.

Measurement will be made by length along the line of the sewer service pipe to the nearest 0.5 feet.

E Construct Inside Drop

This work shall consist of furnishing and installing an Inside Drop Connection in accordance with the City Standard Details listed in Appendix D, Contract Drawings and Special Provisions. Inside Drop Connections will be measured separately by the number of complete units installed, in addition to measured Contract pay items under MN/DOT 2503 and 2506.

2503.5 BASIS OF PAYMENT

All payment for Pipe Sewers- Gravity and related items within this section shall include all incidental work specified under 2451 EXCAVATION, BACKFILL, AND COMPACTION FOR UTILITIES including backfill with suitable onsite materials where specified.

A Sanitary Sewer or Storm Sewer

Payment shall be made for Pipe Sewers – Gravity at the Contract unit bid price for the specified diameter and material installed. Payment for pipe sewer-gravity shall include, in addition to the Basis of Payment in 2503.5, excavation, bedding, encasement materials to 1 foot over the pipe, adapters and construction joints, placing and compacting backfill above encasement zone, all cleaning and testing, and other work necessary to complete the work

B PVC Wye

Payment for wyes of each size shall be compensation in full for all costs of furnishing and installing the wye complete in place as specified.

C Connect Sewer Service

Payment for each connection shall be compensation in full for all costs of furnishing and installing the connection complete in place as specified.

D PVC Sewer Service Pipe

Payment for sewer service pipe shall be compensation in full for all costs of furnishing and installing the sewer service pipe complete in place as specified including, but not limited to, excavation, bedding, encasement materials, placing and compacting backfill and other work necessary to complete the work.

E Construct Inside Drop

Payment for inside drop connections shall be compensation in full for all costs of furnishing and installing the inside drop connection complete in place as specified.

F Schedule

The City will pay for gravity pipe sewers on the basis of the following schedule:

Item No.	Item	Unit
2503.602	(size main)" X (service size)" PVC Wye	each
2503.602	Connect Sewer Service	each
2503.602	Construct Inside Drop	each
2503.603	(size)" PVC Sewer Service Pipe	linear foot

2503 PIPE SEWERS – PRESSURE

Pressure sanitary sewer and forcemain construction and reconstruction shall be performed in accordance with the provisions of MN/DOT 2503 except as supplemented and/or modified below:

2503.1 DESCRIPTION

This work shall consist of the construction or reconstruction of pressure sanitary sewer and forcemain and building service pipelines utilizing plant fabricated pipe and other appurtenant materials, installed for conveyance of wastewater. The work includes the relocation or adjustment of existing facilities as may be specified in the Contract.

All references to Specifications of AASHTO, ASTM, ANSI, AWWA, etc. shall mean the latest published edition or supplement available on the date of advertisement for bids.

2503.2 MATERIALS

A General Requirements

All materials required for this work shall be new material conforming to requirements of the referenced specifications for the class, kind, type, size, grade and other details indicated in the Contract. Unless otherwise indicated, all required material shall be furnished by the Contractor. If any options are provided for, as to type, grade or design of the material, the choice shall be limited as may be stipulated in the Contract Drawings or Specifications.

All manufactured products shall conform in detail to such standard design drawings as may be referenced or furnished in the Contract Drawings. Otherwise, the City may require advance approval of material suppliers, product design, or other unspecified details as it deems desirable for maintaining adopted standards.

B Ductile Iron Pipe

Ductile Iron Pipe shall conform to the latest requirements of ANSI/AWWA C151/A-21.51. In addition, the pipe shall comply with the following supplementary provisions:

(1) All ductile iron pipe shall meet all the requirements listed under 2504 Water Main except as specified below or as specified in the project Special Provisions.

(2) All buried pipe shall be furnished with push-on type joints conforming to ANSI/AWWA C111/A-21.11 unless specified otherwise in the Special Provisions or shown on the contract drawing.

(3) When specified in the Special Provisions or shown on the Contract Drawings, joints shall be boltless, flexible, push-on restrained joint such as Flex-Ring by AMERICAN, or TR Flex by US PIPE. Field adaptable restrained joints may be provided through the use of Field Flex-Ring restraints by AMERICAN.

(4) Where shown on the Contract Drawings, flange joints shall be provided. Flanges shall be standard AWWA C115/A21.15lb threaded on flanges for 250 psi operating pressure. Bolt on flanges such as Uni-flange or Mega-flange may not be substituted for flanged pipe.

(5) All pipe shall be furnished in 18 or 20-foot nominal lengths.

(6) Minimum ANSI thickness class furnished shall be Class 52 for all pipe through 16” pipe. For pipes larger than 16” the appropriate class shall be called out in the Special Provisions. Above grade flanged pipe shall be class 53.

(7) Pipe shall be provided with provisions to maintain electrical continuity for thawing and locating purposes.

(8) A Certificate of Compliance shall be furnished stating that the materials furnished have been tested and are in compliance with the requirements of this Specification.

C Ductile Iron Fittings

Fittings shall conform to the latest requirements of ANSI/AWWA C110/A-21.10-08 (Gray Iron and Ductile Iron Fittings), or ANSI/AWWA C153/A-21.53 (Ductile Iron Compact Fittings), all with ductile iron glands and cement lining.

(1) Buried fittings shall be mechanical joint with rubber gaskets.

(2) Exposed fittings shall be flanged conforming to ANSI B16.1, Class 125 and have full face gaskets.

(3) Exposed fittings shall be shop primed for painting.

(4) Fittings shall be provided with provisions to maintain electrical continuity.

(5) Fittings shall be manufactured in North America or preapproved by the City Chief Engineer of Utilities.

(6) Mechanical joint bolts shall be as specified elsewhere in this section

(7) When specified in the Special Provisions or shown on the Contract Drawings, buried fittings shall be boltless, flexible, push-on restrained joint fittings such as Flex-Ring by AMERICAN, or TR Flex by US PIPE. Field adaptable restrained joints may be provided through the use of Field Flex-Ring restraints by AMERICAN.

D HDPE Pipe and Fittings

HDPE pressure sewer and forcemain pipe shall meet all the requirements listed under 2504 Water Main except as specified below or as specified the project Special Provisions.

(1) Couplings used for pressure sewer force main and services (4 inch and larger) shall be electrofusion type. Couplings used for services (3 inch and smaller) shall be electrofusion or socket fused type.

(2) Pipe shall be new or stored for a period of time that does not exceed the manufacturer’s recommended maximum period of exposure, regardless of the method of storage.

(3) The DR number and pressure rating specified above shall be considered a minimum. Provide stronger class pipe if required by loads imposed by directional drilling pulling operation or pipe bursting.

(4) Shop drawings for HDPE pipe must specify minimum allowable pipe deflection radius.

E Stainless Steel Pipe

Stainless steel pipe materials shall meet the requirements of ASTM A53 schedule 40 with threaded joints meeting the requirements of ASTM A865. All couplings and fittings shall be the same material as the host pipe.

All steel shall be made in North America. The Contractor shall provide certification of steel origin to Engineer prior to installation.

F Transition Couplings

Cast transition couplings shall be as specified under 2504 Water Main or as specified in the project Special Provisions.

G Gate Valves

Gate valves shall be manufactured and furnished in accordance with an approved pattern and shall conform to the requirements of AWWA C509 or C515 for resilient seated gate valves, and all gate valves must meet such supplementary requirements as may be stipulated in the Contract Drawings or Special Provisions and the provisions hereof.

Unless otherwise specified, the valves furnished shall comply with the following supplementary requirements:

(1) All gate valves shall have a working pressure rating of 250 psi.

(2) Gate valves shall be solid disc with resilient seating.

(3) The wedge shall be ductile iron and fully encapsulated with EPDM rubber.

(4) Valves shall have a two-inch square operating nut opening counterclockwise.

(5) All valves shall be of the non-rising stem type.

(6) All valves shall be furnished with triple O-Ring stem seals. The O-Rings above the thrust collar shall be fully replaceable with the valve “open” and under full pressure. The third O-ring shall be provided below the thrust collar.

(7) The exterior of the valve shall be supplied with a fusion bonded epoxy coating.

(8) All buried gate valves shall be furnished with extension stems which extend to within one foot of the finished grade elevation. The extension stem shall have a 2-inch operating nut and be mechanically connected to the valve operator.

(9) All valves within structures or vaults shall have extension stems that extend to within six inches of the top of slab or other designated elevations shown on the drawings. Stem guides shall be provided for all valves within wet wells, vaults or other inaccessible locations.

(10) Gate valves shall be manufactured by American Flow Control, Clow, Dezurik, Mueller, or equal. All "or equal" valves shall be preapproved by the City Chief Engineer for Utilities prior to bidding. All valves shall be made in North America. Shop drawings for gate valves shall include a statement attesting to their country of origin.

(11) Gate valve box adapters shall be ¼ inch steel adapter and ¾ inch neoprene gasket. The steel adapter shall be coated with polyurethane protective coating. Adapters shall be manufactured by Adaptor, Inc.

(12) Buried valves shall have mechanical joint ends or fusible HDPE stubs of the same pipe diameter and SDR as the main. MJ joints shall be complete with gasket, gland, and bolts.

(13) Exposed valves shall have flanged ends conforming to ANSI B16.1, Class 125 with full face gaskets.

(14) Bolts or valve flange shall be provided with means for preventing the bolt from slipping in the slotted holes.

(15) All exposed bolts on the valve, including stuff box and bonnet bolts shall be 316 stainless steel.

(16) Bolts for flanged valves exposed to wastewater shall be 316 stainless steel.

(17) Mechanical joint bolts shall be as specified in the Water Main section (2504).

(18) 6-ounce zinc anode caps conforming to ASTM B-418 shall be installed on the bolts on all mechanical joint fittings.

(19) A 12-pound (minimum) bare zinc anode shall be attached to MJ bolt for all valves as shown in the **City Standard Detail W-18** listed in Appendix D.

H Valve Boxes

Valve Boxes shall be 5 1/4" cast iron shaft, 'three-piece' screw-type, consisting of the following parts:

Table 2503-1: Valve Box Components

Cover	Stay-put type, "**SEWER**" cast thereon, with solid edges (no grooves or flutes on edge)
Top Section	26" or 26.5" length
Extension Section	30" length (effective 24" length)
Bottom Section	36" length
Base	#6 Round Base

All parts must be interchangeable with Bingham and Taylor #4906 and Tyler #6860. Valve box assemblies shall be manufactured in Northern America or preapproved by the Engineer.

I Check Valves

Check valves shall be provided with cast iron or ductile body with top opening for disc replacement without requiring valve body removal. Valve body shall provide a clear waterway in the fully opened position. Trip shall be grade A bronze. Valves shall be furnished with outside lever and weight to assist rapid closure. Disc shall be of cast or ductile iron construction, bronze-mounted. Valves shall be furnished with flanged ends conforming to ANSI B16.1, Class 125. Valves shall meet the general requirements of AWWA C508. Check valves shall be American Flow Control, Clow, Henry Pratt or pre-approved equal.

J Ball Valves

Ball valves up to 2 inch shall be bronze or stainless steel one piece body, chrome plated brass ball, Teflon seats and stuffing box ring, lever handle, solder or threaded ends. PVC ball valves are not acceptable.

K Pressure Gauges

Pressure gauges shall be 2 ½ inch minimum diameter, silicone filled, stainless steel case and bezel, and spiral tube with a polycarbonate lens and ¼ NPT male center back connection. The gauge shall be rated for a maximum pressure of twice the rated pump capacity unless called for otherwise in the Special Provisions or on the Plans.

L Pressure Sewer Services and Fittings

(1) Pressure sewer services shall conform to the same requirements for HDPE pipe and fittings. All new development pressure sewer main with services shall be constructed with butt fusion wye fittings for service connections.

(2) Tapping Tees with Electrofusion Saddle shall be as specified under 2504 Water Main or as specified in the project Special Provisions.

(3) Curb Stops shall be quarter turn check, Minneapolis Pattern thread top, with AWWA standard flared copper pipe connections on both ends. Curb stops shall be Mueller B-25154N, A.Y. McDonald 76104, Ford B22 series, or approved equal.

(4) Curb Boxes shall be magnetized locator wire boxes as specified elsewhere shall be adjustable up and down for a minimum of 7 feet of cover.

M Wall Sleeves and Wall Pipes

Wall sleeves and wall pipes shall conform to the requirements of the process piping as indicated on the contract drawings and as specified as follows:

Cast Iron: ASTM A48, Class 30B

Ductile Iron: ASTM A536, Grade 60-40-18

Mechanical Joint: ANSI/AWWA C111/A21.11

Integral cast or welded intermediate wall collar

Wall pipes shall be used at all locations where pipes penetrate new cast in place concrete walls.

N Modular Rubber Seals

Modular rubber wall seal shall be mechanical type, consisting of inter-locking synthetic rubber links. The elastomeric element shall be sized and selected per manufacturer's recommendation and have the following properties as designated:

- Standard service application (-40 degrees F to 250 degrees F) EPDM: ASTM D2000 M3BA510.
- Hydrocarbon service application (-40 degrees F to 210 degrees F) Nitrile: ASTM D2000 M1BF510
- High temperature or fire seal application (-67 degrees F to 400 degrees F) Silicone: ASTM D2000 M1GE505

Assembly of synthetic rubber links connected with 316 stainless steel bolts. When the bolts are tightened, pressure plates shall compress the rubber links to fill the annular space between the pipe and the wall sleeve to form a watertight seal.

Modular rubber wall seals shall be used where pipes penetrate existing concrete walls or precast walls and as otherwise indicated on the contract drawings. Use of modular rubber seals in any other locations shall require written approval of the Engineer.

Modular rubber wall seal shall be Link-Seal, manufactured by Thunderline Corporation or equal.

O Pipe Supports and Pipe Hangers

Pipe supports bearing on concrete surfaces shall consist of a base flange, support rod with threaded ends for height adjustment and a saddle type or stanchion type support. Provide floor-mounted type support stands where wall or ceiling mount are not feasible and maintenance access will not be interrupted.

Wall mounted support brackets shall be constructed of angle iron and include a u-bolt attachment, roller or pipe saddle above the bracket. Wall mounted pipe support brackets are permitted the pipe is within 2 feet of the wall.

Ceiling installed hangers and supports shall conform to the American Standard Code for Pressure Piping, ANSI B31.1.

All pipe supports installed in above ground building without the presence of wastewater shall be painted steel. All pipe supports installed below ground or in any room where exposed wastewater is present shall be 316 stainless steel.

P Air Release Valves

Air Release Valves will permit discharging the surge of air from an empty line when filling and relieve the vacuum when draining the system. The valve(s) shall also release an accumulation of air when the system is under pressure. This shall be accomplished in a single valve body.

The valves shall have a NPT screwed inlet connection and shall have a ductile iron body and top, stainless steel float and trim with a seal provided by the manufacturer. Valves shall meet the general requirements of AWWA C512. Air release valves shall be Crispin Model UL20 Universal Air Valve as manufactured by Crispin-Multiplex Manufacturing Co., APCO model ARV as manufactured by DeZURIK, Inc or pre-approved equal.

2503.3 CONSTRUCTION REQUIREMENTS

A General Provisions

Requirements for excavation, preparing trench, backfilling and restoration are contained in 2451 EXCAVATION, BACKFILL, AND COMPACTION FOR UTILITIES of these specifications and State of Minnesota Department of Transportation “Standard Specifications for Construction” current edition, and shall govern the execution of work where the specifications therein are not in conflict with more specific requirements contained in this section, the City Standard Details listed in Appendix D, Contact Drawings, or the Special Provisions.

All horizontal directional drilling shall be performed in accordance with 2503 HORIZONTAL DIRECTIONAL DRILLING – PIPE SEWERS of these specifications.

B Handling and Inspection

Proper and adequate implements, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. Unloading, distribution and storage of pipe and appurtenant materials on the job site shall be as approved by the Engineer. All materials shall be handled carefully, as will prevent damage to protective coatings, linings, and joint fittings; preclude contamination of interior areas; and avoid jolting contact, dropping, or dumping.

Before being lowered into laying position, the Contractor shall make a thorough visual inspection of each pipe section and appurtenant units to detect damage or unsound conditions that may need corrective action or be cause for rejection. Inspection procedure shall be as approved by the Engineer, with special methods being required as he deems necessary to investigate suspected defects more definitely. The Contractor shall inform the Engineer of any defects discovered and the Engineer will prescribe the required corrective actions or order rejection. Any pipe with scratches, cuts or scrapes deeper than 10% of the wall thickness shall be used unless the damaged section if cut out.

Immediately before placement, the joint surfaces of each pipe section and fitting shall be inspected for the presence of foreign matter, coating blisters, rough edges or projections, and any imperfections so detected shall be corrected by cleaning, trimming, or repair as needed.

Store pipe on level surface. Pipe may be placed in pyramidal stacks provided the number of courses recommended by manufacturer is followed and pipe is chocked on each side to prevent roll out of the layers. Cover pipe ends to prevent dirt, debris, wildlife and weather from entering. HDPE pipe stored for more than 3 weeks should be covered for protection from sunlight and weather.

Do not dump pipe from conveyance. Unload pipe 12 inches (300 mm) and smaller by hand with ropes and skids. Unload pipe larger than 12 inches (300 mm) or pipe bundles with mobile unloading equipment. Use wide slings for hoisting large pipe with boom trucks, cranes or lifts. Reinforced web slings are acceptable; chains, wire ropes or fiber ropes are not acceptable slings. Use of hooks for unloading is also unacceptable.

C Pipe Laying Operations

Trench excavation and bedding preparations shall proceed ahead of pipe placement as will permit proper placement and joining of the pipe and fittings at the prescribed grade and alignment without unnecessary hindrance. Every reasonable precaution shall be taken to prevent foreign materials from entering the pipe and fittings while they are being placed in the line. The sewer materials shall be carefully lowered into laying position by the use of suitable

restraining devices. Under no circumstances shall the pipe be dropped or dumped into the trench.

At the time of pipe placement, the bedding conditions shall be such as to provide uniform and continuous support for the pipe between bell holes. Bell holes shall be excavated as necessary to make the joint connection, but they shall be no larger than would be adequate. No pipe material shall be laid in water nor when the trench or bedding conditions are otherwise unsuitable or improper. Unless otherwise permitted by the Engineer, bell and spigot pipe shall be laid with the bell ends facing in the direction of laying.

When placement or handling precautions prove inadequate, in the Engineer's opinion, the Contractor shall provide and install suitable plugs or caps effectively closing the open ends of each pipe section before it is lowered into laying position, and they shall remain so covered until removal is necessary for connection of an adjoining unit.

As each length of bell and spigot pipe is placed in laying position, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material, which shall be thoroughly compacted around the pipe. The joint areas shall remain exposed and precautions shall be taken to prevent the soil from entering the joint space, until the joint seal is affected.

At all times when pipe laying is not in progress, including noon hour and overnight periods, all open ends of the pipe line shall be closed by watertight plugs or other means approved by the Engineer. If water is present in the trench, the seals shall remain in place until the trench is pumped completely dry.

D Aligning and Fitting of Pipe

The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe and so as to leave a smooth square-cut end. Cast iron or ductile iron pipe shall be cut with approved mechanical cutters. The electric-arc cutting method, using carbon or steel rod, will be approved for use on the larger size pipe where mechanical cutters are not available. Flame cutting will not be allowed under any conditions. All rough edges shall be removed from the cut ends of pipe and, where rubber gasket joints are used, the outer edge shall be rounded or beveled by grinding or filing to produce a smooth fit.

When necessary to deflect the pipe from a straight line either in the vertical or horizontal plane to avoid obstructions, or produce a long radius curve, the amount of deflection allowed at each joint shall not exceed the allowable limits established in the following tables:

Table 2503-2: Maximum Permissible Deflection in Laying Push-on Joint for Ductile Iron Pipe

Pipe Size	Max. Angle	18’ Pipe Length	20’ Pipe Length
3” to 12”	5°	19” (205’ radius)	21” (230’ radius)
16” to 24”	3°	11” (340’ radius)	12” (380’ radius)
30” to 36”	2°	7.5” (510’ radius)	8” (570’ radius)

Table 2503-2 Notes:

(1) Distance listed is the maximum offset per pipe

(2) Radii listed are approximate

Table 2503-3: Maximum Permissible Deflection in Laying Mechanical Joint for Ductile Iron Pipe

Pipe Size	Max. Angle	18’ Pipe Length	20’ Pipe Length
4”	8.3°	31”	35”
6”	7.1°	27”	30”
8” to 12”	5.3°	20”	22”
16”	3.5°	13”	15”
18” & 20”	3.0°	11”	12”
24” & 30”	2.3°	9”	10”
36”	2.0°	8”	9”

Table 2503-3 Notes:

(1) Distance listed is the maximum offset per pipe

Connection and assembly of joints shall be accomplished during the setting, aligning and fitting operations, in accordance with the provisions of this specification to the extent that the jointing requirements will permit.

HDPE pipe may be deflected at a maximum radius of 25 times the nominal pipe OD. When a fitting or connection is present, the maximum radius shall be 100 times the nominal pipe OD.

E Blocking and Anchoring of Ductile Iron Pipe

All plugs, caps, tees, bends and other thrust points shall be provided with reaction backing, or movement shall be prevented by attachment of suitable restraining devices, in accordance with the requirements listed below and the City Standard Details listed in Appendix D.

(1) All horizontal bends, plugs, caps and branch tees shall be provided with concrete buttresses.

(2) For 16” and smaller diameter, precast concrete blocks may be used in lieu of cast in place concrete when used in conjunction with “Mega-lug” joint restraints. Precast blocks shall be stepped out as installed to provide similar surface area as the cast in place thrust blocks. Use of “Mega-lug” restraints only without blocking is only acceptable if adjacent pipe is restrained as described below.

(3) All vertical bends exceeding 11-1/4 degrees deflection shall be provided with concrete buttress blocking at the low points with metal tie rod or strapping restraints at the high points.

(4) Offset bends made with standard offset fittings need not be strapped or buttressed, unless installed in combination with another fitting.

All necessary fittings, bands, tie rods, nuts, and washers, and all labor and excavation required for installation of reaction restraints shall be furnished by the Contractor at his expense and without direct compensation.

Concrete blocking shall be at least two inches nominal thickness.

Concrete buttresses shall be poured against firm, undisturbed ground and shall be formed in such a way that the joints will be kept free of concrete and remain accessible for repairs. The concrete mix used in buttress construction shall meet the requirements for Type 3 Grade B of MN/DOT 2461. Buttress dimensions shall be as indicated on the City Standard Detail Drawing listed in Appendix D.

All metal parts of tie rod or strap type restraints shall be galvanized.

“Megalug” joint restraints by Ebba Iron, Inc., or Uni-Flange Series 1400 “Block Buster” by Ford, may be substituted for rodding and blocking. Retainer (set screw type) glands may not be used in lieu of approved restraints or buttresses. “Megalug” and “Blockbuster” restraints may only be used on ductile iron pipe and shall not be used on any existing cast iron pipe.

When using “Megalug” type restraints in lieu of blocking, the pipe shall be restrained in each direction from the fitting a sufficient distance to prevent joint separation upstream or downstream. The minimum length of restrained pipe required shall be as shown on the contract drawings or as specified in Special Provisions. If no minimum length for restrained joints is specified, the Contractor shall submit the restrained joint calculations to the Engineer for review prior to construction or restrain a minimum of 42 feet in each direction.

F Blocking of HDPE Pipe

All plugs, caps, tees, bends and other thrust points shall be provided with concrete blocking if there is an unstrained joint within 42 feet of the thrust point. Blocking is not required when all joints within 42 feet are restrained.

When required, concrete blocking shall be installed per the City Standard Details listed in Appendix D.

G Locating Wire

Locating (tracer) wire shall be installed on all HDPE pressure sewers, force mains and services.

H Electrical Continuity in Ductile Iron Pipe

Provisions shall be made to insure electrical continuity between all joints, fittings, and valves. Two serrated brass wedges shall be inserted for 3 inch to 12 inch push-on joints on ductile iron pipe or cable bond may be used. Four wedges per joint shall be used for larger pipe. Continuity for mechanical joints may be provided using copper clips inserted in the gasket by the manufacturer, armored tipped gaskets, copper strap, or cable bond. Megalug joint restraints shall not be used for electrical continuity.

I Connection and Assembly of Joints

I.1 General

Where rubber gasketed joints are specified, care shall be taken during the laying and setting of piping materials to insure that the units being joined have the same nominal dimension of the spigot outside diameter and the socket inside diameter. A special adaptor shall be provided to make the connection when variations in nominal dimension might cause unsatisfactory joint sealing.

Immediately before making the connection, the inside of the bell or socket and the outer surface of the spigot ends shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. Insertion of spigot ends into the socket or bell ends shall be accomplished in a manner that will assure proper centering and insertion to full depth. The joint seal and securing requirements shall be as prescribed below for the applicable pipe and joint type.

I.2 Push-On Joints

The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the ball socket. A thin film of approved gasket lubricant shall be applied to either the inside surface of the gasket or the outside surface of the spigot end, or to both. Care shall be taken while inserting the spigot end to prevent introduction of contaminants. The joint shall be completed by forcing the spigot end to the bottom of the socket by the use of suitable pry-bar or jack type equipment. Spigot ends which do not have depth marks shall be marked before assembly to insure full insertion. Field cut pipe shall be filed or ground at the spigot edge to resemble the manufacturer’s fabricated detailing.

I.3 Mechanical Joints

The last eight inches of the outside spigot surface and the inside bell surface of each pipe and appurtenance joint shall be painted with a soap solution after being thoroughly cleaned. The gland shall then be slipped on the spigot end with the lip extension toward the socket or bell end. The rubber gasket shall be painted with soap solution and be placed on the spigot end with the thick edge toward the gland. An

approved lubricant provided by the pipe manufacturer may be used in lieu of the soap solution.

After the spigot end is inserted into the socket to full depth and centered, the gasket shall be pressed into place evenly around the entire joint. After the gland is positioned behind the gasket, all bolts shall be installed and the nuts tightened alternately to the specified torque, such as to produce equal pressure on all parts of the gland.

Unless otherwise specified, the bolts shall be tightened by means of a suitable torque-limiting wrench to within a foot-pound range of: 45 to 60 for 5/8" bolts; 75 to 90 for 3/4" bolts; 100 to 120 for 1" bolts, and 120 to 150 for 1-1/4" bolts.

6-ounce zinc anode caps conforming to ASTM B-418 shall be installed on the bolts on all mechanical joint fittings.

I.4 Qualifications for Joining HDPE Sewer Pipe

Before being permitted to make joints on the HDPE water main pipe, all joiners shall be qualified and successfully complete a qualification test as required in accordance with Qualifications for Joining PE Pipe, of the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe.

I.5 Fusion Joining of HDPE Sewer Pipe

All HDPE water main pipe and fittings shall be joined by butt fusion, socket fusion, or electrofusion procedures as specified in the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe and as specified under 2504 Water Main.

J Pipe Support Spacing

Contractor shall provide pipe supports as necessary to adequately support exposed piping. At a minimum, one support shall be provided for every 4 feet of PVC pipe installed or one for every 10 feet of steel or ductile pipe installed, at each direction change and at each valve.

K Pressure Gauge Installation

Pressure gauges shall be installed on each City-owned pump discharge within the valve vault or as shown on the Contract Drawings. Provide an isolation ball valve at each installation to allow for gauge removal.

L Pressure Sewer Service Installation

Pressure sewer service facilities consisting of 1 ¼ service lines, complete with all required appurtenances, shall be installed as required by the Contract, in accordance with all pertinent requirements for main line installations together with the provisions hereof.

It shall be the responsibility of the Contractor to keep work exposed so the Engineer may obtain an accurate record of the location, depth and size of each service connection and other pertinent data such as the location of curb stops and pipe endings.

Pressure sewer service lines shall normally be installed by trenching or directional drilling and be subject to the same requirements as prescribed for the main pipeline installation, except for those which may not be pertinent or applicable. Where water service lines are installed alongside pressure sewer services, installation shall be such as to maintain the minimum specified clearances between pipelines and provide proper and adequate bearing for all pipes and appurtenances.

Unless otherwise specified, installation of pressure sewer service lines shall be such as to provide for not less than seven feet of cover over the top of the pipe and for not less than 18 inches of clearance between pipelines. Also, at least three inches of clearance shall be maintained in crossing over or under other structures except that 12 inches shall be maintained when crossing water mains. Where the service pipe may be exposed to freezing due to insufficient cover or exposure from other underground structures, the pipe shall be insulated as directed by the Engineer.

HDPE pressure sewer service piping shall be installed in one piece without intermediate butt fusion or electrofusion joint couplings between the tapping tee with electrofusion saddle at the pressure sewer and the curb stop. Transition couplings shall be used to connect to the curb stop.

Connection of HDPE pressure sewer service lines to the pressure sewer shall be made with an approved tapping tee with electrofusion saddle on HDPE mains.

Unless otherwise indicated, service lines shall be installed on a straight line at right angles to the pressure sewer or property lines as directed by the Engineer. Service lines shall extend for such distance beyond the curb stop as may be specified in the Contract. In the absence of specific requirements, the service line shall be terminated at the curb stop, where it shall be connected to an existing line or, in the case of undeveloped property, capped or plugged, as approved by the Engineer.

The service pipe and curb stop coupling depth shall be such as to maintain not less than the specified minimum cover and provide for a standard service box installation where practicable. Curb stop shall be set on a concrete block. The service box shall be threaded over the curb stop coupling. Service boxes shall be installed plumb and be braced effectively to

remain vertical during and after completion of backfilling. The service boxes shall be brought to existing surface grade when the final grade has not been established. When the final grade has been established, the Contractor shall extend the service box to finished grade.

M Furnish and Install Gate Valve and Box

This work shall consist of furnishing and installing a gate valve and valve box in accordance with the applicable MN/DOT Standard Specifications, the current Standard Practices and Specifications of the City of Duluth as detailed in the Plan, and the following: Prior to installation, the valve shall be cleaned of all foreign matter. A 12 pound (minimum) bare zinc anode shall be attached to MJ bolt for all valves as shown in the City Standard Details listed in Appendix D. 6-ounce zinc anode caps conforming to ASTM B-418 shall be installed on the bolts on all mechanical joint fittings.

N Testing Pressure Sewer, Forcemain, and Pressure Services

Pressure sewer and forcemains shall be subjected to the pressure and leakage tests prescribed herein and in conformance with the pipe manufacturer's recommendations. The Contractor shall furnish the pump, pipe connections, gauges, and measuring equipment, and shall perform the testing under the direct observation of the Engineer.

The Contractor may test each valved section, larger sections, or the entire pressure sewer or forcemain so long as the elevation differential between the highest and lowest point does not exceed 110 feet.

All air must be expelled from the pipe. A hydrostatic pressure of not less than 150 pounds per square inch, measured at the lowest point of elevation, shall be applied by means of a pump connected to the pipe in a satisfactory manner.

For ductile iron mains, pressure shall be maintained for a minimum duration of 2 hours. No drop in pressure will be allowed for acceptance of the main. Any defective joints, pipe, fittings, or valves revealed during the testing, or before final acceptance of the work, shall be satisfactorily corrected and the test shall be repeated until the specified requirement has been met.

For flanged pipe, no visible leakage shall be allowed during the test.

For HDPE mains, fill the main slowly ensuring fill rate does not exceed capacity of air release devices. Once air has been expelled from the system, gradually raise the pressure to 160 psi. Add makeup water as necessary to maintain this pressure for four hours. After four-hour period, reduce main pressure to the 150-psi test pressure and monitor for 1 hour. Do not increase pressure or add make-up water during this one-hour period. The test is passed and considered acceptable if the main pressure does not drop more than 5% (7.5 psi) during the one-hour period.

The connection of pressure sewer services to HDPE pressure sewers with an electrofusion corp saddle and corporation stop or a tapping tee with electrofusion saddle shall be soap tested and tested with air and accepted if it maintains 150 psig for 30 minutes. Accepted electrofusion corp saddle or tapping tee with electrofusion saddle can then be tapped to the main and the tap or punch tee cap reinstalled. Pressure sewer pipes shall be pressure tested either jointly or separately from pressure sewer main testing. Test pressure shall be 150 psi.

O Electrical Continuity Test

For ductile iron pipe systems, the Contractor shall perform a continuity test between hydrants or any accessible point of the backfilled system. If the test shows no continuity, the Contractor shall find and repair the broken circuit. Megalug joint restraints shall not be used for electrical continuity.

For HDPE pipe systems, the Contractor shall perform a continuity test on all tracer wire after installation of pipe. If the test shows no continuity, the Contractor shall find and repair the broken tracer wire.

Pipe that fails to meet continuity requirements above will be considered unacceptable and no payment will be made.

2503.4 METHOD OF MEASUREMENT

All items will be measured separately according to the Pay Item name and as detailed and defined in the Contract Drawings, Specifications, City Standard Details listed in Appendix D or Special Provisions. Pipe will generally be designated by size (nominal diameter), strength class, kind or type, and laying conditions. Complete-in-Place items shall include all component parts thereof as described or required to complete the unit, but excluding any excesses covered by separate Pay Items.

A Pressure Sewer, Pressure Sewer Service or Forcemain

Mainline pipe and service pipe of each kind and size will be measured separately per linear foot by the overall length along the axis of the pipeline, from beginning to end of each installation and without regard to intervening valves or specials. Terminal points of measure will be the spigot or cut end, base of hub or bell end, center of valves, intersecting centers of tee or wye branch service connections, and center of main to center of curb stop. Linear measurement of piping will include the running length of any special fitting (tees, wyes, bends, gates, etc.) installed within the line of measure between specified terminal points. No additional measurement will be made for extra pipe installed due to extra depth required for direction drilling applications.

B Valves

Valves of each size and type will be measured separately per each as complete units, including the required valve box setting.

C HDPE Tapping Tee with Electrofusion Saddle

HDPE tapping tee and electrofusion corp saddle of each size and type will be measured separately per each by the number of complete units installed.

D HDPE Service Wye

This work shall consist of furnishing and installing service wyes in the Pressure Sewer Pipe in accordance with the applicable provisions of MN/DOT 2503.

Measurement will be made by the number of each size tee furnished and installed as specified.

E Tracer Boxes

Tracer Boxes of each type will be measured separately per each by the number of complete units installed.

F Air Vents

Air vents of each type and size will be measured separately per each by the number of complete units installed, including the required manhole or valve box setting.

G Access Structures

Access structures, such as Manholes and Vaults, will be measured for payment separately per each, except when included as a component part of an air vent. When applicable, measurement will be by the number of complete individual units installed of each type and design, including the required manhole or vault castings, and covers.

H Pressure Sewer and Forcemain Fittings

All fittings for pressure sewer and forcemain installations shall be incidental to pipe installation and no measurement shall be made.

2503.5 BASIS OF PAYMENT

A Pressure Sewer, Pressure Sewer Service or Forcemain

Payment for Pressure Sewer and Forcemain of each size and kind at the appropriate Contract prices per linear foot of installation shall be compensation in full for all costs of furnishing and installing the pipe complete in place as specified, including all costs of pipe installation as may not be specifically covered under other Contract Items. All costs of pipeline leakage testing, pipe jointing materials, dead facilities, blocking and anchorage materials, and other work necessary for installation of pipe as specified shall be included for payment as part of the pipe item, without any direct compensation being made thereafter.

Payment for DIP Forcemain shall be compensation in full for all costs of furnishing and installing ductile iron forcemain between the locations shown on the Contract Drawings, including all materials, labor, equipment, ductile iron forcemain pipe, appurtenances, zinc anode caps, excavation, bedding, encasement materials, placing and compacting backfill, testing, and incidentals.

Payment for HDPE Pressure Sewer or Forcemain SDR 11 shall be compensation in full for all costs of furnishing and installing HDPE pressure sewer or force main between the locations shown on the Contract Drawings, including all materials, labor, equipment, HDPE pressure sewer or forcemain pipe and fittings, appurtenances, HDPE by MJ adapters, HDPE to cast iron transition couplings, zinc anode caps, locating wire, excavation, bedding, encasement materials, placing and compacting backfill, testing and incidentals. All costs of furnishing and installing electrofusion flex restraints and concrete collars on the HDPE pressure sewer or forcemain shall be considered incidental to the main. No payment shall be made for pipe with a tracer wire that has not passed the continuity test.

Payment for HDPE SDR 11 Pressure Sewer Service Pipe shall be compensation in full for all labor and equipment necessary to complete the work as described herein including excavation, bedding, encasement materials, placing and compacting backfill, and tracer wire for HDPE pressure sewer service pipe. No payment shall be made for pipe with a tracer wire that has not passed the continuity test.

B Valves

Payment for Gate Valve and Box shall be compensation in full for all costs incidental thereto to furnish and install the gate valve and valve box complete and in place, including but not limited to the gate valve and valve box, blocking, MJ to HDPE adapters, 12 lb. bare zinc anode, zinc anode caps, and crushed stone. No additional payment will be made for valves installed where new mains are deeper than the minimum depth.

C HDPE Tapping Tee with Electrofusion Saddle

Payment for Tapping Tee with Electrofusion Saddle shall be compensation in full for all material, labor and equipment necessary to complete the work as described herein including tapping the pressure sewer, furnishing and installing the connection fitting on the main and butt fusing the HDPE pressure sewer service pipe to the tapping tee with electrofusion saddle.

D HDPE Service Wye

Payment for wye of each size shall be compensation in full for all costs of furnishing and installing the wye complete in place as specified.

E Pressure Sewer Curb Stop and Box

Payment for Pressure Sewer Curb Stop and Box shall be compensation in full for all materials, labor and equipment necessary to install the curb box and furnish and install the curb stop and any transition fittings necessary to connect new HDPE pressure sewer service pipe to the curb stop.

F Air Vents

Payment for air vent of each size shall be compensation in full for all costs of furnishing and installing the air vent complete in place as specified.

G Access Structures

Payment for access structures of each type and design shall be compensation in full for all costs of furnishing and installing the access structure complete in place as specified.

H Schedule

The City will pay for pressure sewers on the basis of the following schedule:

Item No.	Item	Unit
2503.602	(size) Gate Valve and Box	each
2503.602	(size) HDPE Tapping Tee with Electrofusion Saddle	each
2503.602	(size) HDPE Service Wye	each
2503.602	(size) Pressure Sewer Curb Stop and Box	each
2503.602	(size) Air Vent	each
2503.602	(size) Gate Valve and Box	each
2503.603	(size) DIP Pressure Sewer	linear foot
2503.603	(size) HDPE Pressure Sewer	linear foot
2503.603	(size) HDPE Forcemain SDR 11	linear foot
2503.603	(size) HDPE SDR 11 Pressure Sewer Service Pipe	linear foot
2503.603	Access Structure Design ___	linear foot

2503 CURED-IN-PLACE PIPE LINING

2503.1 DESCRIPTION

Provide all labor, equipment, and materials required to install and test cured-in-place pipe (CIPP) lining and appurtenances complete as shown on the Drawings and as specified herein.

A Definition

Cured-in-place pipe lining is a trenchless rehabilitation method for buried pipelines, typically used to rehabilitate cracked, leaking, and deteriorating sewers.

B System Description

Cured-in-place pipelining is typically installed in an inversion-type process that is inserted into the existing pipe at a manhole. The lining is a resin-impregnated flexible felt tube that is inserted into an existing pipe utilizing a free standing or truck-mounted inversion tower.

During the inversion process, the lining material is turned inside out so the tough, but smooth polyurethane side becomes the interior surface of the new pipe. Hydrostatic head or steam pressure is used to insert the liner and provide a continuous tight-fitting liner after the cure process is complete.

C Reference Standards

American Society for Testing and Materials (ASTM):

- ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulation Materials
- ASTM D2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
- ASTM F1216 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube

Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

2503.2 MATERIALS

A CIPP Lining

CIPP lining shall be Insituform by Insituform Technologies, Inc., Inliner by Inliner USA, Inc., National Liner by National Envirotech, Inc., or Engineer approved equal.

(1) The liner shall be composed of tubing material consisting of one or more layers of flexible non-woven polyester complying with ASTM F-1216, Section 5.1. The felt tubing shall be impregnated with a thermosetting polyester resin complying with ASTM F-1216, Section 5.2 and catalyst, vinyl ester and catalyst or epoxy resin and hardener. The liner material and resin shall be completely compatible. The outside layer of the tube shall be coated with an impermeable material compatible with the resin and fabric.

(2) Design Criteria - The following design parameter values shall be based upon the following physical condition of the existing pipe to be rehabilitated.

- Pipe Deterioration: All sections of the pipe shall be considered Fully Deteriorated.

- Soil Parameters: Soil density, 120 lbs/cu.ft.; soil modules, 700 psi
- Live Loads: All pipes beneath roadways shall be assumed to carry HS 20 live loads.
- Ovality: The existing pipe shall be assumed to have an ovality of 2 percent.
- A factor of safety of 2.0 shall be used.
- Groundwater: At the surface.
- Soil Depth: Depth of cover will be determined by field measurements.
- Short Term Flexural Modulus: 250,000 psi.
- Design Life: 50 years

(3) The liner shall be capable of fitting into irregularly shaped pipe sections and through bends and dips within the pipeline.

(4) The liner shall be able to cure in the presence of water at a temperature of 180 degrees F or less.

(5) When inverted and cured, the liner shall form a continuous, tight fitting, hard, impermeable liner that is resistant to chemicals found in domestic sewage.

(6) The liner shall be chemically resistant to trace amounts of gasoline and other oil products commonly found in municipal sewerage and soils adjacent to the sewer pipe to be lined.

(7) The liner shall be fabricated to a size that will tightly fit the sewer being rehabilitated after being installed and cured. Allowance for longitudinal and circumferential expansion shall be taken into account when sizing and installing the liner. All dimensions shall be field verified by the Contractor prior to installation of the liner. Field measurements shall be used to ensure maximum closure between the new liner and the existing sewer pipe.

(8) The application of the resin to the felt tubing (wet-out) shall be conducted under factory conditions and the materials shall be fully protected against UV light, excessive heat and contamination at all times.

(9) The length of the liner shall be the length deemed necessary by the Contractor to effectively carry out the insertion of the liner and sealing of the liner at the outlet and inlet structures (i.e. manhole, catch basin, pipe end, or apron). Liner shall be cut flush with pipe end or apron. The required length of liner shall be verified in the field by the Contractor prior to fabrication.

(10) The CIPP liner shall be watertight. All voids between the new cured liner and the existing host pipe shall be filled with non-shrink grout unless otherwise sealed in accordance with requirements found elsewhere in the Contract.

(11) CIPP liner 'End Seals', when required, shall be LMK Insignia End Seal.

(12) The cured liner shall have the following minimum structural properties:

Table 2503-1: Cured liner minimum structural properties

Property (psi)	Test Method	Minimum Standard (psi)
Flexural Strength	ASTM D790	4,500
Flexural Modulus	ASTM D790	250,000
Tensile Strength		3,000

2503.3 CONSTRUCTION REQUIREMENTS

A Submittals

A.1 Product Data

(a) Shop drawings of all cured-in-place pipe lining (CIPP) materials including resin, felt, and catalysts.

(b) Engineering calculations specifying the design and required thickness for each installation that are signed and sealed by a Professional Engineer licensed in the State of Minnesota.

(c) Prior to mobilization, submit a table of all inside diameter measurements of all sewers scheduled to be lined.

(d) Detailed wet-out, storage, shipping, and installation procedures.

(e) Certified test reports that the CIPP for this Contract was manufactured and tested in accordance with all ASTM Standards specified and referenced herein.

(f) Lining production schedule with locations, lengths and sizes.

A.2 Previous Work Experience

The Contractor shall submit the following information to the Engineer for review and approval before any CIPP lining work is performed:

(a) The number of years of experience installing CIPP lining.

(b) The name of the CIPP lining manufacturer and supplier for this work and previous work listed below.

(c) The Contractor shall submit a certified statement from the manufacturer that he/she is a certified and/or licensed installer of the CIPP lining.

(d) A list of municipal clients that the Contractor has performed this type of work for, including names, phone numbers, linear footage, and a description of the actual work performed. Provide a sufficient number of references to total 20,000 feet or more of lining work to date.

(e) A list of all completed CIPP lining projects within the past three years.

A.3 Equipment and Construction Procedures

A.4 Certificates of Compliance

A.5 Request to Sublet forms

A.6 Access and Site Restoration Agreements with Property Owners

B Qualifications of the Cured-in-Place Pipe Lining Contractor

The Contractor performing the CIPP lining work shall be fully qualified, experienced, and equipped to complete this work expeditiously and in a satisfactory manner and shall be certified and/or licensed as an installer by the CIPP manufacturer. There shall be no exceptions to these requirements.

(a) The Contractor shall have successfully installed a minimum of 20,000 feet of the proposed liner as documented by verifiable references.

(b) The proposed Superintendent shall have successfully installed a minimum of 10,000 feet of the proposed liner as supported by Engineer references.

The Contractor shall also be capable of providing crews as needed to complete the work without undue delay and shall begin work within 10 days from the authorized Notice to Proceed.

The Engineer shall approve or disapprove the Contractor and/or manufacturer based on the submitted information and a follow-up interview, if necessary.

Submit references for any subcontractor that may be used on site.

C Delivery, Storage, and Handling

Care shall be taken in shipping, handling, and storage to avoid damaging the liner. Extra care shall be taken during cold weather construction. Any liner damaged in shipment shall be replaced as directed by the Engineer.

Any liner showing a split or tear, or which has received a blow that may have caused damage, even though damage may not be visible, shall be marked as rejected and removed at once from the job site.

The liner shall be maintained at a proper temperature in refrigerated facilities to prevent premature curing at all times prior to installation. The liner shall be protected from UV light prior to installation. Any liner showing evidence of premature curing will be rejected for use and will be removed from the site immediately.

D Guarantee

All CIPP lining placed shall be guaranteed by the Contractor and manufacturer for a period of one year from the date of final acceptance. During this period, all serious defects discovered in the CIPP lining, as determined by the City's Engineer, shall be removed and replaced in a satisfactory manner by the Contractor at no cost to the City. The City may conduct an independent television inspection, at its own expense, of the lining work prior to the completion of the one-year guarantee period.

E Quality Assurance

All liner to be installed under this Contract may be inspected at the plant for compliance with this Section by the Engineer or an independent testing laboratory provided by the Owner at his own expense. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of plant inspection will be the responsibility of the City.

Inspection of the liner may also be made by the Engineer or other representative of the City after delivery. The liner shall be subject to rejection at any time on account of failure to meet any of the requirements specified, even though sample liner may have been accepted as satisfactory at the place of manufacture. Liner rejected after delivery shall be marked for identification and shall be removed from the job site at once.

F Safety

The Contractor shall conform to all work safety requirements of pertinent regulatory agencies and shall secure the site for the working conditions in compliance with the same. The Contractor shall erect such signs and other devices as are necessary for the safety of the work site.

The Contractor shall also perform all of the Work in accordance with applicable OSHA standards. Emphasis shall be placed upon the requirements for entering confined spaces and working with steam or hot water.

The Contractor shall provide traffic control meeting MUTCD standards.

The safety of pedestrians and the traveling public is the Contractor's responsibility.

G Preparation

Clean each length of pipe to be lined and dispose of any resulting material. The Contractor shall coordinate with the Western Lake Superior Sanitary District (Resource Renew) for disposal at their main treatment plan facility located on Courtland Street. Any dumping fees and disposal costs shall be incidental to the work. The City will not provide a disposal location for project-related waste to the Contractor.

The Contractor shall conduct a CCTV digital video television inspection of each length of pipe after it is cleaned for the purpose of determining if existing conditions are suitable for the installation of the proposed lining process and to document the location of all service lateral connections and confirm point repair locations. Submit video tapes and logs to Engineer for review and approval prior to proceeding with liner installation. The pre-lining television inspection shall be performed prior to any planned spot repair work AND again immediately prior to liner installation.

Contractor shall dye test all service connections prior to lining to determine all active service connections. Contractor shall provide all dye test and/or active service determination documentation to Engineer, with sufficient time for review by the Engineer, prior to installation of liner. The Contractor shall provide all necessary coordination with residents and businesses to gain access to buildings to drop the dye into the wastewater system. The Contractor shall not line over a service connection opening (even if it 'visually' appears inactive) without the approval of the Engineer (or the Engineers' designated representative).

All service connections protruding 1-inch or more into the sewer to be lined shall be internally cut or ground down with a robotic cutter to be flush with the host pipe to be lined, prior to liner installation. The robotic cutter shall be monitored by closed circuit television equipment to verify proper cutting and shall be capable of cutting VCP, PVC, DIP, or CIP pipe. Equipment specifically designed for cutting roots from sewers (such as a chain cutter) shall not be allowed. The cost of this work shall be included in the unit cost of the liner installation.

The Contractor shall provide bypass pumping of sewage flows where the pipe rehabilitation work is being performed.

The Contractor shall notify all property owners who discharge sewage directly into the sewer to be lined that their sewage service will be interrupted and discontinued while the liner is being installed, cured, and active service connections re-opened. The Contractor shall notify each affected property owner once 5 days before and again 24 hours before commencement of the work, giving the date, start time and estimated completion time for the work being performed.

Furnish and install the liner in the full length of sewer as shown on the Drawings. The installation of the liner shall be in complete accordance with the applicable provisions herein and the manufacturers' installation requirements. Depending on the Contractor's work experience, a representative of the liner manufacturer may be required to be present during the actual installation of at least 2,000 feet at the start of the work.

If, in the opinion of the CIPP liner manufacturer AND the Contractor, the rate of infiltration in the sewer segment is too high that there may be risk washout of the resin, then the contractor shall perform measures, as required, to reduce or eliminate the infiltration prior to pipe lining. If additional spot repairs, chemical grouting, pre-liner, or a groundwater

dewatering system is deemed necessary and there are no bid items in the Contract, it will be considered Extra Work. The Contractor shall not proceed with Extra Work without the written approval of the Engineer.

If there are calcium deposits or other 'difficult to remove' debris encountered in the existing host pipe that was not visible in the pre-bid CCTV inspection videos, the contractor shall make an extraordinary effort to remove by grinding or other approved methods. If it could not be anticipated reviewing the pre-bid CCTV inspection videos, the extraordinary effort will be considered Extra Work. The Contractor shall not proceed with Extra Work for a removal of debris without the written approval of the Engineer.

H Installing CIPP

H.1 Inversion Using Hydrostatic Head

The resin impregnated tube shall be inserted through an existing manhole by means of an inversion ring or standpipe, capable of applying the hydrostatic head required to fully extend the tube to the next designated manhole or termination point. The tube shall be inserted into the inversion standpipe and the tube shall be turned inside out and attached to the standpipe so that a watertight connection is made. The inversion head shall be adjusted to a sufficient height to invert the tube from the starting manhole to the ending manhole and to hold it tight against the existing pipe wall, producing dimples at side connections and flared ends at the manholes. Care shall be taken not to overstress the felt tube at the elevated curing temperatures, which may cause damage or failure prior to cure.

H.2 General Housekeeping and Site Clean-Up

The Contractor shall take reasonable precautions to control lubricating fluids, inversion and curing process water, steam vents, excess epoxy and liner cutoffs so that the work site and surrounding area are safe and clean to the satisfaction of the Engineer. Where an unavoidable dispersal occurs, the Contractor shall clean up the site immediately.

I Curing

I.1 Heating

After the inversion process is completed, the Contractor shall supply a suitable heat source of hot water and steam throughout the section to uniformly raise the liner temperature above the temperature to affect a cure of the resin. The heat source shall be fitted with suitable monitors to gauge temperature of the incoming and outgoing water supply. Another gauge shall be placed between the layers of the impregnated felt tube in the upstream, downstream, and intermediate manholes to determine the temperature during curing. Water temperature in the line during the curing period shall

not be less than 140°F or more than 200°F as measured at the heat source return line. Initial cure may be considered complete when the remote sensing device indicates the temperatures and curing time to be adequate, as recommended by the resin/catalyst system manufacturer. The contractor shall maintain a log of the temperature at each sensor during the entire curing process. All condensate water shall be directed into a sanitary sewer. Discharge of condensate water to storm sewers, ground surface, or water bodies will NOT be allowed.

(1) For pipe sizes **less than or equal to 12" in diameter**, the Contractor shall choose either a **hot water cure or steam cure** method as long as the method selected is appropriate (based on manufacturer's installation guidelines) for the existing pipe conditions observed at the time of preparation CCTV inspection.

(2) For pipe sizes **greater than 12" in diameter, a hot water cure method shall be used** unless otherwise specified in the Contract, or as approved by the Engineer.

(3) Regardless of the **method of curing** that is actually utilized, **there will NOT be any adjustment to contract unit bid prices** based on the Contractor's assumed method of curing for the Cost Proposal. A copy of the City's pre-bid CCTV inspections videos is available for review. Refer to the project special provisions for contact information.

I.2 Cooling Down

The Contractor shall cool the hardened cured-in-place-pipe to a temperature below 100°F before relieving the water column. Cool water may be added to the water column while draining hot water from a small hole at the end of the cured-in-place-pipe so that a constant water column height is maintained until cool down is completed. Careful attention should be taken not to cool too quickly to eliminate the possibility of thermos shock. Care should be taken in the release of the static head so that a vacuum will not be developed that could damage the newly installed liner.

Disposal of ALL curing process water shall be at the nearest sanitary sewer. No discharge of curing process water will be allowed into storm sewers, streams, rivers, or lakes.

J Sealing and Cutting of Lining at Manhole

Contractor may line multiple sewer segments at one time where possible as determined by the Contractor. Where this is done, the top one-half of the liner in the intermediate manhole shall be neatly removed, and the void behind the liner shall be filled with non-shrink grout. The channel in the manhole shall be a smooth continuation of the pipe (s) and shall be merged with

other lines or channels, if any. Channel cross section shall be U-shaped and sides of channels shall be built up with mortar/concrete to provide benches at a maximum of 1 in 12 pitch towards the channel.

When cutting around storm sewer and culvert pipe ends, all shavings and dust debris shall be collected and disposed.

All cutting and sealing of the liner at manhole connections shall provide watertight pipe and manhole seals with the use of a quick set cement grout or other approved sealant.

CIPP line and the existing pipe must be sealed as indicated above before proceeding on to the next manhole section, and all manholes shall be individually inspected for liner cut-offs, benches, and sealing works.

CIPP liner End Seals shall be provided at the locations shown on the Plans.

K Service Connections

Reopen all of the existing active service connections in each length of sewer following reformation and cooling of the liner. The exact number and location of service connections shall be determined from the CCTV tapes of the dye testing. It shall be the Contractor's responsibility to accurately field locate all existing active service connections. The service connections shall be reopened from inside the sewer by means of a television camera controlled cutting device appropriate for the liner material and the rehabilitated sewer pipe. All opening shall be clean, smooth, neatly cut, flush with the lateral pipe, and shall receive a brush finish. The bottom of the openings shall be flush with the bottom of the lateral pipe to remove any lip that could catch debris. Openings shall be at least 75 percent of the service lateral pipe if the lateral is to be replaced and at least 95 percent if the lateral is only to be reinstated. If a cleanout is already available, a mini camera from the cleanout shall be used to assist the operator with trimming. All service cut-out coupons and fragments shall be collected at the nearest downstream manhole.

After reopening the service connections, any gaps/voids that are between the liner and the host pipe shall be sealed off with grout, chemical grout, or top hat style of liner as approved by the Engineer. Further, any damage to the service connection lateral or wye caused by the lining Contractor's operation shall be repaired in a similar manner.

L Quality Control

For every 1,000 feet of liner installed, remove specimens of at least 18 inches in length for testing of thickness and flexural properties specified above. The Contractor shall collect the samples using a section of PVC pipe or other device approved by Engineer. The number of tests required may be reduced as approved by the Engineer after sufficient tests are performed to verify the CIPP design, production and installation procedures. Likewise, the frequency of tests may be increased by the Engineer and performed by the Contractor at no additional cost to the City when the required tests show that the installed lining does not meet the specifications. The

specimens shall be cut from a section of installed and reformed line at an intermediate point or the termination point of the installation. All testing shall be paid for by the Contractor and shall be performed by an independent testing laboratory. Results of the tests for each liner shall be submitted within 30 days after the liner is installed.

For every segment of liner installed, the Contractor shall generate a report that documents installation, including date, time, temperature, curing temperature, curing time, etc. The reports shall be submitted to the Engineer prior to requesting payment.

Following installation of the liner and re-opening of the service connections and replacement and re-connection of laterals to the liner, Contractor shall conduct a final video-taped color television inspection of the completed work. Copies of these tapes and the videotapes made prior to the liner installation shall be submitted to the Engineer for approval and shall be retained by the City. The Contractor shall submit two tapes: one copy of the post installation immediately after the installation of the liner and a second tape that includes tapes of all of the installations for the project after installation of the new service laterals. The contractor shall submit tapes a minimum of 10 days in advance of any payment request to provide the Engineer ample time to review the tapes. There shall be no dry spots, lifts, wrinkles, ridges, splits, cracks, de-laminations or other type defects in the CIPP lining. Defective lining will be removed and pipe re-lined at no additional cost to the City. If during the removal process, the pipe is damaged, Contractor will perform a point repair at Contractor's own expense.

Groundwater infiltration of the liner shall be zero.

All service connections shall be open, clear and watertight.

The Contractor is required to maintain the work site in a neat and orderly condition throughout the period of work and after completing the work at each site, remove debris, surplus material and temporary structures erected by the Contractor.

All work areas shall be restored to their original condition.

Acceptance of CIPP lining shall be based on the Engineer's evaluation of the installation and curing data, results of air testing where required, review of the certified test data of the installed liner, and review of the TV videotapes and manhole inspections.

2503.4 MEASUREMENT

Measurement of cured-in-place pipe liner of the respective diameter will be measured along the horizontal distance of the centerline of the pipeline from center to center of all manholes or to the end of the pipe (or pipe apron) at the top of pipe (12 o'clock position).

Measurement for remote cutting and reconnect services will be made for each service adequately re-opened.

Measurement for CIPP liner end seals will be made for each seal adequately installed.

Measurement for dye testing active service connections will be made for each service located.

2503.5 BASIS OF PAYMENT

Payment for CIPP lining shall include all costs of furnishing and installing cured-in-place pipe liner of the respective diameter, including television inspection and taping, cleaning, testing, bypass pumping, connections to existing manholes/structures and all other Work required to complete the items.

Payment for remote cut and reconnect sanitary service shall include all costs of furnishing and completing the remote cutting and reconnection of the sanitary service lines into the main sewer line, including a brush finish and the use of the remote television camera and remote cutting tool and all work required to complete the item.

Payment for CIPP liner end seals shall include all costs of furnishing and installing the end seal in between the new CIPP linear and the existing host pipe.

Payment for dye testing active service connections shall include all costs of coordination with property owners, furnishing and placing dye, CCTV monitoring to confirm evidence of dye at active services, documentation of observations, and reports submitted to the Engineer.

The City will pay for cured in place lining on the basis of the following schedule:

Item No.	Item	Unit
2503.603	(size) CIPP Main Lining	linear foot
2503.602	Remote Cut and Reconnect Sanitary Service	each
2503.602	(size) CIPP Liner End Seal	each
2503.602	Dye Testing Active Service Connection	each

2503 HORIZONTAL DIRECTIONAL DRILLING – PIPE SEWERS

2503.1 DESCRIPTION

This work shall consist of the installation of an underground pipe using the horizontal directional drilling method indicated on the Contract Drawings. Products installed under this section include Pressure Sewer Pipe and Forcemain and Pressure Sanitary Sewer Services.

A Definitions

A.1 Horizontal Directional Drilling (HDD)

Method of trenchless construction producing continuous bores, using a surface launched, remotely steerable, electronically monitored drilling tool controlled from a mobile drilling frame, and including a field power unit, mud mixing, storage and recycling system, and mobile spoils extraction system.

A.2 HDD Subcontractor

Firm engaged in the construction of underground sanitary sewer, water or gas lines and with demonstrated competency using HDD methods of installation of pipe.

B System Description

The drilling system differs from the micro-tunneling, auger boring or pipe jacking equipment in that operations are performed from the surface; large pits to place and align equipment are not necessary. The drilling frame is sited and aligned to bore a pilot tunnel that conforms to the planned line and grade of pipe. The drilling frame is typically set back from an access pit that has been dug at the location of a tie-in, connection, manhole (or other appurtenance), or other location; and a high pressure/low volume fluid-jet toolhead that uses an inert, environmentally acceptable mixture of bentonite clay and water is launched and guided to the correct invert elevation and line required at the manhole (or other appurtenance). This is called the pilot hole. A real-time guidance system is attached behind or within the toolhead to measure inclination, roll and azimuth. Upon reaching the receiving pit, the toolhead is removed and a reamer with the product pipe attached is joined to the drill string and pulled back through the tunnel created by the pilot hole. For some pipe sizes and soil conditions, the Contractor may also introduce cement into the stabilizing mud mix. A vacuum spoils extraction system removes any excess spoils generated during the installation.

C Performance Requirements

(1) Contractor shall provide a horizontal directional drilling system compatible with the subsurface conditions and the size, type, depths and lengths of pipe to be installed.

(2) Contractor shall provide all labor, materials, equipment and incidentals necessary to install pipe by horizontal directional drilling as shown on the Drawings and as specified herein.

(3) Contractor shall provide all survey layout, inspection and record-keeping incidental to the drilling pipe installation.

(4) This procedure is applicable to the installation of sanitary sewer and sewer services, water main and water services and gas main and gas services.

D Submittals

D.1 Submit product data for the drilling fluid including a description of the following items:

- Manufacturer
- Components

- Special Precautions
- Manufacturers recommended method of mixing and application
- Manufacturers recommendation for storage and handling
- Material Safety Data Sheet (MSDS)

D.2 Certificate of Compliance

Submit Certificates of Compliance for products and materials.

D.3 Equipment and Construction Procedures

Submit working drawings, manufacturer's data sheets and written procedures describing in detail the equipment, tools and materials to be used along with the proposed method of product pipe staging and installation. This will include, but not be limited to, size, capacity and setup requirements of equipment; location and sizing of drilling and receiving pits; dewatering if applicable; type of cutting tool head; back-reaming tool types and sizes; method of monitoring and controlling line and grade; locations and sizes of product jointing and staging areas; type of equipment for joining pipe; and time requirements of joint fusion. The Contractor shall detail a description of line and grade control and a viable method to eliminate accumulative error due to the inclinometer (pitch or accelerometer) and demonstrate that method in the field prior to commencing drilling operations.

Grouting techniques to be used for over-excavation, if any, including equipment, pumping procedures, grout types and mixtures.

Proposed procedures, materials and equipment for lubricating the exterior of the pipe during pulling.

Details of spoil removal system, including equipment type, number and disposal location.

Proposed methods, materials and equipment for removing and clearing obstructions so that the HDD can advance forward.

Furnish compliance submittals showing all fabrication and construction details for the directional drilling installation of the pipe.

The Contractor shall submit a construction schedule with starting and completion dates for each of the procedure tasks.

If the Contractor determines that modifications to the methods and equipment as stated in the submittal are necessary during construction, the Contractor shall submit a revised plan.

D.4 Contractor Qualifications

Submit the documentation showing five years of HDD and references for at least three jobs of similar magnitude and detail completed within the past five years. Information must include, but is not limited to, date and duration of work, location, pipe information, project owner information (including a name and phone number), and the contents of the pipeline.

Submit references for any subcontractors that may be used on site.

D.5 Record Drawings

After completion of pilot hole drilling, submit tabulation of pilot hole coordinates as required under "Pilot Hole" paragraph below.

E Qualifications of the Directional Drilling Contractor

The HDD contractor shall be trained and certified to operate the Horizontal Directional Drilling equipment with at least five years of experience in directional drilling, obtained over the last five years. Perform HDD operations under the constant direction of a drilling supervisor who shall remain on site and be in responsible charge throughout the drilling operation. The supervisor shall have supervised directional drilling and a minimum of 10,000 linear feet of pipe. Submit a list of field supervisory personnel and boring machine operator(s) and their experience with HDD operations. At least one of the field supervisors listed must be at the site and responsible for all work at all times when HDD operations are in progress, and both that person and the HDD machine operator shall have been employed with the HDD specialty contractor for a minimum continuous period of one year immediately prior to this work. HDD specialty subcontractor shall not mobilize to the site until the resumé of the Contractor's field supervisory personnel and boring machine operator have been reviewed by the Engineer.

F Delivery, Storage and Handling

Check the materials upon delivery to assure that proper material has been received. Store drilling fluid components in accordance with manufacturer's recommendations and out of the effects of inclement weather.

G Materials

Bentonite for drilling fluid shall be high quality Wyoming bentonite composed primarily of sodium montmorillonite.

H Drilling Site

Additional work space and access may be acquired by Contractor only with approval of the Engineer and applicable property owners. Expense of acquiring additional work space shall

be borne by Contractor. Site access, clearing, grading, and preparation necessary for construction operations shall be performed as required.

I Quality Assurance

Fusing of polyethylene pipe shall be done by qualified fusers. Certification of personnel and fusing of pipe shall comply with the requirements for gas lines in the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe.

2503.2 MATERIALS

A Carrier Piping

Carrier piping shall be as specified in 2503 PIPE SEWERS – PRESSURE.

The pressure rating specified for the carrier pipe in their respective specifications sections shall be considered a minimum. Provide a higher class of pipe if required by the loads imposed by pulling operation.

B Drilling Fluids

Drilling fluid composition shall meet permit requirements and environmental regulations.

C Water

Contractor shall procure, transport, and store water as required for his operations.

D Locating Wire

Locating (tracer) wire shall be as specified in 2503 LOCATING WIRE FOR SEWER.

2503.3 CONSTRUCTION REQUIREMENTS

A Joining Pipe

Pipe fusing shall be done by qualified fusers. Certification of personnel and fusing of pipe shall comply with the requirements for gas lines in the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe, included in these specifications. All sanitary sewer main and tap service pipe of any diameter shall be butt fused.

B Monitoring

Contractor shall at all times provide and maintain instrumentation which will accurately locate pilot hole position in X, Y, and Z axis relative to ground surface. Drilling fluid flow rate and

pressure shall also be monitored. Engineer and the City shall have access to this data at all times during the operation.

The City of Duluth gas utility must be notified 2 Working Days prior to any excavation or directional drilling within 6 feet of a 6 inch or larger natural gas main. City personnel will be on site to monitor excavation and inspect any exposed steel main 6 inches or larger. Notify the Engineering Division at 218-730-5200 to coordinate this inspection.

The Contractor shall notify the Engineer immediately any time a steel natural gas main smaller than 6 inches is exposed within an excavation. Contact the Engineering Division at 218-730-5200 to coordinate an inspection of the exposed main.

Prior to the start of any directional drilling, the Contractor shall pothole all proposed utility and service line crossing locations to confirm the depth of the main. The Contractor shall maintain the excavation or reopen the excavation to verify that pilot hole, pre-reaming, and back-reaming drilling operations did not interfere or damage existing facilities. In addition to all crossing facilities either shown on the Plans and/or as located in the field as a result of the GSOC locate request, the Contractor should anticipate potholing for crossing private water, sewer and gas services to homes and businesses. All costs associated with monitoring shall be incidental to pertinent pipe bid items.

C Pilot Hole

A pilot hole shall be drilled along the path shown on Drawings to the following tolerances:

(1) Elevation: Plus 0.5 feet, minus 0.5 feet for low pressure sanitary sewer.

(2) Alignment: Plus or minus 1 foot for low pressure sanitary sewer.

(3) Curve Radius: minimum 250 feet or pipe manufacturer's recommendation, whichever is greater.

(4) Entry Point: At the location shown on Drawings.

(5) Exit Point: Pilot hole shall penetrate ground surface within plus or minus 10 feet of alignment shown on Drawings and within plus 20 feet and minus 0 feet of length shown on Drawings. In all cases, pipe shall remain within easement and right-of-way areas.

Contractor shall plot actual horizontal and vertical alignment of pilot bore at intervals not exceeding 25 feet for low pressure sanitary sewer. This "as-built" plan and profile shall be updated as pilot bore is advanced.

In all cases, right-of-way restrictions shall take precedence over the tolerances listed above. Regardless of the tolerance achieved, no pilot hole will be accepted if it will result in any

or all of pipeline being installed in violation of right-of-way restrictions. In all cases, concern for adjacent utilities and structures shall take precedent over the tolerances listed above. Specification of tolerances does not relieve Contractor from responsibility for safe operations or damage to adjacent utilities and structures.

After completion of pilot hole drilling, Contractor shall provide a tabulation of coordinates to Engineer, referenced to drilling entry point, which accurately describes location of the pilot bore alignment and profile. No further work may proceed without acceptance of the pilot bore alignment and profile in writing from the Engineer.

D Reaming and Casing Pipe Pull-Back Operation

D.1 General

Upon completion of pilot hole drilling, hole shall be enlarged by reaming and preassembled pipeline pull section shall be installed in hole. Pipeline shall be preassembled to provide one continuous pulling operation. Pipeline shall be

temporarily capped before pulling operations to prevent any drilling fluid, water, or debris from entering pipeline.

D.1.a Prereaming

Prereaming operations shall be conducted at discretion of Contractor. All provisions of this specification relating to simultaneous reaming and pulling back operations shall also pertain to prereaming operations.

D.1.b Backreaming

Backreamer must be of large enough diameter to insure a competent tracer wire can also be pulled back with the pipe.

D.2 Pulling Loads

The maximum allowable tensile load imposed on the pipeline pull section and used for setting weak-link devices for polyethylene pipe shall be in accordance with in accordance with MAB-3 “MAB Model Specifications for PE4710 Buried Potable Water Service, Distribution and Transmission Pipes and Fittings” available from the Plastic Pipe Institute website (https://plasticpipe.org/common/Uploaded%20files/Technical/MAB-03.pdf). The maximum allowable tensile loads for polyethylene pipe shall be within the values shown in the following table for pull durations up to 12 hours and material temperatures of 73°F. For longer pull durations or higher pipe material temperatures, these values will be recalculated by the Engineer. If more than one value is involved for a given pull section, the lesser value shall govern. The Contractor shall maintain accurate records of pull forces at all times for review by the Engineer. The “weak link” may be a pulling head or next smaller diameter pipe (same SDR) than the pipe being pulled.

Table 2503-1: Maximum Allowable Tensile Load for HDPE Pipe

SIZE		SDR	LBS.
4”	DIPS	11.0	7,956
6”	DIPS	11.0	16,440
8”	DIPS	11.0	28,282
10”	DIPS	11.0	42,546
12”	DIPS	11.0	60,168
14”	DIPS	11.0	80,835
16”	DIPS	11.0	104,548
20”	DIPS	11.0	161,110
24”	DIPS	11.0	229,856

Table 2503-1 Notes:

(1) Material temperature @ 73°F

(2) Pipe under tension ≤ 12 hours

D.3 Torsional Stress

A swivel shall be used to connect pipeline pull section to reaming assembly to minimize torsional stress imposed on section.

D.4 Pull Section Support

Pull section shall be supported as it proceeds during pull-back so that it moves freely and pipe is not damaged.

D.5 External Collapse Pressure

Pull section shall be installed in reamed hole in such a manner that external pressures are minimized. Any damage to pipe resulting from external pressure during installation shall be the responsibility of Contractor.

D.6 Buoyancy Modification

Buoyancy modification shall be used at the discretion of Contractor. Any buoyancy modification procedure proposed for use shall be submitted to Engineer for acceptance. No procedure may be used which has not been reviewed by Engineer. Contractor will be responsible for any damage to the pipeline resulting from buoyancy modification.

E Drilling Fluids

E.1 General

Drilling fluids shall be in compliance with environmental regulations.

E.2 Recirculation

Contractor shall employ his best efforts to minimize excess drilling fluid by recirculating surface returns. This shall include, but not be limited to, provision of a solids control system sized and configured to remove spoil from drilling fluid surface returns so that fluid may be returned to active system without hindering drilling progress.

E.3 Inadvertent Returns

Contractor shall employ his best efforts to maintain full annular circulation of drilling fluids. Drilling fluid returns at locations other than entry and exit points shall be minimized. In the event that annular circulation is lost, Contractor shall take steps to restore circulation. If inadvertent surface returns of drilling fluids occur, they shall be immediately contained with hand placed barriers (hay bales, sandbags, silt fences, etc.), and collected using pumps, where practicable. If amount of surface return is not great enough to be collected, affected area shall be flushed with fresh water and fluid shall be allowed to dry and dissipate naturally. If amount of surface return exceeds that which can be contained with hand-placed barriers, small collection sumps (less than 5 cubic yards) may be used. If amount of surface return exceeds that which can be contained and collected in small sumps, drilling operations shall be suspended until surface return volumes can be brought under control. Clean-up of inadvertent returns shall be the responsibility of Contractor.

E.4 Disposal

Disposal of excess drilling fluids and spoil shall be the responsibility of Contractor and shall be conducted in compliance with environmental regulations, right-of-way and workspace agreements, and permit requirements. Drilling fluid and spoil disposal procedures proposed for use shall be submitted to Engineer for acceptance. No procedure may be used which has not been reviewed by Engineer.

F Damage to Surfaces

The contractor will be responsible for restoration of damage caused by drilling, pulling pipe or drilling equipment to surrounding street, parking lot and driveway pavement, sidewalk and curb and gutter and turf by the contractor's equipment at no cost to the City.

G Locating Wire

The locating wires shall be pulled along with the pipe. **The Contractor must pull a minimum of two (2) wires in the event one locating wire does not pass the continuity test.** Wire shall meet the provisions of 2503 LOCATING WIRE FOR SEWER of this Standard. The Contractor shall be responsible for the installation of a locating wire with electrical continuity throughout the entire length. The locating wire shall be made accessible as shown on the City

Standard Details listed in Appendix D or the Contract Drawings. The cost of furnishing and placing locating wire shall be considered incidental to the pipe.

H Testing

H.1 Pressure and Leakage Test

Pressure and leak test of carrier piping shall be as specified in 2503 PIPE SEWERS – PRESSURE.

H.2 Testing Locating Wire Continuity

Test locating wire continuity after installation of each section of continuous tracer wire. The Contractor shall be responsible for the installation of at least one locating wire with electrical continuity throughout the entire length. No payment shall be made for a pipe with a tracer wire that has not passed a continuity test.

2503.4 MEASUREMENT AND PAYMENT

Payment for Horizontal Directional Drilling – Pipe Sewers shall be compensation in full for all costs of furnishing and installing HDPE pressure sewer or force main between the locations shown on the Contract Drawings, including all materials, labor, equipment, HDPE pressure sewer or forcemain pipe and fittings, appurtenances, HDPE by MJ adapters, HDPE to cast iron transition couplings, zinc anode caps, locating wire, excavation, bedding, encasement materials, placing and compacting backfill, testing and incidentals. All costs of furnishing and installing electrofusion flex restraints and concrete collars on the HDPE pressure sewer or forcemain shall be considered incidental to the main.

No payment shall be made for pipe with a tracer wire that has not passed the continuity test. No payment shall be made until drilling logs and installed pipe profiles are provided to the City for each pipe that payment is requested for.

The City will pay for pipe placed by horizontal directional drilling on the basis of the following schedule:

Item No.	Item	Unit
2503.603	(size) DIP Forcemain - HDD	linear foot
2503.603	(size) HDPE Pressure Sewer - HDD	linear foot
2503.603	(size) HDPE Forcemain SDR 11 - HDD	linear foot
2503.603	(size) HDPE SDR 11 Pressure Sewer Service Pipe - HDD	linear foot

No payment shall be made for a pipe with a tracer wire that has not passed a continuity test.

2503 LOCATING WIRE FOR SEWER

2503.1 DESCRIPTION

Locating wire shall be installed on all HDPE and PVC sewer (sanitary or storm) mains and services.

2503.2 MATERIALS

A Locating Wire for Open Cut installations

Locating (tracer) wire shall be #12 solid copper with "HMWPE" 30 mil insulation. Insulation for sanitary and storm sewer shall be green. To minimize splices, wire shall be supplied on spools of not less than 500 feet. **Copper clad steel wires are NOT acceptable.**

B Locating Wire for Directional Drilled Installations.

Two (2) wires shall be pulled for all directional drilled installations. Locating wire shall be **1/8-inch diameter** 7x7 or 7x19 strand braided type 304 alloy stainless steel. The conductors shall be insulated with 45 mil high-density polyethylene (HDPE) jacketing. Insulation for sanitary and storm sewer shall be green. The wire shall be tested in accordance with ASTM B-1 and D-1248 and spark tested at 7500 VAC. The minimum breaking strength of the wire shall be at least **1700 pounds**; wire that has less than this breaking strength shall not be accepted. To minimize splices, wire shall be supplied on spools of not less than 500 feet. **Copper clad steel wires are NOT acceptable.**

C Locating Wire for Pipe Bursting.

Two (2) wires shall be pulled for all pipe bursting installations. Locating wire shall be **3/16-inch diameter**, 7x7 or 7x19 strand braided type 304 alloy stainless steel. The conductors shall be insulated with 45 mil high-density polyethylene (HDPE) jacketing. Insulation for sanitary and storm sewer shall be green. The wire shall be tested in accordance with ASTM B-1 and D-1248 and spark tested at 7500 VAC. The minimum breaking strength of the wire shall be **3700 pounds**; wire that has less than this breaking strength shall not be accepted. To minimize splices, wire shall be supplied on spools of not less than 500 feet. **Copper clad steel wires are NOT acceptable.**

D Locating Wire Splices

Tracer wire shall remain continuous to the greatest extent possible. Splices in the copper tracer wire should be made with solder or split bolt type connectors. Splices in the stainless-steel tracer wire should be made with split bolt type connectors. Wire nuts or clip type connectors shall not be used. All connections shall be protected to make them watertight. Waterproofing material shall be 3M 2200 or equal.

E Locating (Tracer) Boxes

Locating Boxes for sanitary and storm sewer applications shall be Snake Pit's magnetized tracer boxes from Copperhead Industries, LLC, (or approved equal) as follows:

Table 2503-1: Required tracer box models (or approved equal)

Color	Installation Type	Model
Green	Turf	Snake Pit Lite Duty Box Model LD14GTP
Green	Bituminous	Snake Pit Roadway Box Model RB14GTP
Green	Concrete	Snake Pit Roadway Box Model RB14GTP

The tracer box shall have a green powder coated cast iron cover for sanitary and storm sewer.

All tracer box covers shall have insulated brass connecting lug for direct connection hook-up for a locator transmitter.

All tracer box covers shall have an alpha character stamped on top of the pentagon security bolt. Characters shall be "ST" for storm or "SN" for sanitary.

The Contractor may also use Snake Pit Style boxes with an adjustable top as an acceptable equal for turf installations only. All other substitutions must be approved by the City prior to bidding.

All tracer wire boxes must include a manually interruptible conductive/connective link between the terminal(s) for the tracer wire connection and the terminal for the grounding anode wire connection.

F Anodes for tracer wire conductivity

Anodes shall be 1 pound (minimum) magnesium anode.

2503.3 CONSTRUCTION REQUIREMENTS

The locating wire for sewer shall be brought to the ground surface at locations shown on the City Standard Details listed in Appendix D, Contract Drawings or the Special Provisions through a locating box. The wire shall be connected to the tracer box terminal.

Locating wire installed on new services on existing mains where no locating wire is currently present shall be connected to a minimum 1-pound magnesium anode installed at the main.

Anodes (1 pound) shall also be installed at all dead ends on tracer wire. Anodes (1 pound) shall be installed on all tracer wire at a maximum interval of 500 feet.

Locating (tracer) boxes shall also be installed on all tracer wire at a maximum interval of 500 feet where valves, services, or other connections are not available.

The locating wire shall be laid directly over the utility. The Contractor shall be responsible for the installation of a locating wire with electrical continuity throughout the entire length.

For open cut installations, the contractor shall install a loop in the tracer wire at the location of each service connection so that the service may be installed later without splicing the tracer wire.

2503.4 MEASUREMENT AND PAYMENT

All locating wire installed shall be tested for continuity at the completion of the installation. No payment shall be made for pipe with a tracer wire that has not passed the continuity test.

Tracer wire and boxes shall be supplied by the Contractor. There shall be no measurement or payment for tracer wire. The cost of furnishing and placing locating wire shall be considered incidental to the utility.

The Contract Unit Price for Tracer Box shall be compensation in full for all materials, labor and equipment necessary to furnish and install the tracer box where specified in the City Standard Details listed in Appendix D, Contract Drawings or Special Provisions.

The City will pay for tracer boxes on the basis of the following schedule:

Item No.	Item	Unit
2503.602	(type) Tracer Box	each

2504 WATER MAIN AND SERVICE LINE INSTALLATION

2504.1 DESCRIPTION

This work shall consist of the construction of water main and building service pipelines utilizing plant fabricated pipe and other appurtenant materials, installed for conveyance of potable water.

All references to Specifications of AASHTO, ASTM, ANSI, AWWA, etc. shall mean the latest published edition or supplement available on the date of advertisement for bids.

2504.2 MATERIALS

A General Requirements

All materials required for this work shall be new material conforming to requirements of the referenced specifications for the class, kind, type, size, grade and other details indicated in the Contract. Unless otherwise indicated, all required material shall be furnished by the Contractor. If any options are provided for, as to type, grade or design of the material, the choice shall be limited as may be stipulated in the Contract Drawings or Specifications.

All manufactured products shall conform in detail to such standard design drawings as may be referenced or furnished in the Contract Drawings. Otherwise, the City may require advance approval of material suppliers, product design, or other unspecified details as it deems desirable for maintaining adopted standards.

All pipe furnished for water main and service installations shall be of the type, kind, size and class indicated for each particular line segment as shown on the Contract Drawings and designated in the Contract Items. Wherever connection of dissimilar materials or designs is required, the method of joining and any special fittings employed shall be subject to approval of the Engineer.

B Ductile Iron Pipe

Ductile Iron Pipe shall conform to the latest requirements of ANSI/AWWA C151/A-21.51. In addition, the pipe shall comply with the following supplementary provisions:

(1) All pipe shall be furnished with cement mortar lining meeting the latest requirements of ANSI/AWWA C104/A-21.4-08 for standard thickness lining. All interior surfaces of the pipe shall have an asphaltic coating at least one mil thick.

(2) The exterior of the pipe shall be coated with a layer of arc-sprayed zinc per ISO 8179. The mass of the zinc applied shall be 200 g/m2 of pipe surface area. A finishing layer asphaltic topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils with a local minimum not less than 2 mils. The coating system shall conform in every respect to ISO 8179-1 “Ductile iron pipes – External zinc-based coating – Part 1: Metallic zinc with finishing layer. Second edition 2004-06-01.

(3) All pipe shall be furnished with push-on type joints conforming to ANSI/AWWA C111/A-21.11 unless specified otherwise in the Special Provisions or shown on the contract drawing.

(4) When specified in the Special Provisions or shown on the Contract Drawings, joints shall be boltless, flexible, push-on restrained joint such as Flex-Ring by AMERICAN, or TR Flex by US PIPE. Field adaptable restrained joints may be provided through the use of Field Flex-Ring restraints by AMERICAN.

(5) Where shown on the Contract Drawings, flange joints shall be provided. Flanges shall be standard AWWA C115/A21.15lb threaded on flanges for 250 psi operating pressure. Bolt on flanges such as Uni-flange or Mega-flange may not be substituted for flanged pipe.

(6) All pipe shall be furnished in 18 or 20-foot nominal lengths.

(7) Minimum ANSI thickness class furnished shall be Class 52 for all pipe through 16” pipe. For pipes larger than 16” the appropriate class shall be called out in the Special Provisions. Above grade flanged pipe shall be class 53.

(8) Pipe shall be provided with provisions to maintain electrical continuity for thawing and locating purposes.

(9) A Certificate of Compliance shall be furnished stating that the materials furnished have been tested and are in compliance with the requirements of this Specification.

C Ductile Iron Fittings

Fittings shall conform to the latest requirements of ANSI/AWWA C110/A-21.10-08 (Gray Iron and Ductile Iron Fittings), or ANSI/AWWA C153/A-21.53 (Ductile Iron Compact Fittings), all with ductile iron glands and cement lining.

(1) Buried fittings shall be mechanical joint with rubber gaskets.

(2) Exposed fittings shall be flanged conforming to ANSI B16.1, Class 125 and have full face gaskets.

(3) Exposed fittings shall be shop primed for painting.

(4) Fittings shall be provided with provisions to maintain electrical continuity.

(5) Fittings shall be manufactured in North America or preapproved by the City Chief Engineer of Utilities.

(6) Mechanical joint bolts shall be as specified elsewhere in this section.

(7) When specified in the Special Provisions or shown on the Contract Drawings, buried fittings shall be boltless, flexible, push-on restrained joint fittings such as Flex-Ring by AMERICAN, or TR Flex by US PIPE. Field adaptable restrained joints may be provided through the use of Field Flex-Ring restraints by AMERICAN.

D Steel Pipe and Fittings

Steel Pipe shall conform to the requirements of AWWA C202. The grade of steel used in making the pipe and fittings shall be Grade B as covered in AWWA C201 and C202. Joints shall be as specified on the Contact Drawings or in Special Provisions. Pipe coating interior and exterior shall conform to AWWA C203. Scotchkote 202 (3M) or approved equal is also acceptable.

Fittings shall meet the same coating requirements and conform to AWWA C207 and C208. Steel weld flanges shall be installed on the pipe for connecting to valves and flanged appurtenances.

All steel shall be made in North America. The Contractor shall provide certification of steel origin to Engineer prior to installation.

E HDPE Pipe

(1) Water main and service pipe **4 inch and greater** shall be polyethylene pipe conforming to ASTM 3035 and AWWA C906-15, Polyethylene (PE) Pressure Pipe and Fittings, 4" through 63", for Water Distribution. Pipe furnished shall be approved for potable water and marked to indicate so with a minimum of three continuous blue stripes. **Pipe shall be PE4710 compound conforming to ASTM D3350 minimum cell classification 445574C-CC3, Pressure Class 200, SDR 11, at 73 deg. F. and have outside diameters similar to ANSI A-21.51 ductile iron pipe (DIPS).** Joints shall be butt heat fusion type, ASTM F2620. Ends shall be plain for butt fusion joining as specified in the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe.

(2) Water main and service pipe **3 inch and smaller** shall be polyethylene pipe conforming to the requirements of AWWA C901, current edition, "Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm), For Water Service" and ASTM D2239 or D3035. **Pipe shall be PE4710 compound conforming to ASTM D3350 minimum cell classification 445574C-CC3, SDR 9, shall have a minimum working pressure of 250 psi at 73 deg. F. and have outside diameters similar to iron pipe size (IPS).** Joints shall be butt heat fusion type, ASTM F2620. Joints may be socket fused type for service pipes 3 inch and smaller. Ends shall be plain for butt fusion joining as specified the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe.

(3) Pipe shall be new or stored for a period of time that does not exceed the manufacturer's recommended maximum period of exposure, regardless of the method of storage. New pipe shall be delivered with plastic end caps to keep the interior of the pipe free from contaminants.

(4) The SDR number and pressure rating specified above shall be considered a minimum. Provide stronger class pipe if required by loads imposed by directional drilling pulling operation or pipe bursting.

(5) Shop drawings for HDPE pipe must specify minimum allowable pipe deflection radius.

(6) Reference Standards - American Society for Testing and Materials (ASTM)

ASTM D638 – Tensile Method for Tensile Properties of Plastics

ASTM D790 – Test Materials for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D3035 – Polyethylene (PE) Plastic Pipe (DR-PE) Based on Controlled Outside Diameter
ASTM D3261 – Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene Plastic Pipe and Tubing
ASTM D3350 – Polyethylene Plastic Pipe and Fittings Material
ASTM F714 – Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F2206 – Fabricated Fittings of Butt-Fused Polyethylene Plastic Pipe, Fittings, Sheet Stock, Plate Stock or Block Stock.
ASTM F2620 – Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.

F HDPE Fittings for pipe 4 inch and greater

(1) Water main fittings and service fittings for pipe **4 inch and greater** shall be polyethylene pipe conforming to ASTM 3035 and AWWA C906-15, Polyethylene (PE) Pressure Pipe and Fittings, 4" through 63", for Water Distribution. **Fittings shall be PE4710 compound conforming to ASTM D3350 minimum cell classification 445574C-CC3, Pressure Class 200, SDR 11, at 73 deg. F. and have outside diameters similar to ANSI A-21.51 ductile iron pipe.** Fittings shall be butt heat fusion type, ASTM F2620. Ends shall be plain for butt fusion joining as specified in the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe.

(2) All fittings for 4-inch through 12-inch pipe must be molded if a molded fitting is available including all 45 degree elbows, 90 degree elbows and tees. If a molded fitting is not manufactured, then a fabricated fitting may be used.

(3) All 8 x 6 reducers shall be molded or machined. Reducers larger in size may be fabricated. Fabricated reducers shall have a maximum transition angle of 45 degrees. Reducers made by heating and deforming (squeezing or expanding) a piece of pipe are not acceptable. Molded and fabricated fittings by Plasson USA, George Fischer Central Plastics or Integrity Fusion Products.

(4) All fabricated fittings shall be rated for a minimum operating pressure of 200 psi. All fabricated fittings shall be equivalent diameter ratio 11, where the I.D. of the fitting is maintained at the full inside diameter of an equivalent sized SDR 11 pipe, and reinforced externally if necessary to maintain the pressure rating. Fabricated 90 degree elbows shall have a minimum of 4 sections. Fabricated 45 degree elbows shall be 2 sections. Fabricated reducing tees may be made using

branch saddles. Branch diameter shall not exceed two thirds the diameter of the main size, except that 6-inch branch saddles may be installed on 8-inch pipe. Fabricated non-reducing tees and all crosses shall be machined from thicker stock or externally reinforced to provide the 200 psi rating. Any fitting that uses a reduced inside diameter to meet the 200 psi pressure rating will be rejected. Fabricated fittings shall be manufactured by Plasson USA, George Fischer Central Plastics, or ISCO. All other brands of fabricated fittings shall be submitted to the City Chief Engineer of Utilities for pre-approval a minimum of 2 weeks prior to any bids. The City reserves the right to reject a fabricated fitting based solely upon an on-site inspection due to poor workmanship or questionable pressure rating.

(5) HDPE by MJ Adapters shall be molded and shall be manufactured by Central Plastics Company, Plasson USA, Integrity Fusion Products, or equal. The adapter shall comply with AWWA C906 and be manufactured for use on pipe conforming to ASTM D2513, D3035 and F-714. The adapter shall be molded from a PPI and NSF listed pre-blended virgin resin in accordance with the material specifications listed in ASTM D3350 with a cell classification of 445574C and be compatible for heat fusion with any pipe manufactured from a like or similar resin. Adapters shall be tested according to ASTM D1599 and ASTM D1598. HDPE Adapters shall be sized for use with ductile iron pipe size HDPE pipe. Adapters shall be used for all transitions from HDPE to valves, hydrants or ductile iron pipe. All adapters used on pipe larger than 12-inch in diameter shall have a 316 stainless steel stiffener. MJ Adapters for use with butterfly valves shall be designed and shop fabricated not to interfere with valve operation so that the valve can be fully opened. Hand beveling or tapering of MJ adaptors in the field will not be allowed. Mechanical joint bolts shall be as specified elsewhere in this section.

(6) HDPE wall anchors may be molded integral to the pipe or electrofused as specified below. Wall anchor shall cover the full circumference of the pipe.

(7) <u>Reference Standards - American Society for Testing and Materials (ASTM)</u>

ASTM D638 – Tensile Method for Tensile Properties of Plastics
ASTM D790 – Test Materials for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D3035 – Polyethylene (PE) Plastic Pipe (DR-PE) Based on Controlled Outside Diameter
ASTM D3261 – Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene Plastic Pipe and Tubing
ASTM D3350 – Polyethylene Plastic Pipe and Fittings Material

ASTM F714 – Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F2206 – Fabricated Fittings of Butt-Fused Polyethylene Plastic Pipe, Fittings, Sheet Stock, Plate Stock or Block Stock.
ASTM F2620 – Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.

G HDPE Fittings for pipe 3 inch and smaller

(1) Water main fittings and service fittings for pipe **3 inch and smaller** shall be polyethylene pipe conforming to the requirements of AWWA C901, current edition, "Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm), For Water Service" and ASTM D2239 or D3035. **Fittings shall be PE4710 compound conforming to ASTM D3350 minimum cell classification 445574C-CC3, SDR 9, shall have a minimum working pressure of 250 psi at 73 deg. F. and have outside diameters similar to iron pipe size.** Fittings shall be butt heat fusion type, ASTM F2620. Ends shall be plain for butt fusion joining as specified the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe. All fittings shall be molded polyethylene fused-type suitable for use on iron pipe size (IPS) HDPE pipe.

(2) Reference Standards - American Society for Testing and Materials (ASTM)

ASTM D638 – Tensile Method for Tensile Properties of Plastics
ASTM D790 – Test Materials for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D3035 – Polyethylene (PE) Plastic Pipe (DR-PE) Based on Controlled Outside Diameter
ASTM D3261 – Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene Plastic Pipe and Tubing
ASTM D3350 – Polyethylene Plastic Pipe and Fittings Material
ASTM F714 – Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F2206 – Fabricated Fittings of Butt-Fused Polyethylene Plastic Pipe, Fittings, Sheet Stock, Plate Stock or Block Stock.
ASTM F2620 – Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.

H HDPE Electrofusion Fittings

All electrofusion fittings shall be manufactured by Plasson USA, George Fischer Central Plastics Company, Integrity Fusion Products, or ISCO; AND shall meet the following requirements:

(1) Electrofusion Transition Service Saddle with Threaded Brass Insert and Tapping Tees with Electrofusion Saddle shall conform to the requirements for HDPE Pipe and Fittings as specified. The electrofusion transition service saddles shall be suitable for the installation of corporation stops as specified.

(2) Couplings used for water mains and services (4 inch and larger) shall be electrofusion type. Couplings used for services (3 inch and smaller) shall be electrofusion or socket fused type.

(3) Electrofusion flex restraints, for use as an attachment component for use where in line concrete thrust restraint is called for on the plan, shall be suitable for the size of pipe intended. Flex restraints shall cover the full circumference of the pipe.

(4) Any other brand of electrofusion fittings shall be submitted to the City Chief Engineer of Utilities for pre-approval a minimum of 2 weeks prior to any bids. Regardless of any pre-bid approvals or subsequent shop drawing approvals, the City reserves the right to reject any electrofusion fitting (including damages due to poor handling, storage, or workmanship) based solely upon appearance noted during an on-site inspection.

(5) Electrofusion fittings must be stored in the manufacturer's sealed shipping bag until incorporation into the work. All electrofusion fittings found in torn, ripped, or cut-open bags will immediately be unacceptable and not used in the work.

I Transition Couplings

I.1 Cast Transition Couplings – 4" through 12"

Cast transition couplings shall be furnished with ductile iron sleeves, ductile iron followers and 316 stainless steel bolts. Gaskets shall be natural or synthetic vulcanized rubber recommended for water system use. The finish shall be fusion bonded epoxy meeting ASTM C213. Couplings shall have a size range to connect cast iron to cast iron or cast to ductile iron, or ductile iron to ductile iron as necessary for the application. Estimated pipe outside diameters are shown in the table below. Latter dimension is maximum for pit cast end requirement. Contractor shall verify all pipe dimensions prior to ordering couplings. All couplings shall be rated for 250 psi minimum.

Table 2504-1: Estimated cast iron pipe outside diameters

Nominal Pipe Size	Cast Iron O.D. (In.)
4”	4.80 – 5.10
6”	6.90 – 7.20
8”	9.05 – 9.45
10”	11.10 – 11.50
12”	13.20 – 13.50

Couplings shall be Smith Blair 441, JCM 210, Ford FC1, Krausz Hymax, Romac Macro HP, or approved equal.

I.2 Cast Transition Couplings – 16”

Cast transition couplings (16” size) shall meet the above requirements. Estimated pipe diameters for transition are 17.40” cast or ductile iron pipe to 17.80” cast iron pipe. Contractor shall verify all pipe dimensions prior to ordering couplings. Minimum working pressure shall be 150 psi. Couplings shall be Smith Blair 441 or Ford FC2 or approved equal.

I.3 Steel Transition Couplings

Steel transition couplings (18” CI through 48” CI) shall be rated for 150 PSI working pressure. Components shall consist of a steel sleeve and follower coated with 12 mils of 3M epoxy #206N. Bolts shall be 316 stainless steel. Gasket shall be Grade 30 rubber. The couplings shall be designed to connect ductile iron pipes to old cast iron pipes, sizes as follows:

Table 2504-2: Ductile iron pipe to cast iron pipe size conversion

Nominal Pipe Size	Ductile Iron O.D. (In.)	Cast Iron O.D. (In.)
18”	19.50	19.50 – 19.92
20”	21.60	21.60 – 22.06
24”	25.80	25.80 – 26.32
36”	38.30	37.96 – 38.70
42”	44.50	44.20 – 44.50
48”	50.80	50.50 – 50.80

More than one gasket shall be furnished if necessary to allow connection over the entire cast iron O.D. range. If the gaskets furnished are not interchangeable for all the connection pipe size, then each gasket must be clearly labeled or its container labeled to indicate its applicable pipe O.D. range.

Couplings shall be JCM 203, Rockwell #413 or approved equal.

I.4 Transition Couplings for HDPE Main and Services

The HDPE to cast iron or ductile iron transition couplings shall be furnished and installed from new HDPE pipe to existing pipe. The transition couplings shall be Smith Blair model 441 or equal. HDPE pipe stiffeners shall also be provided and installed to prevent compression of the HDPE pipe. Pipe stiffeners shall be Smith Blair or equal. Stiffeners shall be designed to prevent over insertion. This transition coupling shall only be used where approved by the Engineer.

Transition couplings **2-inch and smaller** shall consist of HDPE by flared swivel brass or flared swivel stainless steel connections. HDPE shall be plain end for butt fusing. Coupling shall be manufactured by Poly-Cam, Inc., Central Plastics, Inc. or equal.

I.5 Restrained Couplings

Restrained couplings for used in joining like or unlike pipe materials shall be Romac Alpha Wide Range Restrained Joint couplings or Alphas XL or equal in sizes 4" through 12". No other brands of restrained couplings are currently approved for use. All cast components (end rings, center ring, grippers and bolt guides) shall be ductile iron, meeting or exceeding the requirements of ASTM A536, grade 65-45-12. Grippers shall be machine sharpened and heat treated. Gaskets shall be nitrile butadiene rubber compounded for water and sewer service in accordance with ASTM D2000, NSF61 certified. Ramp runners shall be reinforced nylon. All bolts and nuts shall be 316 stainless steel with anti-galling protection. Center ring shall be fusion bonded epoxy in accordance with AWWA C213 and NSF 61 certified. Couplings shall be rated for a working pressure of 350 psi. Coupling shall be used where shown on the contract drawings for cast iron, ductile iron, or HDPE pipe.

J Bell Joint Leak Clamps (3" through 36")

Clamps shall fit AWWA sand cast pipe classes A, B, C, and D and centrifugally cast pipe diameters. Bell and spigot rings shall be ductile iron, Cor-Ten or similar low corrosion type bolts (All bolts and nuts shall be 316 stainless steel with anti-galling protection.), with gaskets suitable for water service. Bell joint leak clamps shall not be installed on new mains.

K Band Type Repair Clamps

Clamps shall be single band full circle type with a gridded, tapered, overlapping Buna-N Grade 60 gasket designed for repair of water mains. Clamp shall have a stainless steel (Type 316) band and bridge plate, stainless steel (Type 304) lugs, and stainless steel (Type 316) bolts and nuts spaced not more than 2.5 inches c-c. Provisions shall be provided for electrical continuity which will withstand a 10 minute 400-amp current (water filled pipe condition) with no harmful effects. This specification is for band clamps ranging in size from 2" through 12" and widths approximately 7-1/2" to 15". Clamp shall be PowerSeal Model 3121CS or Ford FS1. All other

models must be approved prior to bidding by the Chief Engineer for Utilities. Clamp 16" and larger shall be PowerSeal 3122SST. Band Type Repair Clamps must fit the following O.D. range:

Table 2504-3: Band type repair clamps O.D. range

Pipe Size	Steel O.D. (In.)	Ductile or Cast Iron O.D. (In.)
2"	2.35 – 2.63	-
3"	3.36 – 3.60	3.73 – 4.00
4"	4.45 – 4.73	4.80 – 5.10
6"	6.56 – 6.96	6.90 – 7.20
8"	8.54 – 8.94	8.99 – 9.39
10"	10.64 – 11.04	11.10 – 11.40
12"	12.60 – 13.00	13.20 – 13.50
16"	-	17.13 – 17.90

L Tapping Sleeves

L.1 Tapping Cast Iron, Ductile Iron or Steel Mains

(4" though 10" tap on 6" through 30" cast iron, ductile iron or steel mains) Sleeves shall conform to AWWA C223 and consist of two sections of heavy welded **stainless steel** (Type 316) which bolt together on a main pipe and seal against a full encirclement gasket. Flange shall be AWWA C228 Class SD, ANSI 175 pound (sizes up to 12") or ANSI 150 pound (sizes greater than 12") suitable for mating to a flange by mechanical joint gate valve. Outlet body shall have a 3/4-inch NST test plug. Fitting shall be Type 316 stainless steel. Bolts and nuts shall be Type 316 stainless steel. Fitting shall be similar or equal to **PowerSeal 3490** tapping sleeve or **JCM 452** tapping sleeve and in the sizes and O.D. ranges specified.

L.2 Tapping HDPE Mains

Sleeves shall conform to AWWA C223 and consist of two sections of heavy welded stainless steel (Type 316) which bolt together on a main pipe and seal against a full encirclement gasket. Flange shall be AWWA C228 Class SD, ANSI 175 pound (sizes up to 12") or ANSI 150 pound (sizes greater than 12") suitable for mating to a flange by mechanical joint gate valve. Outlet body shall have a 3/4-inch NST test plug. Fitting shall be 316 stainless steel. Bolts and nuts shall be Type 316 stainless steel. Fitting shall be similar or equal to JCM model 452 tapping sleeve (currently no other product is considered equal for use with HPDE main pipe without field testing by City of Duluth).

The size of the tap pipe shall be restricted to a maximum of two-thirds of the size of the HDPE main pipe, except that a 6" tap on 8" HDPE main will be acceptable.

Stainless steel tapping sleeves for HDPE pipe shall ONLY be used where approved by the Chief Engineer for Utilities.

M Fire Hydrants

Fire Hydrants shall be Waterous Pacer Traffic Model WB67-250 or Mueller Super Centurion 250-A423 conforming to the requirements of AWWA C502 and the following supplemental requirements:

(1) Main Valve Opening – 5 1/4 inches nominal diameter.

(2) Bury Depth – 8 1/2 feet measured from the bottom of the branch pipe connection to the finished ground line at the hydrant.

(3) Upper Standpipe Length – 22 inches or 16 inches.

(4) Nozzles – One pumper nozzle, City of Duluth Standard thread per **City Standard Detail W-16** listed in Appendix D; and two hose nozzles, 2 1/2 inch (ID), with National Standard Fire Hose Coupling Screw Threads. One of the hose nozzles shall have a manufacturer's provided 'vented cap'.

(5) Hydrant operating mechanisms shall be provided with Buna-N "O" ring seals preventing entrance of moisture.

(6) The exterior of the hydrant base shall be supplied with a fusion bonded epoxy coating.

(7) Connection shall be a 6-inch mechanical joint with an anchoring tee, tapping tee or tee complete with gland, Cor-Ten or similar low corrosion type bolts, and harnessing lugs. 6-ounce zinc anode caps conforming to ASTM B-418 shall be installed on the bolts on all mechanical joint fittings. Alpha restraint connection may be provided or fusible HDPE stubs of the same pipe diameter and SDR as the hydrant lead pipe.

(8) Operating and nozzle cap nuts shall be a pentagon, 1-1/2 inches point to face. Operating nut shall be two-piece variation. Operating nut shall have an O-ring or seal ring to keep water and dirt from entering the bonnet. Opening shall be counterclockwise.

(9) Design of hydrant shall allow for removal of the main and waste valve seats without excavating or disturbing the ground.

(10) Portions of City owned hydrants above the ground line shall be primed and painted chrome yellow. Privately owned hydrants shall be primed and painted blue. Coating below the ground line shall be according to standards.

(11) A traffic flange and operating rod coupling shall be located not more than two inches above the ground line and be designed so that in the event of an accident

or breaking of the hydrant above the ground line, the main valve will remain closed.

(12) Lower flange on the nozzle section shall be the swivel type.

(13) Hydrants shall be provided with an outlet for drainage in the base or barrel, or between the base and barrel. Hydrants shall be provided with a suitable plug to be installed if directed by the Engineer.

(14) All hydrant bolts and nuts below grade shall be 316 stainless steel.

(15) Mechanical joint bolts shall be as specified elsewhere in this section.

(16) Hydrant Markers shall meet the following general requirements: 1) rods shall be 60" tall UV resistant fiberglass; 2) springs shall be zinc plated or type 304 stainless steel; 3) base plates shall be zinc plated steel, type 304 stainless steel, or powder coated steel 'top-mount' bracket; and 4) bands shall be 6" red and white highly reflective UV resistant tape/sheeting.

N Valves - General

Valve sizes twelve inches (12") and smaller shall be **gate** type. Valves sixteen inches (16") and larger shall be **butterfly** type exclusively. All valves shall be made in North America.

O Gate Valves (12" and smaller only)

Gate valves shall be manufactured and furnished in accordance with an approved pattern and shall conform to the requirements of AWWA C509 or C515 for resilient seated gate valves, and all gate valves must meet such supplementary requirements as may be stipulated in the Contract Drawings or Special Provisions and the provisions hereof.

Unless otherwise specified, the valves furnished shall comply with the following supplementary requirements.

(1) All gate valves shall have a working pressure rating of 250 psi.

(2) Gate valves shall be solid disc with resilient seating.

(3) The wedge shall be ductile iron and fully encapsulated with EPDM rubber.

(4) All valves shall be furnished with triple O-Ring stem seals. The O-Rings above the thrust collar shall be fully replaceable with the valve "open" and under full pressure. A third O-ring shall be provided below the thrust collar.

(5) Valves shall have a two-inch square operating nut opening counterclockwise.

(6) All valves shall be of the non-rising stem type.

(7) Each valve shall have mechanical joint ends or fusible HDPE stubs of the same pipe diameter and SDR as the main. MJ joints shall be complete with gasket, gland, and bolts. Bolts or valve flange shall be provided with means for preventing the bolt from slipping in the slotted holes. Alpha restraints may be provided for end connections when used for hydrant leads or with metallic main line piping.

(8) The exterior of the valve shall be supplied with a fusion bonded epoxy coating.

(9) All exposed bolts on the valve, including stuff box and bonnet bolts shall be 316 stainless steel.

(10) Mechanical joint bolts shall be as specified elsewhere in this section.

(11) Valves shall be manufactured by American Flow Control, Clow, Dezurik, Mueller, or equal. All "or equal" valves shall be preapproved by the City Chief Engineer for Utilities prior to bidding. All valves shall be made in North America. Shop drawings for gate valves shall include a statement attesting to their country of origin.

(12) Gate valve box adapters shall be ¼ inch steel adapter and ¾ inch neoprene gasket. The steel adapter shall be coated with polyurethane protective coating. Adapters shall be manufactured by Adaptor, Inc., or PowerSeal.

P Butterfly Valves (16" and larger sizes only)

Butterfly valves shall conform to the requirements of AWWA C504, Class 150B and all butterfly valves must meet such supplementary requirements as may be stipulated in the Contract Drawings or Special Provisions and the provisions hereof.

Unless otherwise specified, valves furnished shall comply with the following supplementary requirements:

(1) Unless otherwise noted in the Plan, all butterfly valves shall have a working pressure rating of 150 psi.

(2) Manual actuator equipped with standard 2-inch square operating nut, split V type or O-ring stem seal and enclosed in a lubricating gear box. For buried installations, valves shall be equipped with a side-mounted actuator designed to accept a valve box. Valves shall be permanently lubricated with no packing adjustment.

(3) Valve disc shall be cast iron conforming to ASTM 126, Class B or ASTM A48, Class 40, alloy cast iron conforming to ASTM A436 or A439, or ductile iron conforming to ASTM A536.

(4) Valves shall open counterclockwise.

(5) The exterior of the valve shall be supplied with a fusion bonded epoxy coating.

(6) Valves shall be furnished with mechanical joint ends.

(7) All exposed bolts, screws, washers or nuts on the valve shall be 316 stainless steel.

(8) Mechanical joint bolts shall be as specified elsewhere in this section.

(9) Valves shall be manufactured by American Flow Control, Valmatic, Clow, Dezurik, Henry Pratt, Mueller, Waterous, or equal. All "or equal" valves shall be preapproved by the City Chief Engineer for Utilities prior to bidding. All valves shall be made in North America. Shop drawings for butterfly valves shall include a statement attesting to their country of origin.

(10) Butterfly valve box adapters shall be ¼ inch steel adapter and ¾ inch neoprene gasket. The steel adapter shall be coated with polyurethane protective coating. Adapters shall be manufactured by Adaptor, Inc.

Q Valve Boxes

Valve Boxes shall be 5 1/4" cast iron shaft, 'three-piece' screw-type, consisting of the following parts:

Table 2504-4: Valve box components

Cover	Stay-put type, **"WATER"** cast thereon, with solid edges (no grooves or flutes on edge)
Top Section	26" or 26.5" length
Extension Section	30" length (effective 24" length)
Bottom Section	36" length
Base	#6 Round Base

All parts must be interchangeable with Bingham and Taylor #4906 and Tyler #6860. Valve box assemblies shall be manufactured in Northern America or preapproved by the Engineer.

Water valve pavement adjustment rings shall be ESS Brothers pavement adjustment ring or equal. Rings shall be cast iron.

R Copper Pipe and Fittings

(1) Copper pipe less than three inches in nominal diameter shall conform to the requirements of ASTM B88 for Seamless Copper Water Tube, Type K, Soft Annealed temper.

(2) Fittings for Copper Tubing shall be "No-Lead Brass", having uniformity in wall thickness and strength, and shall be free of defects affecting serviceability. No-Lead Brass shall not contain more than nine one hundredths of one percent (0.09% or less) total lead content by weight. All brass fittings shall meet AWWA C800 (latest revision), ASTM B584, ANSI/NSF Standard 61 and 372. All threads for underground service line fittings shall conform to the requirements of AWWA C800. Unless specified, the fittings furnished shall comply with the following requirements:

(a) Quarter (90°) bend corporation stop couplings and eighth (45°) bend corporation stop couplings shall be Mueller H-15068, AY McDonald 74779 and Mueller H-15063, AY McDonald 74747 respectively, or an approved equal. Couplings shall be provided with an inside copper service flare thread on one end and a copper tube flare nut on the other end.

(b) Three-part union couplings for connecting copper tubing to copper tubing shall be Mueller H-15400, A.Y. McDonald 74758 or an approved equal. Couplings shall be provided with copper tube flare nuts on both ends.

(c) Pack joint straight couplings for connecting copper tubing to copper tubing if specified, shall be Ford C44-XX-NL, A.Y. McDonald 74758-22 (as appropriate for the required size) or an approved equal. Both ends of couplings shall be pack joints, with split clamp joint nuts with 316 stainless steel set screws.

S Corporation Stops

Corporation Stops shall be Mueller H-15000N, A.Y. McDonald 74701 Ford F600 series or an approved equal. Inlet connection shall be a male tap end and shall have Mueller (cc) tapered threads conforming to AWWA Standard. Outlet connection shall be a copper service thread straight coupling connection suitable for use with ASTM B88 Type K copper service tubing and shall be provided with a copper tube flare nut.

T Curb Stops

Curb Stops shall be quarter turn check, Minneapolis Pattern thread top, with AWWA standard flared copper pipe connections on both ends. Curb stops shall be Mueller B-25154N, A.Y. McDonald 76104, Ford B22 series, or approved equal.

U Curb Boxes

Curb Box shall be magnetized tracer box style as specified in 2504 LOCATING WIRE FOR WATER, furnished and installed by the Contractor. Iron pipe for curb box shall be supplied by the City and installed by the Contractor as shown on the City Standard Details listed in Appendix D.

V Polyethylene Encasement Material

Polyethylene encasement shall be V-Bio. V-Bio encasement shall consist of three layers of co-extruded linear low density polyethylene (LLDPE), fused into a single thickness of not less than 8 mils. The inside surface shall be infused with a blend of antimicrobial biocide and a volatile corrosion inhibitor. Ductile iron water main shall be encased in polyethylene where shown on the Contract Drawings or required in the Special Provisions.

W Mechanical Joint Bolts

All mechanical joint bolts and nuts used on all buried fittings, valves and hydrants shall be high strength, low-alloy, corrosion resistant, Cor-Ten or similar low corrosion steel bolts. Bolts shall meet or exceed ASTM A242 or ASTM A588 and ANSI/AWWA C111/A21.11-17. Nuts shall meet or exceed ASTM A563 Grade C3 and ANSI/AWWA C111/A21.11-17. Bolts and nuts shall also have a base zinc plating and a “blue” colored fluoropolymer dry film coating and lubricant commonly referred to as polytetrafluoroethylene (PTFE) and under the product name of Xylan 1424, Cor-Blue, FluoroKote#1 or approved equal. Anode caps shall also be installed as specified below.

X Zinc Anode for Corrosion Protection

A 12-pound (minimum) zinc anode, packaged in backfill bag and copper lead wire, shall be attached to an MJ bolt for all fittings, valves, and hydrants as shown in the **City Standard Detail W-18** listed in Appendix D.

A 5-pound (minimum) zinc anode, packaged in backfill bag and copper lead wire, shall be attached to a brass clamp provided on all copper water service pipes as shown in the **City Standard Detail W-5** listed in Appendix D.

Anode shall be composed of LME Grade Zinc, Super High Grade Zinc, or High Grade Zinc conforming to ASTM B-418 Type II alloy standard. The anode shall be packaged in a low resistance backfill mixture (gypsum) bag and supplied with 10 feet of #12 solid copper lead wire that is connected to galvanized steel core by manufacturer.

Y Magnesium Anode for Locating (Tracer) Wire Continuity

A 1-pound (minimum) magnesium anode shall be provided at all dead ends on tracer wire, and/or at 500 feet maximum intervals. Refer to section 2503/2504 Locating Wire for Water and Sewer elsewhere in this standard.

Z Anode Bolt Caps

Zinc anode bolt caps shall be 6 ounce conforming to ASTM B-418. All MJ bolts, coupling bolts, saddle bolts, and any other buried bolts shall have anode caps installed.

2504.3 CONSTRUCTION REQUIREMENTS

A General Provisions

Water main shall be installed to provide a minimum 7.5 feet of cover over the top of the pipe (except that a minimum 8.0 feet of cover shall be provided for 'dead end' water main) AND provide minimum separation distance from other pipes and structures in accordance with the current edition of the '*Recommended Standards for Water Works*' published by Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Mangers (also commonly referred to as '10 states standards') unless otherwise approved by the Chief Engineer of Utilities.

In no case shall the water main be installed with less than six inches of clearance to another structure. Where the water main may be exposed to freezing due to insufficient cover or exposure from other underground structures, the water main shall be insulated as directed by the Engineer.

Requirements for site clearing, excavation, preparing trench, backfilling and restoration are contained in 2451 EXCAVATION, BACKFILL, AND COMPACTION FOR UTILITIES of these specifications and the State of Minnesota Department of Transportation "Standard Specifications for Construction 2025 edition" and shall govern the execution of work where the specifications therein are not in conflict with more specific requirements contained in this section, the City Standard Details listed in Appendix D, Contract Drawings or the Special Provisions.

All horizontal directional drilling shall be performed in accordance with 2504 HORIZONTAL DIRECTIONAL DRILLING – WATER of these specifications.

B Handling and Inspection

Proper and adequate implements, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. Unloading, distribution and storage of pipe and appurtenant materials on the job site shall be as approved by the Engineer. All materials shall be handled carefully, as will prevent damage to protective coatings, linings, and joint fittings; preclude contamination of interior areas; and avoid jolting contact, dropping, or dumping.

Before being lowered into laying position, the Contractor shall make a thorough visual inspection of each pipe section and appurtenant units to detect damage or unsound conditions that may need corrective action or be cause for rejection. Inspection procedure shall be as approved by the Engineer, with special methods being required as he deems necessary to

investigate suspected defects more definitely. The Contractor shall inform the Engineer of any defects discovered and the Engineer will prescribe the required corrective actions or order rejection. Any HDPE pipe with scratches, cuts or scrapes deeper than 10% of the wall thickness shall not be used unless the damaged section is cut out.

Immediately before placement, the joint surfaces of each pipe section and fitting shall be inspected for the presence of foreign matter, coating blisters, rough edges or projections, and any imperfections so detected shall be corrected by cleaning, trimming, or repair as needed.

Store pipe on level surface. Pipe may be placed in pyramidal stacks provided the number of courses recommended by manufacturer is followed and pipe is chocked on each side to prevent roll out of the layers. Cover pipe ends to prevent dirt, debris, wildlife and weather from entering. HDPE pipe stored for more than 3 weeks should be covered for protection from sunlight and weather.

Do not dump pipe from conveyance. Unload pipe 12 inches (300 mm) and smaller by hand with ropes and skids. Unload pipe larger than 12 inches (300 mm) or pipe bundles with mobile unloading equipment. Use wide slings for hoisting large pipe with boom trucks, cranes or lifts. Reinforced web slings are acceptable; chains, wire ropes or fiber ropes are not acceptable slings. Use of hooks for unloading is also unacceptable.

C Pipe Laying Operations

Trench excavation and bedding preparations shall proceed ahead of pipe placement as will permit proper placement and joining of the pipe and fittings at the prescribed grade and alignment without unnecessary hindrance. Every reasonable precaution shall be taken to prevent foreign materials from entering the pipe and fittings while they are being placed in the line. The water main materials shall be carefully lowered into laying position by the use of suitable restraining devices. Under no circumstances shall the pipe be dropped or dumped into the trench.

At the time of pipe placement, the bedding conditions shall be such as to provide uniform and continuous support for the pipe between bell holes. Bell holes shall be excavated as necessary to make the joint connection, but they shall be no larger than would be adequate. No pipe material shall be laid in water nor when the trench or bedding conditions are otherwise unsuitable or improper. Unless otherwise permitted by the Engineer, bell and spigot pipe shall be laid with the bell ends facing in the direction of laying.

When placement or handling precautions prove inadequate, in the Engineer’s opinion, the Contractor shall provide and install suitable plugs or caps effectively closing the open ends of each pipe section before it is lowered into laying position, and they shall remain so covered until removal is necessary for connection of an adjoining unit.

As each length of bell and spigot pipe is placed in laying position, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material, which shall be thoroughly compacted around the pipe. The joint areas shall remain exposed and precautions shall be taken to prevent the soil from entering the joint space, until the joint seal is affected.

At all times when pipe laying is not in progress, including noon hour and overnight periods, all open ends of the pipe line shall be closed by watertight plugs or other means approved by the Engineer. If water is present in the trench, the seals shall remain in place until the trench is pumped completely dry.

D Aligning and Fitting of Pipe

The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe and so as to leave a smooth square-cut end. Cast iron or ductile iron pipe shall be cut with approved mechanical cutters. The electric-arc cutting method, using carbon or steel rod, will be approved for use on the larger size pipe where mechanical cutters are not available. Flame cutting will not be allowed under any conditions. All rough edges shall be removed from the cut ends of pipe and, where rubber gasket joints are used, the outer edge shall be rounded or beveled by grinding or filing to produce a smooth fit.

When necessary to deflect the pipe from a straight line either in the vertical or horizontal plane, to avoid obstructions, or produce a long radius curve, the amount of deflection allowed at each joint shall not exceed the allowable limits established in the following tables:

Table 2504-5: Maximum Permissible Deflection in Laying Push-on Joint for Ductile Iron Pipe

Pipe Size	Max. Angle	18’ Pipe Length	20’ Pipe Length
3” to 12”	5°	19” (205’ radius)	21” (230’ radius)
16” to 24”	3°	11” (340’ radius)	12” (380’ radius)
30” to 36”	2°	7.5” (510’ radius)	8” (570’ radius)

Table 2504-5 Notes:

(1) Distance listed is the maximum offset per pipe

(2) Radii listed are approximate

Table 2504-6: Maximum Permissible Deflection in Laying Mechanical Joint for Ductile Iron Pipe

Pipe Size	Max. Angle	18’ Pipe Length	20’ Pipe Length
4”	8.3°	31”	35”
6”	7.1°	27”	30”
8” to 12”	5.3°	20”	22”
16”	3.5°	13”	15”
18” & 20”	3.0°	11”	12”
24” & 30”	2.3°	9”	10”
36”	2.0°	8”	9”

Table 2504-6 Notes:

(1) Distance listed is the maximum offset per pipe

Connection and assembly of joints shall be accomplished during the setting, aligning and fitting operations, in accordance with the provisions of this specification to the extent that the jointing requirements will permit.

HDPE pipe may be deflected at a maximum radius of 25 times the nominal pipe OD. When a fitting or connection is present, the maximum radius shall be 100 times the nominal pipe OD.

E Blocking and Anchoring of Ductile Iron Pipe

All plugs, caps, tees, bends and other thrust points shall be provided with reaction backing, or movement shall be prevented by attachment of suitable restraining devices, in accordance with the requirements listed below and the City Standard Detail listed in Appendix D.

(1) All horizontal bends, plugs, caps and branch tees shall be provided with concrete buttresses.

(2) For 16” and smaller diameter, precast concrete blocks may be used in lieu of cast in place concrete when used in conjunction with “Mega-lug” joint restraints. Precast blocks shall be stepped out as installed to provide similar surface area as the cast in place thrust blocks. Use of “Mega-lug” restraints only without blocking is only acceptable if adjacent pipe is restrained as described below.

(3) All vertical bends, except welded steel joints, exceeding 11-1/4 degrees deflection shall be provided with concrete buttress blocking at the low points with metal tie rod or strapping restraints at the high points.

(4) Offset bends made with standard offset fittings need not be strapped or buttressed, unless installed in combination with another fitting.

All necessary fittings, bands, tie rods, nuts, and washers, and all labor and excavation required for installation of reaction restraints shall be furnished by the Contractor and included in the contract unit price for the pipe installation.

Concrete blocking shall be at least two inches nominal thickness.

Concrete buttresses shall be poured against firm, undisturbed ground and shall be formed in such a way that the joints will be kept free of concrete and remain accessible for repairs. The concrete mix used in buttress construction shall meet the requirements for Concrete Mix No. 3G52 of MN/DOT 2461. Buttress dimensions shall be as indicated on the City Standard Details listed in Appendix D.

All metal parts of tie rod or strap type restraints shall be galvanized.

"Megalug" joint restraints by Ebba Iron, Inc., or Uni-Flange Series 1400 "Block Buster" by Ford, may be substituted for rodding and blocking. Retainer (set screw type) glands may not be used in lieu of approved restraints or buttresses. "Megalug" and "Blockbuster" restraints may only be used on ductile iron pipe and shall not be used on any existing cast iron pipe.

When using "Megalug" type restraints in lieu of blocking, the pipe shall be restrained in each direction from the fitting a sufficient distance to prevent joint separation upstream or downstream. The minimum length of restrained pipe required shall be as shown on the contract drawings or as specified in Special Provisions. If no minimum length for restrained joints is specified, the Contractor shall submit the restrained joint calculations to the Engineer for review prior to construction or restrain a minimum of 42 feet in each direction for pipes 12 inch and smaller in diameter.

F Blocking of HDPE Pipe

All plugs, caps, tees, bends, and other thrust points shall be provided with concrete blocking if there is an unstrained joint within 42 feet of the thrust point. Blocking is not required when all joints within 42 feet are restrained or fused. When required, concrete blocking shall be installed per the City Standard Details listed in Appendix D.

G Locating Wire

Locating (tracer) wire shall be installed on all plastic water mains and services.

H Polyethylene Encasement of Pipeline

Ductile iron pipe, valves, fittings, and appurtenances, shall be fully encased in V-Bio encasement where shown on the Contract Drawings or required in the Special Provisions. The film shall be furnished in tube form for installation on pipe and all pipe-shaped appurtenances such as bends, reducers, off-sets, etc. Sheet film shall be provided and used for encasing all odd-shaped appurtenances such as valves, tees, crosses, etc.

The polyethylene tubing shall be installed on the pipe prior to being lowered into the trench. Tubing lengths shall be sufficient to provide a minimum overlap at all joints of one foot or more. Overlap may be accomplished with a separate sleeve tube placed over one end of the pipe prior to connecting another section of pipe, or by bunching extra overlap material at the

pipe ends in accordion fashion. After completing the pipe jointing and positioning the overlap material, the overlap shall be secured in place with plastic adhesive tape wrapped circumferentially around the pipe not less than three turns.

After encasement, the circumferential slack in the tubing film shall be folded over at the top of the pipe to provide a snug fit along the barrel of the pipe. The fold shall be held in place with plastic adhesive tape applied at intervals approximately three feet along the pipe length. Also, any rips, punctures, or other damage to the tubing shall be repaired as they are detected. These repairs shall be made with adhesive tape and overlapping patches cut from sheet or tubing materials.

At odd-shaped appurtenances such as valves, the tubing shall overlap the joint and be secured with tape, after which the appurtenant piece shall be wrapped with a flat film sheet or split length of tubing by passing the sheet under the appurtenance and bringing it up around the body. Seams shall be made by bringing the edges together, folding over twice and taping down. Wherever encasement is terminated, it shall extend for at least two feet beyond the joint area.

Openings in the tubing for branches, service taps, air valves and similar appurtenances shall be made by cutting an X-shaped slit and temporarily folding back the film. After installing the appurtenance, the cut tabs shall be secured with tape and the encasement shall be completed as necessary for an odd-shaped appurtenance.

I Electrical Continuity in Ductile Iron Pipe

Provisions shall be made to ensure electrical continuity between all joints, fittings, and valves. Two serrated brass wedges shall be inserted for 2 inch to 12 inch push-on joints on ductile iron pipe or cable bond may be used. Four wedges per joint shall be used for larger pipe. Continuity for mechanical joints may be provided using copper clips inserted in the gasket by the manufacturer, armored tipped gaskets, copper strap, or cable bond. Megalug joint restraints shall not be used for electrical continuity.

J Connection and Assembly of Joints

J.1 General

Where rubber gasketed joints are specified, care shall be taken during the laying and setting of piping materials to insure that the units being joined have the same nominal dimension of the spigot outside diameter and the socket inside diameter. A special adaptor shall be provided to make the connection when variations in nominal dimension might cause unsatisfactory joint sealing.

Immediately before making the connection, the inside of the bell or socket and the outer surface of the spigot ends shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. Insertion of spigot ends into the socket or bell ends shall be accomplished in a manner that will assure proper centering and insertion

to full depth. The joint seal and securing requirements shall be as prescribed below for the applicable pipe and joint type.

No open ends of water main pipe will be allowed for more than one hour on any pipe section. Caps shall be mechanically attached to the end of the pipe. Taping and bagging the end of the pipe will not be allowed. The Contractor shall weight the pipe as necessary to prevent floatation.

J.2 Push-On Joints

The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the ball socket. A thin film of approved gasket lubricant shall be applied to either the inside surface of the gasket or the outside surface of the spigot end, or to both. Care shall be taken while inserting the spigot end to prevent introduction of contaminants. The joint shall be completed by forcing the spigot end to the bottom of the socket by the use of suitable pry-bar or jack type equipment. Spigot ends which do not have depth marks shall be marked before assembly to insure full insertion. Field cut pipe shall be filed or ground at the spigot edge to resemble the manufacturer's fabricated detailing.

J.3 Mechanical Joints

The last eight inches of the outside spigot surface and the inside bell surface of each pipe and appurtenance joint shall be painted with a soap solution after being thoroughly cleaned. The gland shall then be slipped on the spigot end with the lip extension toward the socket or bell end. The rubber gasket shall be painted with soap solution and be placed on the spigot end with the thick edge toward the gland. An approved lubricant provided by the pipe manufacturer may be used in lieu of the soap solution.

After the spigot end is inserted into the socket to full depth and centered, the gasket shall be pressed into place evenly around the entire joint. After the gland is positioned behind the gasket, all bolts shall be installed and the nuts tightened alternately to the specified torque, such as to produce equal pressure on all parts of the gland.

Unless otherwise specified, the bolts shall be tightened by means of a suitable torque-limiting wrench to within a foot-pound range of: 45 to 60 for 5/8" bolts; 75 to 90 for 3/4" bolts; 100 to 120 for 1" bolts, and 120 to 150 for 1-1/4" bolts.

J.4 Welded Joints for Steel Pipe

All steel pipeline welding shall be done by Certified Pipeline Welders in accordance with AWWA C206. Contractor shall furnish the City with evidence of certification at or prior to the contract award date unless a current certification is

presently on file with the City. Pipe and fittings shall be joined with a butt weld. Valves and other control devices shall be connected to the pipe with a steel flange welded to the pipe. Any exposed metal surface, weld or damaged coating shall be prepared and coated with an approved rust preventative prior to backfilling.

J.5 Qualifications for Joining HDPE Water Main Pipe

Before being permitted to make joints on the HDPE water main pipe, all joiners shall be qualified and successfully complete a qualification test as required in accordance with the Qualifications for Joining PE Pipe, of the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe.

J.6 Fusion Joining of HDPE Water Main and Service Pipe

All HDPE water main pipe and fittings shall be joined by butt fusion or electrofusion procedures as specified in the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe. Water branch or tap service pipe of any diameter shall be joined by butt fusion except where approved by the Engineer.

Socket couplings may also be used on tap service pipe where approved by the Engineer. Unless otherwise directed by the pipe manufacturer's recommendations, the heating tool surface temperature must be minimum 400^{o}F to 450^{o}F maximum.

The use of electrofusion couplings shall be minimized. Electrofusion couplings may not be installed directly on HDPE fittings. All fittings must have a minimum of 2'-0" stub of HDPE pipe butt fused directly to the fitting prior to installation of an electrofusion coupling. Use of an alignment clamp is required for installation of ALL electrofusion couplings. On 12" and larger HDPE pipes, rounding clamps must be used for installation of ALL electrofusion couplings AND prior to electrofusion, ALL couplings shall be checked with a feeler gauge to ensure the gap between the coupler and the pipe is within the manufacturers tolerance.

HDPE pipe shall be prepared prior to fusing by use of an approved peeler. Paint scrapers, wood rasp or together similar device shall NOT be used. The peeler shall remove a strip of material between 0.007" and 0.014" thick. The total cumulative thickness of material removed shall not exceed 0.04" when multiple passes are made with the peeler.

When peeling, the Contractor shall lightly precut the pipe longitudinally so that peels fall off and do not rub on the freshly peeled surface.

All pipe cleaning, peeling and fusion shall be completed in one continuous process. Where fittings are not immediately fused, the pipe must be peeled again in a

new location. During fusing operations, the pipe must be protected from dirt and dust accumulation. If the peeled areas are allowed to be covered with dust or dirt, the pipe must be peeled again in a new location.

All electrofusion joining shall be completed in accordance with the "MAB Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe" available from the Plastic Pipe Institute website (https://plasticpipe.org/common/Uploaded%20files/Technical/MAB-01.pdf).

K Connect to Existing Water Main

This work consists of connecting the new water main to the existing water main, including locating the existing water main and furnishing and installing the proper fittings and adapters or transition couplings needed to make a complete connection. Where specified, use restrained couplings.

L Water Service Installation

L.1 General Provisions

Water service lines, complete with all required appurtenances, shall be installed as required by the Contract, in accordance with all pertinent requirements for main line installations together with the provisions hereof.

Installation of service lines shall be in accordance with the City Standard Detail(s) listed in Appendix D, the applicable requirements of these construction standards, and the project Special Provisions.

It shall be the responsibility of the Contractor to keep work exposed so the Engineer may obtain an accurate record of the location, depth and size of each service connection and other pertinent data such as the location of curb stops and pipe ends.

Water service lines shall normally be installed by trenching and be subject to the same requirements as prescribed for the main pipeline installation. Where water service lines are installed alongside sanitary, or storm sewer service lines, installation shall be such as to maintain the minimum specified clearances between pipelines and provide proper and adequate bearing for all pipes and appurtenances. Subject to minimum clearances, the water service may be laid in a common trench excavated principally for sewer installation, either by widening the trench as necessary or by providing a shelf in the trench wall where ground stability will permit.

Water service lines may be laid directly on any solid foundation soil that is relatively free of stones and hard lumps. However, when specified or ordered, aggregate materials shall be furnished and placed as necessary to secure proper foundation drainage, pipe covering, or backfill support. Where existing soils do not meet the

requirements of bedding and encasement materials, the Contractor shall furnish the required granular materials unless otherwise approved by the Engineer.

Water service lines shall be installed to provide a minimum 7 feet of cover over the top of the pipe AND provide minimum separation distance from other pipes and structures in accordance with the current edition of the '*Recommended Standards for Water Works*' published by Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Mangers (also commonly referred to as '10 states standards'). In no case shall the water service line be installed with less than six inches of clearance to another structure. Where the service pipe may be exposed to freezing due to insufficient cover or exposure from other underground structures, the water pipe shall be insulated as directed by the Engineer.

Water service lines shall be installed on a straight line at **right angles to the water main** or property lines as directed by the Engineer. Unless otherwise specified, the service line shall be terminated at the curb stop, where it shall be connected to an existing line or, in the case of undeveloped property, capped or plugged at the right of way line, as approved by the Engineer.

Reconnecting existing water service shall be required when installing a new water service and connecting it to an existing water main. The contractor shall confirm the size of each existing water service and provide necessary fittings to adapt from the new service pipe to the existing service pipe.

L.2 Service Pipe

Minimum pipe size for service installations shall be ¾-inch nominal diameter for copper pipe, or 1-inch nominal diameter for HDPE pipe. Larger size pipe will be specified for commercial and industrial tap service and for some domestic service as specifically identified.

Seamless copper service piping of ¾-inch to and including 1-1/4 inch in diameter shall be installed in one piece without intermediate joint couplings between the corporation stop at the water main tap and the curb stop. Larger pipe may be furnished in standard cut-lengths of 20 feet or longer and be joined with approved couplings, provided that the installation of pipe less than full standard length in any run be limited to the needs for closure. All pipe and appurtenances shall be joined by means of approved flared type threaded couplings. The flaring of copper tubing ends shall be accomplished only with the use of proper size and type of tools as designed for the purpose, such as will provide accurate sizing and rounding of the ends. Tubing shall be cut squarely and all roughness shall be removed prior to flaring. All couplings shall be tightened securely, so the flared end fits snugly against the bevel of the fitting without leakage. The flared joint couplings shall be made up without the use of joint compound.

High Density Polyethylene (HDPE) service piping of 1 inch to and including 3 inch in diameter shall be installed in one piece without intermediate butt fusion, socket or electrofusion joint couplings between the main and the curb stop transition. For HDPE service pipe 4 inch and larger in diameter, the pipe may be furnished in standard cut-lengths of 40 feet or longer, provided that the installation of pipe less than full standard length in any run be limited to the needs for closure. All pipe and appurtenances shall be joined by means of butt fusion.

L.3 Service Connections to Main

Connection of seamless copper service lines to ductile iron water main shall be made with an approved corporation stop and saddle. Connection of seamless copper service lines to HDPE main shall be made with an approved electrofusion corp saddle and corporation stop. The water main tap shall be made at an angle of not more than 45 degrees from the horizontal. Service pipe may have a 45-degree bend connected to the corporation stop to bring the pipe to horizontal.

Connection of 2” and smaller HDPE service lines to HDPE water main 12” or smaller shall be made with an approved tapping tee with electrofusion saddle. Connection of 2” and smaller HDPE service lines to HDPE water main larger than 12” shall be made with an approved branch saddle. Connection of 3” and larger HDPE service lines to the HDPE water main of all sizes shall be made with branch saddle or tee. The water main tap shall be made at an angle of 90 degrees from the horizontal. The service pipe shall be butt fused to the tap fitting. Electrofusion saddle fittings shall not be installed on an HDPE water main constructed with a bending radius greater than 100 times the pipe outside diameter.

On HDPE main pipe 12” and larger, rounding clamps must be used for installation of all electrofusion saddles AND prior to electrofusion, all saddles shall be checked with a feeler gauge to ensure the gap between the saddle and the pipe is within the manufacturers tolerance.

Tapping of HDPE mains shall be performed using only an approved tapping tool designed specifically for the purpose of tapping HDPE pipe. Use of an electric drill with paddle bits or hole saws with serrated teeth for tapping is not allowed.

All taps into HDPE main shall be separated by a minimum of 2 pipe diameters or a minimum of 2 feet, whichever is greater. The distance shall be measured at the edge of the tapping saddle.

L.4 Curb Stop

The service pipe and curb stop coupling depth shall be such as to maintain not less than the specified minimum cover and provide for a standard service box

installation where practicable. Curb stop shall be set on a concrete block. The service box shall be threaded over the curb stop coupling. Service boxes shall be installed plumb and be braced effectively to remain vertical during and after completion of backfilling. The service boxes shall be brought to existing surface grade when the final grade has not been established. When the final grade has been established, the Contractor shall extend the service box to finished grade.

The Contractor will furnish all materials except for the iron pipe for curb box stand pipes and caps (if necessary), which will be furnished by the City of Duluth Department of Public Works and Utilities. The Contractor shall be responsible for picking up the iron pipe at the City of Duluth Department of Public Works and Utilities facility located at 520 Garfield Avenue.

L.5 Coordination of Water Service Disruption

The Contractor shall notify property owners of the upcoming water service shutdown at least 24 hours prior to the shutdown.

M Setting of Valves, Hydrants, Fittings and Specials

M.1 General

Valves, hydrants, fittings and specials shall be provided and installed as required by the Contract Drawings, City Standard Details listed in Appendix D and Special Provisions, with the exact locations and setting being as directed by the Engineer, and with each installation being accomplished in accordance with the requirements for installation of mainline pipe to the extent applicable. Support blocking, reaction backing, and anchorage devices shall be provided as required by the City Standard Details listed in Appendix D and this specification.

Hydrants shall be installed plumb, with the height and orientation of nozzles as shown in the Contract Drawings or as directed by the Engineer. Unless otherwise specified, the hydrants shall be connected to the mainline pipe with 6-inch diameter branch pipe, controlled by an independent gate valve, and tied back to the tee with a hydrant holding tee or rodding as shown on the City Standard Details listed in Appendix D.

All hydrants and valves shall have a minimum 12-pound bare zinc anode attached to one of the mechanical joint bolts.

Valve boxes shall be centered over the wrench nut of the valve and set on a valve box adapter bracket, and be installed plumb, with the box cover 3/8” below the surface of the finished pavement or at such other level as may be directed. Valve boxes shall not be installed so as to transmit shock or stress to the valve.

Masonry valve pit structures for valves, air vents or meters shall be constructed in accordance with the City Standard Detail Drawing listed in Appendix D or plan details and with the applicable provisions of MN/DOT 2506.

Drainage branches, blow-offs, air vents, and other special appurtenances shall be closed with approved plugs or caps and shall be equipped with suitable blow-off facilities when specified.

All mechanical joint bolts used on all buried fittings, valves and hydrants shall have Cor-Ten or similar low corrosion bolts and nuts and 6-ounce zinc anode caps conforming to ASTM B-418.

The Contractor shall close the hydrant valve, install an end cap on the main and remove the hydrant and valve box.

This work shall consist of relocating hydrants after extending the hydrant leads as shown on the Contract Drawings or at a location outside of the roadbed as directed by the Engineer.

All additional materials furnished under this specification shall be new and like in kind to that in place.

Prior to installation, the hydrant, gate valve, fitting, and all related piping shall be cleaned of all foreign matter and may be swabbed with a minimum 1 percent free chlorine disinfecting solution just before being installed, if the total length of the connection from the hydrant to the main connection is equal to or less than 20 ft, or set up aboveground, disinfected, and bacteriological samples taken if the connection distance is greater than 20 ft in accordance with AWWA C651-Section 4.10.

M.2 Hydrant

This work shall consist of furnishing and installing a hydrant after extending the hydrant lead as shown on the Contract Drawings or at a new location outside the roadbed as directed by the Engineer. The work shall be performed in conformance with the applicable provisions of MN/DOT Standard Specifications and the current Standard Practices and Specifications of the City of Duluth. Hydrant construction requiring a new connection at the water main shall be performed by the Contractor. The Contractor shall furnish all materials and perform all piping work related to the new connection at the water main.

Where specified in the Plans, and prior to reinstalling, the hydrant drain valve shall be plugged if it is currently open and a tag affixed which states “NO DRAIN – Pump After Using.”

M.3 Butterfly Valve or Gate Valve and Box

This work shall consist of furnishing and installing a butterfly valve or gate valve and valve box in accordance with the applicable MN/DOT Standard Specifications, the City of Duluth Construction Standards, and as detailed in the Plan.

N Adjust Valve Box

This work shall consist of adjusting existing water valve boxes to new surface elevations without changing the elevation of the valves.

- No adjusting rings shall be used unless approved by the Engineer. Adjustments shall be made prior to placing the final surfacing course unless otherwise approved by the Engineer.
- Pavement adjustment rings will only be allowed on pavement overlay projects where approved by the engineer. Where used on projects, only one may be used per valve box. All pavement adjustment rings shall be glued into place with a manufacturer recommended adhesive. The Contractor shall measure all valve boxes to determine the appropriate size of each adjustment ring.

When bituminous wearing course is to be held over to the next construction season, all valve boxes shall be adjusted to conform to 3/8 inch below the adjacent interim surface of the bituminous base or binder course prior to winter suspension.

O Disinfection of Ductile Iron Water Mains

Water mains with shall be disinfected by the Contractor. The procedure followed will be in accordance with AWWA C651-Section 5.2 whereby a constant flow of water is introduced simultaneously with a calculated and constant feed of chlorine solution into the main. When at least 25 ppm chlorine is measured at the opposite end, both water and chlorine feed shall be discontinued and the solution allowed to set in the pipe at least 24 hours. The Contractor will work intermediate valves and hydrants during the setting period and will operate valve to introduce the water into the main under the supervision of the City.

For water mains 12” and smaller, as an alternative calcium hypochlorite tablets may be attached to the inside top of each pipe using a NSF 61 certified adhesive. A disinfection plan shall be approved by the Engineer.

All pipe and fittings which must be disinfected prior to installation shall be thoroughly swabbed and brushed with a 1% hypochlorite (chlorine) solution or undiluted household bleach.

<u>Procedure for Disinfection and Testing shall be as follows:</u>

(a) Contractor shall fill the main under the direct observation of the Inspector or Engineer after notifying the Public Works and Utilities

Department. Filling shall proceed slowly and stop when water begins to come out the end. Contractor shall provide a tap if the end of the main is not accessible. Do not flush test. Filled main shall sit for 24 hours to allow chlorine to work, or 48 hours if water is less than 41°F.

(b) Contractor shall flush main, hydrant branches, and any blow-offs under the direct observation of the Inspector or Engineer. City will arrange to have the City take chlorine test when flushing begins, and a bacteria-turbidity sample when flushing is complete.

(c) Upon passing a bacteria-turbidity test, the Contractor may arrange for a pressure test. The order of the bacteriological test and then the pressure test may be reversed only if the new section is completely disconnected from the city water system.

(d) Engineer will order main opened to system only after bacteria-turbidity test and pressure test pass. At all times prior to this, the new main shall be isolated by valving or other means except for filling, flushing, or taking samples. To insure against possible non-flow contact to the water system, it shall always be necessary to open the hydrant or blow-off before allowing system water to enter the new section.

(e) In the case of failed tests, the City reserves the right to charge the Contractor for retests.

P Cleaning and Disinfection of HDPE Water Mains

All HDPE water mains shall be pigged with a new foam pig to remove dirt, HDPE chips, curls and shavings prior to disinfection and testing. The Engineer may approve pigging exemptions for water mains and branch lines which are visually inspected and verified free of any debris and pipe shavings. Water services are exempt from the pigging requirement.

Procedure for disinfection shall be in accordance with AWWA C651-Section 5.2 whereby a constant feed of chlorine solution is introduced into the main while it is filled with water at a constant rate. When at least 25 ppm chlorine is measured at the opposite end, the chlorine feed shall be stopped and the solution be allowed to set in the pipe for at least 24 hours. The approximate amount of chlorine bleach required is summarized in the table below.

Table 2504-8: Approximate amount of chlorine bleach required for cleaning and disinfection

Nominal Pipe Diameter	Actual Pipe Diameter for HDPE DIPS SDR 11	Gallons of Water per 100 Feet of Pipe	Gallons of Bleach per 100 Feet of Pipe
2	1.847*	13.9	0.007
4	3.876	61	0.03
6	5.571	127	0.06
8	7.305	218	0.10
10	8.961	328	0.16
12	10.656	463	0.22

Table 2504-8 Notes:

(1) Gallons of bleach are based upon an assumed 5.25% chlorine bleach concentration and a target concentration of 25 ppm.

(2) *HDPE IPS SDR 9

Calcium hypochlorite tablets or granules shall NOT be used for disinfection of HDPE mains or services.

Disinfection of HDPE pipes may be performed on temporarily capped pipes above grade prior to installation in the trench. Where this method is used, temporary caps must remain on the pipe during installation until the connection at each end is made. Temporary caps should include a method for filling and draining the water main.

Q Alternate Disinfection Procedures

When conditions preclude disinfection stated above, the Contractor may use the alternate procedure for disinfecting mains and branch services which consists of thoroughly swabbing pipe and brushing fittings with a 1% hypochlorite solution (4 parts of water to 1 part standard bleach) prior to installation. This method will only be considered acceptable with the prior written approval of the Engineer.

R Water Main Flushing

Flushing water shall be discharged to the sanitary sewer, if not practical consult the Engineer for de-chlorination requirements. Upon completion of flushing the disinfection solution from the water main, the main shall remain stagnant for a minimum of 16 hours prior to sample collection by the City.

S Testing Water Main and Services

S.1 Bacteriological Test

Sampling and testing for bacteria will be performed by the City. Contractor shall provide sampling locations for every 1,200 feet of new water main and at the end. Branch mains longer than 20 feet with the availability to sample should also be tested. A test result will be provided after both 24 and 48 hours. Both tests must be passed. The

Contractor shall be responsible for re-chlorination of the water main in the event the test result fails.

S.2 Pressure and Leakage Test

Following a passing bacteria test, the water mains shall be subjected to the pressure and leakage tests prescribed herein and in conformance with the pipe manufacturer's recommendations. The Contractor shall furnish the pump, pipe connections, gauges, and measuring equipment, and shall perform the testing under the direct observation of the Engineer.

The order of the bacteriological test and then the pressure test may be reversed only if the new section is completely disconnected from the city water system.

All air must be expelled from the pipe. A hydrostatic pressure of not less than 150 pounds per square inch, measured at the lowest point of elevation, shall be applied by means of a pump connected to the pipe in a satisfactory manner. Higher pressures may be specified in the project's Special Provisions. The Contractor may test each valved section, larger sections, or the entire water main so long as the elevation differential between the highest and lowest point does not exceed 110 feet.

The pump water container, and water used shall be disinfected prior to injecting water into the section of main.

For ductile iron mains, pressure shall be maintained for a minimum duration of 2 hours. No drop in pressure will be allowed for acceptance of the main.

For HDPE mains, fill the main slowly ensuring fill rate does not exceed capacity of air release devices. Once air has been expelled from the system, gradually raise the pressure to 160 psi. Add makeup water as necessary to maintain this pressure as necessary for four hours. After the four hour acclimation period, reduce main pressure to the 150 psi test pressure and monitor for one hour. Do not increase pressure or add make-up water during this one hour test period. The test is passed and considered acceptable if the main pressure does not drop more than 5% (7.5 psi) during the one hour test period.

HDPE mains may be temporarily capped and tested above grade prior to installation in the trench. This method shall follow the procedure described above. In addition, there may be no visible leakage. When this method is used, a visual inspection of the connections at each end shall be made after the main is filled and prior to backfilling.

Any defective joints, pipe, fittings, valves, or hydrants revealed during the testing, or before final acceptance of the work, shall be satisfactorily corrected and the test shall be repeated until the specified requirement has been met.

Unless otherwise specified, services shall be tested for pressure and leakage by inspection of all exposed joints while under system pressure.

Service pipe may be tested at the time of the pressure test of the main, at the Contractor's option. Pressure testing of service pipes may also be completed as a separate operation from the main. Services tested independently shall be tested at 150 PSI for 30 minutes with no noticeable pressure change.

Service and main branch saddle fittings, sleeves, service tapping tees, and tapping valves shall be pressure tested with air or water before cutting out coupon.

The connection of services to HDPE water mains with an electrofusion corp saddle and corporation stop or a tapping tee with electrofusion saddle shall be soap tested and tested with air and accepted if it maintains 150 PSI for 30 minutes. Accepted electrofusion corp saddle or tapping tee with electrofusion saddle can then be tapped to the main and the tap or punch tee cap reinstalled.

S.3 Electrical Continuity Test

For ductile iron pipe systems, the Contractor shall perform a continuity test between hydrants or any accessible point of the backfilled system. If the test shows no continuity, the Contractor shall find and repair the broken circuit. Megalug joint restraints shall not be used for electrical continuity.

For HDPE pipe systems, the Contractor shall perform a continuity test on all tracer wire after installation of pipe. If the test shows no continuity, the Contractor shall find and repair the broken tracer wire.

Pipe that fails to meet continuity requirements above will be considered unacceptable and no payment will be made.

S.4 Retesting

In the case of failed tests, the City reserves the right to charge the Contractor for retests.

T HDPE Water Main Repairs on Existing Ductile Iron or Cast Iron Pipe

Where it is deemed convenient and appropriate to repair an existing water main with HDPE pipe, the following applies:

(1) All materials must meet the requirements of this Standard;

(2) For pipe repair length less than 10 feet, a tracer wire is NOT required;

(3) For a pipe repair length between 10 feet to 40 feet, provide tracer wire with one small (1 pound) anode stakes at each end of the repair and do not bring the tracer wire to grade;

(4) For a pipe repair length greater than 40 feet, provide tracer wire and one tracer box at each end of the repair and connect tracer wires to tracer boxes set at grade;

(5) For HDPE pipe repairs to existing cast iron hydrant leads, tracer wire is not required; and

(6) Whenever practical, pipe repairs (regardless of length) should be field located with 'survey grade' GPS equipment to update utility system maps.

2504.4 METHOD OF MEASUREMENT

Measurement for reconnecting a new water service to an existing water service will be measured per each by the number services reconnected.

Measurement for connecting to existing water main will be measured per each by the number of acceptable connections.

Hydrants will be measured per each by the number of complete units installed.

Hydrant relocation will be measured by the number of hydrants relocated as specified.

Hydrant Assembly installation will be measured per each by the number of complete hydrant assemblies installed.

Adjusting existing valve boxes will be measured per each by the number of boxes adjusted.

Corporation stops of each size and type, except when already included under the Electrofusion Transition Service Saddle and Corporation Stop bid item, will be measured per each by the number of complete units installed.

Electrofusion transition service saddle and corporation stops of each size and type will be measured per each by the number of complete units installed.

Tapping tees with electrofusion saddle of each size and type will be measured per each by the number of complete units installed.

Curb stops and box of each size and type will be measured per each by the number of complete units installed.

Valves of each size and type will be measured separately per each as complete units, including the required valve box setting.

Tracer boxes of each type will be measured per each by the number of complete units installed.

Blow-off valve and fittings will be measured per each by the number of complete units installed, including the required manhole or vault castings, and covers.

Ductile iron fittings will be measured separately by the pound without joint accessories and shall be the standard weight of fittings as published in AWWA C110. If the Contractor chooses to use compact ductile iron fittings in accordance with AWWA C153, the fittings shall be measured separately by the pound without joint accessories and shall be the weight of fittings as published in AWWA C153. Or ductile iron fittings may be measured on per each basis as installed for each type of fitting used.

Mainline pipe and service pipe of each kind and size will be measured separately per linear foot by the overall length along the horizontal axis of the pipeline, from beginning to end of each installation and without regard to intervening valves or specials. Terminal points of measure will be the spigot or cut end, base of hub or bell end, center of valves or hydrants, intersecting centers of tee or wye branch service connections, and center of main to center of curb stop. Linear measurement of piping will include the running length of any special fitting (tees, wyes, bends, gates, etc.) installed within the line of measure between specified terminal points. No additional measurement will be made for extra pipe installed due to extra depth required for horizontal direction drilling applications. HDPE fittings are incidental to pipe installation and as such no measurement will be made.

Water service pipe will be measured by the horizontal length, in feet, from the center of the water main to the new curb stop.

Insulation will be measured by the area in square yards of polystyrene insulation board installed to the thickness specified.

2504.5 BASIS OF PAYMENT

Payment for construction of water distribution facilities will be made ONLY under the appropriate Contract Items at the Contract unit price; with all other costs of constructing the complete facility as required by Contract being incidental thereto the extent that the work does not qualify as an Extra Work Item.

Payment for Reconnect Existing Water Service and Connect to Existing Water Main shall be compensation in full for all costs incidental thereto including, but not limited to, all labor, equipment and materials for locating the existing water service or water main, furnishing and installing water main DI mechanical joint sleeves for reconnecting the HDPE water main to the existing CI water main, furnishing and installing fittings, adapters, transition couplings necessary to make a complete connection.

Payment for Hydrant and Relocate Hydrant shall be compensation in full for all costs incidental thereto including, but not limited to, any additional ductile iron pipe or HDPE hydrant leads, drain pits, blocking, crushed stone, extensions, risers, MJ to HDPE adapters, zinc anode bolt caps, 12-pound bare zinc anode, and fittings necessary to complete the installation.

Payment for Hydrant Assembly shall be compensation in full for all costs incidental thereto including, but not limited to, the hydrant, 6" gate valve and valve box, ductile iron pipe or HDPE hydrant lead, drain pits, blocking, crushed stone, extensions, risers, MJ to HDPE adapters, zinc anode bolt caps, 12-pound bare zinc anode, main line tee or fittings necessary to complete the installation.

Payment for Relocate Hydrant shall be compensation in full for all costs incidental thereto including, but not limited to, any additional ductile iron pipe or HDPE hydrant leads, drain pits, blocking, crushed stone, extensions, risers, MJ to HDPE adapters, zinc anode bolt caps, 12-pound bare zinc anode, main line tee or fittings necessary to complete the relocation.

Payment for Adjust Valve Box shall be compensation in full for all costs incidental thereto, including but not limited to, furnishing extensions as required and replacing any materials damaged by the Contractor's operations.

Payment for Corporation Stop, Electrofusion Transition Service Saddle and Corporation Stop, or Tapping Tee with Electrofusion Saddle shall be compensation in full for all material, labor and equipment necessary to complete the work as described herein including tapping the water main, furnishing and installing the connection fittings on the main and butt fusing the HDPE water service pipe to the tapping tee with electrofusion saddle.

Payment for Curb Stop and Box shall be compensation in full for all materials, labor and equipment necessary to install the curb box and furnish and install the curb stop and any transition fittings necessary to connect new HDPE water service pipe to the curb stop.

Payment for Butterfly Valve and Box or Gate Valve and Box shall be compensation in full for all costs incidental thereto to furnish and install the valve and valve box complete and in place, including but not limited to the valve and valve box, blocking, MJ to HDPE adapters, zinc anode bolt caps, 12-pound bare zinc anode, and crushed stone. No additional payment will be made for valves installed where new mains are deeper than the minimum depth.

Payment for Water Tracer Box shall be compensation in full for all materials, labor and equipment necessary to furnish and install the tracer box.

Payment for Blow-offs shall be compensation in full for all costs of furnishing and installing the necessary materials complete in place as specified, including all costs of excavation, bedding, backfill, pipe, tapping main, valves, curb stops, caps, blocking, castings, valve box, tracer wire, and necessary adapters or transition couplings, and other work necessary to complete the work.

Payment for Ductile Iron Fittings for water main shall be compensation in full for all costs of providing the necessary materials complete in place as specified including, but not limited to, furnishing and installing reducers, tees, crosses, bends, plugs, and other work necessary to complete the work.

Payment for Water Service Pipe shall be compensation in full for all labor, equipment, and materials costs of furnishing and installing the pipe complete in place including, but not limited to,

trench excavation, foundation preparation, bedding, placement and compaction of encasement materials, coarse filter aggregate, placement and compaction of backfill, cleaning, disinfection, bacteria testing, leakage testing, tracer wire, continuity testing, fittings, hardware, zinc anode bolt caps, 12-pound bare zinc anode, MJ adapters, transition couplings, blocking and anchorage materials, and other work necessary to complete the work. No payment shall be made for water service pipe with a tracer wire that has not passed an electrical continuity test.

Payment for Water Main Ductile Iron (class) shall be compensation in full for all labor, equipment, and materials costs of furnishing and installing ductile iron water main complete in place including, but not limited to, trench excavation, foundation preparation, bedding, polyethylene encasement, placement and compaction of pipe encasement materials, placement and compaction of backfill, cleaning, disinfection, bacteria testing, leakage testing, continuity testing, fittings, hardware, zinc anode bolt caps, transition couplings, blocking and anchorage materials, and other work necessary to complete the work. No payment shall be made for ductile iron water main pipe that has not passed an electrical continuity test.

Payment for HDPE Water Main SDR 11 shall be compensation in full for all labor, equipment, and materials costs of furnishing and installing HDPE water main including, but not limited to, trench excavation, foundation preparation, bedding, placement and compaction of pipe encasement materials, placement and compaction of backfill, cleaning, disinfection, bacteria testing, leakage testing, tracer wire, continuity testing, HDPE by MJ adapters, HDPE to cast iron transition couplings, fittings, hardware, zinc anode caps, blocking and anchorage materials, and other work necessary to complete the work. All costs of furnishing and installing electrofusion flex restraints and concrete collars on the HDPE Water Main shall be considered incidental to the water main. No payment shall be made for water main pipe with a tracer wire that has not passed an electrical continuity test.

Payment for Polystyrene Insulation shall be compensation in full for all costs incidental thereto including, but not limited to, the extra trench excavation, furnishing and placing polystyrene insulation board, granular backfill, and off-site disposal excess excavated material.

Payment for water main and service construction will generally be made on the basis of the following schedule:

Item No.	Item	Unit
2504.602	Reconnect Water Service	each
2504.602	Connect to Existing Water Main	each
2504.602	Hydrant	each
2504.602	Relocate Hydrant	each
2504.602	Hydrant Assembly	each
2504.602	Adjust Valve Box	each
2504.602	(size)” Corporation Stop	each
2504.602	(main size)”x(service size)” Electrofusion Transition Service Saddle and Corporation Stop	each
2504.602	(main size)”x(service size)” Tapping Tee w/Electrofusion Saddle	each

2504.602	(size)" Curb Stop and Box	each
2504.602	(size)" Butterfly Valve and Box	each
2504.602	(size)" Gate Valve and Box	each
2504.602	Water Tracer Box	each
2504.602	Blow-Off	each
2504.602	(size) Ductile Iron (fitting type)	each
2504.603	(size)" Type K Copper Service Pipe	linear foot
2504.603	(size)" HDPE SDR 11 Service Pipe	linear foot
2504.603	(size)" Water Main Ductile Iron (class)	linear foot
2504.603	(size)" HDPE Water Main SDR 11	linear foot
2504.603	(size)" HDPE Water Main SDR 11 (Horizontal Directional Drill)	linear foot
2504.608	Ductile Iron Fittings	pound

2504 HORIZONTAL DIRECTIONAL DRILLING – WATER

2504.1 DESCRIPTION

This work shall consist of the installation of an underground pipe using the horizontal directional drilling method indicated on the Contract Drawings. Products installed under this section include Water Main Pipe and Fittings and Water Services.

Horizontal Directional Drilling - Water shall be performed in accordance with the provisions of 2503 HORIZONTAL DIRECTIONAL DRILLING – PIPE SEWERS, except as supplemented and/or modified below:

A Quality Assurance

Fusing of polyethylene pipe shall be done by qualified fusers. Certification of personnel and fusing of pipe shall comply with the requirements for gas lines in the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe.

2504.2 MATERIALS

A Carrier Piping

Carrier piping shall be as specified in 2504 WATER MAIN AND SERVICE LINE INSTALLATION.

The pressure rating specified for the carrier pipe in their respective specifications sections shall be considered a minimum. Provide a higher class of pipe if required by the loads imposed by pulling operation.

D Locating Wire

Locating (tracer) wire shall be as specified in 2504 LOCATING WIRE FOR WATER.

2504.3 CONSTRUCTION REQUIREMENTS

A Joining Pipe

Pipe fusing shall be done by qualified fusers. Certification of personnel and fusing of pipe shall comply with the requirements for gas lines in the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe, included in these specifications. All water main and water branch or tap service pipe of any diameter shall be butt fused.

B Monitoring

The City of Duluth gas utility must be notified 2 Working Days prior to any excavation or directional drilling within 6 feet of a 6 inch or larger natural gas main. City personnel will be on site to monitor excavation and inspect any exposed steel main 6 inches or larger. Notify the Engineering Division at 218-730-5200 to coordinate this inspection.

The Contractor shall notify the Engineer immediately any time a steel natural gas main smaller than 6 inches is exposed within an excavation. Contact the Engineering Division at 218-730-5200 to coordinate an inspection of the exposed main.

C Pilot Hole

A pilot hole shall be drilled along the path shown on Drawings to the following tolerances:

(1) Elevation: Plus 0 feet, minus 1 foot for water main.

(2) Alignment: Plus or minus 2 feet for water main.

(3) Curve Radius: minimum 250 feet or pipe manufacturer's recommendation, whichever is greater.

(4) Entry Point: At the location shown on Drawings.

(5) Exit Point: Pilot hole shall penetrate ground surface within plus or minus 10 feet of alignment shown on Drawings and within plus 20 feet and minus 0 feet of length shown on Drawings. In all cases, pipe shall remain within easement and right-of-way areas.

Contractor shall plot actual horizontal and vertical alignment of pilot bore at intervals not exceeding 50 feet for water main. This "as-built" plan and profile shall be updated as pilot bore is advanced.

In all cases, right-of-way restrictions shall take precedence over the tolerances listed above. Regardless of the tolerance achieved, no pilot hole will be accepted if it will result in any or all of pipeline being installed in violation of right-of-way restrictions. In all cases, concern for

adjacent utilities and structures shall take precedent over the tolerances listed above. Specification of tolerances does not relieve Contractor from responsibility for safe operations or damage to adjacent utilities and structures.

After completion of pilot hole drilling, Contractor shall provide a tabulation of coordinates to Engineer, referenced to drilling entry point, which accurately describes location of the pilot bore alignment and profile. No further work may proceed without acceptance of the pilot bore alignment and profile in writing from the Engineer.

D Reaming and Casing Pipe Pull-Back Operation

D.2 Pulling Loads

The maximum allowable tensile load imposed on the pipeline pull section and used for setting weak-link devices for polyethylene pipe shall be in accordance with in accordance with MAB-3 “MAB Model Specifications for PE4710 Buried Potable Water Service, Distribution and Transmission Pipes and Fittings” available from the Plastic Pipe Institute website (https://plasticpipe.org/common/Uploaded%20files/Technical/MAB-03.pdf). The maximum allowable tensile loads for polyethylene pipe shall be within the values shown in the following table for pull durations up to 12 hours and material temperatures of 73°F. For longer pull durations or higher pipe material temperatures, these values will be recalculated by the Engineer. If more than one value is involved for a given pull section, the lesser value shall govern. The Contractor shall maintain accurate records of pull forces at all times for review by the Engineer. The “weak link” may be a pulling head or next smaller diameter pipe (same SDR) than the pipe being pulled.

Table 2504-1: Maximum Allowable Tensile Load for HDPE Pipe

SIZE		SDR	LBS.
4”	DIPS	11.0	7,956
6”	DIPS	11.0	16,440
8”	DIPS	11.0	28,282
10”	DIPS	11.0	42,546
12”	DIPS	11.0	60,168
14”	DIPS	11.0	80,835
16”	DIPS	11.0	104,548
20”	DIPS	11.0	161,110
24”	DIPS	11.0	229,856

Table 2504-1 Notes:

(1) Material temperature @ 73°F

(2) Pipe under tension ≤ 12 hours

E Locating Wire

The locating wires shall be pulled along with the pipe. **The Contractor must pull a minimum of two (2) wires in the event one locating wire does not pass the continuity test.** Wire shall meet the provisions of 2504 LOCATING WIRE FOR WATER of this Standard. The Contractor shall be responsible for the installation of a locating wire with electrical continuity throughout the entire length. The locating wire shall be made accessible as shown on the City Standard Details listed in Appendix D or the Contract Drawings. The cost of furnishing and placing locating wire shall be considered incidental to the pipe.

E Testing

E.1 Pressure and Leakage Test

Pressure and leak test of carrier piping shall be as specified in 2504 WATER MAIN AND SERVICE LINE INSTALLATION.

2504.4 MEASUREMENT AND PAYMENT

Pipe placed by horizontal directional drilling shall be paid for under the applicable utility. No payment shall be made for a pipe with a tracer wire that has not passed a continuity test.

2504 LOCATING WIRE FOR WATER

Locating wire for water shall be performed in accordance with the provisions of 2503 LOCATING WIRE FOR SEWER, except as supplemented and/or modified below:

2504.1 DESCRIPTION

Locating wire shall be installed on all HDPE and PVC water mains and services.

2504.2 MATERIALS

A Locating Wire for Open Cut installations

Insulation for water main shall be blue.

B Locating Wire for Directional Drilled Installations.

Insulation for water main shall be blue.

C Locating Wire for Pipe Bursting.

Insulation for water main shall be blue.

E Locating (Tracer Boxes)

Locating Boxes for water applications shall be Snake Pit’s magnetized tracer boxes from Copperhead Industries, LLC, (or approved equal) as follows:

Table 2504-1: Required tracer box models (or approved equal)

Color	Installation Type	Model
Blue	Turf	Snake Pit Lite Duty Box Model LD14BTP
Blue	Bituminous	Snake Pit Roadway Box Model RB14BTP
Blue	Concrete	Snake Pit Roadway Box Model RB14BTP

The tracer box shall have a blue powder coated cast iron cover for water.

All tracer box covers shall have an alpha character stamped on top of the pentagon security bolt. Character shall be “W” for water.

2504.3 CONSTRUCTION REQUIREMENTS

The locating wire for water shall be brought to the ground surface at locations shown on the City Standard Details listed in Appendix D, Contract Drawings or the Special Provisions through a locating box. The wire shall be connected to the tracer box terminal.

2504.4 MEASUREMENT AND PAYMENT

All locating wire installed shall be tested for continuity at the completion of the installation. No payment shall be made for pipe with a tracer wire that has not passed the continuity test.

Tracer wire and boxes shall be supplied by the Contractor. There shall be no measurement or payment for tracer wire. The cost of furnishing and placing locating wire shall be considered incidental to the utility.

The Contract Unit Price for Tracer Box shall be compensation in full for all materials, labor and equipment necessary to furnish and install the tracer box where specified in the City Standard Details listed in Appendix D, Contract Drawings or Special Provisions.

The City will pay for tracer boxes on the basis of the following schedule:

Item No.	Item	Unit
2504.602	(type) Tracer Box	each

2504 CONCRETE ENCASED VALVE BOX COLLAR

2504.1 DESCRIPTION

This work shall consist of: cutting and extracting the pavement and base section in a circular layout around the perimeter of the valve box; installing the valve box casting assembly; and placing a reinforced concrete encasement collar around the casting frame to match the adjacent pavement grades in accordance with the City of Duluth Standard Specifications, the Plan details, and the following provisions.

2504.2 MATERIALS

A Reinforcement for encasement collar shall epoxy coated in accordance with MN/DOT 3301.

B Concrete for encasement collar shall be **Mix No. 3G52** in accordance with MN/DOT 2461.

2504.3 CONSTRUCTION REQUIREMENTS

A Pavement Removal and Preparation

(1) Precautions must be taken to prevent debris from entering the valve box during the entire removal and reconstruction process.

(2) Cut and remove the asphalt pavement structure, around the valve box casting, with a rotating cutter device that creates a circle with a minimum diameter of 32" and centered about the casting. For all "shallow" valve installations, remove centering pin or provide "short" centering pin, so that the valve is not damaged during cutting operation. Remove and dispose of the asphalt off-site.

(3) Remove the upper section casting and cover from the top of the valve box. Inspect the valve box section and cover for defects. If defects are present, replace with a new valve box/cover as needed. If defects are not present, clean & retain for use in reconstruction.

(4) Remove all aggregate around the valve box that has been exposed by the asphalt removal and dispose of this aggregate. The aggregate must be removed to a minimum of **12"** below the level of the top finished pavement surface.

(5) Reset the top valve box section and adjust the top of the casting so that it shall be exactly **0.25 inch below flush** with the pavement surface in all directions.

(6) Place the cover/lid on the valve box casting to lessen the possibility of debris entering the manhole.

B Concrete Encasement Collar Installation

(1) Place epoxy coated reinforcement around casting frame adequately supported to hold position during concrete placement.

(2) Place concrete encasement collar in accordance with reference standards.

(3) The surface of the concrete shall be finished from flush with the pavement to flush with the rim casting. The edge of the concrete shall be rounded (1/4" radius) where it meets the asphalt.

(4) Fill the groove with a cold pour crack sealer. This will prevent water from entering the circular seam where the concrete collar meets the asphalt.

(5) Apply a concrete curing and sealing compound to the surface of the concrete collar.

(6) Protect concrete from loading & vibration until the concrete attains a compressive strength of 3,000 psi.

2504.4 MEASUREMENT AND PAYMENT

Measurement will be made for each structure completed as specified.

The Contract Unity Price for Concrete Encased Valve Box Collar shall be compensation in full for all labor, equipment, and materials necessary to complete the work.

The City will pay for Concrete Encased Valve Box Collars on the basis of the following schedule:

Item No.	Item	Unit
2504.602	Concrete Encased Valve Box Collar	each

2504 TEMPORARY WATER SERVICE

2504.1 DESCRIPTION

This work shall consist of providing a temporary water service system to adjacent buildings in accordance with the Plans, the City of Duluth Standard Specifications & Details, and as directed by the Engineer.

2504.2 MATERIALS

A HDPE PIPE

HDPE Pipe used for temporary water services shall comply with the requirements of 2504 WATER MAIN AND SERVICE LINE INSTALLATION 2 D except that all service pipe shall be SDR 11.

2504.3 CONSTRUCTION REQUIREMENTS

A General Requirements

Temporary water main pipe shall be 2” or 3” HDPE SDR 11 pipe or as shown on the contract drawings. Temporary water service pipe shall be ¾” or 1” HDPE pipe to within 5 feet of the hose bib or building connection or as shown on the contract drawings. Final connection to residential homes may be made with a hose rated for potable water (RV water supply hose). All HDPE connections shall be butt fused or fused fittings, no band clamps will be allowed. Pressure reducing valves shall be provided (when necessary) to control the water pressure of the

temporary water service system to a maximum pressure of 80 psi at the house. Fittings and restraints (when necessary) shall be in accordance with City of Duluth Standards. End caps shall be installed on all temporary water service system pipes when moving the pipe on the ground.

All temporary water service system components shall meet requirements of City of Duluth Standards for pipe cleaning, bacteria, and pressure & leakage testing. Temporary water mains 6 inch and larger shall be pigged prior to disinfection. All services shall be disinfected with temporary main and flushed individually. Temporary water service system shall be fully operational and achieve passing test results prior to disconnection of the existing water main. Where pipe is reused from previous stages of construction, it shall be cleaned and completely retested prior to use as a temporary water service system. All temporary water service system pipes shall be protected from construction equipment and local vehicle traffic.

B Submittals and Coordination

The Contractor shall prepare and submit a Temporary Water Service Installation Plan to Engineer at least 14 days prior to installation. The Plan shall include: planned construction, staging & schedule; connection points; proposed tie-ins; existing hydrants & shut-off valves; temporary pipe size & materials information; and emergency contact information. Emergency information shall include the name and phone number of at least two personnel available 24 hours per day 7 days a week. Emergency contact personnel shall be familiar with the project and have the authority to make repairs to the temporary water service system within 8 hours of notification from resident. The Contractor shall furnish and deliver emergency contact information “door hangers” to all residents at least 48 hours prior to connecting to the temporary water supply system. The Contractor shall attend a mandatory pre-installation coordination meeting with the Engineer prior to beginning temporary water service system work.

2504.4 MEASUREMENT AND PAYMENT

No measurement will be made of the various Items that constitute Temporary Water Service but furnishing all such items as specified will be construed to be included in the single lump sum item.

The Contract Unit Price for Temporary Water Service shall be considered full compensation for all costs for labor, equipment, and materials associated with installation, testing, protection, maintenance, removal, and restoration.

The City will pay for Temporary Water Service on the basis of the following schedule:

Item No.	Item	Unit
2504.601	Temporary Water Service	lump sum

2504 INSULATION BOARD (POLYSTYRENE)

2504.1 DESCRIPTION

This work shall consist of furnishing and installing the total combined thickness specified of insulation board at the locations designated on the Contract Drawings. This work shall be performed in accordance with the City Standard Details listed in Appendix D, the Contract Drawing and the Special Provisions, the applicable MN/DOT Standard Specifications, and the following:

2504.2 MATERIALS

A Insulation Board

Insulation board shall be extruded polystyrene foam designed for use in high load underground applications as listed in MN/DOT 3760 and as modified below. Insulation board shall comply with ASTM C578 Type VI specifications. Insulation board shall meet the following minimum requirements:

Compressive Strength	=	Min. 40 psi
Water Absorption	=	Less than 0.3% volume
Water Vapor Permeability	=	Less than 1.1 perms

Thickness specified may be made up by layering 1 inch, 1-1/2 inch or 2 inch thick sheets provided the overlaying joints are offset from those below.

Insulation board shall be similar or equal to “DiversiFoam Products CertiFoam 40”, “DOW STYROFOAM HIGHLOAD 40”, or “Owens Corning FOAMULAR 400, XPS.”

2504.3 CONSTRUCTION REQUIREMENTS

Rigid insulation board shall be placed within the pipe encasement zone, six inches above the pipe. Prior to placement of the insulation, encasement material shall be compacted until there is no further evidence of increased consolidation or the density of the compacted layer conforms to the density required in the Special Provisions, then leveled and lightly scarified to a depth of 1/2 inch. Encasement zone material placed below the insulation shall be free of rock or stone fragments measuring 1-1/2 inches or greater.

Insulation boards shall be furnished in panels 1-inch thick, 1-1/2 inch thick or 2 inch thick, and shall be placed on the scarified material with the long dimension parallel to the centerline of the pipe. Boards placed in a single layer shall be overlapped at least six inches on all sides to eliminate continuous joints for the full depth of the insulation. If two or more layers of insulation boards are used, each layer shall be placed to cover the joints of the layer immediately below with an overlap of at least six inches. The edges shall be trim and square. A minimum of two (2) wood skewers per board in each layer driven flush with the surface of the material shall be utilized to hold the insulation material in-place during the backfill operations.

The Contractor shall exercise precaution to ensure that all joints between boards are tight during placement and backfilling with only extruded ends placed end to end or edge to edge.

The placement of the backfill material over the insulation board and compaction thereof shall be accomplished in a manner that will preclude damage to the insulation material. The first layer of material placed over the insulation shall be six inches in depth, free of rock or stone fragments measuring 1-1/2 inches or greater. The material shall be placed in such a manner that construction equipment of any kind does not operate directly on the insulation and shall be compacted with equipment which exerts a contract pressure of less than 80 psi. Sections of insulation board damaged by the Contractor's construction operations shall be replaced at the Contractor's own expense. The first layer shall be compacted until there is no further evidence of increased consolidation or the density of the compacted layer conforms to the requirements of 2451 EXCAVATION, BACKFILL, AND COMPACTION FOR UTILITIES.

2504.4 METHOD OF MEASUREMENT

Insulation will be measured separately by the area in square yards of polystyrene insulation board furnished and installed to the thickness specified on the Contract Drawings, Special Provisions or City Standard Details listed in Appendix D.

2504.5 BASIS OF PAYMENT

The Contract Unit Price shall be compensation in full for all costs incidental thereto including, but not limited to the providing insulation board, extra trench excavation, bedding preparation, insulation board installation, furnishing and placing granular backfill and removal and disposal off the site of excess excavated material.

The City will pay for polystyrene insulation on the basis of the following schedule:

Item No.	Item	Unit
2504.604	(size)" Polystyrene Insulation	square yard

2505 HORIZONTAL DIRECTIONAL DRILLING – GAS

2505.1 DESCRIPTION

This work shall consist of the installation of an underground pipe using the horizontal directional drilling method indicated on the Contract Drawings. Products installed under this section include Gas Main Pipe and Fittings, Gas Service Pipe and Fittings, and Special Connections.

Horizontal Directional Drilling - Gas shall be performed in accordance with the provisions of 2503 HORIZONTAL DIRECTIONAL DRILLING – PIPE SEWERS, except as supplemented and/or modified below:

I Quality Assurance

Fusing of polyethylene pipe shall be done by qualified fusers. Certification of personnel and fusing of pipe shall comply with the requirements for gas lines in the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe.

J Drilling Equipment

For natural gas installations, the drilling head must be equipped with a sonde which meets the requirements of the Minnesota Office of Pipeline Safety when drilling near sanitary sewer laterals.

2505.2 MATERIALS

A Carrier Piping

Carrier piping shall be as specified in the special provisions.

The pressure rating specified for the carrier pipe in their respective specifications sections shall be considered a minimum. Provide a higher class of pipe if required by the loads imposed by pulling operation.

D Locating Wire

Locating (tracer) wire shall be as specified in Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe (Appendix A), included in these specifications.

2505.3 CONSTRUCTION REQUIREMENTS

A Joining Pipe

Pipe fusing shall be done by qualified fusers. Certification of personnel and fusing of pipe shall comply with the requirements for gas lines in the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe, included in these specifications.

B Monitoring

The City of Duluth gas utility must be notified 2 Working Days prior to any excavation or directional drilling within 6 feet of a 6 inch or larger natural gas main. City personnel will be on site to monitor excavation and inspect any exposed steel main 6 inches or larger. Notify the Engineering Division at 218-730-5200 to coordinate this inspection.

The Contractor shall notify the Engineer immediately any time a steel natural gas main smaller than 6 inches is exposed within an excavation. Contact the Engineering Division at 218-730-5200 to coordinate an inspection of the exposed main.

C Pilot Hole

A pilot hole shall be drilled along the path shown on Drawings to the following tolerances:

(6) Elevation: Plus 0 feet, minus 1 foot for gas main.

(7) Alignment: Plus or minus 2 feet for gas main.

(8) Curve Radius: minimum 250 feet or pipe manufacturer's recommendation, whichever is greater.

(9) Entry Point: At the location shown on Drawings.

(10) Exit Point: Pilot hole shall penetrate ground surface within plus or minus 10 feet of alignment shown on Drawings and within plus 20 feet and minus 0 feet of length shown on Drawings. In all cases, pipe shall remain within easement and right-of-way areas.

Contractor shall plot actual horizontal and vertical alignment of pilot bore at intervals not exceeding 50 feet for gas main. This "as-built" plan and profile shall be updated as pilot bore is advanced.

In all cases, right-of-way restrictions shall take precedence over the tolerances listed above. Regardless of the tolerance achieved, no pilot hole will be accepted if it will result in any or all of pipeline being installed in violation of right-of-way restrictions. In all cases, concern for adjacent utilities and structures shall take precedent over the tolerances listed above. Specification of tolerances does not relieve Contractor from responsibility for safe operations or damage to adjacent utilities and structures.

After completion of pilot hole drilling, Contractor shall provide a tabulation of coordinates to Engineer, referenced to drilling entry point, which accurately describes location of pilot hole.

D Reaming and Casing Pipe Pull-Back Operation

D.2 Pulling Loads

The maximum allowable tensile load imposed on the pipeline pull section and used for setting weak-link devices for polyethylene pipe shall be in accordance with ASTM F 1804 "Standard Practice for Determining Allowable Tensile Load for Polyethylene (PE) Gas Pipe During Pull-In Installation." The maximum allowable tensile loads for

polyethylene pipe shall be within the values shown in the following table for pull durations up to 12 hours and material temperature of 100°F. For longer pull durations or higher pipe material temperatures, these values will be recalculated by the Engineer. If more than one value is involved for a given pull section, the lesser value shall govern. The Contractor shall maintain accurate records of pull forces at all times for review by the Engineer. The "weak link" may be a pulling head or next smaller diameter pipe (same SDR) than the pipe being pulled.

Table 2505-1: Maximum Allowable Tensile Load for MDPE Pipe

SIZE	SDR	LBS.
1/2" CTS	7.0	135
1" CTS	9.3	343
2" IPS	11.0	1,316
3" IPS	11.5	2,746
4" IPS	11.5	4,539
6" IPS	11.5	9,839
8" IPS	11.5	16,675
12" IPS	11.0 *	46,673

Table 2505-1 Notes:

(1) Material temperature @ 100°F

(2) Pipe under tension ≤ 12 hours

(3) *HDPE pipe for 12" IPS gas main only

G Locating Wire

The locating wires shall be pulled along with the pipe. **The Contractor must pull a minimum of two (2) wires in the event one locating wire does not pass the continuity test.** Wire shall meet the provisions of the natural gas specifications. The Contractor shall be responsible for the installation of a locating wire with electrical continuity throughout the entire length. The locating wire shall be made accessible as shown on the City Standard Details listed in Appendix D or the Contract Drawings. The cost of furnishing and placing locating wire shall be considered incidental to the pipe.

H Testing

H.1 Pressure and Leakage Test

Pressure and leak test of carrier piping shall be as specified in the current version of the City of Duluth Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe, included in these specifications.

2505.4 MEASUREMENT AND PAYMENT

Pipe placed by horizontal directional drilling shall be paid for under the applicable utility. No payment shall be made for a pipe with a tracer wire that has not passed a continuity test.

2505 ADJUST VALVE BOX – GAS

2505.1 DESCRIPTION

All work performed around existing gas mains shall be in accordance with the provisions of the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe (Appendix A), included in these specifications, except as modified herein.

2505.2 CONSTRUCTION REQUIREMENTS

A Adjust Valve Box

This work shall consist of adjusting existing gas valve boxes to new surface elevations without changing the elevation of the valves.

B Replacement Valve Boxes

The Contractor shall take care to salvage existing valve boxes for reuse. If the Engineer determines that the existing valve box is too badly deteriorated to be reused, the Engineer will provide a replacement valve box for the contractor to install.

2505.3 MEASUREMENT AND PAYMENT

Measurement for adjust valve box will be by the number of gas valve boxes adjusted to final grade.

The Contract Unit Price for adjust gas valve box shall be compensation in full for all labor, materials, and equipment to complete the work.

The City will pay for adjust gas valve box on the basis of the following schedule:

Item No.	Item	Unit
2505.602	Adjust Valve Box – Gas	each

2506 MANHOLES AND CATCH BASINS

The provisions of MN/DOT 2506 are supplemented and/or modified with the following:

2506.1 DESCRIPTION

Manhole and Catch Basin construction and reconstruction, both storm and sanitary, shall be performed in accordance with the provisions of MN/DOT 2506, except as modified herein.

2506.2 MATERIALS

A Sanitary Manholes

All sanitary manholes, air-release manholes and cleanout manholes shall meet the requirements of **City Standard Detail SAN-11** listed in Appendix D. The Contractor shall be responsible for providing openings in the manhole section at the proper locations according to the contract drawings. A 27-inch nominal diameter opening shall be provided in the cone. Unless otherwise shown in the City Standard Details listed in Appendix D or Plans, the cone sections shall be **concentric**. No steps will be allowed in the manholes. Manhole structures shall be sectional precast concrete manhole units conforming to the requirements of MN/DOT 3622. "O" ring gaskets conforming to MN/DOT 3726 shall be used in the joints in the barrel sections. All manholes must have **integral concrete base**. Manhole flexible sleeves for sanitary manholes shall be NPC Kor-N-Seal1, Press Seal PSX Direct Drive, Z-Lok Boot Connector, or approved equal. All pipe sleeves must be water tight.

B Storm Manholes and Catch Basins

Storm sewer structures shall be sectional precast concrete manhole units conforming to the requirements of MN/DOT 3622 and the current version of MN/DOT Standard Plates 4005 (Design F), 4006 (Design G), 4020, or 4024 (Type SD). A 27-inch nominal diameter opening shall be provided in the cone or flat top cover. Unless otherwise shown in the Plans, the cone sections shall be **concentric** and openings in flat top covers shall be **centered**. "O" ring gaskets conforming to MN/DOT 3726 shall be used in the joints in the barrel sections. No steps will be allowed in the manholes.

C Catch Basin Castings

Catch basin frame castings shall conform to **City Standard Details STRM-2, STRM-2B, STRM-3, STRM-3A and STRM-3B** listed in Appendix D. Catch basin grate castings shall be 814A on MN/DOT Standard Plate 4152; or 816 on MN/DOT Standard Plate 4154. Catch basin curb box castings shall be 823A on MN/DOT Standard Plate 4160. Unless otherwise noted in the project Special Provisions, catch basin castings shall be supplied by the Contractor.

Catch basin frame and grate castings for existing structure maintenance repairs by CITY CREWS (ONLY) shall be Neenah R-3349-A or Neenah R-3250-BSP4. These are not acceptable for new structures.

D Manhole Castings

Manhole Casting Assemblies with lids shall conform to **City Standard Details SAN-1 and STRM-1** listed in Appendix D for sanitary and storm manholes. Unless otherwise noted in the project Special Provisions, manhole castings shall be supplied by the Contractor.

E Manhole Adjustment Rings

Except where concrete encased casting collar is required in the Plans, the manhole adjusting rings shall be molded from high-density polyethylene as defined in ASTM D-1248. The complete adjustment system utilizing the HDPE rings shall consist of the rings, sealed to the manhole structure, casting and one another by means of an approved butyl sealant. The Contractor shall utilize a combination of "wedge" rings and "flat" rings to achieve proper slope of the casting. Shims shall not be used. Concrete adjustment rings shall not be used.

F Casting Extensions

Casting Extensions shall be Neenah R-1979 or ESS Brothers paving adjustment ring. Extensions shall be cast iron.

G Non-Shrink Grout or Cement-Base Polymer Modified Patching and Repair Mortar

Non-shrink grout shall be a non-metallic type grout which is durable in wetting and drying, freezing and thawing conditions and shall conform to the requirements set forth in ASTM C 1107-01. Cement-based polymer modified patching mortar shall conform to the requirements set forth in ASTM C 109, ASTM C 490-77, and ASTM C 807-83 (modified).

H Bedding

Manholes and Catch Basins shall be bedded on granular material meeting MN/DOT 3149.2.H Coarse Filter Aggregate.

I Structure Backfill

Unless otherwise noted in the Plans, or directed by the Engineer, manholes and catch basins shall be backfilled with granular material meeting MN/DOT 3149.2.D.1 Granular Backfill.

J Sanitary Casting Sealant

DOW Corning 700 Industrial Grade (Clear) sealant shall be provided between manhole cover and casting frame to create an 'airtight' seal for all WLSSD manholes and City manholes where directed by the Engineer.

2506.3 CONSTRUCTION REQUIREMENTS

A Manholes and Catch Basins shall be bedded on six inches of Coarse Filter Aggregate.

B When using plastic pipe, manhole water stops supplied by the manufacturer shall be installed.

C All annular wall space surrounding the in-place pipes shall be completely filled with mortar or concrete and the inside bottom of each manhole shall be shaped with fresh concrete to form free flow through invert troughs as directed. The troughs shall be as

deep as a half-pipe and the shelves shall slope up three inches from the trough to the wall.

D When a sewer connects with an existing manhole or catch basin, the Contractor shall make a suitable connection through the wall of the manhole or catch basin and shall reshape the invert to assure a smooth and unobstructed flow line through. All pipe connections to existing manholes shall be water tight.

E Non-shrink grout or cement-based polymer modified patching mortar shall be used to patch lifting holes in manholes and catch basins.

F The Contractor shall utilize a combination of flat and sloping manhole adjustment rings to adjust the casting to the slope and grade as specified below.

G Manhole casting assemblies with lids shall be installed in accordance with **City Standard Details SAN-3, SAN-3A, STRM-5, and STRM-5A** listed in Appendix D. The straightedge will be placed across the center of the casting and will touch both sides of the pavement. The measurement will be taken at the center of the casting. Castings that are measured at more than 3/8 inch below the pavement prior to final acceptance of the project will be raised to the prescribed depth of 3/8 inch. All costs associated with this corrective action will be assumed by the contractor.

H Casting Extensions shall only be used where approved by the Engineer on pavement overlay projects. Casting extensions shall not be used to adjust incorrectly installed manhole castings. Where casting extensions are installed, only one may be used per casting to achieve the proper height adjustment. All casting extensions shall be glued into place with a manufacturer recommended adhesive. The Contractor shall measure all manhole castings to determine the appropriate size of each casting extension.

I All sanitary manholes must pass a vacuum test as specified elsewhere in this specification. Any manholes which do not pass the vacuum test or have visible leakage within the manhole will not be accepted.

J All storm manhole castings and catch basin castings shall be wrapped with geotextile fabric as shown on the City Standard Details listed in Appendix D.

K Manhole and catch basin structures shall not be placed over/above water, gas, sanitary, or storm pipes.

2506.4 BASIS OF PAYMENT

Payment for Drainage Structures, Manholes and Catch Basins shall be at the contract unit price per unit of measure and shall include, in addition to the MN/DOT 2506.5 Basis of Payment, furnishing and placing granular materials for bedding and structure backfill.

2506 CONCRETE ENCASED CASTING COLLAR

The provisions of MN/DOT 2506 are supplemented and/or modified with the following:

2506.1 DESCRIPTION

This work shall consist of vertical adjustment, leveling, and place concrete encasement collar around manhole castings in accordance with MN/DOT 2506 and the following provisions.

The process for adjusting manhole frame and ring castings to finish grade shall be done by utilizing a pipe adjustment ring for temporary support and a concrete pavement encasement collar. The adjustment pipe and concrete collar system shall consist of providing a temporary cover plate prior to paving; cutting and extracting the pavement and base section in a circular layout around the perimeter of the manhole; installing a watertight PVC pipe adjusting ring (casting support) on top of the manhole structure; installing the manhole frame and casting assembly; and placing a reinforced concrete encasement collar around the casting frame to match the adjacent pavement grades.

2506.2 MATERIALS

A PVC pipe adjustment ring (casting support) in accordance with MN/DOT 2503 or approved equal.

B Waterstop shall be a controlled expansion butyl rubber water stop meeting the following:

- Specific Gravity shall be 1.15 –1.50 when tested in accordance with ASTM D-71.
- Volatile Matter shall not exceed 2% when tested in accordance with ASTM D-6.
- Minimum application temperature range between 20 degrees F to 120 degrees F.
- Minimum service temperature range between -30 degrees F to 180 degrees F.

C Sealant shall be **elastomeric material** intended for the use depicted in the Plans and/or City Standard Details listed in Appendix D.

D Reinforcement for encasement collar shall **epoxy coated** in accordance with MN/DOT 3301.

E Concrete for encasement collar shall be **Mix No. 3G52** in accordance with MN/DOT 2301 and MN/DOT 2461.

2506.3 CONSTRUCTION REQUIREMENTS

A Temporary Cover Plate Installation

(1) The manhole shall be built with the top of the manhole cone 12" below proposed asphalt elevation.

(2) The area around the manhole must be backfilled with compacted aggregate base. This aggregate must surround the entire manhole to the elevation of the top of the cone section or the bottom of the proposed roadway aggregate, whichever is lower.

(3) A steel plate shall be equipped with a device that will prevent excessive horizontal movement of the steel plate during the roadway construction process. The steel plate shall be centered on top of the cone, free of sealants and adhesives that would inhibit the ability to easily remove it from the manhole cone. The location of the center of the steel plate shall be preserved, through measurements and/or other accurate means of relocation, before paving.

B Pavement Removal and Preparation

(1) Precautions must be taken to prevent debris from entering the manhole during the entire removal and reconstruction process. This will prevent the possibility of plugged sewers, interruptions in sewage flow and time required to remove the debris after construction.

(2) Cut and remove the asphalt pavement structure, around the manhole casting, with a rotating cutter device that creates a circle with a minimum diameter of 54” and centered about the casting. Dispose of the asphalt off-site.

(3) Remove the casting (manhole rim and cover) from the top of the manhole or manhole adjusting ring. Inspect the rim and cover for defects. If defects are present, replace with a new rim/cover as needed. If defects are not present, clean & retain for use in reconstruction.

(4) Remove all adjusting rings to the top of the manhole structure (concrete cone). Dispose of this material.

(5) Remove all aggregate around the manhole that has been exposed by the asphalt removal and dispose of this aggregate. The aggregate must be removed to a minimum of 2” below the level of the top of the concrete cone.

(6) Clean and inspect the top surface of the concrete cone. The surface should be smooth and free of bumps and pits that may prevent a good water tight seal. Grind the surface as needed to remove protrusions. Utilize compressed air to blow dust and debris from the surface after grinding. Clean the surface with acetone. Utilize hydraulic cement, according to manufacturer’s recommendations, to fill in depressions.

(7) A PVC pipe shall be used as an adjustment ring and temporary casting support. PVC adjustment ring must be cut to the exact profile and/or cross-slope of the

road in all directions such that when the manhole rim and cover are resting on top of the support liner, the top of the casting shall be exactly **0.25 inch below flush** with the pavement surface in all directions. The adjustment ring support shall be marked in such a way, upon completion of the cutting process, that rotation does not occur, which could be detrimental to the end product. The top and/or bottom of the adjustment ring support shall also be marked to prevent the support from being installed upside down, which could be detrimental to the end product.

(8) Apply a liberal amount of elastomeric sealant to the bottom of the adjustment ring support and set in place on top of the concrete cone while making sure it is properly aligned. This will create a water tight seal between the adjustment ring support and the concrete cone.

(9) Apply a liberal amount of elastomeric sealant to the top of the adjustment ring support. Set the manhole frame casting on the adjustment ring support while making sure it is properly aligned. This will create a water tight seal between the adjustment ring support and the bottom flange of the manhole frame casting.

(10) Place the manhole lid on the rim casting to lessen the possibility of debris entering the manhole.

C Concrete Encasement Collar Installation

(1) Place epoxy coated reinforcement around casting frame adequately supported to hold position during concrete placement.

(2) Place concrete encasement collar in accordance with reference standards.

(3) The surface of the concrete shall be finished from flush with the pavement to flush with the rim casting. The edge of the concrete shall be rounded (1/4” radius) where it meets the asphalt.

(4) Fill the groove with a cold pour crack sealer. This will prevent water from entering the circular seam where the concrete collar meets the asphalt.

(5) Apply a concrete curing and sealing compound to the surface of the concrete collar.

(6) Protect concrete from loading & vibration until the concrete attains a compressive strength of 3,000 psi.

2506.4 MEASUREMENT AND PAYMENT

Measurement will be made for each structure completed as specified.

The Contract Unit Price for Concrete Encased Casting Collar shall be compensation in full for all labor, equipment, and materials necessary to complete the work.

The City will pay for concrete encased casting collar on the basis of the following schedule:

Item No.	Item	Unit
2506.602	Concrete Encased Casting Collar	each

2506 CONNECT INTO EXISTING MANHOLE OR CATCH BASIN

The provisions of MN/DOT 2506 are supplemented and/or modified with the following:

This work shall consist of constructing connections into existing drainage structures in accordance with the applicable MN/DOT Standard Specifications and the following.

Connections to existing precast concrete sanitary manholes shall be made with core drill hole and water tight pipe sleeve. Connections to existing brick sanitary manholes shall be made with non-shrink grout to make a water tight connection.

Measurement will be made by the number of connections constructed as specified.

The Contract Unit Price for Connect Into Existing MH OR CB shall be compensation in full for all costs incidental thereto, including but not limited to, all materials and labor necessary to install proposed pipe into an existing drainage structure. Any damage caused to the existing drainage structure shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

The City will pay for Connect Into Existing MH or CB on the basis of the following schedule:

Item No.	Item	Unit
2506.602	Connect into Existing Manhole	each
2506.602	Connect into Existing Catch Basin	each

2506 MANHOLE FRAME SEAL (INTERNAL/EXTERNAL)

The provisions of MN/DOT 2506 are supplemented and/or modified with the following:

2506.1 DESCRIPTION

This work shall consist of the construction of Internal or External type manhole seals with stainless steel compression bands.

A Work Required

An internal or external flexible rubber frame seal, and where allowed by the Engineer, an interlocking extension or extensions, meeting the requirements of this section, shall be used to seal the entire chimney section of sanitary manholes, air release manholes, clean out manholes and all other structures identified on the Contract Drawings or in the Special Provisions. The seal and extension or extensions shall extend from the frame down to the top of the cone.

B System Description

Performance Requirements - The frame seal shall be capable of repeated vertical movement of the frame of not less than two inches and/or repeated horizontal movement of not less than ½ inch after installation and throughout its design life.

C Quality Assurance

Acceptance Testing - Manhole frame seals shall be visually inspected after installation to insure that the seal is properly positioned, tight against the manhole and frame surfaces, that no voids or leakage points exist and that the bands are securely locked in place. Any seals failing this test shall be reworked as necessary and retested at no additional cost to the City.

Any seals not passing this visual inspection may, at the Contractor's option, be tested for leakage using a method approved by the Engineer.

2506.2 MATERIALS

A Products

An internal or external manhole frame seal, as shown on the City Standard Details listed in Appendix D, with extensions where needed to cover the entire chimney area, shall be installed on all sanitary manholes air release manholes, clean out manholes and all other structures identified on the Contract Drawings or in the Special Provisions in accordance with the manufacturer’s instructions.

Frame seals shall consist of a flexible rubber sleeve, interlocking extensions and stainless-steel expansion bands as manufactured by Cretex Specialty Products or a pre-approved equal conforming to the following requirements.

The seal shall remain flexible throughout a 25-year design life, allowing repeated vertical movement of the frame of not less than two inches and/or repeated horizontal movement of not less than ½ inch. The sleeve portion of the seal shall be either double or triple pleated with a minimum unexpanded vertical height of either 8 inches or 10 inches respectively. The sleeve and extension shall have a minimum thickness of 3/16 inches and shall be made from a high-quality rubber compound conforming to the applicable requirements of ASTM C-923, with a minimum 1500 psi tensile strength, a maximum 18% compression set and a hardness (durometer) of 48+5. The bands shall be integrally formed from 16-gauge stainless steel conforming to ASTM A-240,

Type 304, with no welded attachments, shall have a minimum adjustment range of two diameter inches and a positive locking mechanism. Any screws, bolts or nuts used for this mechanism shall be 316 stainless steel conforming to ASTM F-593 and 594.

B Equipment

The contractor shall have a manufacturer's recommended installation tool and all other equipment/tools necessary to install the frame seals.

2506.3 CONSTRUCTION REQUIREMENTS

A Field Measurements

The Contractor shall measure the manhole to determine the information required on the manufacturer's "Sizing and Ordering" procedure. This information is needed to obtain the proper size of bands, the size and shape of the rubber sleeve and the need for and size of any extensions.

B Surface Preparation for Seals

All sealing surfaces shall be reasonably smooth, clean, and free of any form offsets or excessive honeycomb. All loose and protruding mortar and brick that would interfere with the seal's performance shall be removed and the areas of the manhole frame, chimney and/or cone/corbel cleaned by wire brushing. All sealing surfaces shall be reasonably smooth and circular, clean and free of any loose material or excessive voids. Repair mortar, Non-Shrink Grout or Cement-Base Polymer Modified Patching and Repair Mortar shall be used to prepare a uniformly vertical 3" - 4" wide surface for the sleeve and extensions to seal against, if any adequate surface does not exist.

Detail surface preparation, including providing a vertical surface on a cone when none exists, shall be in accordance with the frame seal manufacturer's instructions.

The top portions of the cone shall have a minimum 2 inch high vertical surface. The preparation of this vertical surface when none exists shall be in accordance with the frame seal manufacturer's instructions.

C Installation of Frame Seal

The frame seals and extensions shall be installed in accordance with the manufacturer's instructions.

D Frame Seal Type

All manholes specified to have chimney seals located within the roadway shall have internal type seals. All manholes specified to have chimney seals located outside of the roadway shall have external style seals.

2506.4 MEASUREMENT AND PAYMENT

Measurement will be made for each frame seal completed as specified.

The Contract Unit Price for Manhole Frame Seal shall be compensation in full for all labor, equipment, and materials necessary to complete the work including, where allowed by the Engineer, an extension or extensions.

The City will pay for manhole frame seal on the basis of the following schedule:

Item No.	Item	Unit
2506.602	Manhole Frame Seal	each

2506 MANHOLE VACUUM TESTING

2506.1 DESCRIPTION

This work shall consist of vacuum testing on manholes using vacuum testing equipment acceptable to Engineer.

2506.2 MATERIALS - BLANK

2506.3 CONSTRUCTION REQUIREMENTS

Isolate manhole to be tested by plugging inlet and outlet pipes with inflatable stopper or other suitable test plugs. Securely brace plugs to avoid plugs being drawn into manhole. Plug lift holes with a non-shrink grout.

Place vacuum test equipment inside of top cone section and conduct vacuum test in accordance with manufacturer’s recommendations. Operate vacuum pump until 10 in. of mercury is obtained.

Shut off vacuum pump and measure time for vacuum to drop from 10 to 9 inches of mercury. Manhole test is acceptable if the time exceeds the values in the table below:

Table 2506-1: Minimum Test Time for 48-inch Diameter Manhole

Depth in Feet	Test Time in Seconds
8	20
10	25
12	30
14	35
16	40
18	45
20	50
22	55
24	59
26	64
28	69
30	74

If test fails, repair or seal manhole using non-shrink grout or other materials that are approved by Engineer. Retest until an acceptable test is obtained. Test may be conducted before or after backfilling.

2506.4 MEASUREMENT AND PAYMENT

All costs for furnishing and installing the equipment, maintenance, and labor necessary to perform the testing shall be incidental.

2521 WALKS

The provisions of MN/DOT 2521 are supplemented and/or modified with the following:

MN/DOT 2521.3.D.2 is supplemented with the following:

Sawcutting shall take place as soon as the concrete is hard enough not to be torn or damaged. Any sidewalk with random cracking shall be considered unacceptable work and it shall be removed and replaced at no cost to the City.

MN/DOT 2521.5 is supplemented with the following:

Payment for __" Concrete Walk shall include all costs of root cutting, excavation, disposing of excavated materials, grading, furnishing, placing and compacting the required Class 5 Aggregate base.

2531 CONCRETE CURBING

The provisions of MN/DOT 2531 are supplemented and/or modified with the following:

A Payment for driveway pavement shall include excavating, grading, and furnishing and placing required of Class 5 Aggregate Base.

B All concrete gutters shall be stamped at the junction with all catch basins with a "NO DUMPING, LEADS TO LAKE" stamp meeting the requirements of **City Standard Detail STRM-7** listed in Appendix D.

2531 CONCRETE CURB DESIGN V (ADA)

2531.1 DESCRIPTION

This Work consists of constructing Concrete Curb Design V of varying heights up to 8 inches in accordance with MN/DOT 2531, "Concrete Curbing," MN/DOT 2521, "Walks," and the **City Standard Detail STR-3** listed in Appendix D.

2531.2 MATERIALS - BLANK

2531.3 CONSTRUCTION REQUIREMENTS

Concrete Curb Design V may be constructed independent of, or integral to, the adjacent sidewalk. Match the bottom elevation of the Concrete Curb Design V to the bottom elevation of the adjacent sidewalk slab.

When Concrete Curb Design V is constructed independent of the sidewalk, clean the joint to maximize the bond between the walk and Concrete Curb Design V. Align the joint locations in the Concrete Curb Design V with the joint locations in the adjacent concrete walk.

The locations requiring the use of Concrete Curb Design V will be as shown in the Plans or as determined in the field by the Engineer. Any Concrete Curb Design V that is constructed without pre approval of the Engineer will be considered unauthorized work for which no compensation will be made and may be removed at the Engineer's discretion. The height and length of the Concrete Curb Design V to be constructed shall be recommended by the Contractor and approved by the Engineer before the Concrete Curb Design V is constructed.

2531.4 METHOD OF MEASUREMENT

The Engineer will measure the length of Concrete Curb Design V constructed, along the face of the curb. Curb height is measured from the top of the adjacent concrete curb ramp walk to the top of the curb.

Pedestrian concrete approach nose adjacent to the pedestrian ramp will be measured as 2 feet of Concrete Curb Design V. No measurement will be made for pedestrian concrete approach nose adjacent to Roadway curb and gutter.

2531.5 BASIS OF PAYMENT

The Contract Unit Price for Concrete Curb Design V is compensation in full for Equipment, Materials and Labor required to complete the Work.

Lengths of Concrete Curb Design V that is constructed integral and never reach 3-inch height will be paid for as Concrete Walk.

The City will pay for Concrete Curb Design V on the basis of the following schedule:

Item No.	Item	Unit
2531.603	Concrete Curb Design V	linear foot

2532 CONSTRUCT SURVEY MONUMENT

2532.1 DESCRIPTION

This work shall consist of providing a survey monument to re-establish monuments displaced by the construction. The survey monument will generally consist of a steel reinforcement bar set in concrete to a precise location. The top elevation of the monument will be set below the finished surface and covered with a casting assembly. Refer to **City Standard Detail Drawings SUR-1 and SUR-2** listed in Appendix D.

2532.2 MATERIALS

A The City of Duluth will supply the monument casting cover and frame.

B The Contractor shall supply all other materials necessary to provide the monument as shown in the details including the PVC pipe sleeve, backfill, epoxy reinforcement bar, and concrete.

2532.3 CONSTRUCTION

A The Engineer will set the 1” rebar.

B The contractor shall set the PVC tube and place the concrete around the rebar as detailed.

C The contractor shall notify the Engineer 48 hours prior to setting the monument.

D Where the monument is located within the roadway, the Contractor shall additionally provide a concrete encasement casting collar as detailed. The concrete shall be protected from traffic for a minimum of 7 days to allow for curing.

2532.4 MEASUREMENT AND PAYMENT

Survey monuments will be measured by the number of completed monuments.

The Contract Unit Price for survey monuments shall be compensation in full for all materials, labor, and equipment necessary to provide the monument.

The City will pay for survey monuments on the basis of the following schedule:

Item No.	Item	Unit
2540.602	Survey Monument	each
2540.602	Survey Monument in Roadway	each

2540 BRICK PAVEMENT RESTORATION

2540.1 DESCRIPTION

This work shall consist of constructing or reconstructing brick paver street pavement and brick paver sidewalk shall be in accordance with the relevant MN/DOT standards, and as modified in these standard specifications.

2540.2 MATERIALS

Materials for brick paver street pavement and brick paver sidewalk shall generally match the size, color, and texture of existing brick pavers; and shall meet the relevant physical properties necessary to perform adequately for the intended use. Submit product samples and certificate of compliance from manufacturer for review by Engineer.

A Brick pavers shall be dense, with extruded wire cut face and shall comply with ASTM Designation C902-79a as modified below:

- Class SX: Compressive strength, flatwise, gross area (min.) .....15,000 P.S.I.
- Cold water absorption (max.) 6%
- Modulus of Rupture (per ASTM C67-80a) .....1,500 P.S.I.
- Type I Traffic, Abrasion Index Maximum 0.04

  (50 cycle freeze thaw, Submit manufacturer test results)
- Unit Size: .....4 inch (W) x 8 inch (L) x 2-1/4 inch (D)
- Unit Size over Vault:.....4 inch (W) x 8 inch (L) x 1-5/8 inch (D)
- Unit Size Allowed Variation (+/-): ..... 3/32 inch for Width
  1/16 inch for Depth
- Skid Resistance (ASTM-E-303-74 British Pendulum Method (min.) 70

B Color and texture of brick pavers shall be similar to:

(1) Street/Sidewalk Paver

- Endicott - #46 Medium Ironspot & Dark Ironspot
- TK Yankee Hill – Modified Tan Flashed and Dark Flashed Brown

(2) Centerline/Driving Lane Paver

- Endicott – Coppertone
- TK Yankee Hill – Mojave

C Asphalt setting bed materials shall meet gradation "A" of Table 3139.2-2 Aggregate Gradation Broad Band of MN/DOT 3139 or approved equal. Asphalt binder for asphalt setting bed material shall be Type B (PG 58S-28) or approved equal. Submit design mix for review by Engineer.

D Neoprene-modified asphalt adhesive (or approved equal) shall meet:

- Mastic (asphalt adhesive):
  Solids (base) ..... 75 +1%
  Lbs./Gallon ..... 8 – 8.5 lbs.
  Solvent ..... Varsol (>100 degree F. flash)
- Base (2% neoprene, 10% fibers, 88% asphalt):
  Melting Point (ASTM D-36) ..... 200 degree F. minimum
  Penetration (.1 m.m.) ..... 23 - 27
  Ductility (ASTM D-133-44) ..... 125 cm minimum

E Joint filler shall be Portland Cement, or approved equal, with pre-mixed color conforming to ASTM C-150, consisting of clean natural sand, free of organic material, 100 percent passing a No. 8 sieve, with a maximum of 10 percent passing a No. 200 sieve. Mixture shall be: one part Portland Cement to three parts sand. Submit color sample for review by Engineer.

F Expansion joint (board) material shall meet MN/DOT 3702 or approved equal.

G Expansion joint sealant materials shall meet the following or approved equal.

G.1 Horizontal Joints

Sealant shall be **two-part**, self-leveling, non-tooling, polyurethane. Shore "A" hardness of not less than 38. Tack fee four hours after application with non-asbestos filler to prevent running or sagging on 5 percent slope. Color to match existing as closely as reasonable. Submit color sample for review by Engineer.

(a) For joints with a **slope less than or equal to 5 percent**, sealant products shall be: MasterSeal SL2 by Master Builders - BASF; Urexpan NR200 by Pecora Corp; Sikaflex 2cSL by Sika Corp.; or approved equal.

(b) For joints with a **slope greater than 5 percent**, sealant products shall be: MasterSeal SL2 by Master Builders - BASF; DynaTrol II-SG by Pecora Corp; Sikaflex 1cSL by Sika Corp.; or approved equal.

G.2 Vertical Joints

Sealant shall be **one-part**, non-prime, urethane. Sealant products shall be: MasterSeal NP1 by Master Builders - BASF; DynaTrol II by Pecora Corp; Sikaflex 1a by Sika Corp.; or approved equal.

H Brick paver cleaner shall meet the following: Sure Klean “Protec Tile” by Pro-So-Co, Inc.; Super Grout Release by Klein Co.; Dry-Seal by Concrete Service Materials Co.; or approved equal. Emulsion is a temporary protective liquid coating formulated to coat brick pavers prior to grouting (joint filling). Paver detergent shall be final clean-up material. Detergent shall be a blend of surface acting acids, chelating and wetting systems. Its form shall be water-clear liquid with specific gravity of 1.13 and a pH of 0.5 (at 1:6 dilution); or approved equal.

I Concrete shall meet MN/DOT 2301 and MN/DOT 2461.

- Concrete design mix 3F52 (sidewalk) and 3R52 (concrete base).
- Drill and grout 1” dia. dowel bars or No. 8 reinforcement “tie” bars (24” length) at 16” O.C. into adjacent existing concrete base.

2540.3 CONSTRUCTION

The work shall generally be completed in accordance with relevant sections of MN/DOT for excavation, aggregate base, concrete base, concrete pavement, and concrete walk. In addition, the brick installation work shall meet the following:

A Placing Asphalt Setting Bed & Adhesive

To install the setting bed over the concrete base surface, place ¾ inch deep control bars directly over the base. If the grades must be adjusted, set wood chocks under depth control bars to proper grade. Set two bars parallel to each other approximately 11 feet apart to serve as guides for striking board (12 ft. long x 2 in. x 6 in.). The depth control bars shall be set carefully to bring the pavers, when laid, to proper grade.

Place asphalt setting bed materials between the parallel depth control bars. Pull this bed with the striking board over these bars several times. After each passage, low porous spots shall be filled with fresh asphalt setting bed materials to produce smooth, firm, and even setting bed. As soon as this initial panel is completed, advance the first bar to the next position in readiness for striking the next panel. Carefully fill up any depressions that remain after removing the depth control bars and wood chocks.

The setting bed shall be rolled with a power roller to a nominal depth of ¾ inch while still hot. The thickness shall be adjusted so that when the bricks are placed, the top surface of the pavers will be at the required finished grade.

A coating of two percent neoprene-modified asphalt adhesive shall be applied by mopping, squeegeeing, or troweling over the top surface of the asphalt setting bed so as to provide a bond under the pavers. If it is troweled, the trowel shall be serrated to provide 1/16-inch adhesive height. Adhesive shall be installed in accordance with manufacturer's recommendations.

B Brick Paver Installation

After brick adhesive is applied, carefully install pavers in straight courses with hand tight joints and uniform top surface. The pattern shall be herringbone as shown in the Plans or as directed by the Engineer. The face of the brick shall be the street surface. Generally, hand tight joints shall be approximately 1/8 inch. However, the following tolerances shall pertain as well:

- Maximum joint spacing for up to 10 consecutive parallel joints shall not exceed ¼ inch width per joint. Joints exceeding ¼ inch width will not be acceptable and shall be corrected immediately.
- Vertical displacement of any one or more bricks shall not exceed 1/8 inch either above or below and adjacent surface. Surface variations exceeding 1/8 inch will not be acceptable and shall be corrected immediately.

If the finished paver surface has a differential height exceeding tolerances described above, remove pavers, fill, compact, and level setting bed, apply adhesive and re-install pavers as specified.

Allowable tolerance for overall surface shall be ¼ inch per 10 feet from the finished grade. Allowable tolerance between concrete base and brick pavers is ¼ in surface height.

C Brick Layout

Install 1-5/8 inch thick paver over vault sidewalk to remain. Where non-structural topping sidewalk is removed, install 2-1/4 inch thick pavers. Install 2-1/4 inch thick pavers elsewhere. Install centerline/driving lane pavers in soldier course pattern, double row at centerline, single row at driving lane as shown in the Plans, or as directed by Engineer.

To obtain smooth surface, cover pavers with ½ inch thick plywood, or similar sheathing, and roll with roller to level paver surface to comply with specified tolerance.

Make necessary brick paver cuts with a saw to create clean-cut edges. Units with chipped surfaces or irregular cuts will not be accepted.

D Paver Joint

Apply protective emulsion in accordance manufacturer's recommendations. Avoid excessive application of material to avoid brick joints being coated. Allow approximately 20 minutes drying or manufacturer's recommendation.

Sweep joint filler mixture of dry sand and colored cement into joints until completely filled. Remove excess materials and broom sweep surface.

Fog the entire area of sand filled joints with a list mist of water spray. Allow the cement in joints to take initial set before heavy rinse.

E Cleaning and Repairing

Clean, repair, adjust, or replace brick pavers when directed by the Engineer. This may include materials which have been soiled, discolored, or damaged by work covered under these provisions.

Clean paver surface with cleaning detergent within 48 hours of joint filling, according to manufacturer's recommendations. Spray or brush onto surface, allow detergent to sit for 3-5 minutes. Scour with stiff bristle brushing action and completely rinse surface of cement residue.

2540.4 METHOD OF MEASUREMENT

Brick paver street pavement and brick paver sidewalk will be measured by top surface area in square feet.

2540.5 BASIS OF PAYMENT

The Contract Unit Price for Brick Paver Street Pavement and Brick Paver Sidewalk is compensation in full for all labor, equipment, and materials necessary to complete the work including, but not limited to; excavation, foundation preparation, aggregate base, concrete base, concrete sidewalk, concrete curb and gutter, asphalt setting bed, asphalt adhesive, brick, joint filling, joint sealing, and cleaning completed and accepted.

The City will pay for Brick Paver Street Pavement and Brick Paver Sidewalk on the basis of the following schedule:

Item No.	Item	Unit
2540.618	Brick Paver Street Pavement	square foot
2540.618	Brick Paver Sidewalk	square foot

2545 ADJUST HANDHOLE FRAME AND COVER

2545.1 DESCRIPTION

This work consists of adjusting existing hand holes to match the surrounding sidewalk. This work shall be in accordance with the applicable MN/DOT Standard Specifications, as detailed in the plans, and the following.

2545.2 MATERIALS – BLANK

2545.3 CONSTRUCTION REQUIREMENTS

This work shall consist of:

A Salvage the existing frames and covers and prepare them for reuse. If the Engineer determines that the existing frame and/or cover are not suitable to be salvaged the Engineer will direct the Contractor to obtain a new frame and/or cover from the City Signal Shop at 1530 W. Michigan Street or to provide a new one. Providing a new frame and/or cover will be considered Extra Work and the Contractor will be compensated in accordance with the provisions of MN/DOT 1904.

B Remove concrete from walls of hand hole so that the frame and cover will stand clear of the hand hole and be flush with the concrete walk.

C Replace the salvaged frame and cover, making sure it is supported by at least two inches above the hand hole frame by material that can be removed after the sidewalk concrete is set. If necessary, place new concrete to the nearest joint adjacent to the frame and as shown on **City Standard Details STR-14, STR-15, or STR-16** listed in Appendix D as appropriate.

2545.4 METHOD OF MEASUREMENT

The Engineer will measure the number of Adjust Handhole Frame and Cover acceptably completed.

2545.5 BASIS OF PAYMENT

The Contract Unit Price for Adjust Handhole Frame and Cover is compensation in full for all labor, equipment, and materials necessary to complete the work including, but not limited to; salvaging items and any required sidewalk replacement or reinforcing steel. The City will pay separately for concrete sidewalk if the Contract contains specific Unit Prices for these items.

The City will pay for Adjust Handhole Frame and Cover on the basis of the following schedule:

Item No.	Item	Unit
2545.602	Adjust Handhole Frame and Cover	each

2564 TRAFFIC SIGNS AND SIGN POST INSTALLATION

The provisions of MN/DOT 2564 are supplemented and/or modified with the following:

2564.1 DESCRIPTION

The size of all traffic signs, materials, and posts shall be approved by the Engineer.

2564.2 MATERIALS

All sign faces shall consist of 3-M brand, Diamond Grade DG³ reflective sheeting or approved equal, unless authorized by the City of Duluth.

All traffic signs shall be fastened to sign posts with 316 stainless steel bolts, washers, and Nyloc nuts. The washer shall be separated from sign sheeting by a nylon washer.

All traffic sign posts inserted into soil shall have a weight of three pounds per foot and shall be manufactured of galvanized steel with a minimum length of six feet.

All traffic sign upright posts shall have a minimum weight of two pounds per foot and shall be manufactured of galvanized steel with a minimum length of eight feet.

2564.3 CONSTRUCTION REQUIREMENTS

All traffic signs shall be installed to a minimum height of seven feet to the bottom of the sign, with highest priority signage at the top on posts with more than one sign.

All traffic posts installed in sidewalks or concrete surfaces shall conform to **City Standard Detail T-2** listed in Appendix D with use of MN/DOT approved/qualified products. Installation on new concrete surfaces shall not take place until at least 30 days after the concrete was poured or as directed by the manufacturer, whichever is longer. Provide a temporary sign at no additional cost to the City if the sign is pertinent to traffic before the permanent sign can be installed. No extension to contract time or roadway restrictions will be granted due to this requirement. All bases shall be located in an area clear of utilities to a distance of two feet in all directions, and a minimum of two feet behind the face of curb.

2564.4 BASIS OF PAYMENT

Payment for the installation of traffic signs and devices shall be made at the contract price per unit of measure per MN/DOT 2564.

2564 STREET NAME SIGNS, CONCRETE FOOTING, SIGN POST, AND BRACKET ASSEMBLY

The provisions of MN/DOT 2564 are supplemented and/or modified with the following:

2564.1 DESCRIPTION

This Work includes furnishing and installing street name signs, concrete footings, sign posts, and bracket assemblies.

2564.2 MATERIALS

A Reflective sheeting shall be 3-M brand, Diamond Grade V.I.P. or approved equal.

B Length and Width

Mounted name signs shall have a standard width of 9 inches. The length of the face and blade shall be determined by the number of letters in the street name, including the prefixes and suffixes. The nameplate shall have a minimum length of 30 inches or as requested by the Engineer. Where extra length is required, it shall be provided in 6-inch increments.

Unmounted street name faces to be mounted on flat metal sign blades shall have sufficient width and length to permit application and trimming to the finished sign blank 9 inches wide by 30 inches, 36 inches or 42 inches in length.

All 9-inch street name sign plates shall be notched to properly fit the brackets shown on **City Standard Details T-4, T-5 and T-6** listed in Appendix D; and punched on each end for either stainless bolts (1" long x 1/4" x 20) with nylon and stainless washers and stainless locking nuts, or rivets as approved by the Engineer. The bolts or rivets shall be furnished and installed on each sign unit.

C Bracket Assembly

The street name bracket assembly shall consist of a post top cap, center rod welded to the post top cap, center clip spacers, and vandal resistant top finial nut.

The post top cap shall be cast iron and of a design which shall fit a round post. The post top cap designed for round posts shall weigh not less than 2.15 pounds each. The post top cap for round post installations shall fit a 2-3/8" O.D. post and shall have two 3/8" x 3/8" Allen set screws capable of providing a secure bond to the post. Post-top caps shall have a smooth surface and be painted black.

A 5/8" square steel center tie rod shall be inserted 7/8" into the post cap then welded into the post top cap. The tie rod shall be of the proper length to accommodate either two, four, or six, nine-inch notched street name signs. The tie rod bolt shall be threaded at the top with a standard 5/8"-11 thread with a maximum diameter of .625" and a minimum diameter of .61". The tie rod shall be galvanized after threading to ensure a rust-free thread operation.

The sign support holders shall be 18-gauge galvanized steel formed to hold two sign plates within notches formed in the sign plates and fitting over the center tie rod. Sign holders shall be six inches wide and at least 1-1/4" high, providing ample space between the upper and lower sets of sign plates. Each holder shall have a star hole to prevent turning on the center tie rod and shall allow alignment of 45, 90, 135, and 180 degrees. Sign support holders shall be free of burrs and painted black.

Top finial nut shall be cast iron, bored and threaded to fit the 5/8" center tie rod. The finial nut shall have a hole bored on the exterior, 13/64" diameter and 1/4" deep to accommodate a spanner wrench for attachment and removal. The nut shall have a hole drilled and threaded to accommodate a 1/4"- 20 x ½" 316 stainless steel Allen set screw which will be used as a vandal resistant device. The finial nut shall have a smooth and burr free surface and be painted black. Anti-seize coating shall be applied to all threaded fittings.

2564.3 CONSTRUCTION REQUIREMENTS

The concrete footing and sign post shall conform to **City Standard Detail T-3** listed in Appendix D. The street sign unit E-250 shall conform to **City Standard Detail T-4** listed in Appendix D. The street sign unit E-450 shall conform to **City Standard Detail T-5** listed in Appendix D. The street sign unit E-650 shall conform to **City Standard Detail T-6** listed in Appendix D.

2564.4 METHOD OF MEASUREMENT

The Engineer will measure the number of Street Name Signs acceptably completed.

2564.5 BASIS OF PAYMENT

The Contract Unit Price for Street Name Signs is compensation in full for all labor, equipment, and materials necessary to complete the work including, but not limited to; furnishing and installing concrete footings, sign post design special and street sign units E-250, 450, and 650 complete with brackets.

The City will pay for Street Name Signs on the basis of the following schedule:

Item No.	Item	Unit
2564.602	Street Name Signs	each

2564 SIGNS – REMOVE AND REINSTALL

2564.1 DESCRIPTION

This work shall consist of removal, storage, protection and reinstallation of signs in accordance with the provisions of MN/DOT 2564, and the following:

2564.2 MATERIALS – BLANK

2564.3 CONSTRUCTION REQUIREMENTS

All signs that are removed to be reinstalled at a later date will be stored in such a manner as to prevent any damage to the sign and the post. The sign will be installed in the same condition that it was removed. Any traffic sign or street name sign within the project limits that is damaged by construction operations or lost shall be replaced with a new sign by the Contractor at the Contractor’s expense.

2564.4 METHOD OF MEASUREMENT

Measurement will be made by each pole for removal and reinstall signs as specified. Multiple pole signs will be measured as a single unit. If more than one sign is attached to a single pole, the pole and signs will be paid as a single unit.

2564.5 BASIS OF PAYMENT

The Contract Unit Price for Signs – Remove and Reinstall is compensation in full for all costs incidental thereto, including but not limited to: removing and installing the signs; mounting hardware; excavation for footings; concrete and rebar for footings if required; and protecting and storing the signs. Payment under this item shall only be made for the specific signs identified for removal and reinstallation in the Plans. No payment shall be made for the temporary relocation of signs required or made to accommodate the Contractor's operations.

The City will pay for Signs – Remove and Reinstall on the basis of the following schedule:

Item No.	Item	Unit
2564.602	Signs – Remove and Reinstall	each

2571 PLANT INSTALLATION AND ESTABLISHMENT – STREET TREES

The provisions of MN/DOT 2571 are supplemented with the following:

2571.1 DESCRIPTION

This work consists of providing, planting, and establishing trees of the species, size, variety and root category specified for locations shown on the plans, and including planting trees provided by the City of Duluth.

Street Trees. This standard applies to 'Street Trees' that will be owned/maintained by the City of Duluth within the established roadway right of way. The term 'Street Trees' applies to those trees planted along a street/roadway in close proximity to the street, where limits of the road structure (geotextile fabric, subsurface drain, subbase, aggregate base, pavement, curb and gutter, and sidewalk) are within the 'drip line' of the anticipated crown spread (or canopy) of the mature tree.

2571.2 MATERIALS

A Street Tree Planting Zone Soil Treatment - A soil mixture meeting the requirements of MN/DOT 3877.2.F Boulevard Topsoil Borrow shall provide a 24-inch planting zone treatment in street boulevards and/or within street right of way in accordance with **City Standard Details STR-12 and STR-13** listed in Appendix D. Submit a copy of the design mixture of topsoil addressing: soil source(s), blending/mixing procedures, and test reports of sieve analysis at least 3 weeks prior to commencing work.

B Species Selection and Diversity Guidelines – Selection of the tree species shall be in accordance with all of the following:

(1) The Plans shall govern if tree species are shown there.

(2) City Forester's recommendations. An existing tree survey completed by the City Forester may be necessary prior to issuing recommendation.

(3) No more than five (5) trees per genera may be on any one block. (i.e. 6 trees = 2 genera; 11 trees = 3 genera; 16 trees = 4 genera).

(4) Each side of a street shall have two species of trees planted (four species total per block) in a simple alternating pattern. The species shall switch every block.

(5) For projects less than 50 trees, not more than 50% may be of single genus.

(6) For projects of 50-100 trees, not more than 50% of single genus, and not more than 30% of a single species.

(7) For projects greater than 100 trees, not more than 30% of a single genus, and not more than 20% of a single species.

(8) Trees size/stature shall be determined per Table 2571-1:

Table 2571-1: Acceptable Mature Tree Size/Stature

Boulevard Width	Small Trees	Medium Trees	Large Trees
less than 5 feet	No	No	No
5 feet to 7 feet	Yes	No	No
7 feet to 9 feet	Yes	Yes	No
greater than 9 feet	Yes	Yes	Yes

C Acceptable Tree Species – Refer to the lists below:

(1) Small Trees (mature height less than 30 feet)

- Ironwood (Carpinus caroliana)
- Serviceberry – "Autumn brilliance" (Amelanchier x grandiflora)
- Hawthorn – Crimson cloud (Crataegus laevigata 'Crimson Cloud')
- Flowering pear – Prairie Gem or Mountain Frost (Pyrus ussurienses)
- Sargent cherry – Spring Wonder or Pink Flair (Prunus sargentii)
- Blackhaw – (Viburnum prunifolium)
- Redbud – Northern Herald (Cercis canadensis)

- Pagoda dogwood – (Cornus alternifolia)
- Flowering crabapples – Adirondack, Firebird or Sugar Tyme

(2) Medium Trees (mature height less than 40 feet)

- Buckeye – Autumn Splendor, Prairie Torch, Lavaburst (Aesculus glabra)
- Ginkgo – Princeton Sentry, Autumn Gold (Ginkgo biloba)
- Elm – Discovery (Ulmus davidiana var. japonica 'Discovery')
- Prairie horizon alder (Alnus hirsuta 'Harbin')
- Linden – American Sentry (Tilia americana 'McKSentry')
- Sugar maple – Apollo (Acer saccharum 'Barrett Cole')
- Yellowwood – (Cladrastis kentukea)
- Serviceberry – Spring Flurry (Amelanchier laevis)
- Columnar oaks – Regal Prince, Crimson Spire, Kindred Spirit (Quercus spp.)

(3) Large Trees (mature height greater than 40 feet)

- Red oak (Quercus rubra)
- Swamp white oak (Quercus bicolor)
- Bur oak (Quercus macrocarpa)
- White oak (Quercus alba)
- Pin oak (Quercus ellipsoidalis)
- Hackberry (Celtis occidentalis)
- River birch (Betula nigra)
- Paper birch – Prairie dream, Renaissance Oasis (Betula papyrifera)
- Kentucky Coffeetree - Espresso (Gymnocladus dioicus)
- American elm - Prairie Expedition, Jefferson (Ulmus Americana)
- Yellow buckeye (Aesculus flava)
- Sycamore – Northern Advance (Platanus occidentalis)
- Butternut (Juglans cinera)

- Black walnut (Juglans nigra)
- European larch (Larix decidua)
- Basswood (Tilia americana)
- Silver maple – Silver queen (Acer saccharinum)
- Sugar maple (Acer saccharum)
- Red maple (Acer rubrum)

2571.3 CONSTRUCTION REQUIREMENTS

The provisions of MN/DOT 2571.3 Construction Requirements are supplemented with the following:

A Tree Locations

Determine planting locations based on the following guidelines:

(1) Tree Spacing

Table 2571-2: Minimum Spacing between Street Trees

Tree Size/Stature	Min. Distance Tree to Tree
Small	20 feet O.C.
Medium	25 feet O.C.
Large	30 feet O.C.

(2) Tree Clearances

Table 2571-3: Minimum Clearances for Tree Placement

Element	Min. Distance from Tree O.C.
Traffic signal pole base	75 feet
Stop or yield sign	50 feet
Cross street unmarked	40 feet
Street signs	20 feet
Street light poles	20 feet
Utility poles	20 feet
Fire hydrant	10 feet
Alleys or driveways	10 feet
Catch basin or pipe inlet	10 feet
Underground gas main	5 feet
Underground utility service lines	5 feet
Utility service shutoff and locate boxes	5 feet
Edge of crossing sidewalks	5 feet
Curb and edge of parallel sidewalks	2 feet
Bus stop	Clear of entire loading zone
Overhead power and communication lines	No medium or large trees

B Plant Installation

Perform this work in accordance with the current edition of the *Inspection and Contract Administration Manual for MN/DOT Landscape Projects* (ICAMMLP).

C Standard Planting Details

Refer to the current version of the MN/DOT Standard Plan 5-297.301 (3 sheets).

D Protection and Restoration of Vegetation

Refer to the current version of the MN/DOT Standard Plan 5-297.302 (1 sheet).

2572 PROTECTION AND RESTORATION OF VEGETATION

The provisions of MN/DOT 2572 are supplemented with the following:

Contractor shall consult with the City Forester, or designee, prior to beginning any construction activities to identify, verify, and establish concurrence with plan of tree removal, preservation, and protection.

Preserved trees shall be protected from direct damage and soil compaction in accordance with MN/DOT Standard Specifications for Construction, 2572.3.A Protecting and Preserving.

The provisions of MN/DOT Specification 2572.3.A.7, Destroyed or Disfigured Vegetation, are amended below:

Damage to preserved trees on public property by contractors through negligence or non-compliance with the City's Standard Construction Specifications may be subject to a fine established by the Tree Inspector per the *Council of Tree and Landscape Appraisers – Guide for Plant Appraisal*. A copy of this guide is available for review in the City Engineering Office, 240 City Hall.

2573 EROSION CONTROL SUPERVISOR

Section 2573.5G is deleted and replaced with the following:

G Erosion Control Supervisor

Providing the Erosion Control Supervisor for this Contract shall be considered incidental work for which no direct payment will be made.

2575 TURF ESTABLISHMENT

Turf establishment shall be performed in accordance with the provisions of MN/DOT 2575, except as modified below:

2575.1 DESCRIPTION

This Work consists of establishing turf to restore project sites and reduce the risk of soil erosion.

2575.2 MATERIALS – BLANK

2575.3 CONSTRUCTION REQUIREMENTS

A Lawn type sod shall be placed on all disturbed turf areas in well- established lawns and around all culvert ends and storm sewer inlets and outlets as directed by the Engineer.

B Where the new sod meets the existing, a sod cutter shall be used to make the new sod level with the existing and to eliminate the ragged appearance of the existing sod caused by excavation. Areas to be sodded shall be cut to at least two feet wide.

C Areas of disturbed soil located on private property will be topsoiled and sodded immediately after the underlying work is completed. No additional compensation will be made for this early sodding.

D Topsoil salvage material shall be placed to a thickness of four inches on all disturbed turf areas to be sodded and seeded in accordance with the provisions of MN/DOT 2106. Where the salvage topsoil material found on site is inadequate, topsoil borrow shall be provided in turf establishment areas in accordance with the provisions of MN/DOT 2574.

E Turf establishment on disturbed turf areas not designated for sodding shall consist of seeding, fertilizing and mulching. Unless otherwise provided in the Plans, turf establishment by seeding shall include:

(1) Seed, Mixture No. 25-151 (High Maintenance Turf) as specified in MN/DOT 3876, shall be applied at the rate of 200 pounds per acre.

(2) Fertilizer, Type 3, (analysis 22-5-10) as specified in MN/DOT 3881 shall be applied at the rate of 350 pounds per acre.

(3) Hydraulic Matrix, Type RFM as specified in MN/DOT 3884 shall be applied at the rate of 3,900 pounds per acre.

F Seed shall be placed with a hydro-seeder, unless otherwise approved by the Engineer.

2575.4 METHOD OF MEASUREMENT – BLANK

2575.5 BASIS OF PAYMENT

Final acceptance of turf establishment will not be made until area restored has a satisfactory stand of grass established. Project payment retainage will be held until final acceptance of turf establishment.

A Payment for sodding at the contract price per square yard shall include importing or salvaging and placing four inches of topsoil, shaping, or otherwise preparing the ground, cutting as required, furnishing, laying the sod on the areas designated to be covered, and pressing the sod into the underlying soil by rolling or tamping, and staking or stapling as necessary for sloped areas.

B Payment for turf establishment shall include importing or salvaging and placing four inches of topsoil, shaping, or otherwise preparing the ground, seeding, fertilizing and hydro-mulching the disturbed turf areas not designated for sodding. Final acceptance of turf establishment will not be made until the area restored has a satisfactory stand of grass established. A satisfactory stand of grass shall be defined as a consistent root of growth three inches or more. Root growth shall be determined on a random sample basis of plugs taken by the Engineer when the contractor determines that the root growth has been obtained. Turf will not be accepted until the minimum root growth has been obtained.

C Upon expiration of the sod maintenance period on individual areas or sections of the Project, the Engineer will make an inspection of the work and will accept all sod that is in normal, healthy growing condition. No payment will be made for sod that is not in acceptable condition at the time of the final inspection an amount will be deducted from any moneys due or that may become due the Contractor equal to 100 percent of the Contract bid price per unit of measure of unacceptable sod. Sod that is within 3 m (10

feet) of the shoulder or is directly abutting a roadway surface that is acceptably maintained but dies out due to salt or winter maintenance activities beyond the Contractor's control, may be paid for at 100 percent of Contract price provided that the sod has been maintained for at least 20 calendar days prior to December 1."

2582 PAVEMENT MARKINGS

The provisions of MN/DOT 2582 are supplemented with the following:

All pavement messages, stop bars, and crosswalks shall be recessed in accordance with MN/DOT 2582.3B.7.

3601 RIPRAP MATERIAL

The provisions of MN/DOT 3601 are modified with the following:

All riprap shall have a minimum of **two fractured faces**.

3885 ROLLED EROSION PREVENTION PRODUCTS

The provisions of MN/DOT 3885 are supplemented with the following:

Unless otherwise approved by the Engineer, all rolled erosion prevention products shall consist of bio-degradable natural fiber netting interlaced in a natural organic mulching material. The use of plastic or photodegradable plastic netting is not permitted.

- END -