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City of Duluth, Minnesota Construction Standards

Public Works & Utilities
Engineering Division
Duluth, MN
January 8, 2016

CITY APPROVAL

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APPROVED	CHIEF ENGINEER OF TRANSPORTATION	DATE
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CITY OF DULUTH GENERAL REQUIREMENTS

S-1 INSURANCE PROVISIONS

A. 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 has been 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.

B. Insurance

Contractor shall provide Public Liability and Automobile Liability Insurance with limits not less than $1,500,000 Single Limit and twice the limits provided when a claim arises out of the release of a hazardous substance; shall be written by a company approved by the City of Duluth and licensed to do business in the State of Minnesota; and shall provide for the following: Liability for Premises, Operations, Completed Operations, Independent Contractors, and Contractual Liability; Property damage coverage for explosion, collapse, and underground "XCU" to be included.

City of Duluth shall be named as Additional Insured under the Public Liability, or as alternate, Contractor may provide Owners-Contractors Protective policy, naming himself and City of Duluth. Contractor shall provide evidence of Statutory Minnesota Workers' Compensation Insurance. Contractor to provide Certificate of Insurance evidencing such coverage with 30-day notice of cancellation, non-renewal or material change provisions included. The use of an “Accord” form as a certificate of insurance shall be accompanied by an endorsement evidence that the above 30-day notice requirement has been met.

C. Comprehensive Owner’s Protective Insurance

If a certificate of insurance is provided, the form of the certificate shall contain an unconditional requirement that the insurer notify the City without fail not less than 30 days prior to any cancellation, non-renewal or modification of the policy or coverages evidenced by said certificate, and shall further provide that failure to give such notice to the City will render any such change or changes in said policy or coverages ineffective as against the City. In the cancellation provisions, the words “endeavor to” must be deleted in reference to the 30-day notice of cancellation, non-renewal or material change provisions included. As an additional insured under the contract, the City of Duluth has contractual rights for exceeding that of a certificate holder. Therefore, additional named insured endorsement shall read as follows: This policy insures the named insured and the city of Duluth and will be primary and not contributory with city of Duluth coverage. The City of Duluth is an additional insured

not subject to the "other insurance" condition or other policy terms which conflict with the agreement between the named insured and the City of Duluth.

D. Subcontractor's Insurance
In the event any work contemplated by the Contract is subcontracted, the Contractor shall be responsible to see that the subcontractors provide insurance in accord with the minimum requirements herein above imposed on the Contractor.

E. Indemnification
The Contractor shall defend, indemnify and save harmless the City and all of its officers, agents, and employees from all suits, actions, or claims of any character, name, and description brought for or on account of any injuries or damages received or sustained by any person, persons, or property, by or from the act or acts of said Contractor, or by or in consequence of any negligence in safeguarding the work, or through the use of unacceptable materials in constructing the work, or by or on account of any act or omission, neglect or misconduct of said Contractor, or from any claims or amount arising or recovered under the Workmen's Compensation Law or any other bylaw, ordinance, order or decree, and so much of the money due the said Contractor under and by virtue of his contract, as shall be considered necessary by the City, may be retained for the use of the City or in case no money is due, his surety shall be held until such suit or suits, action or actions, claim or claims, for injuries or damages as aforesaid, shall have been settled and suitable evidence to that effect furnished to the City. The Contractor shall indemnify and save harmless the City from any and all losses caused by or an account of any claims or amounts recovered for any infringement of patent, trademark or copyright.

The unauthorized use by the Contractor of public or private property for any purpose may be considered an injury or damage to the property so used.

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 two 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 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.

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

B. 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.

C. Supply iron pipe curb box materials as shown on details W-5, W-5A, and W-5D.

D. 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.

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.

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 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 requires 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 whom 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, sub-contractors 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 to include the following:

If within one year after the date which the contractor signs the final estimate for payment (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 Owner is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with written instructions:

A. Repair such defective land or areas; or
B. Correct such defective work; or
C. If the defective work has been rejected by owner, remove it from the project and replace it with work that is not defective, and
D. 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 Owner, 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 PROJECT LABOR AGREEMENT

In accordance with Duluth City Code, Chapter 2, Article IV, Section 2-29, a Project Labor Agreement will be required for projects of $150,000 or greater. The Contractor and all direct subcontractors of the Contractor--of whatever tier--who have been awarded contracts for this Project shall accept and be bound by the terms and conditions of the

Project Labor Agreement. The Contractor shall be signatory to the Project Labor Agreement; a copy of which, in its substantial form, is included in Appendix C of this specification.

S-12 GOVERNING SPECIFICATIONS

A. The 2016 Edition of the Minnesota Department of Transportation 'Standard Specifications for Construction' shall govern.
B. Latest version of Minnesota MUTCD, including the latest version of the Temporary Traffic Control Zone Layouts field manual.
C. 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-13 DAMAGE TO CITY UTILITIES

Section 48-224 through Section 48-228 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. It also states that it is prima facie evidence of the excavator's negligence in a civil court action if damage to the underground facilities of the City resulted from excavation, and the excavator failed to give an excavation notice under the Gopher State One Call rules.

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

S-14 RESPONSIBLE CONTRACTOR

REVISED 06/04/15 modified

The Department 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 submitting a Proposal for this Project must verify that it meets the minimum criteria specified in that statute by submitting the "Responsible Contractor Verification and Certification of Compliance" form. A company owner or officer must sign

the "Responsible Contractor Verification and Certification of Compliance" form under oath verifying compliance with each of the minimum criteria.

THE COMPLETED FORMS MUST BE SUMITTED WITH THE BID PROPOSAL.

A bidder must obtain a verification from each subcontractor it will have a direct contractual relationship with. At the Department's request, a bidder must submit signed subcontractor verifications. A contractor or subcontractor must obtain an annual verification from each motor carrier it has a direct contractual relationship with. 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 Department may, but is not required to, award a contract even if that bidder does not meet the minimum criteria.

1103 DEFINITIONS

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

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.

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.

1203 ACCESS TO PROPOSAL PACKAGE

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

The Department may provide Bidders with access to the Proposal Package through online posting at the Departments web site. The Department may require a fee for Bidders to purchase paper copies of the Proposal Package.

1206 PREPARATION OF PROPOSAL

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

MN/DOT 1206.1 is hereby deleted from the MN/DOT Standard Specifications.

MN/DOT 1206.2 is hereby deleted from the MN/DOT Standard Specifications and replaced with the following:

1206.2 ALLOWABLE SUBSTITUTIONS

For all Proposals the Bidder shall use the following method:

(1) Submit a Proposal on the Bid Schedule forms provided by the Department. The Bidder shall:
   - (1.1) Submit a Unit Price in numeric figures for each Pay Item for which a quantity is shown. Assume a numeric quantity of “1” for each “Lump Sum” Pay Item, except as not required in the case of alternate Pay Items,
   - (1.2) Show the extensions resulting from Unit Prices multiplied by the shown quantities in the specified column, and
   - (1.3) Add the extended Pay Item amounts to show the total amount of the Proposal.

The Bidder shall write the figures in ink or provide typed or computer printed figures. In the case of a discrepancy between a Unit Price and extension in a Proposal, the Unit Price will govern.

If a Bidder fails to provide a Unit Price for any Pay Item on the Bid Schedule, except for “Lump Sum” Pay Items, the Department 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.

An authorized representative of the Bidder must sign the Proposal.

1209 DELIVERY OF PROPOSALS

The provisions of MN/DOT 1209 are modified with the following:

When submitting a Proposal in accordance with 1206.2, "Allowable Substitutions," of these Special Provisions, the Bidder shall deliver the Proposal and the Proposal Guaranty in a sealed envelope. The Bidder shall mark the sealed envelope with the name of the Bidder, the Project number, and the letting date.

The Bidder shall deliver the sealed envelope to the Department as specified in the Advertisement for Bids as follows:

(1) To the address specified,
(2) In care of the official receiving the Proposals, and
(3) By the date and time for opening Proposals.

The Bidder shall return paper copies of the following with the submitted Proposal:

(1) The Bid Proposal on the form attached to the proposal package, with signatures and all Addenda acknowledged;
(2) The Schedule of Prices with all changes made in ink and initialed, plus initials on all sheets of the exhibit;
(3) Bid Guaranty (certified check, bank draft, government bond, or bid bond);
(4) Responsible Contractor Certification forms; and
(5) Any other forms included in the Proposal Package.

If the Department receives a Proposal after the date and time for opening Proposals, the Department will return the Proposal to the Bidder unopened.

1210 REVISION OF PROPOSAL PACKAGE OR WITHDRAWAL OF PROPOSALS

The provisions of MN/DOT 1210 are deleted and replaced with the following:

When submitting a Proposal in accordance with 1206.2, "Allowable Substitutions," of these Special Provisions, the Bidder may revise or withdraw its Proposal after delivery to the Department if the Department receives the Bidder's written request for withdrawal or revision before the date and time for opening Proposals.

The Department reserves the right to revise the Proposal Package at any time before the date and time for opening Proposals. The Department will issue a numbered and dated Addendum for any revision of the Proposal Package. The Department will post each Addendum as announced in an e-mail or other method of notification to each Bidder on the Department's list of Bidders.

The Department will include each Addendum with all Proposal Forms issued to the Bidder after the date of the Addendum.

If revisions made by an Addendum require change to Proposals or reconsideration by the Bidder, the Department may postpone opening Proposals. If the Department postpones opening Proposals, the Department will specify the new date and time for opening Proposals in the Addendum.

The Bidder shall acknowledge receipt of each Addendum in the proposal.

1212 OPENING OF PROPOSALS

The provisions of MN/DOT 1212 are hereby deleted and replaced with the following:

The Department will open Proposals at the time, date, and place defined in the Proposal Package and the Advertisement for Bids.

1213 DISQUALIFICAITON OF BIDDERS

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

The provisions of MN/DOT 1302 are changed to read as follows:

The award of Contract, if to be awarded, will be made by City Council Resolution after the opening of proposals to the lowest responsible bidder who complies with all prescribed requirements. The successful bidder will be notified by a "Letter of Intent", mailed to the address shown on his/her proposal, that his/her bid has been accepted subject to execution and approval of the Contract as required by law.

The Letter of Intent will identify the date on which the City Council is expected to approve the Resolution awarding the Contract. Included with the Letter of Intent will be:

A. Three (3) copies of the pending Contract covering the Project.

B. A copy of the City of Duluth Performance Bond form.
C. A copy of the City of Duluth Payment Bond form.
D. Notice of whether an annual Certificate of Insurance is on file or whether Proof of Insurance is needed.

As a condition precedent to approval of a Contract, a corporation to whom a Contract is awarded shall furnish proof that it has met all legal requirements for transacting business in the State of Minnesota.

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.

1305 REQUIREMENT OF CONTRACT BOND

The provisions of MN/DOT 1305 are changed to read as follows:

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 changed to read as follows:

The three (3) copies of the Contract shall be signed by the successful bidder and returned, together with the Performance Bond and the Payment Bond, non-collusion affidavit, EEO affidavit, and Proof of Insurance, within ten (10) calendar days after the date the “Letter of Intent” has been mailed advising the bidder that his/her bid has been accepted subject to execution and approval of the Contract as required by law.

Notice of approval or disapproval of the Contract and Bonds will be given to the successful bidder by means of a “Notice to Proceed” letter after award by City Council Resolution.

Contract Time shall start ten (10) calendar days after the date of award by City Council resolution or on the date specified in the Special Provision modifying 1806, whichever is later. Failure of the bidder to properly execute and return all pertinent items within the prescribed period shall not change the start of Contract Time.

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.

All members of a partnership, and the President or Vice President and the Secretary or Treasurer of each corporation shall sign the Contract and Bonds. In the case of joint ventures, signature requirements shall apply to each firm represented.

1404/2563 MAINTENANCE OF TRAFFIC AND TRAFFIC CONTROL

REVISED 11/06/15
SP2016-18 modified: MN/DOT 1404 is hereby supplemented as follows:

All traffic control devices shall conform and be installed in accordance to:

- the "Minnesota Manual on Uniform Traffic Control Devices" (MN MUTCD);
- Part 6, "Field Manual for Temporary Traffic Control Zone Layouts"(Field Manual);
- the Speed Limits in Work Zones Guideline;
- the Minnesota Flagging Handbook;
- the Minnesota Standard Signs Manual;
- the Traffic Engineering Manual;

And the provisions of MN/DOT 1404 and 1710, the Plan, and these Special Provisions.

The Contractor shall furnish, install, maintain, and remove all traffic control devices required to provide safe movement of vehicular traffic through the Project during the life of the Contract from the start of Contract operations to the completion thereof. The Engineer will have the right to modify the requirements for traffic control as deemed necessary due to existing field conditions. The highways shall be kept open to traffic at all times, except as modified below.

Traffic control devices include, but are not limited to, barricades, warning signs, trailers, flashers, cones, and drums, as required and sufficient barricade weights to maintain barricade stability.

1. TRAFFIC CONTROL

(A) If traffic control layouts are not present in the Plan, or if the Contractor modifies the layout or sequence from the Plan, the Contractor shall submit the proposed traffic control layout to the Engineer, for approval, at least seven (7) days prior to the

start of construction. The Contractor does not need to submit layouts that can be found in the Field Manual. All other layouts that are not found in the plan shall be submitted. At least 24 hours prior to placement, all traffic control devices shall be available on the Project for inspection by the Engineer. The Contractor shall modify his/her proposed traffic control layout and/or devices as deemed necessary by the Engineer.

(B) The Contractor shall be responsible for the immediate repair or replacement of all traffic control devices that become damaged, moved or destroyed, of all lights that cease to function properly, and of all barricade weights that are damaged, destroyed, or otherwise fail to stabilize the barricades. The Contractor shall further provide sufficient surveillance of all traffic control devices at least once every 24 hours.

The Contractor shall furnish names, addresses, and phone numbers of at least three (3) individuals responsible for the placement and maintenance of traffic control devices. These individuals shall be **"on call" 24 hours per day, seven days per week** during the times any traffic control devices, furnished and installed by the Contractor, are in place. The required information shall be submitted to the Engineer at the Pre-construction Conference.

The Contractor shall, at the pre-construction conference, designate a **Work Zone Safety Coordinator** who shall be responsible for safety and traffic control management in the Project work zone. The Work Zone Safety Coordinator shall be either an employee of the Contractor such as a superintendent or a foreman, or an employee of a firm which has a subcontract for overall work zone safety and traffic control management for the Project. The responsibilities of the Work Zone Safety Coordinator shall include, but not be limited to:

- Coordinating all work zone traffic control operations of the Project, including those of the Contractor, subcontractors and suppliers.
- Establishing contact with local school district, government, law enforcement, and emergency response agencies affected by construction before work begins.
- Maintaining a record of all known crashes within a work zone. This record should include all available information, such as: time of day, probable cause, location, pictures, sketches, weather conditions, interferences to traffic, etc. These records shall be made available to the Engineer upon request.

(C) The Contractor shall **inspect**, **on a daily basis**, all traffic control devices, which the Contractor has furnished and installed, and verify that the devices are placed in accordance with **the Traffic Control Layouts,** these Special Provisions, and/or the MN MUTCD. Any discrepancy between the placement and the required placement shall be immediately corrected.

The Contractor shall be required to respond immediately to any call from the Engineer or his designated representative concerning any request for improving or correcting traffic control devices. **If the Contractor is negligent in correcting the deficiency within one hour of notification the Contractor shall be subject to an hourly charge assessed at a rate of $250.00 per hour for each hour or any portion thereof with which the Engineer determines that the Contractor has not complied.**

The Contractor is required to meet the traffic control device quality standards as determined in the Field Manual. The Contractor shall immediately replace traffic control devices that are deemed unacceptable. Signs that are dirty and result in a noticeable loss of reflectivity at night are also considered unacceptable and shall be cleaned or replaced. The Contractor shall be required to respond immediately to any call from the Engineer or his designated representative concerning the notification of unacceptable traffic control devices. **If the Contractor is negligent in correcting the deficiency within one day of notification the Contractor shall be subject to a daily charge assessed at a rate of $500 for each day or any portion thereof with which the Engineer determines that the Contractor has not complied.**

(D) The person performing the inspection in paragraph (C) above shall be required to make a daily log. This log shall also include the date and time any changes in the stages, phases, or portions thereof go into effect. The log shall identify the location and verify that the devices are placed as directed or corrected in accordance with the Plan. All entries in the log shall include the date and time of the entry and be signed by the person making the inspection. The Engineer reserves the right to request copies of the inspection logs, as he deems necessary.

The Contractor shall provide copies of the inspection logs on a weekly basis on a day of the week determined by the Engineer. Additionally the Engineer may request copies of the logs at any time he deems necessary. **If the Contractor is negligent in providing the inspection logs on the predetermined weekly date or at the Engineer's request, the Contractor shall be subject to an hourly charge assessed at a rate of $250.00 per hour for each hour or any portion thereof with which the Engineer determines that the Contractor has not complied.**

(E) If, at any time, the Contractor fails to, in a timely manner, properly furnish, install, maintain or remove any of the required traffic control devices, the Department reserves the right to correct the deficiency. **Each time the Department takes such corrective action, the costs thereof, including mobilization, plus $5,000 will be deducted from monies due or coming due the Contractor.**

2. <u>GENERAL REQUIREMENTS</u>

(A) All portable sign assemblies shall be perpendicular to the ground. No traffic control device (signs, channelizing devices, arrowboards, etc.) shall be weighted so they become hazardous to motorists and workers. The approved ballast system for devices mounted on temporary portable supports is sandbags, unless it is designed, crash tested, and approved for the specific device. During freezing conditions, the sand for bags shall be mixed with a de-icer to prevent the sand from freezing. The sandbags shall be placed and maintained at the base of the traffic control device to the satisfaction of the Engineer.

When signs will remain in the same location for more than 30 consecutive days the signs shall be post mounted. This would not include portable signs, which are set up and taken down at the beginning and end of each work shift. The signs must be post mounted according to the Typical Temporary Sign Framing and Installation Detail Sheet found in the Plan or in these Special Provisions.

(B) When signs are installed, they shall be mounted on posts driven into the ground at the proper height and lateral offset as detailed in the MN MUTCD. **When signs are removed, the sign posts and stub posts shall also be removed from the Right of Way within two (2) weeks or the Contractor shall be subject to a daily charge assessed at a rate of $100.00 per day for each day or portion thereof with which the Engineer determines that the Contractor has not complied.**

(C) All temporary rigid signs shall be fabricated with an approved retroreflective sheeting material of the appropriate color, and be listed on the Qualified Product Listing (QPL) for either "Sheeting for Rigid Temporary Work Zone Signs, Delineators, and Markers (Type IX and XI) " or "Sheeting for Rigid Permanent Signs, Delineators, and Markers (Type IX and XI)". Signs remaining inplace that still apply during temporary operations need no change in sign sheeting.

Signs shall have an easily identifiable marking on the face to make the identification of approved retroreflective sign sheeting on temporary rigid signs in the field easier. This marking verifies that the sign sheeting has been approved for Rigid Sign. Temporary rigid signs 4 sq. feet and under in size and all barricades and route markers will be exempt from this marking. The appropriate marking shall be used for each type of the approved sheeting types. Refer to the instructions for the marking of temporary signs that are on the APL or directly at the following link:

http://www.dot.state.mn.us/products/signing/pdf/typelabel.pdf

The retroreflective sheeting types and qualified products used for temporary signs and barricades are shown at the following link:

http://www.dot.state.mn.us/products/signing/sheeting.html.

(D) **<u>In Place Signing</u>**

All in place signs and delineators that interfere with the Contractor's normal operation shall be relocated outside of the work area or removed by the Contractor at the direction of the Engineer. **This includes any other sign that interfere with the Contractor's operation.** Signs that are removed and will be reused are to be stored in such a manner as to protect the sign from scratching, fading, or other harmful affects until said signs are reinstalled. Upon completion of work at each sign location, or at the direction of the Engineer, the signs shall be replaced as near to their original locations as possible or to a location designated by the Engineer. **Signs and structures damaged by the Contractor shall be replaced by him at his own expense.**

The reinstalled sign posts shall be plumb and the sign panels shall be level. The minimum mounting height shall be 7 feet above the elevation of the traveled roadway. The minimum embedment length of the stub posts shall be 3.5 feet. The splice between the stub post and the riser post shall be a minimum of 12 inches. **The Contractor will be assessed a $100 charge for each sign that does not comply with the In Place Signing requirements. In addition the Contractor will be required to correct the deficiency at his own cost within 2 weeks of being notified by the Engineer. If the deficiency has not been corrected within 2 weeks, the Contractor will be charged $50 per sign per day until the deficiency has been corrected.**

All costs incurred to relocate, salvage, and reinstall in place signing shall be incidental work.

(E) Open excavation adjacent to the existing pavement will not be permitted on opposite sides of the roadway at the same time.

(F) **The Contractor shall provide protective devices necessary to protect traffic from excavations, drop-offs, falling objects, splatter or other hazards that may exist during construction. This work shall be incidental.** The Contractor will not be allowed to suspend material, equipment, tools and personnel over traffic unless a lane closure is established below. All costs associated with the lane closure will be considered incidental.

(G) The Contractor will not be permitted to park vehicles or construction equipment in a location that obstructs any traffic control device. The parking of workers' private vehicles will not be allowed within the Project limits unless so approved by the Engineer.

(H) The Contractor will not be allowed to store materials or equipment within 30 feet [10 m] of through traffic unless approved by the Engineer. If materials or equipment must be stored within 30 feet [10 m] of through traffic, the Contractor shall

provide Type B channelizers, barricades or barriers, placed near the object to warn and protect traffic.

(I) **High Visibility Apparel**

All workers within the road Right-of-Way who are exposed to either traffic or to construction equipment shall wear reflectorized high-visibility safety apparel.

High-visibility safety apparel means personal protective safety clothing that is intended to provide conspicuity during both daytime and nighttime usage, and meets the minimum performance Class 2 requirements of the ANSI/ISEA 107 – 2004 publication entitled "American National Standard for High-Visibility Safety Apparel and Headwear".

Additional Requirements: ANSI/ISEA 107-2004 Class 3 Requirements (Class 2 Vest with Class E Long Pants)

- Flag Persons – In addition to an ANSI Class 2 hat, vest, shirt, or jacket, flaggers shall wear high visibility Class E long pants.
- Nighttime and Low Light Conditions – All workers working at night or in low light conditions shall wear high visibility Class E long pants in addition to an ANSI Class 2 vest, shirt, or jacket.

All high visibility apparel must be worn in the manner for which it was designed. All apparel worn on the torso must be closed in the front to provide contiguous 360 degree visibility. If a worker's high-visibility apparel becomes faded, worn, torn, dirty, or defaced, reducing the conspicuity of the apparel, the apparel shall be removed from service and replaced with new apparel.

The Contractor will be subject to a non-compliant charge for failure to adhere to the clothing requirements as listed above. Non-compliance charges, for each incident, will **assessed at a rate of $500.00 per incident** that the Engineer determines that the Contractor has not complied.

3. VEHICLE WARNING LIGHT SPECIFICATION

All Contractors, subcontractors' and suppliers' mobile equipment, operating within the limits of the Project with potential exposure to passing traffic, shall be equipped with operable warning lights that meet the appropriate requirements of the SAE specifications. This would include closed roads that are open to local traffic only. This also includes any vehicle that enters the traveled roadway at any time. The SAE specification requirements are as follows:

- 360 Degree Rotating Lights - SAE Specification J845
- Flashing Lights - SAE Specification J595

- Flashing Strobe Lights - SAE Specification J1318

Lights shall be mounted so that at least one light is visible at all times from a height of 3.5 feet and from a 60 foot radius about the equipment. In order to meet the 360 degree at 60 foot [18 m] radius requirements supplemental lighting may be used in addition to the lights on the Approved Products List. All supplemental lights must be SAE Class 1 certified. This specification is to be used for both day and night time operations. All costs incurred to provide warning lights shall be at no cost to the Department. These warning lights shall also be operating and visible when a vehicle decelerates to enter a construction work zone and again when a vehicle leaves the work zone and enters the traveled traffic lane.

Any warning lights shall be on the Approved Products List for Vehicle Lighting which is found at the following weblink: http://www.dot.state.mn.us/products/vehiclelighting/vehiclesafetylights.html. The list may also be obtained by contacting:

Vehicle Warning Lights
Office of Construction MS722
Transportation Bldg. OR by calling: (651)366-3585
395 John Ireland Blvd.
St. Paul, MN 55155

This list is updated periodically. Warning light suppliers and manufacturers may contact the above for information on adding new products to the list.

A **$100 penalty (per incident) will be assessed** against the Contractor each time failure to comply with the above requirements is observed on the Project site.

4. <u>LANE CLOSURE REQUIREMENTS</u>

(A) Temporary lane closures or other traffic restrictions by the Contractor, during work hours and consistent with the time restrictions, will be permitted only during those hours and at those locations approved by the Engineer. Requests for temporary lane closures shall be made at least **72 hours prior** to such closures. When a temporary lane closure is used by the Contractor, the closure shall be incidental work.

5. <u>FLAGGER TRAINING AND REQUIREMENTS</u>

(A) Any person acting as a flagger on this Project shall have attended a training session taught by a Contractor's qualified trainer. The Contractor's qualified trainer shall have completed a "MN/DOT Flagger Train the Trainer Session" in the five years before the start date of this Contract and shall be on file as a qualified flagger trainer with the Department. The Flagger Trainer's name and Qualification Number shall

be furnished by the Contractor at the pre-construction meeting. The Contractor shall provide all flaggers with the MN/DOT Flagger Handbook and shall observe the rules and regulations contained therein. This handbook shall be in the possession of all flaggers while flagging on the Project. The Contractor shall obtain handbooks from the Department. Flaggers shall not be assigned other duties while working as authorized flaggers. The "Checklist for Flagger training" form shall be furnished to the Engineer any time a new flagger reports to work on the Project. The "Checklist for Flagger Training" form is found at:

http://www.dot.state.mn.us/const/wzs/documents/flaggertrainingchecklist.pdf.

The Engineer will have the right to waive the above requirements.

(B) The Contractor shall furnish flag persons as required to adequately control traffic. Flag persons shall conform to the requirements set forth in the MN MUTCD. All costs incurred to provide such flag persons shall be incidental.

(C) The Contractor shall provide two-way radios for flag persons.

Flag persons shall wear high visibility retroreflective safety vests, pants and hats at all times while actively flagging on the Project. High visibility apparel shall also comply with current Minnesota OSHA Rules 5207.0100 and 5207.1000. The flag persons clothing shall be considered incidental.

The Contractor shall keep the separation distance between the last sign in the "flagger ahead" signing sequence and the actual flagger to the amount shown in the Field Manual, whenever it is practical. The maximum separation distance allowed from the signs to the flagger shall be ½ mile [0.8 km]. The Contractor shall use multiple flagger signing set-ups or continuously move the signing for moving flagging operations to keep within the distance limit. The "flagger ahead" signing sequence shall not be in place when flagging operations are not in effect.

The maximum distance between flaggers shall be ½ mile [0.8 km] unless otherwise authorized by the Engineer. In the event a distance longer than one mile is authorized, the Engineer may order the Contractor to provide two pilot cars at no additional cost to the Department.

All signs associated with the flagging operation must be removed or covered when flagging operations are not present.

The Contractor will be subject to a non-compliant charge for failure to adhere to the requirements listed in this Section (Flagger Training and Requirements). These requirements include: providing two-way radios for flaggers, properly attired flaggers,

flagging operation length requirements, and distance limit between the flagger and the last sign in the flagger sequence, and removing or covering flagger signs when flagging operations are not present. **Non-compliance charges, for each incident will be assessed at a rate of $500 per incident that the Engineer determines that the Contractor has not complied.** The charges may be assessed equally, separately, and may be assessed concurrently.

The Contractor shall coordinate the flagging operations in a manner that causes as little delay to the traveling public as possible, and at no time shall the delay exceed fifteen (15) minutes. In the event that the Contractor is unable to meet the maximum delay requirements, operations shall shut down until such time a new traffic control plan is developed which does meet the maximum delay requirement.

If hauling operations create hazards for the traveling public, the Contractor will be required to provide additional flaggers, as directed by the Engineer. All costs incurred to provide the additional flaggers shall be incidental.

6. <u>MAINTENANCE AND STAGING OF TRAFFIC CONTROL</u>

(A) Pedestrian traffic shall be maintained and guided through the Project at all times.

(B) The Contractor shall cover all signs are not consistent with traffic operations. The cover should be a plate of solid material covering the entire legend or all of that part of the legend that is inappropriate. The cover shall be bolted to the sign and shall have a minimum of 1/8 inch [3 mm] plastic washers between the sign face and the cover. See Figures 8.2A, 8.2B and 8.2C of the Traffic Engineering Manual for details. This work will be done as required by the Engineer.

(C) Street identification signage shall be maintained at all times. Where the only existing signs are small city or county signs located at the intersection, street names and address numbers shall be maintained by temporary installations as required by the Engineer. This is necessary to maintain the 911 emergency system.

(D) The Contractor may ban parking within the construction limits with the approval of the Engineer. All necessary signing is the responsibility of the Contractor and shall be installed, as directed by the Engineer, 24 hours prior to the parking ban. The Contractor shall remove that signing as soon as the work in the area has been completed.

The Contractor shall notify the City of Duluth Engineering Division Front Desk, phone number 218-730-5200, to obtain “No Parking Signs” at least 48 hours prior to posting any parking ban within the city.

1. MEASUREMENT AND PAYMENT

Traffic Control will be measured and paid for as follows:

Payment for all traffic control required to complete the Project as shown in the Plans and specified in these Special Provisions shall be made as a lump sum payment under Item 2563.601 (Traffic Control). Payment includes all costs associated with furnishing, installing, maintaining, relocating and subsequently removing traffic control devices (including flag persons) as required. No additional measurement for payment will be made for individual activities and devices that constitute Traffic Control, except for other traffic control Bid Items specifically provided in the Contract.

Traffic Control layouts or devices not shown in the plan or stated in these Special Provisions that are a necessary part of the Contractor's operations to complete the project as shown in the plan are included in the lump sum traffic control item. There will be no increase or decrease in the lump sum payment or additional payment for other traffic control Contract Items, except as provided in the following paragraph.

If the Engineer orders a change in traffic control because of a Plan error, omission, changed condition or change of project scope, payment for such changes will be made as Extra Work.

The Traffic Control Payment Schedule will be as follows:

(1) When 5 percent of the Contract amount is earned, 50 percent of the amount bid for traffic control will be paid.
(2) When 10 percent, or more, of the Contract amount is earned, an additional 25 percent of the amount bid for traffic control will be paid.
(3) When 50 percent, or more, of the Contract amount is earned, an additional 20 percent of the amount bid for traffic control will be paid.
(4) The remaining 5 percent bid for traffic control will be paid when all work has been completed and accepted.
(5) In all items above, the original Contract amount shall be the total value of all Contract Items including the traffic control item, but the percentage earned in each case shall be exclusive of the traffic control item.

1502 PLANS AND WORKING DRAWINGS

MN/DOT 1502 is supplemented with 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:

(1) Addenda,
(2) Special Provisions,
(3) Project-Specific Plan Sheets,
(4) City of Duluth Standard Construction Details,
(5) City of Duluth Standard Construction Specifications,
(6) MN/DOT Supplemental Specifications,
(7) MN/DOT Standard Plan Sheets and Standard Plates,
(8) MN/DOT Standard Specifications.

1507 UTILITY PROPERTY AND SERVICE

Construction operations in the proximity of utility properties shall be performed in accordance with the provisions of MN/DOT 1507, except as modified below:

A. 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 and SANITARY SEWER
City of Duluth--Public Works & Utilities
211 City Hall
411 West 1st St.
Duluth, MN 55802
(218) 730-4130

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

GAS (in Bayview Heights)
Minnesota Energy Resources
(800) 889-9508

TELEPHONE
CenturyLInk
322 West 1st St
Duluth, MN 55802
(218) 723-4210 (Manager)

POWER
Minnesota Power
30 West Superior St
Duluth, MN 55802
(218) 722-2641

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

SANITARY INTERCEPTOR SEWERS
Western Lake Superior Sanitary District
2626 Courtland St
Duluth, MN 55806
(218) 722-3336

CABLE TELEVISION
Charter Communications
602 Garfield Ave
Duluth, MN 55802
(218) 529-8000

B. 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.

C. 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.

1508 CONSTRUCTION STAKES, LINES AND GRADES

The provisions of MN/DOT 1508 are supplemented to include the following:

The primary line and grade for utility installation will be established by the Engineer. For trench installation, line and grade stakes will be set parallel to the proposed pipeline at an appropriate offset as will best serve the Contractor's operations wherever practical. For tunnel or directional drilling installation, line and grade stakes will be set directly above the proposed pipeline setting. Grade and stakes will be set at appropriate intervals along the pipeline and at appurtenances and service lines.

For sanitary or storm sewer installation, the Contractor shall use a "laser beam" instrument to maintain line and grade.

The Contractor shall arrange his operations as will avoid necessary interference with the establishment of the primary line and grade stakes and shall render whatever assistance may be required by the Engineer in accomplishing the staking. The Contractor shall be responsible for preservation of the primary stakes and shall bear the full cost of any re-staking necessitated by his negligence. The Contractor shall be solely responsible for the correct transfer of the primary line and grade to all working points and for construction of the work to the prescribed lines and grades as established by the Engineer.

1604 PLANT INSPECTION – COMMERCIAL FACILITY

The provisions of MN/DOT 1604 are supplemented as follows:
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 (WETLANDS)

SP2016-31: The provisions of MN/DOT 1701 are supplemented with the following:

If the Contractor operations involve the excavation and/or disposal of material outside the limits of the project site, the Contractor is advised of the following:

MN Statutes Sections 103G.2212 and 103G.241 stipulate that an agent or employee of another may not:

1) drain, excavate, or fill a wetland, wholly or partially; or
2) construct, reconstruct, remove, or make any change in any reservoir, dam, or the course, current, or cross-section of any public water;

unless a signed statement from the property owner is obtained stating that any permit or wetland replacement plan required for the work is in place, or that a permit or replacement plan is not required; AND this statement is mailed to the appropriate office with jurisdiction over the wetland or public water prior to initiating the work.

The "Landowner Statement and Contractor Responsibility For Work in Wetlands or Public Waters" can be found at:

http://www.bwsr.state.mn.us/wetlands/forms/Contractor_Responsibility.doc .

The Contractor shall provide the Engineer with a copy of the completed "Landowner Statement and Contractor Responsibility for Work in Wetlands or Public Waters" for the excavation and/or disposal site prior to initiating the work.

1706 EMPLOYEE HEALTH AND WELFARE

The Contractor shall not use any motor vehicle equipment on this Project having an obstructed view to the rear unless:

A. The vehicle has a reverse signal alarm which is audible above the surrounding noise level; or
B. The vehicle is backed up only when an observer signals that it is safe to do so.
C. The first incident of non-compliance observed on the project site shall subject the Contractor to a $50.00 penalty for failure to comply with these backup requirements. The second incident of non-compliance observed on the Project shall subject the Contractor to a $500.00 penalty for failure to comply with these backup requirements. Subsequent to the second incident, each additional incident of non-compliance observed on the Project shall subject the Contractor to a $1000.00 penalty for failure to comply with these backup requirements.
D. None of the penalty (penalties) listed above shall be considered by the Contractor as allowance of non-compliance incidents of these backup requirements on this Project. The Contractor is advised that at any time the Contractor is not in compliance, the Engineer may take additional remedial measures which may include, but not be limited to, contacting the Contractor's insurance company and/or MN/OSHA.

1717 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT

SP2016-40 modified: The provisions of MN/DOT 1717 are supplemented and/or modified with the following:

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 and established by the Minnesota Pollution Control

Agency (M.P.C.A.), and in accordance with the provisions of MN/DOT 1717, these Special Provisions, and the following:

1. By signing the NPDES Declaration and completing the electronic online NPDES CSW permit, the Contractor is a co-permitee with the Department to ensure compliance with the terms and conditions of the Construction General Storm Water Permit (MN R100001) and is responsible for those portions of the permit where the operator is referenced. This Permit establishes conditions for discharging storm water to waters of the State from construction activities that disturb 1 acre [0.4 hectares] or more of total land area.

A copy of the permit is available at:
http://www.pca.state.mn.us/water/stormwater/stormwater-c.html
or by calling 651-296-3890.

(A) Unless otherwise noted in the project special provisions, the **Contractor shall apply and pay for the NPDES Permit** on this Project. Payment for the application shall be incidental to the Contract. The Department 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 and MPCA's letter of coverage onsite. A copy of the MPCA confirmation and a signed Permit Declaration form must be returned to the Engineer.

OR

(B) If the Department has obtained the NPDES General Construction Stormwater Permit as Owner and Contractor on this project prior to Bidding, the Department will provide the Contractor with a copy of the original completed application, the Notice of Termination/Permit Modification Form with the Existing Permit Identification, Option 2, Current Owners Authorization Signature, and Current Contractor Authorization signature completed, as part of the Contract document package. The Contractor shall complete New Contractors Authorized signature section, send the form to the MPCA and post the transfer document, the Permit and MPCA's letter of coverage onsite. A copy of the signed permit Transfer form and a signed Permit Declaration form must be returned to the Engineer.

No work which disturbs soil and/or work in waters of the state will be allowed on this Project until the NPDES Permit is in effect and the Department has received the required documentation.

2. 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 Paragraphs 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. All inspection and maintenance forms used on this Project shall be turned over to the Engineer every two weeks for retention in accordance with the permit.

The Contractor shall have all logs, documentation, inspection reports on site for the Engineer's review and shall post the permit and MPCA's letter of coverage on site. The Contractor shall immediately rectify any shortcomings noted by the Engineer. All meetings with the MPCA or any local authority shall be attended by both the Engineer and the Contractor or their representatives. No work required by said entities, and for which the Contractor would request additional compensation from Department, shall be started without approval from the Engineer. No work required by said entities and for which the changes will impact the design or requirements of the Contract documents or impact traffic shall be started without approval from the Engineer.

The Contractor shall immediately notify the Engineer of any site visits by Local Permitting Authorities performed in accordance with Part V.H.

3. Emergency Best Management Practices must be enacted to help minimize turbidity of surface waters and relieve runoff from extreme weather events. It is required to notify the MPCA Regional Contact Person within 2 days of an uncontrolled storm water release. The names and phone numbers of the MPCA Regional Contract personnel can be found at: http://www.pca.state.mn.us/water/stormwater/stormwater-c.html.

The Contractor is reminded that during emergency situations involving uncontrolled storm water releases that the State Duty Officer must be contacted immediately at 1-800-422-0798 or 1-651-649-5451.

4. The Contractor shall review and abide by the instructions contained in the permit package. The Contractor shall hold Department harmless for any fines or sanctions caused by the Contractor's actions or inactions regarding compliance with the permit or erosion control provisions of the Contract Documents.

5. The Contractor is advised that Section 1 of the NPDES application form makes reference to a Storm Water Pollution Prevention Plan (SWPPP). This Projects' 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.

6. In accordance with section IV.C.6 of the NPDES permit, 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.

7. In addition to the requirements of the project SWPPP incorporated into the Contract documents, the Contractor shall incorporate the MPCA guidance and recommendations into their site management activities. Refer to the MPCA's web site:

http://www.pca.state.mn.us/index.php/water/water-types-and-programs/stormwater/construction-stormwater/index.html

NPDES Permit Requirements	Cross-Reference within this Contract
Obtain NPDES Permit; Permit Compliance; Submit Notice of Termination	MN/DOT 1701, 1702; and 1717 Special Provisions: 1717 (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; Special Provisions: 1717 (National Pollutant Discharge Elimination System (NPDES) Permit)
Project / Weekly Schedule (for Erosion / Sediment Control) Completing Inspection / Maintenance Log / Records	MN/DOT 1717 and 2573; Special Provisions: 1717 (National Pollutant Discharge Elimination System (NPDES) Permit); and
Project Specific Construction Staging	The Plans; MN/DOT 1717; Special Provisions: 1717 (National Pollutant Discharge Elimination System (NPDES) Permit); and 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 or Tracked Sediment Removal of Devices	The Plans; MN/DOT 1717 and 2573; Special Provisions: 1514 (Maintenance During Construction), and 1717 (National Pollutant Discharge Elimination System (NPDES) Permit)
Dewatering	MN/DOT 2105.3C and 2451.3C; May also require DNR Permit
Temporary work not shown in the Plans Grading areas (unfinished acres exposed to erosion)	MN/DOT 1717, 2573, and 2575; Special Provisions: 1717 (National Pollutant Discharge Elimination System (NPDES) Permit)
Permanent Erosion / Sediment Control and Turf Establishment	The Plans; MN/DOT 1717, 2573,2574, and 2575; Special Provisions: 1717 (National Pollutant Discharge Elimination System (NPDES) Permit)

1717 EROSION AND SEDIMENT CONTROL PERMIT FOR MS4 COMPLIANCE

The provisions of MN/DOT 1717 are supplemented with the following:

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:

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**.

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**.

3. The Erosion and Sediment Control Permit application form can be picked up at the City's Construction Services & Inspections Office, Room 210, City Hall, or downloaded from the City's web site as follows:

http://www.duluthmn.gov/construction-services-inspections/permits/

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

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.

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 web site:

http://www.pca.state.mn.us/index.php/water/water-types-and-programs/stormwater/construction-stormwater/index.html

1801 SUBLETTING OF CONTRACT

REVISED 06/04/15
The provisions of MN/DOT 1801 are modified as follows:

For Projects in excess of $50,000, the Contractor may sublet work only to subcontractors that meet the definition of "responsible contractor" in Minnesota Statutes §16C.285, subdivision 3. The Contractor shall obtain verifications of compliance with §16C.285 from subcontractors using a form provided by the Department. The Contractor must provide such verifications to the Department upon the Department's request. .

The third paragraph of MN/DOT 1801 is modified to read:

On Contracts with Disadvantaged Business Enterprise (DBE), the Contractor's organization shall perform Work amounting to not less than 30 percent of the total original Contract Amount. The Department will deduct specialty items from the total original Contract Amount before calculating the amount of Work that the Contractor shall perform.

1803 PROGRESS SCHEDULES

The provisions of MN/DOT 1803 are supplemented as follows:

A "Progress Schedule" (Bar Chart or Critical Path Diagram), referred to in MN/DOT 1803.1 will be required on this Project. The Contractor shall furnish the Engineer with the schedule at or before the preconstruction conference.

1803 LIMITATION OF OPERATIONS

The provisions of MN/DOT 1803 are supplemented as follows:

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.

1803 PROSECUTION OF WORK (SPECIAL PROJECT ADA REQUIREMENTS)

REVISED 08/20/15
SP2016-47 modified: The provisions of MN/DOT 1803 are supplemented and/or modified with the following:

1. SPECIAL PROJECT ADA REQUIREMENTS

All pedestrian facilities and shared use paths on this Project must be constructed according to Public Rights-of-Way Accessibility Guidelines (PROWAG) which can be found at:

http://www.dot.state.mn.us/ada/pdf/PROWAG.pdf

The appropriate pedestrian ramp details for each quadrant are included in the Plan. The Engineer may provide additional details to those provided in the Plan that meet the PROWAG guidelines as the need arises and field conditions dictate.

(A) The Contractor must designate a responsible person competent in all aspects PROWAG to assess proposed sidewalk layouts at each site before work begins. Any time work the Contractor is performing concerns pedestrian facilities, the Contractor's responsible person shall be on site.

(B) Pedestrian facilities must be constructed to meet the following criteria:

(1) Pedestrian Access Routes (PAR) must be constructed to meet the following:
- Minimum 4 feet width.
- A maximum cross slope of 2.0%.
- Vertical discontinuities must be less than 0.25 inches.
- Must provide positive drainage without allowing any ponding and maintain existing drainage flow patterns unless indicated otherwise in the Plan.
- All grade breaks shall be constructed perpendicular to the path of travel.

(2) Landings are part of the PAR and must be constructed to meet the following:
- 4 feet by 4 feet minimum width.
- Maximum slope of 2.0% in all directions.
- Required at all locations where the PAR changes directions or inverse grades.
- Must be connected to the PAR.

(3) Ramps are part of the PAR and must be constructed to meet either of the following criteria:
- Longitudinal slopes less than 5% in the direction of travel requires no landing at the top of the ramp (unless the PAR changes direction).
- Longitudinal slopes between 5 - 8.3% in the direction of travel require a landing at the top of the ramp.

If the Contractor constructs any pedestrian or shared-use trail facilities that are not per Plan, do not meet the above requirements, or do not follow the agreed upon resolution, the Contractor will be responsible for correcting the deficient facilities with no compensation paid for the corrective work. To ensure that the pedestrian facilities are constructed in compliance with PROWAG, the Contractor shall follow the following three steps:

(1) The Contractor shall use the appropriate ramp details in the Plan and identify the removal limits for the sidewalk and curb and gutter. If Contractor determines the removal limits are not adequate to meet PROWAG, the Contractor shall stop work immediately and consult the Engineer to determine the best solution. Once the Engineer and the

Contractor reach agreement on how to proceed, the Contractor may finish the removals.

(2) Prior to pouring each curb and gutter segment, the Contractor must verify the zero height curb and curb transitions will be located as shown in the Plans and will provide an adequate detectable edge as shown on MN/DOT Standard Plan Sheet No. 5-297.250 (sheet 4 of 5). The Contractor shall also verify the proposed curb flow lines will provide positive drainage as well as maintain existing drainage patterns including existing gutter inflows/outflows. The curb and gutter shall be constructed as detailed in the Plan with a defined flow line and no vertical discontinuities. The Contractor shall consult with the Engineer to determine a resolution if any of these conditions cannot be met. Once the Engineer and the Contractor reach agreement on how to proceed, the Contractor may proceed with pouring the curb and gutter.

(3) After the curb has been correctly poured, the Contractor has set the sidewalk forms, and prior to placing the concrete curb ramps/sidewalks, the Contractor shall verify the requirements in Section B will be achieved.

In addition, the longitudinal slopes shown in the Construction Plans and the Standard Plans shall be utilized unless these conditions cannot be met. The starting point for setting the forms on the controlling ramp leg should be the following:

Steep (S) = 7%
Flat (F) = 4%
Landing = 1.5%
Sidewalk Cross Slope = 1.5%
Fan ramp = 5%

If any of these requirements cannot be met the Contractor shall meet with the Engineer to determine the best solution. Once the Engineer and the Contractor reach agreement on how to proceed, the Contractor may proceed with the curb ramp/sidewalk pour.

Landings – An initial landing is the first required landing of a pedestrian ramp. All initial landings required at the top of a ramped sloped surface (>2% longitudinal slope), shall be formed and placed separately in an independent concrete pour. This does not include initial landings placed at roadway grade such as depressed corners, parallel ramps, or rural flat landings. Secondary landings consist of all landings beyond the initial landing. These secondary landings do not require a separate landing pour. All landings adjacent to push buttons shall be formed and placed separately in an independent concrete pour, regardless of ramp type.

Wet casting or drill and grouting of dowel bars will be required in accordance with the details shown in Standard Plan 5-297.250 Sheet 5 of 5. These bars may be either smooth or deformed and shall be installed with 2 inch minimum concrete cover. When not accounted for in the Plan, payment for these bars will be made under Item 2301.602 (Drill & Grout Reinforcement Bar (Epoxy Coated)) by the Each at the Predetermined Price of $10.00 per bar furnished and installed. All necessary subgrade preparation and aggregate base placement for the entire ramp construction limit shall be done before the initial landing is constructed at each location.

(C) It shall be the responsibility of the Contractor, or Contractor's Surveyor if applicable, to layout all proposed work at each intersection in accordance with the Plan and requirements listed in this Special Provision. The Contractor may confer with the Engineer for guidance in laying out the proposed work, but it will be the Contractor's responsibility to ensure the proposed work meets all the requirements of this Special Provision. This layout includes, but is not limited to placement of grade breaks, curb transitions, gutter flow lines, truncated dome placement, crosswalk marking placement, flares, landing limits, and ramp limits. It is important that the Contractor layout this work properly to achieve the construction of a compliant pedestrian facility. The owner's surveyor will only stake points and elevations provided in the Plan. For custom designs, other than specific dimensions provided in the Plan, the Contractor shall be expected to scale dimensions from the Plan as needed to construct the facility. If scaled dimensions do not allow for a facility to be constructed to meet the requirements of this Special Provision, the Contractor shall follow the process listed in Section B. This layout work shall be incidental.

(D) The Contractor shall utilize measures and methods when working near existing buildings that will avoid damaging the building's face or structure. The contractor will be responsible for any damage to the building's face or structure, both below and above ground. Any damage resulting from Contractor operations will be repaired at the Contractor's expense to the satisfaction of the Engineer.

(E) This section applies when no sidewalk joint information is provided in the Plan. The Contractor will round all sidewalk joints with a ¼ inch radius edging tool, contraction joints shall extend to at least 30 percent of walk thickness and shall be ¼ inch maximum width. The Contractor shall have the option of providing saw cuts to construct all sidewalk joints and the gutter joints within the PAR. When greater than 50 feet of continuous sidewalk runs are constructed, the Contractor shall saw cut all joints. The top grade break of walk-able flares need a visual joint to indicate a change in grade. This visual joint shall have ¼ inch radius, ¼ inch maximum width, and ¼ inch depth. All saw cut work associated with PAR construction shall be incidental.

(F) In areas where the sidewalk is to be constructed around fixed structures and the grade has been changed, the sidewalk shall be finished around these structures to the satisfaction of the Engineer at no additional cost.

(G) All pedestrian signal systems should be installed as shown in the Plan and must be constructed to meet the following criteria. The Contractor shall verify that the proposed push button locations will meet all of the following criteria before proceeding with the installation of the pedestrian push button system:

- Pedestrian push buttons shall be oriented with the button facing towards the intersection and the button face placed parallel to the outside edge of the crosswalk.
- Pedestrian push buttons shall be a minimum of 4 feet and a maximum of 10 feet from the back of curb/edge of roadway, but may be placed 1.5 feet to 4 feet from the back of curb/edge of roadway if mounted on a signal pole as indicated in the Plan or as approved by the Engineer.
- Pedestrian push buttons shall be located at the outside crosswalk edge and shall be no more than 5 feet offset from the projected outside edge of the crosswalk/outside edge of detectable warnings.
- Pedestrian push buttons shall be a minimum of 10 feet apart, except in islands and medians where only a 6’ clear distance must be maintained
- Each pedestrian push button shall have a landing immediately adjacent to the push button face with minimum dimensions of 4 feet by 4 feet and a maximum slope of 2.0% in all directions. Center the push button on the landing if possible to do so without violating any of the requirements listed in this Special Provision. The landing must be connected to the Pedestrian Access Route.
- A 6-foot wide clear distance between obstructions in the same path as the PAR shall be maintained wherever it is possible to do so for snow removal purposes. This 6 foot obstruction free area is called a (MAR) Maintenance Access Route
- All new hand holes shall be placed outside of the PAR, inclusive of ramps and landings.
- The push buttons shall be mounted at a height of 42 inches as indicated in the Plan.
- Crosswalks shall be striped in a straight alignment between the outside edges of the detectable warnings with no kinks unless the crosswalks are shown as kinked in the Plan.
- The Contractor shall maintain all working points marked by the surveyor and use the working points to layout push button locations in accordance with the Plans and Special Provisions.

If any of these conditions cannot be met, the Contractor shall consult with the Engineer to determine a resolution. Once the Engineer and the Contractor reach an agreement on how to proceed, the Contractor may proceed. If the Contractor constructs any pedestrian push button systems or pedestrian facilities which do not meet the criteria or the agreed upon resolution, the Contractor will be responsible for correcting the deficiencies with no compensation paid for the corrective work.

To help ensure signal systems are properly constructed the Contractor must adhere to the following practices:

- All push button station bases shall be installed using a breakaway pedestal base, see Typical APS Pedestrian Push Button Location and MN/DOT approved /qualified products list. The pedestal base shall be fastened to the station foundation using 4 5/8 inch (UNC) x 7 ½ inch' stainless steel anchor rods. The push button station foundation shall be constructed as part of the sidewalk by increasing the sidewalk dimension to a 12 inch minimum thickness and an 18 inch minimum diameter to top of sidewalk surface. The push button station foundation shall be placed as part of the landing. All construction joints/grade breaks shall be located outside of foundation area and designated landing area.

- When not accounted for in the Plan, and determined necessary by the Engineer payment to furnish and install additional APS pedestrian push button station will be $ 1,000.00 each and will be made under Item 2565.602 (Pedestrian Push Button Station). Payment shall include all components necessary to furnish and install APS push button station, including additional conduit, wiring, APS push button base installation, and shaft with reflective tape and cap.

- Signal pole foundations which are being constructed in or adjacent to sidewalk shall be constructed in accordance with the applicable MN/DOT Standard Plate 8120 or 8126. If a push button is proposed to be mounted on a signal pole, the APS push button shall meet the vertical, horizontal, and crosswalk skew requirements. If these specifications cannot be met a MN/DOT approved extension bracket must be used.

1807 FAILURE TO COMPLETE WORK ON TIME

The provisions of MN/DOT 1807 are supplemented as follows:

A. The liquidated damages as set forth above may apply equally, separately, and may be assessed concurrently. These provisions shall apply in full to both the Substantial Completion Date and the Final Completion Date.

1906 PARTIAL PAYMENTS

Partial Payments shall be made in accordance with the provisions of MN/DOT 1906 and the following:

A. The first sentence of Paragraph Three 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.

B. 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.

1908 FINAL PAYMENT

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

1) 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 five percent (5%) 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.

2) The City will withhold and retain up to five percent (5%) of the final estimate for a period of up to one year after the contract completion date.

3) Where the provisions of MN/DOT 2571.3.K Plant Establishment Period pertain to the contract, the City will withhold and retain an amount equal to the final value of planting bid items or one percent (1%) of the final estimate, whichever is greater, for a period of up to two calendar years after the initial planting operations are complete.

4) <u>Condition for Release of Five Percent (5%) of Retainage:</u>

The Contractor and all of its subcontractors shall comply with Minnesota Statutes, Section 290.92. Pursuant to Minnesota Statutes, Section 270C.66, the City will not release the five percent (5%) retainage or any portion thereof to the Contractor prior to receipt of an "Affidavit For Obtaining Final Settlement of Contractor With the State of Minnesota and Any of its Political or Governmental Subdivisions" (Form IC-134) from the Contractor and from each of the Contractor's subcontractors (if any). The Contractor and subcontractors shall submit to the City original copies of Form IC-134 already fully executed by the Commissioner of Revenue of the State of Minnesota. It shall be the responsibility of the Contractor to ensure that all of the Affidavits herein required are submitted to the City.

2051 MAINTENANCE AND RESTORATION OF HAUL ROADS

REVISED 01/08/16

The provisions of MN/DOT 2051 hereby deleted and replaced with the following:

A GENERAL

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

B DESIGNATED HAUL ROUTE

1. 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 online at:

   http://www.duluthmn.gov/engineering/standard-construction-specifications/construction-documents/

2. 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.

3. 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 to coordinate.

C RESTORATION OF HAUL ROADS

1. 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.
2. 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:

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.

2104 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. In 1998, the City of Duluth street name signs were replaced. The 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. The Contractor shall coordinate and deliver the castings to the City of Duluth Sewer Division storage facility at 40th Avenue West. 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.

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. Sawing of sidewalks 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. In addition, a 1 inch PE or Type K copper "jumper" pipe shall be installed to connect the both cut ends to relieve accumulated water in the pipe. Plugs and jumper pipe shall be considered incidental and no direct payment will be made.

2104 REMOVE AND HAUL TREATED WOOD

REVISED 08/20/15

SP2016-71: The provisions of MN/DOT 2104 are supplemented with the following:

The Contractor can elect to reuse the treated wood for its original intended purpose. The Contractor shall furnish a completed Transfer of Ownership form to the Engineer prior to removing any treated wood from the Project limits. The Transfer of Ownership form is available at the following website:

http://www.dot.state.mn.us/environment/buildingbridge/index.html.

If the Contractor cannot or elects not to re-use the treated wood for its original intended purpose, but must be disposed, the following shall apply:

(A) The Contractor shall dispose of all waste treated wood in a MPCA permitted Minnesota solid waste or industrial landfill or landfills listed under Landfills/Regulated Waste at http://www.dot.state.mn.us/environment/regulated-materials/pdf/waste-contractors.pdf. The Contractor shall not dispose of waste treated wood in a demolition landfill. Within 30 days after the treated wood is transported to the landfill, the Contractor shall provide the Engineer with shipping manifests, scale tickets and invoices. Shipping manifests shall include, but are not limited to, the following information: specify treated wood as the type of waste, quantity of wood, date of hauling and disposal, and location of disposal.

(B) The Contractor has the option to chip creosote treated wood on site instead of hauling it to a landfill. After the wood is chipped on site, the Contractor shall transport the chipped wood off site to a MPCA permitted incinerator that is permitted to burn creosote treated wood. Call 651.366.3630 for list of incinerators permitted to burn creosoted treated wood. This applies to creosote treated wood only.

Measurement and payment for the removal and disposal of treated wood will be made only when specifically included for payment as such in the Proposal and as listed in the Plans. All other removal and disposal of treated wood operations shall be incidental.

2105/2451 ROCK BLASTING AND VIBRATION CONTROL

The provisions for rock 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 below. Construction details for these items are found elsewhere in these specifications.

A. Definitions

1. (2105.601) 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. (2105.503) Rock Excavation refers to the main fragmentation blasting resulting from appropriately spaced production holes drilled throughout the rock excavation area. This includes rock excavated outside the normal roadway grading section as defined under Rock Channel Excavation.

3. (2451.501) 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, water main, culverts, pipe sewers, drainage structures, subsurface drains, etc.

B. General Requirements

1. 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. or as otherwise approved by the Engineer.

2. 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):

   a. Name and experience of Blaster(s).
   b. Type of explosives, primers and initiators including manufacturer's data sheets for all explosive products.
   c. 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.
   d. Procedures to inform and protect the public and adjacent property (e.g., signs, horns, letters, personal visits, etc.).
   e. Flyrock control plan.
   f. 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 his responsibility for the accuracy and adequacy of the plan when implemented in the field. When the contract requires the Contractor to retain a blasting consultant to assist with the blast design, all blasting plan submittals must be approved by the blasting consultant.

3. 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);

   a. Location of the shot by station and offset.
   b. Plan view of the drill pattern including free face, burden, hole spacing, diameters and angles.
   c. Section view showing type and amount of explosives, primers, initiators, location and depth of stemming, lift height, and subdrill depth.
   d. Initiation sequence of holes including cumulative delay times and delay system.
   e. Maximum peak particle velocity measured at the closest (or most critical receptor), location of monitoring station, and scaled distance.

4. 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 on 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 to the Contract unit price for rock excavation.

   If in-place stabilization of back slope 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 will 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.

5. 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 shall, 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 may be 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 his activities.

6. Public Relations

   The Contractor is required to have both letter and personal contact with residents or 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 will be made prior to the beginning of any blasting or other vibration producing activity. The

Contractor will furnish a list of those contacted to the Engineer, as part of the blasting plan.

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

C. 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. Flyrock control procedures shall be approved by the Engineer.

D. 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:

Concrete Age (hours)	Maximum Peak Particle Velocity [inches per second (mm/sec)]
0-3	No Limit
3-12	1.00 (25)
12-24	1.50 (40)
24-48	2.50 (65)
48 or greater	4.00 (100)

(*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 [100 mm 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.

If the Contractor desires to utilize higher vibration limits than those permitted above, he must submit a recommendation prepared by a recognized Consultant with expertise in this field. The Consultant report must be specific to this Project and shall include (at a minimum): 1) the proposed vibration limits, 2) basis for these limits, 3) specific equipment that will be employed to monitor the vibrations, and 4) potential impact of the proposed vibration levels on other structures or buildings on or off the Right of Way. The Engineer will review the submittal and respond within two weeks. If the use of higher vibration levels is approved and subsequent damage occurs, such as cracking of the concrete or deterioration of support rock below the structure, lower vibration levels will be established. Any damage caused by the higher limits shall be repaired by the Contractor to the satisfaction of the Engineer at no cost to the State.

The above vibration limits, or any new limits established for the protection of fresh concrete on this Project, do not relieve the Contractor from complying with any other vibration limits that may be 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 his discretion (or in consultation with the Geology Unit, Office of Construction Materials and Engineering), may waive the requirement for vibration monitoring 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.

E. Vibration Control and Monitoring

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.

1. Ground Vibration Control Limit

Measurements for this limit will be made at external ground locations adjacent to affected buildings or structures. This vibration criteria will be measured in peak particle velocity. No controls have been established for in place utilities and the Contractor shall conduct operations to prevent damage to same.

The maximum single component peak particle velocity resulting from construction activity shall not exceed the values given in the table below:

Frequency of the Peak Particle Velocity (Hz)	Allowable Peak Particle Velocity [inches per second (mm/sec)]
1 or less	0.20 (5)
4	0.75 (19)
11	0.75 (19)
30 or greater	2.00 (51)

The frequency and peak particle velocity shall be analyzed for each of the three components and the velocity limit shall apply to each component. The frequency is defined as that associated with peak particle velocity pulse of the ground motion and is calculated as the inverse of twice the time interval between the two zero crossings of that pulse.

2. Air Blast Control Limit
The maximum air blast resulting from blasting shall not exceed the values given in the table below:

Frequency Range of Instrumentation	Maximum Air Blast (dB)	Maximum Air Blast [psi (kPa)]
0.1-200 Hz, flat response	134	0.015 (0.103)
2.0-200 Hz, flat response	133	0.013 (0.090)
6.0-200 Hz, flat response	129	0.008 (0.055)

3. Vibration Monitors
The amplitude/frequency vibration monitor shall be an Instantel Blastmate DS677 or equivalent. This instrument shall be capable of measuring, recording, and producing a hard copy of the frequency and peak particle velocity in three mutually perpendicular axes ("vector sum" instrumentation is not allowed). 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.

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.

F. Measurement and Basis of Payment

Blast Monitor/Survey will be 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 under Item 2105.601 (Blast Monitor/Survey) for 50 percent of the amount bid. When the rock removal items are completed, the remaining 50 percent of the amount bid for Blast Monitor/Survey will be paid.

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 incidental.

2105 EXCAVATION AND EMBANKMENT

Roadway excavation and embankment construction shall be performed in accordance with the provisions of MN/DOT 2105, 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 2105.3.F.1. 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

Select Granular Borrow (MN/DOT 3149.2.B.2) shall 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 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. Department personnel will be on site to monitor excavation and inspect any exposed steel main 6 inches or larger. Notify the Engineering Division at 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 730-5200 to coordinate an inspection of the exposed main.

D 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 2105.501 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.

2105 GEOTEXTILE FOR SEPARATION (STABILIZATION)

This work shall consist of placing geotextile below the fill material (may be underwater) at the location(s) shown in the Plan, or as directed by the Engineer. The work shall be accomplished according to MN/DOT 2105, these Special Provisions, or as directed by the Engineer. The purpose of the geotextile layer is to provide separation between the fill and underlying softer soils, to prevent mixing, to provide stability during compaction, to provide some reinforcement and to minimize differential movement. The Contractor's proposed construction sequence for geotextile and fill placement shall be submitted to the Engineer for review at least 21 days prior to beginning of this element of construction.

A. Material Requirements
Geotextile shall conform to the requirements of MN/DOT 3733, Type V, and be non-woven.

B. Construction Requirements

The prepared surface shall be relatively smooth and free of stones, sticks, or other debris or irregularities that would tend to puncture or tear the geotextile. Unless otherwise directed or approved by the Engineer, the geotextile shall be placed with the highest strength direction (usually the "machine" or roll direction) oriented in the direction of the greatest expected field stress. (This will usually be at right angles to the centerline of the construction.)

If multiple pieces of geotextile are required, adjacent strips shall be field or factory sewn with the seams to have strength as specified in MN/DOT 3733.2.B. All **seams shall be sewn using a "double spool" machine** capable of sewing a Federal Type 401 locking stitch. Seam Type "J," thread strength (25-lbs minimum), number of rows of stitching (1 or 2), and stitches per inch (typically, 5 to 7) shall be consistent with achieving the required seam strength and as recommended by the geotextile manufacturer. The Contractor may use **spray adhesive seams** as an alternative to sewn seams under the following conditions: 1) adhesive product shall be a MN/DOT Approved/Qualified Product; 2) adhesive spray shall be installed in accordance manufacturer's recommendations; 3) installer shall spray both sides of geotextile fabric; and 4) twelve inch minimum overlap is required.

The geotextile shall be adequately secured so that it is not displaced during subsequent construction. No traffic or construction equipment will be permitted to operate directly on the geotextile. Any damaged geotextile shall be repaired to the satisfaction of the Engineer by patching and sewing or, when appropriate, a 36-inch overlap on all sides without sewing.

Fill shall be placed onto the fabric in uniform lifts as required by the applicable specification and approved by the Engineer, but in no case shall lifts in excess of 12-18 inches be used, unless required to bring the fill above water level or provide stability. Fill material shall be as shown in the Plan or as directed by the Engineer. For placement underwater and for two (2) feet above water level, granular materials shall be used unless otherwise provided in the Contract Drawings or approved by the Engineer.

C. Measurement and Payment

Measurement will be made of the number of square yards of satisfactorily installed geotextile approved by the Engineer. No allowance will be made for seams. Payment will be made under Item 2105.604 Geotextile Fabric Type V at the Contract bid price per square yard, and shall include but not be limited to, geotextile, seaming, placement, anchoring, and any needed repairs.

2211 AGGREGATE BASE

Aggregate base courses shall be constructed 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.

2357 BITUMINOUS TACK COAT

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

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 2 inches) the longitudinal joint of the adjacent road surface to seal the joint.

B. Section MN/DOT 2360.4 Method of Measurement and section MN/DOT 2360.5 Basis of Payment are deleted.

No measurement will be made of bituminous material for tack coat and no direct compensation will be made. All costs for providing bituminous materials for tack coat will be incidental.

2360 PLANT MIXED ASPHALT PAVEMENT

MN/DOT 2360 specification is hereby modified with the following:

A. The provisions of MN/DOT 2360.2.E.5.a(1) Aggregate are modified with the following: Scrap shingles, as an asphalt binder source, shall not be included in any wear or non-wear layer.

B. The provisions of MN/DOT 2360.2.G.4.b Sampling and Testing are modified with the following:

1. The Contractor will take the first QC sample from the second, third or fourth truck on the construction job. Thereafter, the Contractor shall ensure that all QC samples are taken at random locations.
2. The Contractor shall store and retain mixture bulk samples and companion samples for the city for a period of 30 working days.

C. 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, 218-730-5907." **The City will assess monetary deductions in the amount of $250.00 each day that the Contractor fails to comply**.

D. The provisions of MN/DOT 2360.3.E Surface Requirements are hereby modified with the following:

The sentence "In addition to the list the above pavement surface must meet requirements of 2399 (Pavement Surface Smoothness) requirements." is deleted.

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

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

D.1 Maximum Density
Compact the pavement to at least the minimum required maximum density values in accordance with Table 2360-19, "Required Minimum Lot Density (Mat)".

(2) MN/DOT Table 2360-20 Longitudinal Joint Density Requirement is hereby deleted.

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

D.1.h Mat Density Cores
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 [0.3 m] 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 [150 mm **±** 12.5 mm] from the edge of the top of the mat (ex. center of 4 inch [100 mm] core barrel 8 ± 0.5 inches [200 mm **±** 12.5 mm] from the edge of the top of the mat). Cores will not be taken within 1 foot [300 mm] 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.

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

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

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

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

(7) MN/DOT Table 2360-24 Payment Schedule for Longitudinal Joint Density (SP Non-Wear and SP Shoulders, 4% Void) is hereby deleted.

(8) MN/DOT Table 2360-25 Payment Schedule for Longitudinal Joint Density (SP Non-wear and SP Shoulders, 3% Void) is hereby deleted.

(9) MN/DOT 2360.3.D.1.r Pay Factor Determination is hereby deleted.

F. The provisions of MN/DOT 2360.4 Method of Measurement are hereby modified:

The following sentences are added: Asphalt mixtures paid by the square yard per inch will be for areas where it is impractical for a paving machine to pave driveways and other areas not on the mainline. If areas behind the curb and gutter can be paved with a paving machine, then that quantity will be paid for under the unit price per ton of asphalt placed.

G. The provisions of MN/DOT 2360.5 Basis of Payment are hereby modified as follows:

Payment for the accepted quantities of asphalt mixture 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.

2360 PLANT MIXED ASPHALT PAVEMENT – STREET RESTORATION PATCHING

The provisions of MN/DOT 2360 and the City of Duluth Standard Specifications are supplemented with the following:

A. 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 preclude the use of standard asphalt street paving equipment.

Asphalt pavement street restoration patch thickness shall match the existing asphalt pavement section or unless otherwise provided in the Plan Details.

Unless otherwise indicated in the Plans or special provisions, asphalt mixture for street restoration patch shall be: SP 12.5 Wearing Course Mixture (3,B) (SPWEB340B)

B. Materials

1) MN/DOT 2360.2 Materials is supplemented with the following: The Contractor shall submit Mixture Design to the Engineer at least 14 days prior to the asphalt paving work.

2) 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.

C. Construction Requirements

1) 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.

2) 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.

3) 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.

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

5) 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 3 inches.

D. Method of Measurement

MN/DOT 2360.4 Method of Measurement is supplemented as follows: 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.

E. Basis of Payment

MN/DOT 2360.5 Basis of Payment is supplemented as follows: 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.

Payment will be made for asphalt pavement for street restoration patch under Item 2360.604 Type SP 12.5 Wearing Course Mixture (3,B) Street Restoration Patch (x)" Thick at the contract unit price per square yard.

Note:
(x) Total Thickness of asphalt pavement for street restoration patch. Thicknesses greater than 3 inches WILL require more than one lift of pavement.

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

This work shall consist of constructing concrete structures in accordance with MN/DOT 2411 and the following:

A. Description

1) Concrete Steps shall be constructed as shown in Standard Detail STR-7.
2) Concrete retaining wall shall be constructed as shown in Standard Detail STR-6.

B. Measurement

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

C. Basis of Payment

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.

Item	Description	Unit
2411.607	Concrete Steps	Cubic Yard
2411.607	Concrete Retaining Wall, Type L	Cubic Yard

2451 STRUCTURE EXCAVATION AND BACKFILLS

NEW WRITEUP 11/06/15
SP2016-149.1: In MN/DOT 2451.5 Basis of Payment, the last paragraph is changed to read as follows:

The Department will pay for structure excavation and backfill in accordance with the following schedule:

Item No.:	Item:	Unit:
2451.501	Structure Excavation, Class ___	cubic yard [cubic meter]
2451.503	Granular Backfill ___*	cubic yard [cubic meter]
2451.505	Aggregate Backfill ___*	cubic yard [cubic meter]
2451.507	Granular Bedding ___*	cubic yard [cubic meter]
2451.509	Aggregate Bedding ___*	cubic yard [cubic meter]
2451.511	Coarse Filter Aggregate ___*	cubic yard [cubic meter]
2451.513	Fine Filter Aggregate ___*	cubic yard [cubic meter]
2451.514	Fine Aggregate Bedding ___*	cubic yard [cubic meter]
2451.515	Coarse Aggregate Bedding ___*	cubic yard [cubic meter]
2451.516	Conduit Aggregate Bedding ___*	cubic yard [cubic meter]

*For all granular material items, specify the basis of measure (loose volume or compacted volume) after the item name in accordance with 2451.4.B, "Granular Material."

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 modified in the following:

A. 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'.

B. USE OF ON-SITE 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.

C. MATERIALS

MN/DOT 2451.2 Materials is supplemented with the following:

1. <u>Suitable On-Site Backfill Material</u>

Suitable materials shall be defined as a mineral soil reasonably free of foreign materials (rubbish, debris, etc.), frozen clumps, aggregate larger than 3 inches, rock, concrete or bituminous chunks, and other unsuitable materials, that may damage the pipe installation, prevent thorough compaction, or increase the risks of after settlement unnecessarily. Suitable backfill shall meet the provisions of MN/DOT 2105.1A.6 Select Grading Material. The Engineer shall determine if any material is suitable.

2. 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 Standard Details, the Contract Drawings and the Special Provisions.

3. Imported Granular Materials for Manholes and Catch Basins
   Granular materials furnished for foundation and bedding shall consist of granular materials as specified on the Standard Details, the Contract Drawings and the Special Provisions. Structure backfill for manholes and catch basins shall meet MN/DOT 3149.2.D.1 Granular Backfill.

4. 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 2105.1.B Common Borrow 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.

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/1in).

D. CONSTRUCTION

1. General Provisions
   a) 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.

Obstruction 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 replaced in their proper setting at the sole expense of the Contractor.

b) 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. Department personnel will be on site to monitor excavation and inspect any exposed steel main 6 inches or larger. Notify the Engineering Division at 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 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.

c) 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.

2. Excavation and Repair of Trench

a) 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. All blasting shall be performed in accordance with 2105/2451 ROCK BLASTING AND VIBRATION CONTROL specifications.

b) 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 the 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.

c) 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 Standard Details 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 Standard Details 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 Standard Details 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.

d) 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.

e) 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 Standard Details, 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.

f) 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 Excavations is supplemented with the following:

3. Backfilling Operations
   a) General Requirements. Sequence of operations necessary prior to commencing final backfilling may be governed by the Standard Details, 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 Standard Details, 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.

   b) 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.

c) 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 6 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 2105.3.F.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, except that 12 inches will be permitted for Granular Materials placed above an elevation one foot above the top of pipe, and 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 his 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) 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.

E. MEASUREMENT

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 of Duluth Standard Details.

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

B1 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.

B2 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:

C1 On-Site Materials for Backfill

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

C2 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 of Duluth Standard Details, 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.

F. BASIS OF PAYMENT

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.

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

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) will be made under bid Item 2451.607 (Furnish Granular Backfill (CV)) or 2451.607 (Furnish Common Backfill (CV)) at the Contract unit price per cubic yard, which 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.

2461 STRUCTURAL CONCRETE (VIBRATION CONTROL)

MN/DOT 2461 is supplemented with the following:

The Contractor shall protect all freshly placed concrete from vibration in accordance with the provisions of section D. (Freshly Concrete Vibration Controls) of 2105/2451 Rock Blasting and Vibration Control.

2461 STRUCTURAL CONCRETE

MN/DOT 2461 is hereby modified as noted in Appendix E – 2461 Structural Concrete Supplemental Specifications (09/25/2015):

2502 SUBSURFACE DRAINS

Subsurface drain construction shall be performed in accordance with the provisions of MN/DOT 2502, the detailed drawing in the Contract Drawings, 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

SP2014-146 modified: MN/DOT 2503 is 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.

Payment will be under Item 2503.602 Connect to Existing [Sanitary or Storm] Sewer at the Contract bid price per each, which shall 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 Department and to the satisfaction of the Engineer.

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 modified below:

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.

A. Materials
   1. 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.

2. 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.

3. 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.

4. Corrugated Polyethylene Pipe
   This work shall consist of furnishing and installing dual-wall corrugated polyethylene pipe and fittings in accordance with the Contract Drawings, MN/DOT 2503, AASHTO M294, Design Section 18 of the AASHTO Standard Specifications for Highway Bridges 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 and Design Section 18 of the AASHTO Standard Specifications for Highway Bridges. The polyethylene compounds shall conform to the requirements of ASTM D 3350 Cell Class 335420C. 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 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 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 1.

TABLE 1

DUAL WALL CORRUGATED POLYETHYLENE PIPE
NOMINAL DIAMETER (IN.)

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

5. Connections to Polyethylene Storm Sewer Pipe
   Private sump pump discharge connections to HDPE storm pipe must have soil tight connections and meet manufacturer's recommendations for Tee connections. Inserta Tee, ADS UNI-T Tapping Tee, and other proprietary connections may be used with the project engineer's prior approval.

6. 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 water tight. Couplings shall be attached to pipe utilizing stainless steel bands.

B. Construction Requirements
   1. 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.

2. 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.

3. 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 standard details and the contract drawings.

4. 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 Owner.

5. Locating Wire
   Locating wire shall be installed in accordance with 2503/2504 LOCATING WIRE FOR WATER AND SEWER of these specifications and the Standard Details and the Special Provisions.

6. 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 Standard Details. Outside drops shall not be used except where approved by the City Engineer.

7. 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. Four-inch service pipe may be used in new developments with new sewer main and new sewer services for residential homes. All service pipe installation shall meet the requirement of the State of Minnesota Plumbing Code.

8. 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 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.

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

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

11. 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.

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

13. 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.

14. 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. 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.

15. 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.

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

16. 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.

C. Basis of Measurement and Payment
1. 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.

2. Sanitary Sewer or Storm Sewer
   Measurement for Pipe Sewers – Gravity shall be per lineal foot of the specified diameter and material installed. 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..

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

   Payment for wyes of each size will be made under item 2503.602 ((size main)" X (service size)" PVC Wye) at the Contract price per each, which shall be compensation in full for all costs of furnishing and installing the wye complete in place as specified.

4. 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.

   Payment for each connection will be made under Item 2503.602 (Connect Sewer Service), at the Contract price per each, which shall be compensation in full for all costs of furnishing and installing the connection complete in place as specified.

5. 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. Payment for sewer service pipe will be made under Item 2503.603, ((size)"PVC Sewer Service Pipe), at the Contract price per foot, which 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.

6. Construct Inside Drop
   This work shall consist of furnishing and installing an Inside Drop Connection in accordance with the Standard Details, 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. Payment for inside drop connections will be made under Item 2503.602 (Construct Inside Drop) at the Contract bid price per each, which shall be compensation in full for all costs of furnishing and installing the inside drop connection complete in place as specified.

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 modified below: 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.

A. Materials
   1. 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 Department may require advance approval of material suppliers, product

design, or other unspecified details as it deems desirable for maintaining adopted standards.

2. 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:

   a. 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.
   b. The exterior of the pipe shall have an asphaltic coating at least one mill thick unless specified otherwise in the Special Provisions.
   c. When specified in the Special Provisions, 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.
   d. 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.
   e. 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.
   f. 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.
   g. All pipe shall be furnished in 18 or 20-foot nominal lengths.
   h. 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.
   i. Pipe shall be provided with provisions to maintain electrical continuity for thawing and locating purposes.
   j. 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.

3. 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.
   a. Buried fittings shall be mechanical joint with rubber gaskets.
   b. Exposed fittings shall be flanged conforming to ANSI B16.1, Class 125 and have full face gaskets.
   c. Exposed fittings shall be shop primed for painting.
   d. Fittings shall be provided with provisions to maintain electrical continuity.
   e. Fittings shall be manufactured in North America or preapproved by the City Chief Engineer of Utilities.
   f. Mechanical joint bolts shall be as specified elsewhere in this section
   g. 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.

4. HDPE Pipe and Fittings
   a. HDPE pressure sewer and forcemain pipe 4 inches and greater shall be polyethylene pipe conforming to ASTM D3035 and AWWA C906-15, Polyethylene (PE) Pressure Pipe and Fittings, 4" through 63", for Water Distribution. Pipe furnished shall be marked with a continuous green stripe. Pipe and fittings shall be PE4710, HDPE Pressure Class 200, SDR 11, and have outside diameters similar to ANSI A-21.51 ductile iron pipe. Joints and 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.
   b. Pressure sewer pipe less than 4-inch shall be polyethylene pipe conforming to the requirements of ASTM D2239 or D3035 and shall have a minimum working pressure of 200 psi at 73 deg. F., DR11. Joints and fittings shall be butt heat fusion type, ASTM F2620.
   c. 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. All 8 x 6 reducers shall be molded or machined. Other size reducers may be fabricated. All fabricated fittings shall be rated for a minimum operating pressure of 200 psi. All fabricated fittings shall be made from a minimum thickness material of SDR 9. Fabricated 90 degree elbows shall have a minimum of 4 sections. Fabricated 45 degree elbows shall be 2 sections.

Fabricated fittings shall be manufactured by Plasson USA or George Fischer Central Plastics. 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.

d. All fittings for 3 inch and smaller pipe shall be molded. All fittings shall be rated for 200 psi.
e. Couplings used for pressure sewer force main and services (4 inches and larger) shall be electrofusion type. Couplings used for services (3 inches and smaller) shall be electrofusion or socket fused type.
f. 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.
g. 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.
h. Shop drawings for HDPE pipe must specify minimum allowable pipe deflection radius.
g. <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.

5. <u>Stainless Steel Pipe</u>

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.

6. HDPE Transition Couplings and Adapters
   a. The HDPE by MJ Adapters shall be manufactured by Central Plastics Company 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 provide joint restraint. Adapters shall be used for all transitions from HDPE to valves or ductile iron pipe.
   b. 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.
   c. Transition couplings 2-inch and smaller shall consist of HDPE by threaded stainless steel connections. The coupling shall include a stainless steel transition compression ring with O-ring seal. Adapters shall have a pressure rating equal to that of the mating pipe. HDPE shall be plain end for butt fusing. Coupling shall be manufactured by Central Plastics, Inc. or equal.
   d. All bolts to be used on adapters and couplings shall be supplied with 6 ounce zinc anode caps conforming to ASTM B-418.

7. Transition Couplings

   Cast transition couplings for 4 inch through 12 inch 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.

4”	4.80” to 5.10”
6”	6.90” to 7.20”
8”	9.05” to 9.45”
10”	11.10” to 11.50”
12”	13.20” to 13.50”

Couplings shall be Smith Blair 441, JCM 210, Ford FC1, Krauz Hymax, Romac Macro HP, or approved equal.

8. 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:

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

b. Gate valves shall be solid disc with resilient seating.

c. The wedge shall be ductile iron and fully encapsulated with EPDM rubber.

d. Valves shall have a two inch square operating nut opening counter-clockwise.

e. All valves shall be of the non-rising stem type.

f. All valves shall be furnished with O-Ring stem seals. The O-Rings above the thrust collar shall be fully replaceable with the valve “open” and under full pressure.

g. The exterior of the valve shall be supplied with a fusion baked epoxy coating.

h. 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.

i. All valves within structures or vaults shall have extension stems that extend to within 6 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.

j. Gate valves shall be manufactured by American Flow Control, Clow, Waterous, Mueller, AVK, 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.

k. Gate valve box adapters shall be ¼ inch steel adapter and ¾ inch neoprene gasket. The steel adapter shall be coated with bitumastic coal tar epoxy. Adapters shall be manufactured by Adaptor, Inc.

l. 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.

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

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

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

p. Bolts for flanged valves exposed to wastewater shall be 316 stainless steel.

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

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

s. A 5-pound (minimum) magnesium anode shall be attached to MJ bolt for all valves as shown in the Standard Detail W-18.

9. Valve Boxes

Valve Boxes shall be 5 1/4” cast iron screw-type, consisting of the following parts:

Cover	**Stay-put type, “SEWER” cast thereon, with solid edges (no grooves or flutes on edge)**
Top Section	26” length
Extension Section	30” length
Bottom Section	30” 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.

10. 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 Clow, Henry Pratt or pre-approved equal.

11. Ball Valves
    Ball valves up to 2-inches 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.

12. Pressure Gauges
    Pressure gauges shall be 2 ½ inch minimum diameter, silicone filled, stainless steel case and basel, and spiral tube with a polycarbonated 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.
13. Pressure Sewer Services and Fittings
    a. Pressure sewer services shall conform to the same requirements for HDPE pipe and fittings.
    b. Tapping Tees with Electrofusion Saddle shall be manufactured by Central Plastics Company or equal and shall conform to the requirements for Water Pipe Materials and Fittings as specified.
    c. Curb Stop shall have threaded connections for use with HDPE adapters.
    d. 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.

14. 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.

15. 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.

16. 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.

B. Construction Requirements

1. 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 Standard Details, Contact Drawings, or the Special Provisions.

All horizontal directional drilling shall be performed in accordance with (2503/2504/2505) HORIZONTAL DIRECTIONAL DRILLING of these specifications.

2. 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 inch (300 mm) and smaller by hand with ropes and skids. Unload pipe larger than 12 inch (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.

3. 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.

4. 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:

MAXIMUM PERMISSIBLE DEFLECTION IN LAYING PUSH-ON JOINT FOR DUCTILE IRON PIPE					
Pipe Size	**Max. Angle**	**MAX OFFSET PER PIPE**		**Approx. Radius**	
		18' length	**20' length**	**18' length**	**20'length**
3" to 12"	5°	19"	21"	205'	230'
16" to 24"	3°	11"	12"	340'	380'
30" to 36"	2°	7.5"	8"	510'	570'

MAXIMUM PERMISSIBLE DEFLECTION IN LAYING MECHANICAL JOINT FOR DUCTILE IRON PIPE			
Pipe Size	**Max. Angle**	**MAX. OFFSET PER PIPE 18' length**	**20' 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"

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.

5. 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 Standard Details.

   a. All horizontal bends, plugs, caps and branch tees shall be provided with concrete buttresses.
   b. 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.
   c. 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.
   d. 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 2 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 Standard Detail Drawing.

   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.

6. 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 install per the Standard Details.

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

8. 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.

9. Connection and Assembly of Joints
   a. 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.

b. 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.

c. 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.

d. 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.

e. Fusion Joining of HDPE Sewer 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.

Unless otherwise directed by the pipe manufacturer's recommendations, the heating tool surface temperature must be minimum 400°F to 450°F maximum.

10. 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.

11. 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.

12. 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 of 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.

13. 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 5 pound (minimum) magnesium anode shall be attached to MJ bolt for all valves as shown in the standard details. 6 ounce zinc anode caps conforming to ASTM B-418 shall be installed on the bolts on all mechanical joint fittings.

14. Testing Pressure Sewer and Forcemain and Service
    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 as necessary for 4 hours. After 4 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 100 psig for 5 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.

15. 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.

C. 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, standard details 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.

1. 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.

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

3. 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.

4. HDPE Service Tees
   This work shall consist of furnishing and installing service tees 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.

   Payment for tee of each size will be made under item 2503.602 at the Contract price per each, which shall be compensation in full for all costs of furnishing and installing the tee complete in place as specified.
5. Tracer Boxes
   Tracer Boxes of each type will be measured separately per each by the number of complete units installed.

6. 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.

7. 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.

8. 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.

D. Basis of Payment

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 will be made under Item 2503.603 (size) DIP Forcemain at the contract bid price per linear foot which 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 will be made under Item 2503.603 (size) HDPE Pressure Sewer or Forcemain SDR 11 at the contract bid price per linear foot which 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 will be made under Item 2503.603 (size) HDPE SDR 11 Pressure Sewer Service Pipe at the Contract bid price per foot, which 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.

Payment will be made under Item 2503.602 (size) Tapping Tee with Electrofusion Saddle at the Contract bid price per each, which 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.

Payment will be made under Item 2503.602 (size) Pressure Sewer Curb Stop and Box at the Contract bid price per each, which 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.

Payment will be made under Item 2503.602 (size) Gate Valve and Box at the Contract bid price per each, which 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, 5 lb. anode bag, zinc anode caps, and crushed stone. No additional payment will be made for valves installed where new mains are deeper than the minimum depth.

2503 CURED-IN-PLACE PIPE LINING

Furnish all labor, materials, equipment, and incidentals required to install and test cured-in-place (CIPP) pipe lining and appurtenances complete as shown on the Drawings and as specified herein. Cured-in-place pipe lining is an acceptable procedure for lining the sewers where specified on the Drawings.

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 vertical standpipe and hydrostatic head. The standpipe is erected with scaffolding over the manhole.

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 is used to insert the liner and provide a continuous tight fitting liner after the cure process is complete.

C. Submittals

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 Registered Professional Engineer.

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.

2. 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 projects within the past three years.
3. Equipment and Construction Procedures
4. Certificates of Compliance
5. Reference Standards
   a. 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
   b. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

D. <u>Qualifications of the Cured-in-Place Pipe Lining Contractor</u>
1. 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 <u>no</u> 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 Owner references.

2. 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.
3. The Owner shall approve or disapprove the Contractor and/or manufacturer based on the submitted information and a follow up interview.
4. Submit references for any subcontractor that may be used on site.

E Delivery, Storage, and Handling

1. 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.
2. 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.
3. 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.

F. Guarantee

1. 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 Owner's Engineer, shall be removed and replaced in a satisfactory manner by the Contractor at no cost to the Owner. The Owner may conduct an independent television inspection, at his own expense, of the lining work prior to the completion of the one year guarantee period.

G. Quality Assurance

1. 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 Owner.
2. Inspection of the liner may also be made by the Engineer or other representative of the Owner 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.

H. Safety

1. 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.
2. 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.
3. The Contractor shall provide traffic control meeting MUTCD standards.
4. The safety of pedestrians and the traveling public is the Contractor's responsibility.

I. Materials

1. CIPP Lining
   a. CIPP lining shall be Insituform by Insituform Technologies, Inc., Inliner by Inliner USA, Inc., National Liner by National Envirotech, Inc., or Engineer approved equal.
   b. 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.
   c. 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
   d. The liner shall be capable of fitting into irregularly shaped pipe sections and through bends and dips within the pipeline.
   e. The liner shall be able to cure in the presence of water at a temperature of 180 degrees F or less.

f. When inverted and cured, the liner shall form a continuous, tight fitting, hard, impermeable liner that is resistant to chemicals found in domestic sewage.
g. 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.
h. 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.
i. 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.
j. 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 manholes. The required length of liner shall be verified in the field by the Contractor prior to fabrication.
k. The CIPP liner shall be watertight.
l. The cured liner shall have the following 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

J. Preparation
1. Clean each length of pipe to be lined and dispose of any resulting material. The Contractor may be allowed to dispose of waste materials generated by pipe cleaning operations at the City's West Duluth Tool House, located at 40th Avenue West and Superior Street. Disposal only applies to sewer line materials generated from cleaning the pipe. Prior to disposing of material, the City needs to be notified and the clear water needs to be decanted. Unsupervised disposal will not be permitted.
2. 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.

3. Contractor shall dye test all service connections prior to lining to determine all active service connections and shall plug inactive service connections.
4. 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 so as to be flush with the 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.
5. The Contractor shall provide bypass pumping of sewage flows where the pipe rehabilitation work is being performed.
6. 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 at least 24 hours in advance of commencement of the work, giving the date, start time and estimated completion time for the work being performed.
7. 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 and a representative of the manufacturer shall be present during the actual installation of at least 2,000 feet at the start of the work.
8. If, in the opinion of the CIPP liner manufacturer, the rate of infiltration in the sewer segment is high enough to risk washout of the resin, then the contractor shall perform measures, as required, to minimize the infiltration prior to pipe lining.

K. <u>Installing CIPP</u>

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.

L. Curing

After the inversion process is completed, the Contractor shall supply a suitable heat source of water and steam throughout the section to uniformly raise the water 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.

A HOT WATER CURE MUST BE USED FOR ALL PIPES GREATER THAN TWELVE (12) INCHES DIAMETER.

M. Cooling Time

1. 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 thermoshock. 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.

N. Sealing and Cutting of Lining at Manhole

1. 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.
2. 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 approved equal.

3. CIPP 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.

O. Service Connections

1. 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 action 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 shall be collected at the nearest downstream manhole.

P. Quality Control

1. 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 Owner 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.
2. 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.

3. Following installation of the linter 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 Owner. 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, delaminations or other type defects in the CIPP lining. Defective lining will be removed and pipe re-lined at no additional cost to the Owner. If during the removal process, the pipe is damaged, Contractor will perform a point repair at Contractor's own expense.
4. Groundwater infiltration of the liner shall be zero.
5. All service connections shall be open, clear and watertight.
6. 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.
7. All work areas shall be restored to their original condition.
8. 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.

Q. <u>Measurement and Payment</u>

1. All costs of furnishing and installing cured-in-place pipe 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 shall be paid for at the contract unit price per linear foot of pipeline actually required and installed, measured along the centerline of the pipeline from center to center of all manholes or to the inside wall of structures as CIPP (size) Main Lining.

2. 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 shall be paid for at the contract unit price each connection actually required to be cut and reinstalled as Remote Cut and Reconnect Sanitary Service.

2503/2504 LOCATING WIRE FOR WATER AND SEWER

Locating wire shall be installed on all HDPE and PVC water and sewer (sanitary or storm) mains and services. Refer to natural gas specifications for locating wire requirements for natural gas installations.

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. Insulation for water main shall be blue. To minimize splices, wire shall be supplied on spools of not less than 500 feet.

B. Locating Wire for Directional Drilled Installations.
Two (2) wires shall be pulled for all directional drilled installations. Locating wire shall be annealed 49-strand braided 302 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. Insulation for water main shall be blue. The wire shall be tested in accordance with ASTM B-1 and D-1248 and spark tested at 7500 VAC. The breaking strength of the wire shall be at least 1150 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 Splices
Tracer wire shall remain continuous to the greatest extent possible. Splices in the copper tracer wire should be made with solder, split bolt type connectors or other type approved by the engineer. Splices in the stainless steel tracer wire should be made with split bolt type connectors or other type approved by the engineer. 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.

D. 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:

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 Concrete/Driveway Box Model CD14GTP

Locating Boxes for **water** applications shall be Snake Pit's magnetized tracer boxes from Copperhead Industries, LLC, (or approved equal) as follows:

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 Concrete/Driveway Box Model CD14BTP

The tracer box shall have a green powder coated cast iron cover for sanitary and storm sewer; or a blue powder coated cast iron cover for water.

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 "W" for water; "ST" for storm; "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.

E. Anodes
Anodes shall be 5 pound (minimum) magnesium anode.

F. Installation Requirements
The locating wire for sewer and water shall be brought to the ground surface at locations shown on the Standard Details, 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 shall also be installed at all dead ends on tracer wire. Anodes shall be installed on all tracer wire at a maximum interval of 500 feet.

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.

G. 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.

Payment will be made under Item 2503.602 or 2504.602 (type) Tracer Box at the Contract bid price per each, which shall be compensation in full for all materials, labor and equipment necessary to furnish and install the tracer box where specified in the Standard Details, Contract Drawings or Special Provisions.

2504 WATER MAIN AND SERVICE LINE INSTALLATION

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.

A. Materials

1. 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.

2. 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:

   a. 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.
   b. The exterior of the pipe shall have an asphaltic coating at least one mill thick unless specified otherwise in the Special Provisions.
   c. When specified in the Special Provisions, 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.
   d. 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.
   e. 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.
   f. 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.
   g. All pipe shall be furnished in 18 or 20-foot nominal lengths.
   h. 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.
   i. Pipe shall be provided with provisions to maintain electrical continuity for thawing and locating purposes.
   j. 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.

3. 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.
   a. Buried fittings shall be mechanical joint with rubber gaskets.
   b. Exposed fittings shall be flanged conforming to ANSI B16.1, Class 125 and have full face gaskets.
   c. Exposed fittings shall be shop primed for painting.
   d. Fittings shall be provided with provisions to maintain electrical continuity.
   e. Fittings shall be manufactured in North America or preapproved by the City Chief Engineer of Utilities.
   f. Mechanical joint bolts shall be as specified elsewhere in this section
   g. 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.

4. 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.

5. HDPE Pipe and Fittings
   a. Water main and service **pipe 4 inches 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 continuous blue stripe. **Pipe and fittings shall be PE4710, HDPE Pressure Class 200, SDR 11, at 73 deg. F. and have outside diameters similar to ANSI A-21.51 ductile iron pipe.** Joints and 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.

b. Water main and service **pipe less than 4-inch** 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 and fittings shall be PE4710, DR 11, shall have a minimum working pressure of 200 psi at 73 deg. F. and have outside diameters similar to <u>iron pipe size</u>**. Joints and 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.

c. 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. All 8 x 6 reducers shall be molded or machined. Other size reducers may be fabricated. All fabricated fittings shall be rated for a minimum operating pressure of 200 psi. All fabricated fittings shall be made from a minimum thickness material of SDR 9. Fabricated 90 degree elbows shall have a minimum of 4 sections. Fabricated 45 degree elbows shall be 2 sections. 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..

d. All **fittings for 3 inch and smaller pipe** shall be molded. All fittings shall be rated for 200 psi.

e. Couplings used for water mains and services (4 inches and larger) shall be electrofusion type. Couplings used for services (3 inches and smaller) shall be electrofusion or socket fused type.

f. 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.

g. 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.

h. Shop drawings for HDPE pipe must specify minimum allowable pipe deflection radius.

i. 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.

6. HDPE by MJ Adapters
   a. The HDPE by MJ Adapters shall be manufactured by Central Plastics Company 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.
   b. 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.
   c. Mechanical joint bolts shall be as specified elsewhere in this section.

7. Transition Couplings
   a. 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.

4”	4.80” to 5.10”
6”	6.90” to 7.20”
8”	9.05” to 9.45”
10”	11.10” to 11.50”
12”	13.20” to 13.50”

Couplings shall be Smith Blair 441, JCM 210, Ford FC1, Krausz Hymax, Romac Macro HP, or approved equal.

b. 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.

c. 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:

Nominal Pipe Size	Ductile Iron O.D.	Cast Iron O.D. (Range)
18”	19.50” to	19.50” – 19.92”
20”	21.60” to	21.60” – 22.06”
24”	25.80” to	25.80” – 26.32”
36”	38.30” to	37.96” – 38.70”
42”	44.50” to	44.20” – 44.50”
48”	50.80” to	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.

d. HDPE Transition Couplings

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 brass connections or threaded stainless steel connections. Stainless steel transitions shall include a compression ring with o-ring seal and shall be used with an adapter from threaded to flare. Adapters shall have a pressure rating equal to that of the mating pipe. HDPE shall be plain end for butt fusing. Coupling shall be manufactured by Poly-Cam, Central Plastics, Inc. or equal.

e. 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. 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.

8. 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, with gaskets suitable for water service.

9. 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 band and bridge plate, ductile iron glands, and 316 stainless steel

bolts 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 16" and widths approximately 7-1/2" to 15". Clamp shall be Smith Blair 226-00090515, PowerSeal Model 3121 Range C or Ford F1-939-15. All other models must be approved prior to bidding by the Chief Engineer for Utilities. Band Type Repair Clamps must fit the following O.D. range:

Pipe Size	Steel OD (In.)	Ductile or Cast Iron OD (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

10. <u>Tapping Sleeves</u>

(4" though 10" tap on 6" through 30" cast iron, ductile iron or steel mains.) Sleeves shall consist of two sections of heavy welded steel which bolt together on a main pipe and seal against a gasket around the top opening. Flange shall be AWWA C207 Class D, ANSI 150 pound and have recess cavity for mating to a standard tapping valve. Outlet body shall have a 3/4 inch NST test plug. Fitting shall be coated with 12 mil fusion bonded epoxy. Bolts and nuts shall be Type 316 stainless steel. Fitting shall be similar or equal to Rockwell 622 or Ford FTSC Tapping Sleeve, and in the sizes and O.D. ranges specified.

An approved alternate tapping sleeve shall consist of two sections of heavy welded stainless steel which bolt together on a main pipe and seal against a full encirclement gasket. Flange shall be AWWA C207 Class D, ANSI 150 pound suitable for mating to a standard mechanical joint gate valve. Outlet body shall have a 3/4 inch NST test plug. Fitting shall be stainless steel. Bolts and nuts shall be Type 316 stainless steel. Fitting shall be similar or equal to PowerSeal 3490MJ Tapping Sleeve and in the sizes and O.D. ranges specified.

HDPE pipes may not be tapped except for2 inch and smaller mains or services using electrofusion tapping saddles.

11. Fire Hydrants

    Fire Hydrants shall be Waterous Pacer Traffic Model WB67-250 or Mueller Super Centurion 250 conforming to the requirements of AWWA C502 and the following supplemental requirements:

    a. Main Valve Opening – 5 1/4 inches nominal diameter.
    b. Bury Depth – 8 1/2 feet measured from the bottom of the branch pipe connection to the finished ground line at the hydrant.
    c. Upper Standpipe Length –22 inches or 16 inches.
    d. Nozzles – One steamer connection, 4 1/2 inch (ID), City of Duluth Standard threads, 7 threads per inch and two hose nozzles, 2 1/2 inch (ID), with National Standard Fire Hose Coupling Screw Threads.
    e. Hydrant operating mechanisms shall be provided with Buna-N "O" ring seals preventing entrance of moisture and shall be lubricated through an opening in the operating nut or bonnet.
    f. The exterior of the hydrant base shall be supplied with an epoxy coating.
    g. 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.
    h. Operating and nozzle cap nuts shall be a pentagon, 1-1/2 inches point to face. Operating nut shall have an O-ring or seal ring to keep water and dirt from entering the bonnet. Opening shall be counterclockwise.
    i. Design of hydrant shall allow for removal of the main and waste valve seats without excavating or disturbing the ground.
    j. 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.
    k. A traffic flange and operating rod coupling shall be located not more than 2 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.
    l. Lower flange on the nozzle section shall be the swivel type.
    m. Hydrants shall be provided with an outlet for drainage in the base or barrel, or between the base and barrel, unless the Special Provisions require that drain outlets be omitted or plugged.
    n. All hydrant bolts and nuts below grade shall be 316 stainless steel.
    o. Mechanical joint bolts shall be as specified elsewhere in this section.

12. Valves

    Valve sizes ten inches (10") and smaller shall be gate type. Valves twelve inches (12") and larger shall be butterfly type exclusively. All valves shall be made in the North America.

13. Gate Valves (10" 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.

    a. All gate valves shall have a working pressure rating of 250 psi.
    b. Gate valves shall be solid disc with resilient seating.
    c. The wedge shall be ductile iron and fully encapsulated with EPDM rubber.
    d. All valves shall be furnished with O-Ring stem seals. The O-Rings above the thrust collar shall be fully replaceable with the valve "open" and under full pressure.
    e. Valves shall have a two inch square operating nut opening counter-clockwise.
    f. All valves shall be of the non-rising stem type.
    g. 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.
    h. The exterior of the valve shall be supplied with a fusion baked epoxy coating.
    i. All exposed bolts on the valve, including stuff box and bonnet bolts shall be 316 stainless steel.
    j. Mechanical joint bolts shall be as specified elsewhere in this section.
    k. Valves shall be manufactured by American Flow Control, Clow, Waterous, Mueller, AVK, 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.
    l. Gate valve box adapters shall be ¼ inch steel adapter and ¾ inch neoprene gasket. The steel adapter shall be coated with bitumastic coal tar epoxy. Adapters shall be manufactured by Adaptor, Inc.

14. Butterfly Valves (12" 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:

a. All butterfly valves shall have a working pressure rating of 250 psi.

b. 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.

c. 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.

d. Valves shall open counter-clockwise.

e. The exterior of the valve shall be supplied with a fusion baked epoxy coating.

f. Valves shall be furnished with mechanical joint ends.

g. All exposed bolts, screws, washers or nuts on the valve shall be 316 stainless steel.

h. Mechanical joint bolts shall be as specified elsewhere in this section.

i. Valves shall be manufactured by Clow, Waterous, 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.

15. Valve Boxes

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

Cover	**Stay-put type, "WATER" cast thereon, with solid edges (no grooves or flutes on edge)**
Top Section	26" length
Extension Section	30" length
Bottom Section	30" 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.

16. Copper Pipe and Fittings
    a. Copper pipe less than 3 inches in nominal diameter shall conform to the requirements of ASTM B88 for Seamless Copper Water Tube, Type K, Soft Annealed temper.
    b. 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 ANSI/NSF Standard 61. 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:
        1) Quarter (90°) bend corporation stop couplings and eighth (45°) bend corporation stop couplings shall be Mueller H-15068 and H-15063 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.
        2) Three-part union couplings for connecting copper tubing to copper tubing shall be Mueller H-15400 or an approved equal. Couplings shall be provided with copper tube flare nuts on both ends.
        3) Pack joint straight couplings for connecting copper tubing to copper tubing if specified, shall be Ford C44-XX (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.

17. Corporation Stops
    Corporation Stops shall be Mueller H-300 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.

18. Electrofusion Saddles
    Electrofusion Transition Service Saddle with Threaded Brass Insert and Tapping Tees with Electrofusion Saddle shall be manufactured by Central Plastics Company or equal and 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.

19. Curb Stops
    Curb Stops shall be Minneapolis Pattern with AWWA standard flared copper pipe connections on both ends. Where threaded connections are necessary for HDPE adapters, a flare by threaded adapter shall be used.

20. Curb Boxes
    Curb Box shall be magnetized tracer box style as specified in 2503/2504 LOCATING WIRE FOR WATER AND SEWER, 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 Standard Details.

21. Polyethylene Encasement Material
    All ductile iron water main shall be encased in polyethylene. When specified in the Special Provisions or shown on the Contract Drawings, 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..

22. 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 bolts. Bolts shall meet or exceed ASTM A 588 Grade E and AWWA C111. Nuts shall meet or exceed ASTM A563 Grade C3 and AWWA C111. Bolts and nuts shall also have a base zinc plating and a coating of Xylan 1424 polytetrafluoroethylene (PTFE) dry film coating and lubricant. Anode caps shall also be installed as specified below.

23. Magnesium Anode (5 lbs.)
    A 5-pound (minimum) magnesium anode shall be attached to an MJ bolt for all fittings, valves and hydrants as shown in the standard detail W-18. An anode shall be installed on all copper water services, at all dead ends on tracer wire, and at 500 feet maximum intervals on tracer wire.

24. Anode Caps
    Zinc anode caps shall be 6 ounce conforming to ASTM B-418. All MJ bolts shall have anode caps installed.

B. Construction Requirements
   1. General Provisions
      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" 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 Standard Details, Contract Drawings or the Special Provisions.

All horizontal directional drilling shall be performed in accordance with (2503/2504/2505) HORIZONTAL DIRECTIONAL DRILLING of these specifications.

2. 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 inch (300 mm) and smaller by hand with ropes and skids. Unload pipe larger than 12 inch (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.

3. 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.

4. 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:

MAXIMUM PERMISSIBLE DEFLECTION IN LAYING PUSH-ON JOINT FOR DUCTILE IRON PIPE					
Pipe Size	**Max. Angle**	**MAX OFFSET PER PIPE**		**Approx. Minimum Radius**	
		18' length	**20' length**	**18' length**	**20'length**
3" to 12"	5°	19"	21"	205'	230'
16" to 24"	3°	11"	12"	340'	380'
30" to 36"	2°	7.5"	8"	510'	570'

MAXIMUM PERMISSIBLE DEFLECTION IN LAYING MECHANICAL JOINT FOR DUCTILE IRON PIPE			
Pipe Size	**Max. Angle**	**MAX. OFFSET PER PIPE**	
		18' length	**20' 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"

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.

5. 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 Standard Detail Drawing.

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

   b. 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.

   c. 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.

   d. 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 2 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 Standard Details.

   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 inches and smaller in diameter.

6. 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 Standard Details.

7. Locating Wire
   Locating (tracer) wire shall be installed on all plastic water mains and services.

8. Polyethylene Encasement of Pipeline
   All ductile iron pipe, valves, fittings, and appurtenances, shall be fully encased in polyethylene film or V-Bio encasement as specified. 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.

9. 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.

10. Connection and Assembly of Joints
    a. 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.

b. 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.

c. 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.

d. 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 Department with evidence of certification at or prior to the contract award date unless a current certification is presently on file with the Department. 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.

e. 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.

f. 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 the Engineer.

Unless otherwise directed by the pipe manufacturer's recommendations, the heating tool surface temperature must be minimum 400°F to 450°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" of HDPE pipe butt fused directly to the fitting prior to installation of an electrofusion coupling.

11. 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.

12. Water Service Installation
    a. 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.

    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 of 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.

    Unless otherwise specified, installation of water 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 sewer mains. 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.

    b. Service Lines

    Water service piping shall be of the size and type specified in this specification for Water Service Replacement or Water Service Installation or in the Contract Special Provisions. Minimum pipe size for service installations shall be 3/4 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.

    Installation of service lines shall be in accordance with the Standard Detail Drawing and all applicable requirements of these specifications and Special Provisions as they pertain to the mainline installations.

Unless otherwise indicated, service piping 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.

Seamless copper service piping of 3/4 inch to and including 1-1/4 inches 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.

High Density Polyethylene (HDPE) service piping of 1 inch to and including 3 inches in diameter shall be installed in one piece without intermediate butt fusion, socket or electrofusion joint couplings between the tapping tee with electrofusion saddle at the main and the curb stop transition. Larger pipe may be furnished in standard cut-lengths of 40 feet or longer and be joined by butt fusion, socket or with approved electrofusion 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 butt fusion or approved socket couplings.

Connection of seamless copper service lines to the water main shall be made with an approved corporation stop and saddle if specified on ductile iron mains or with an approved electrofusion corp saddle and corporation stop on HDPE mains. 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 HDPE service lines to the water main shall be made with an approved tapping tee with electrofusion saddle on HDPE mains. The water main tap shall be made at an angle of 90 degrees from the horizontal. Service pipe shall be butt fused to the tapping tee with electrofusion saddle.

Unless otherwise indicated, service lines shall be installed on a straight line at right angles to the water main 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 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.

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.

1) <u>Water Service Replacement</u>
   This work shall consist of excavation of trenches and the installation or moving of water service lines. The work shall be performed in conformance with the applicable provisions of MN/DOT Standard Specifications, the current Standard Practices and Specifications of the City of Duluth, and the following:

   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. The Contractor will perform all piping work. The Contractor shall notify property owners of the upcoming service shutdown at least 24 hours prior to the shutdown.

   Piping work shall include, but not be limited to, shut down of the corporation at the main, removal of existing lead service and curb stop, furnishing and installation of the proper fitting for the new service, furnishing and installation of a continuous component of pipe to the curb

stop location, furnishing and installation of a new curb stop and box, connection to existing private service with the proper fitting, open corporation and check for leaks, backfill and compact backfill material.

2) Water Service Installation

This work shall consist of excavation of trenches and the installation of water service lines. The work shall be performed in conformance with the applicable provisions of MN/DOT Standard Specifications, the current Standard Practices and Specifications of the City of Duluth, and the following:

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 as shown on the Standard Details. The Contractor shall be responsible for prior notification and picking up the iron pipe at the City of Duluth Department of Public Works and Utilities facility located at 520 Garfield Avenue. The Contractor will perform all piping work. The Contractor shall notify property owners of any upcoming service shutdown.

Water service pipe shall be seamless Type K copper or HDPE, SDR 11 of the size indicated in the Contract Drawings. Copper water service pipe shall be connected to the HDPE water main after an electrofusion transition service saddle with threaded brass insert and corporation stop of the size indicated are installed and the main is tapped.

HDPE water service pipe shall be butt fused or socket fused to the tapping tee with electrofusion saddle as shown in the Contract Drawings. Piping work shall include, but not be limited to, furnishing and installation of the proper electrofusion transition service saddle (for copper service pipe and HDPE main) or tapping tee with electrofusion saddle (for copper or HDPE service pipe and HDPE main), corporation stop and fittings for new copper services, tapping the new water main, furnishing and installation of a continuous component of new copper or HDPE service pipe to the curb stop location, furnishing and installation of a new curb stop and box, open corporation stop or tapping tee with electrofusion saddle and check for leaks, reconnect existing water service, backfill and compact backfill material.

Tapping of HDPE mains shall be performed using a tapping tool designed specifically for that purpose. Use of an electric drill for tapping an HDPE main is not allowed.

Reconnecting existing water service shall be required when installing a new water service and connecting it to an existing water service. 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.

13. Setting of Valves, Hydrants, Fittings and Specials

a. General

Valves, hydrants, fittings and specials shall be provided and installed as required by the Contract Drawings, Standard Details 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 Standard Details 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 Standard Details.

All hydrants and valves shall have a minimum 5 pound magnesium 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 Standard Detail Drawing 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 after installation shall be disinfected in accordance with the procedures described in paragraphs No.'s 1227 and 1228 of Section XII "Manual of Water Supply Sanitation" of the Minnesota Department of Health.

b. 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."

c. 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 current Standard Practices and Specifications of the City of Duluth as detailed in the Plan.

14. 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.

15. Disinfection of 4 inch to 12 inch Ductile Iron Water Mains

Water mains 4” to and including 12” shall have chlorine tablets fixed in each pipe. While the water main is being laid, Calcium Hypochlorite tablets shall be attached to the inside top of each pipe using inorganic adhesive equal or similar to Permatex No. 1. Number of tablets per pipe segment shall be according to the table below to obtain at least a 25 ppm solution.

Pipe Length	**Number of 5-Gram Tablets Required* Diameter of Pipe**				
	4”	6”	8”	10”	12”
Less than 13’	1	1	1	2	3
18’	1	1	2	3	4
20’	1	1	2	3	4

*****Based on 3.25 grams of available chlorine per tablet.

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.

Procedure for Disinfection and Testing shall be as follows:

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. Department 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.

16. <u>Disinfection of 16 inch and Larger Ductile Iron Water Mains</u>
Water mains with nominal diameters 16 inches and larger shall be disinfected by the Contractor. 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 Department.

17. <u>Cleaning and Disinfection of HDPE Water Mains</u>
Prior to disinfection and testing, all HDPE water mains shall be pigged with a foam pipe to remove dirt, HDPE chips, curls and shavings. Water mains and branch lines less than 100 feet in length and water services are exempt from this 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.

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
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
Gallons of bleach are based upon an assumed 5.25% chlorine bleach concentration and a target concentration of 25 ppm.			

18. 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 prior to installation. This method will only be considered acceptable with the prior written approval of the Engineer.

19. Testing Water Main and Services

a. Bacteriological Test
Sampling and testing for bacteria will be performed by the City. 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.

b. 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.

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.

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 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 4 hours. After 4 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.

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.

Tap valves and sleeves to be pressure tested before cutting out coupon.

Unless otherwise specified, services shall be tested for pressure and leakage by inspection of all exposed joints while under system pressure. If specified for pressure testing, 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 main pressure testing by applying a test pressure of 150 PSI.

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 100 psig for 5 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.

c. 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.

d. Retesting
In the case of failed tests, the City reserves the right to charge the Contractor for retests.

C. 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.

D. 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 caps, magnesium anode bag, 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 caps, magnesium anode bag, 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 caps, magnesium anode bag, 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 caps, magnesium anode bag, 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 caps, 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 encasement materials, placement and compaction of backfill, cleaning, disinfection, bacteria testing, leakage testing, continuity testing, fittings, hardware, zinc anode 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, polyethylene encasement, placement and compaction of 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	Description	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)” DIPS HDPE Water Main SDR 11	Linear Foot
2504.603	(size)” DIPS HDPE Water Main SDR 11 (Horizontal Directional Drill)	Linear Foot
2504.604	3” Polystyrene Insulation	Square Yard
2504.608	Ductile Iron Fittings	Pound

2504 CONCRETE ENCASED VALVE BOX COLLAR

This work shall consist of vertical adjustment, leveling, and place concrete encasement collar around valve box castings in accordance with the City of Duluth Standard Specifications, the Plan details, and the following provisions:

A. Description

The adjust valve box work shall consist of: cutting and extracting the pavement and base section in a circular layout around the perimeter of the manhole; installing the valve box casting assembly; and placing a reinforced concrete encasement collar around the casting frame to match the adjacent pavement grades.

B. Materials

1) Reinforcement for encasement collar shall epoxy coated in accordance with MN/DOT 3301.
2) Concrete for encasement collar shall be Mix No. 3Y43 in accordance with MN/DOT 2301 and MN/DOT 2461.

C. Construction Requirements

1) Pavement Removal and Preparation

a. Precautions must be taken to prevent debris from entering the valve box during the entire removal and reconstruction process.

b. 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. Dispose of the asphalt off-site.

c. 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.

d. 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.

e. 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.

f. Place the cover/lid on the valve box casting to lessen the possibility of debris entering the manhole.

2) Concrete Encasement Collar Installation

a. Place epoxy coated reinforcement around casting frame adequately supported to hold position during concrete placement.

b. Place concrete encasement collar in accordance with reference standards.

c. 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.

d. 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.

e. Apply a concrete curing and sealing compound to the surface of the concrete collar.

f. Protect concrete from loading & vibration until the concrete attains a compressive strength of 3,000 psi.

D. Measurement and Payment

Measurement will be made for each structure completed as specified. Payment will be made under Item 2504.602 (Concrete Encased Valve Box Collar) at the Contract bid price per each, which shall be compensation in full for all labor, equipment, and materials necessary to complete the work.

2504 TEMPORARY WATER SERVICE

New 1/30/15

The provisions of MN/DOT 2504 and the City of Duluth Standard Specifications are supplemented with the following:

A. Description

This work shall consist of providing a temporary water service system to adjacent residents and businesses in accordance with the Plans, the City of Duluth Standard Specifications & Details, and as directed by the Engineer.

B. Construction Requirements

Temporary water main pipe shall be 2" or 3" HDPE SDR 11 pipe. Temporary water service pipe shall be ¾" HDPE SDR 11 pipe to within 5 feet of the hose bib or building connection. 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 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.

C. 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.

D. 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 payment under Item 2504.601 (Temporary Water Service). Such payment shall be considered full compensation for all costs for labor, equipment, and materials associated with installation, testing, protection, maintenance, removal, and restoration.

2503/2504/2505 HORIZONTAL DIRECTIONAL DRILLING

A. General

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, Pressure Sanitary Sewer Services, Water Main Pipe and Fittings, Water Services, Gas Main Pipe and Fittings, Gas Service Pipe and Fittings, and Special Connections.

1. Definitions

a. 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.

b. 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.

2. 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.

3. Performance Requirements
   a. 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.
   b. 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.
   c. Contractor shall provide all survey layout, inspection and record-keeping incidental to the drilling pipe installation.
   d. This procedure is applicable to the installation of sanitary sewer and sewer services, water main and water services and gas main and gas services.

4. Submittals

a. 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)

b. Certificate of Compliance
   Submit Certificates of Compliance for products and materials.

c. 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. 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.

e. Record Drawings:
   After completion of pilot hole drilling, submit tabulation of pilot hole coordinates as required under "Pilot Hole" paragraph below.

5. 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.

6. 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.

7. Materials
   Bentonite for drilling fluid shall be high quality Wyoming bentonite composed primarily of sodium montmorillonite.

8. Drilling Site
   Additional work space and access may be acquired by Contractor only with approval of Owner 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.

9. 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.

10. 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.

B. Products
   1. Carrier Piping
      Carrier piping shall be as specified in 2503 PIPE SEWER - PRESSURE, 2504 WATER MAIN AND SERVICE LINE INSTALLATION or the 2015 Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe (Gas Operations and Maintenance Manual – Section 14 through Section 29).

      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.

   2. Drilling Fluids
      Drilling fluid composition shall meet permit requirements and environmental regulations.

   3. Water
      Contractor shall procure, transport, and store water as required for his operations.

   4. Locating Wire
      Locating (tracer) wire shall be as specified in 2503/2504 LOCATING WIRE FOR WATER AND SEWER.

C. Execution
   1. 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 water main shall be butt fused. Sanitary sewer and water branch or tap service pipe of any diameter shall also be butt fused.

2. 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 Owner 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. Department personnel will be on site to monitor excavation and inspect any exposed steel main 6 inches or larger. Notify the Engineering Division at 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 730-5200 to coordinate an inspection of the exposed main.

   Prior to the start of any directional drilling, the Contractor shall pothole all proposed gas line crossing locations to confirm the depth of the main. The Contractor shall maintain the excavation or reopen the excavation to verify drilling operations did not interfere with any gas main or gas service.

3. Pilot Hole
   A pilot hole shall be drilled along the path shown on Drawings to the following tolerances:
   a. Elevation: Plus 0.5 feet, minus 0.5 feet for low pressure sanitary sewer and plus 0 feet, minus 1 foot for water main and gas main.
   b. Alignment: Plus or minus 1 foot for low pressure sanitary sewer and plus or minus 2 feet for water main and gas main.
   c. Curve Radius: minimum 250 feet or pipe manufacturer's recommendation, whichever is greater.
   d. Entry Point: At the location shown on Drawings.

e. 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 and 50 feet for water main and 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.

4. Reaming and Casing Pipe Pull-Back Operation

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.

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.

Backreaming: Backreamer must be of large enough diameter to insure a competent tracer wire can also be pulled back with the pipe.

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 of 1 to 12 hours. For longer pull

durations, 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.

MAXIMUM ALLOWABLE TENSILE LOAD FOR MDPE AND HDPE PIPE

NATURAL GAS PIPE (MDPE)			WATER & SEWER PIPE (HDPE)				
SIZE	SDR	LBS.	SIZE	SDR	LBS.	SDR	LBS.
1/2" CTS	7.0	149	3/4" IPS	11.0	348		
1” CTS	9.3	377	1” IPS	11.0	546		
2” IPS	11.0	1,447	1 1/4" IPS	11.0	870		
3” IPS	11.5	3.019	1 1/2" IPS	11.0	1,140		
6” IPS	11.5	10,816	2” IPS	11.0	1,781		
8” IPS	11.5	18,332	3” IPS	11.0	3,868		
12” IPS	11.0	51,323	4” DIPS	11.0	7,274		
			6” DIPS	11.0	15,031		
			8” DIPS	11.0	25,858		
			10” DIPS	11.0	38,900		
			12” DIPS	11.0	55,011	9.0	65,741
			14” DIPS	11.0	73,906	9.0	88,323
			16” DIPS	11.0	95,587	9.0	114,232
			20” DIPS	11.0	14,307	9.0	176,304
			24” DIPS	11.0	210,154	9.0	251,147

Torsional Stress: A swivel shall be used to connect pipeline pull section to reaming assembly to minimize torsional stress imposed on section.

Pull Section Support: Pull section shall be supported as it proceeds during pull-back so that it moves freely and pipe is not damaged.

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.

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.

5. Drilling Fluids

   General: Drilling fluids shall be in compliance with environmental regulations.

   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.

   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.

   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.

6. 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 Department.

7. 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.** 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 Standard Details or the Contract Drawings. The cost of furnishing and placing locating wire shall be considered incidental to the pipe.

D. Testing
   1. Pressure and Leakage Test
      Pressure and leak test of carrier piping shall be as specified in 2503 PIPE SEWER - PRESSURE, 2504 WATER MAIN AND SERVICE LINE INSTALLATION or the 2015 Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe, included in these specifications.

   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.

E. 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

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.

A. Construction Requirements
   1. Adjust Valve Box
      This work shall consist of adjusting existing gas valve boxes to new surface elevations without changing the elevation of the valves.

   2. 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.

B. Measurement and Payment

Measurement for adjust valve box will be by the number of gas valve boxes adjusted to final grade. Payment for adjust gas valve box will be made item 2505.602 (Adjust Valve Box – Gas) at the contract price per each, which shall be compensation in full for all labor, materials, and equipment to complete the work.

2506 MANHOLES AND CATCH BASINS

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 below:

A. Materials

1. Sanitary Manholes

All sanitary manholes, air-release manholes and cleanout manholes shall meet the requirements of **City Standard Detail San-11**. 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 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.

2. Storm Manholes and Catch Basins

Storm sewer structures shall be sectional precast concrete manhole units conforming to the requirements of MN/DOT 3622 and MN/DOT Standard Plates 4005M (Design F), 4006L (Design G), 4020J, or 4024A (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.

3. Catch Castings
   Catch basin frame castings shall conform to **City Standard Details Strm-2 and Strm-3**. Catch basin grate castings shall be 816 on MN/DOT Standard Plate 4154B. Catch basin curb box castings shall be 823A on MN/DOT Standard Plate 4160D. Unless otherwise noted in the project Special Provisions, catch basin castings shall be supplied by the Contractor.

4. Manhole Castings
   Manhole Casting Assemblies with lids shall conform to **City Standard Details San-1 and Strm-1** for sanitary and storm manholes. Unless otherwise noted in the project Special Provisions, manhole castings shall be supplied by the Contractor.

5. 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.

6. Casting Extensions
   Casting Extensions shall be Neenah R-1979 or ESS Brothers paving adjustment ring. Extensions shall be cast iron.

7. 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).

8. Bedding
   Manholes and Catch Basins shall be bedded on granular material meeting MN/DOT 3149.2.H Coarse Filter Aggregate.

8. 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.

B. Construction Requirements

1. Manholes and Catch Basins shall be bedded on 6-inches of Coarse Filter Aggregate.
2. When using plastic pipe, manhole water stops supplied by the manufacturer shall be installed.
3. 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 3 inches from the trough to the wall.
4. 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.
5. Non-shrink grout or cement-based polymer modified patching mortar shall be used to patch lifting holes in manholes and catch basins.
6. 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.
7. Manhole casting assemblies with lids shall be installed in accordance with Standard Details SAN-3, SAN-3A, STRM-5, and STRM-5A. 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.
8. 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.
9. 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.
10. All storm manhole castings and catch basin castings shall be wrapped with geotextile fabric as shown on the standard details.

C. 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

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:

A. Description

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.

B. Materials

1. PVC pipe adjustment ring (casting support) in accordance with MN/DOT 2503 or approved equal.
2. Waterstop shall be a **controlled expansion butyl rubber** water stop meeting the following:
   a. Specific Gravity shall be 1.55 (+/- 5%) when tested in accordance with ASTM D-71.
   b. Volatile Matter shall not exceed 1% when tested in accordance with ASTM D-6.
   c. Minimum application temperature range between -10 degrees F to 125 degrees F.
   d. Minimum service temperature range between -30 degrees F to 180 degrees F.
3. Sealant shall be **elastomeric material** intended for the use depicted in the Plans and/or Standard Details.
4. Reinforcement for encasement collar shall **epoxy coated** in accordance with MN/DOT 3301.
5. Concrete for encasement collar shall be **Mix No. 3Y43** in accordance with MN/DOT 2301 and MN/DOT 2461.

C. Construction Requirements

1. Temporary Cover Plate Installation

a. The manhole shall be built with the top of the manhole cone 12" below proposed asphalt elevation.

b. 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.

c. 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.

2. Pavement Removal and Preparation

a. 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.

b. 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.

c. 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.

d. Remove all adjusting rings to the top of the manhole structure (concrete cone). Dispose of this material.

e. 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.

f. 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.

g. 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 up-side down, which could be detrimental to the end product.

h. 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.

i. 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.

j. Place the manhole lid on the rim casting to lessen the possibility of debris entering the manhole.

3. Concrete Encasement Collar Installation

a. Place epoxy coated reinforcement around casting frame adequately supported to hold position during concrete placement.

b. Place concrete encasement collar in accordance with reference standards.

c. 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.

d. 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.

e. Apply a concrete curing and sealing compound to the surface of the concrete collar.

f. Protect concrete from loading & vibration until the concrete attains a compressive strength of 3,000 psi.

D. Measurement and Payment
Measurement will be made for each structure completed as specified. Payment will be made under Item 2506.602 (Concrete Encased Casting Collar) at the Contract bid price per each, which shall be compensation in full for all labor, equipment, and materials necessary to complete the work.

2506 CONNECT INTO EXISTING MANHOLE AND CATCH BASIN

SP2014-161 modified: MN/DOT 2506 is supplemented with the following:

This work consist of constructing connections into existing drainage structures in accordance with the applicable MN/DOT Standard Specifications and the following:

Connections to existing sanitary manholes shall be made with core drill hole and water tight pipe sleeve.

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

Payment will be made under Item 2506.602 (Connect Into Existing MH OR CB) at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto, including but not limited to, all materials and labor necessary to install proposed concrete 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.

2506 MANHOLE FRAME SEAL (INTERNAL/EXTERNAL)

Internal or External type manhole seals with stainless steel compression bands shall be used.

A. General
1. 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.

2. System Description
   Performance Requirements - The frame seal shall be capable of repeated vertical movement of the frame of not less than 2 inches and/or repeated horizontal movement of not less than ½ inch after installation and throughout its design life.

3. 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 owner.

   Any seals not passing this visual inspection may, at the Contractor's option, be tested for leakage using a method approved by the Engineer.

B. Products

An internal or external manhole frame seal, as shown on the Standard Details, 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 2 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 2 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.

C. Equipment

The contractor shall have a manufacturer's recommended installation tool and all other equipment/tools necessary to install the frame seals.

D. Execution

1. 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.

2. 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.

3. Installation of Frame Seal

The frame seals and extensions shall be installed in accordance with the manufacturer's instructions.

3. 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.

E. Measurement and Payment
All costs for furnishing and installing a frame seal and where allowed by the Engineer, an extension or extensions, shall be included in the unit price bid for manhole frame seals.

2506 MANHOLE VACUUM TESTING

A. Description
Conduct vacuum testing on manholes using vacuum testing equipment acceptable to Engineer.

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:

Minimum Test Time for 48-inch Diameter Manhole			
Depth/Feet	Test Time/Seconds	Depth/Feet	Test Time/Seconds
8	20	20	50
10	25	22	55
12	30	24	59
14	35	26	64
16	40	28	69
18	45	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.

B. Basis of Payment
All costs for furnishing and installing the equipment, maintenance, and labor necessary to perform the testing shall be included in the unit price for Manhole Vacuum Testing where a bid item is included. Where no bid item is included, manhole vacuum testing shall be incidental.

2511 RIPRAP

Riprap shall be furnished and placed in accordance with the provisions of MN/DOT 2511 and MN/DOT 3601.

All riprap shall have a minimum of **two fractured faces**.

2521 WALKS

Walks shall be constructed in accordance with the provisions of MN/DOT 2521 and the following:

Payment for 4 inch Concrete Walk shall include all costs of root cutting, excavation, disposing of excavated materials, grading, furnishing, placing and compacting the 4 inch Class 5 Aggregate base.

2521 CONCRETE WALK (ADA)

REVISED 10/31/14
SP2014-163: This work shall consist of constructing Concrete Walk, including necessary Subgrade Preparation, Aggregate Base, and Grading as indicated in the Plan, in accordance with the provisions of MN/DOT 2112, 2211, 2521, other Contract provisions, and the following:

1. CONSTRUCTION REQUIREMENTS

(A) **Concrete Walk** – The walk shall be constructed as detailed in the Plan and conform to the requirements of MN/DOT 2521, Walks.

To avoid corner breaks, all walk edges shall be formed and constructed perpendicular to the back of curb and gutter sections and concrete structures for a one foot minimum distance.

All existing signs shall be salvaged and reinstalled as directed by the Engineer or as indicated in the Plan.

(B) **Grading** – If not otherwise detailed in the Plan, all fill sections shall be graded flush with the top of walk for a minimum 18 inches from the edge of walk and then down at a maximum 1:3 slope to existing terrain. The Contractor shall blend in the toe of fill slope and adjacent areas so as not to adversely affect drainage.

(C) **Landings** – An initial landing is the first required landing of a pedestrian ramp. All initial landings required at the top of a ramped sloped surface (>2% longitudinal slope), shall be formed and placed separately in an independent concrete pour. This does not include initial landings placed at roadway grade such as depressed corners, parallel ramps, rural flat landings, or flat cut-throughs. Secondary landings consist of all landings beyond the initial landing. These secondary landings do not require a separate landing pour. All landings adjacent to push buttons shall be formed and placed separately in an independent concrete pour, regardless of ramp type.

Wet casting or drill and grouting of dowel bars will be required in accordance with the details shown in MN/DOT Standard Plan 5-297.250 Sheet 5 of 5. These bars may be either smooth or deformed and shall be installed with 2 inch minimum concrete cover.

When not accounted for in the Plan, payment for these bars will be made under Item 2301.602 (Drill & Grout Reinforcement Bar (Epoxy Coated)) by the Each at the Predetermined Price of $10.00 per bar furnished and installed. All necessary subgrade preparation and aggregate base placement for the entire ramp construction limit shall be done before the initial landing is constructed at each location.

2. METHOD OF MEASUREMENT

Measurement of Concrete Walk will be made by top surface area.

3. BASIS OF PAYMENT

Payment will be made under Item 2521.618 (Concrete Walk) at the Contract bid price per square foot, including the area of walk under the truncated domes, which shall be compensation in full for all costs of furnishing, and installing the required material. In areas where Directional Curb is constructed, the triangular area that is behind the projected back of curb line will be paid for as Concrete Walk at the Contract bid price for Item 2521.618 (Concrete Walk). All excavation or borrow including hauling or disposal that is necessary to meet the walk grades in the Contract shall be incidental unless specifically provided for in the Plan. If common borrow requirements exceed 8 cubic yards (CV) at any individual site/quadrant, than the common borrow required at that location and not specifically accounted for in the Plan will be paid for at $20 per cubic yard (CV).

If the Plan calls for payment of Aggregate Base and/or other Grading items for a pedestrian facility, then payment will only be made for the locations specifically provided for in the Plan. All salvaging and reinstalling of signs as a result of concrete walk construction shall be incidental unless specifically provided for in the Plan.

2531 CONCRETE CURBING

Concrete curb, concrete curb and gutter, medians, and driveway pavement, shall be constructed in accordance with the provisions of MN/DOT 2531 except as modified below:

A. Payment for driveway pavement shall include excavating, grading, and furnishing and placing 12 inches 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 of Duluth Standard Detail STRM-7 listed in Appendix D.

C. Where the Engineer requires replacement of unacceptable concrete curb and gutter work, the Contractor shall drill and grout 2 No. 4 x 12 inch long reinforcement bars (Epoxy coated) at each connection. Reinforcement bars shall be placed a minimum of 3 inches from face and back of gutter section. No measurement will be made for drill and grout reinforcement bars for replacement concrete curb and gutter. All costs for drill and grout reinforcement bars for replacement concrete curb and gutter shall be incidental, and no payment will be made.

2531 CONCRETE CURB

NEW WRITEUP 11/6/13
SP2014-163.1: MN/DOT 2531 is hereby modified as follows:

The following items are deleted from the Payment Schedule:

Item No.	Item:	Unit:
2531.530	Concrete Entrance Nose, Design 7107	each
2531.531	Concrete Entrance Nose, Design 7108	each
2531.532	Pedestrian Curb Ramp (Type ___)	each
2531.533	Pedestrian Curb Ramp (Type ___)	square yard [square meter]

2531 CONCRETE CURB AND GUTTER (ADA)

REVISED 08/20/15
SP2016-187 modified: This work shall consist of constructing Concrete Curb and Gutter and the necessary Aggregate Base in accordance with the provisions of MN/DOT 2531, other Contract provisions, and the following:

1. CONSTRUCTION REQUIREMENTS

Concrete Curb and Gutter - The curb and gutter shall be constructed to meet the details in the Plan. The transition from the existing curb and gutter section to the new curb and gutter section should occur within 5-10 feet of the point where the curb and gutter construction begins. The gutter inslope shall be constructed as detailed in the Plans. The gutter inslope transitions shall occur outside of the zero height curb area. The proposed gutter width shall be modified as necessary so as not to protrude into the adjacent travel lane with approval from the Engineer.

At all locations where new curb and gutter meets existing curb and gutter, place saw cut to leave a minimum 3 feet of in place curb and gutter between an existing joint and the proposed saw cut. If the 3 foot minimum cannot be maintained, place the saw cut over the existing joint. At this saw cut location the Contractor shall drill and grout 2 No. 4 x 12 inch long reinforcement bars (Epoxy coated). Reinforcement bars shall be placed a minimum of 3 inches from face and back of gutter section. When not accounted for in the Plan, payment for these bars will be made under Item 2301.602 (Drill & Grout Reinforcement Bar (Epoxy Coated)) by the Each at the Predetermined Price of $ 10.00 per bar furnished and installed. **The Contractor shall not be eligible for compensation at the Predetermined Price above for drill and grout reinforcement bar work when required for replacement of unacceptable work.**

The Contractor must form, at a minimum, the top 1.5 inches of the gutter face. The Contractor shall not use the existing roadway edge as a form for the top 1.5 inches of the gutter face unless approved by the Engineer.

If the gutter flow line in front of the proposed curb ramps exceeds 2.0% slope, the flow line should be adjusted to allow a flatter slope in front of the curb ramps, but still provide positive drainage. The bituminous patch in front of the truncated domes must not exceed 5% measured perpendicular to the flow line. In no case shall a newly constructed curb and gutter flow line exceed 8% unless the roadway profile exceeds 8%.

The Contractor shall not alter any existing drainage patterns unless called for in the plans or approved by the Engineer.

The Contractor shall construct a contraction joint through the curb and gutter section at the bottom of the curb height transitions where the curb height equals zero inches. If any curb and gutter joints fall within the PAR, they shall meet MN/DOT 2521.3C.

When constructing directional curb where truncated domes are placed perpendicular to the path of travel, the concrete between the grade break/edge of truncated domes and the gutter toe shall be constructed integral.

2. METHOD OF MEASUREMENT

Measurement of Concrete Curb and Gutter will be by the linear foot measured at the face of the curb.

3. BASIS OF PAYMENT

Payment will be made under Item 2531.603 (Concrete Curb and Gutter) at the Contract bid price per linear foot, which shall be compensation in full for all costs of furnishing and installing the required material including Aggregate Base.

2531 PEDESTRIAN CURB RAMP – TRUNCATED DOME SYSTEMS

REVISED 08/20/15
SP2016-189:
This work consists of furnishing and installing Truncated Dome Systems (detectable warning surfaces) at pedestrian curb ramps in compliance with the Public Rights-of-Way Accessibility Guidelines (PROWAG). This work shall be performed in accordance with the applicable MN/DOT Standard Specifications, these Special Provisions, the details in the Plan, and the following:

A. Construction Requirements

The Contractor shall select a truncated dome product from the approved products list at:
http://www.dot.state.mn.us/products/miscmaterials/truncateddomes.html.

The truncated domes shall be placed in concrete and shall be pressed firmly into the concrete to the point that concrete fills the vent holes on the truncated dome plates. No cutting of truncated domes will be allowed unless approved by the Engineer. Any swelling of the concrete that occurs around the truncated domes must be screeded off and the surrounding concrete shall be finished flush with the truncated dome plate edge. To ensure that the truncated domes are well seated in concrete, the Contractor should provide a 3 inch minimum border around the edges of the truncated domes.

The Contractor will be allowed to interchange 9 foot 5 inch and 10 foot radial truncated domes when either is called for in the Plan. If the Contractor does make a substitution, the Contractor will be required to modify the curb line radius to match the truncated domes and meet the detectable edge requirements shown on MN/DOT Standard Plan Sheet No. 5-297.250 (Sheet 4 of 5). The Contractor will be allowed to adjust plan locations of zero inch height curb up to 6 inches laterally to make field fit adjustments for redial truncated domes placement.

B. Material Requirements
Square or rectangular truncated dome area will be measured by the square foot. Radial Truncated Domes will be measured along the long cord and multiplied by 2 feet to compute square feet.

C. Basis of Payment
Payment will be made under Item 2531.618 (Truncated Domes) at the Contract bid price per square foot, which shall be compensation in full for furnishing and installation of truncated domes. If additional radial domes are required and not called for in the plans they will be paid for at 4 square feet per each additional plate.

2540 MAIL BOX SUPPORT

REVISED 08/20/15
SP2016-196: This work shall consist of removing existing mailbox supports and furnishing and installing new Mail Box Supports in accordance with the applicable MN/DOT Standard Specifications, Standard Plate 9350A, and the following:

A. It is the Contractor's responsibility to coordinate with property owners and the local postal authority as to establishing and installing permanent mailbox location(s).

The inplace mail box, or a new mail box if furnished by the owner, attached distribution box and/or sign, if present, shall be salvaged and installed on the new support. The inplace support shall be removed with as little damage as possible and offered to the property owner. If the owner does not want the support the Contractor shall dispose of it off the Right-of-Way in accordance with MN/DOT 2104.3D3. All depressions resulting from removal process shall be filled.

All removal and replacement operations shall be done in such a manner so as to cause no interruption of mail delivery if at all possible. In no case shall the owner or resident be without a mailbox installation for more than 24 hours.

B. Measurement will be made by the number of Mail Box Supports furnished and installed as specified in the Plan.

C. Payment will be made under Item 2540.602 (Mail Box Support) at the Contract bid price per each, which shall include but not be limited to all items as specified above, except those that the Contract specifically designates as having been included for payment under separate items.

2540 RELOCATE MAIL BOX SUPPORT

REVISED 08/20/15

SP2016-196: This work shall consist of relocating existing mailbox supports in accordance with the applicable MN/DOT Standard Specifications, Standard Plate 9350A, and the following:

A. It is the Contractor's responsibility to coordinate with the local postal authority as to where the temporary location(s) shall be and to notify the postal patrons of the locations.

   The inplace mail box, or a new mail box if furnished by the owner, attached distribution box and/or sign, if present, shall be salvaged and installed at the new location as staked in the field by the Contractor. All depressions resulting from the relocation process shall be filled.

   All relocation operations shall be done in such a manner so as to cause no interruption of mail delivery if at all possible. In no case shall the owner or resident be without a mailbox installation for more than 24 hours.

B. Measurement will be made by the number of Mail Box Supports relocated, as specified in the Plan.

C. Payment will be made under Item 2540.602 (Relocate Mail Box Support) at the Contract bid price per each, which shall include but not be limited to all items as specified above, except those that the Contract specifically designates as having been included for payment under separate items.

2540 CONSTRUCT SURVEY MONUMENT

The work shall consist of providing 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 Standard Detail Drawings SUR-1 and SUR-2 listed in Appendix D.

A. Materials

1) The City of Duluth will supply the monument casting cover and frame.

2) 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.

B. Construction

1) The Engineer will set the 1" rebar.

2) The contractor shall set the PVC tube and place the concrete around the rebar as detailed.

3) The contractor shall notify the Engineer 48 hours prior to setting the monument.

4) 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.

C. Measurement and Payment

Survey monuments will be measured by the number of completed monuments. Payment will be made under Item 2540.602 (Survey Monument) or Item 2540.602 (Survey Monument in Roadway) at the contract unit price per each, which shall be compensation in full for all materials, labor, and equipment necessary to provide the monument.

2540 PARKING METER POST/BRACKET INSTALLATION

The size of all material and posts shall be approved by the City of Duluth. All parking meter posts shall be inserted into soil at a minimum depth of 36 inches and surrounded by six inches of concrete. All parking meters installed in sidewalks or other areas of concrete surfaces shall use an installation bracket and comply with Standard Detail T-1. All traffic meter upright posts, when used, shall have a minimum height of 4 feet above surface level.

2540 BRICK PAVEMENT RESTORATION

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.

A 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.

1. 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

2. Color and texture of brick pavers shall be similar to:
   a) Street/Sidewalk Paver
   - Endicott - #46 Medium Ironspot & Dark Ironspot
   - TK Yankee Hill – Modified Tan Flashed and Dark Flashed Brown

   b) Centerline/Driving Lane Paver
   - Endicott – Coppertone
   - TK Yankee Hill – Mojave

3. Asphalt setting bed materials shall meet gradation "D" of Table 3139-2 Aggregate Gradation Broad Band of MN/DOT 3139 or approved equal. Submit design mix for review by Engineer.

4. 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

5. 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.

6. Expansion joint (board) material shall meet MN/DOT 3702 or approved equal.

7. Expansion joint sealant materials shall meet the following or approved equal.

- A) 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.

  (1) 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.

  (2) 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.

- B) Verticall 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.

8. Brick paver cleaner shall meeting 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.

9. Concrete shall meet MN/DOT 2301 and MN/DOT 2461.
   - Concrete design mix 3A32.
   - Drill and grout 1" dia. dowel bars or No. 8 reinforcement "tie" bars (24" length) at 16" O.C. into adjacent existing concrete base.

B 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:

1. 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.

2. <u>Brick Paver Installation</u>

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.

3. 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 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.

4. 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.

5. 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 3-5 minutes. Scour with stiff bristle brushing action and completely rinse surface of cement residue.

C MEASUREMENT AND PAYMENT

Brick paver street pavement and brick paver sidewalk will be measure by top surface area in square feet. Payment for brick paver work will be made under Item 2540.618 (Brick Paver Street Pavement) or 2540.618 (Brick Paver Sidewalk) at the Contract unit price per square foot, which shall be 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.

2563 ALTERNATE PEDESTRIAN ROUTE

NEW 08/20/15
SP2016-232 modified: MN/DOT 2563 is supplemented with the following:

A. Maintain and guide pedestrian traffic through the Project at all times using continuous Alternate Pedestrian Routes (APRs) per standards set forth in the MN MUTCD Chapter 6D. Provide each APR to the same level of accessibility of each existing access and walkway prior to construction. Incorporate accessible pedestrian signals (APS), temporary curb ramps, pedestrian barricades, pedestrian channelizers, detectable edges, temporary walkway surfaces and other accessible design features as necessary. Provide continuous walkway surfaces that are smooth, stable and slip resistant. Use accessible device standards as shown in Figures 6K-12 and 6K-13 in the Field Manual. For bypasses and detours, utilize Layouts 84 and 85 in the Field Manual. Use 6F.74.1 from the MN MUTCD if using temporary walkway surface devices as part of the continuous walkway surface over short segments of rough, soft or uneven ground.

B. Minimize disruption to pedestrians to the maximum extent feasible by providing APRs in the following order of preference:

1. Provide the APR on the same side of the street as the disrupted route utilizing bypasses.
2. Where it is not feasible to provide a same side APR, provide an APR on the other side of the street.
3. Where it is not feasible to provide an APR on the other side of the street, provide an APR detour with trailblazing signs.

C. Schedule and coordinate the replacement of pedestrian access to accommodate the needs of businesses and residences 2 days prior to the replacement. Leave the existing sidewalks in-place until such time that it is required to remove them to accommodate new construction. Pedestrian access may be provided to

businesses and homes through the use of any public access from adjacent parking lots and side streets. Provide front door access to buildings without alternate public entrances.

D. Protect the pedestrian route with pedestrian barricades or pedestrian channelizing devices if it is adjacent to construction, excavation drop-offs, traffic, or other hazards. Protect the pedestrian route with portable barrier if it is on the shoulder, in a parking lane, or in a closed lane adjacent to traffic on a multilane road or if the speed limit is greater than 40 mph. When both sides of a pedestrian route require channelizing devices, use similar types, unless portable barrier is used to protect pedestrians from traffic.

E. No pedestrian curb ramp or blended transition work shall occur concurrently at adjacent intersections.

F. The Contractor is advised that the corridor has Transit service. Re-locations of stops can only be made with the approval of the Engineer.

G. Notify the Engineer in writing at least 24 hours prior to the start of any construction operation that will necessitate a change in pedestrian access.

H. Furnish the name, address, email, and phone number of at least one individual responsible for the maintenance of the APR. This individual shall be "on call" 24 hours a day, seven days per week during the times any devices, furnished and installed by the Contractor, are in place. Submit the required information to the Engineer at the pre-construction meeting.

I. Answer calls immediately and begin corrective measures needed within one hour. If the Contractor is negligent in correcting the deficiency within one hour of notification the Contractor shall be subject to a monetary deduction at the <u>rate of $100.00 per hour when only one residence or location is affected and at the rate of $500.000 per hour in all other cases that the Engineer determines the Contractor has not complied.</u>

J. No measurement will be made of the various items that constitute APRs. Payment for all costs of the APRs, including furnishing, installing, maintaining and removing the individual devices, shall be included in the lump sum payment for traffic control.

2564 TRAFFIC SIGNS AND SIGN POST INSTALLATION

A. General
The size of all traffic signs, materials, and posts shall be approved by the Engineer.

B. Material Requirements
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.

C. Post Installation
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 must be inserted into a four inch PVC collar, in concrete with the use of approved Telspar posts. All collars 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.

D. 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

A. General
The concrete footing and sign post shall conform to Standard Detail T-3. The street sign unit E-250 shall conform to Standard Detail T-4. The street sign unit E-450 shall conform to Standard Detail T-5. The street sign unit E-650 shall conform to Standard Detail T-6.

B. Material Requirements
1. Reflective sheeting shall be 3-M brand, Diamond Grade V.I.P. or approved equal.

2. 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 Standard Details T-4, T-5 and T-6; 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.

3. 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.

C. Basis of Payment
Payment for furnishing and installing concrete footings, sign post design special and street sign units E-250, 450, and 650 complete with brackets at the contract price per each will be compensation in full for all costs of furnishing and installing the concrete footing, sign post, and street sign.

2564 SIGNS-REMOVE AND REINSTALL

This work shall consist of removal, storage, protection and reinstallation of signs in accordance with the provisions of MN/DOT 2564, and the following:

A. General
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 shall be replaced with a new sign by the Contractor at the Contractor's expense.

B. 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.

C. Basis of Payment
Payment will be made under Item 2564.602 Signs - Remove and Reinstall at the Contract bid price per each pole, which shall be 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.

2572 PROTECTION AND RESTORATION OF VEGETATION

The provisions of MN/DOT Specification 2572, Protection and Restoration of Vegetation, shall apply to this contract except where otherwise defined in the Contract Special Provisions, and as amended below:

Contractor shall consult with the City Tree Inspector, 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, 2572.3A Protecting and Preserving.

The provisions of MN/DOT Specification 2572.3A8, Destroyed or Disfigured Vegetation, is 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, 211 City Hall.

2573 STORM WATER MANAGEMENT

MN/DOT storm water construction details shall apply to all construction performed under this specification.

Storm water management shall be performed in accordance with the provisions of MN/DOT 2573, except as modified below:

The Contractor is required to be a co-permittee on the MPCA Stormwater for Construction Activity NPDES permit and shall be fully familiar with the current permit (www.pca.state.mn.us/water/stormwater/stormwater-c.html) and be able to comply with all conditions of the permit and the project's Storm Water Pollution Prevention Plan (SWPPP).

MN/DOT Section 1717 Air, Land, and Water Pollution and Section 2573 Storm Water Management of the MN/DOT Standard Specifications for Construction 2016 Edition shall apply except as modified below:

A. Slope Protection
   On all exposed slopes 1v:3h, or steeper, temporary or permanent erosion protection must be installed within 3 days of being worked. For all other exposed slopes, temporary or permanent erosion protection must be installed within 7 days of being worked.
B. Direct Connection to an Inlet

Ditches/swales/channels that direct water from the construction site to any storm water or surface water inlet shall have the ditch bottom stabilized the same day as connection to the inlet occurs. Same day stabilization shall be done using Erosion Control Blanket (ECB) securely anchored in accordance with the manufacturer's recommendation and extended the full length of the channel and covering to full width of the bottom and both sides of the channel. The type of ECB shall be selected in accordance with MN/DOT 3885 depending on channel slope and expected velocity but must be Category 3 or better.

C. Materials Required at the Construction Site
As a spill and contingency measure a minimum of 5 Sediment Control Logs Type Rock (MN/DOT 3897) shall be always available on the jobsite in addition to absorbent pads and other materials to contain spills and prevent migration to the storm water system.

D. Construction Entrance
In addition to the MN/DOT approved materials list, Mudmat© Reusable Matting shall also be considered an acceptable construction entrance (minimum length of 45 feet). Maintenance of either Mudmat or Stone Construction Entrance is required to prevent tracking offsite.

2573 STORM WATER MANAGEMENT

REVISED 08/20/15
SP2016-243: The following is added to MN/DOT 2573:

J Unit Prices

The Department will pay the following unit prices for temporary sediment control items in the absence of a Contract bid price:

Bale Barrier ..... $4.10 /foot ($13.45/meter)
Silt Fence, HI ..... $3.00/ foot ($10/meter)
Silt Fence, Type MS ..... $2.00/ foot ($6.50/meter)
Silt Fence, Type SD ..... $2.00/ foot ($6.50/meter)
Sandbag Barrier ..... $6.00 square foot ($64.68/ sq meter)
Flotation Silt Curtain, Type: Still Water, 1.2 m (4 foot) depth $12.50 /foot ($41.00/meter)
Sediment Trap Excavation ..... $5.50/cubic yard ($7.20/cubic meter)
Bituminous Lined Flume ..... $50.00/square yard ($59.52/square meter)
Sediment Removal, Backhoe ..... $175.00/ hour
Sediment Removal, Vacuum truck ..... $175.00 /hour
Sediment Control Log, Type Wood Fiber $4.00/foot ($13.00/meter)
Sediment Control Log, Type Rock $5.00/foot ($16.50/meter)
Flocculant Sock ..... $200 each

2573 EROSION CONTROL SUPERVISOR

Section 2573.5H is deleted and replaced by the following:

H Erosion Control Supervisor

Providing the Erosion Control Supervisor for this Contract shall be considered incidental work for which no direct payment will be made.

2574 SOIL PREPARATION

REVISED 08/20/15

SP2016-244: MN/DOT 2574 is modified as follows:

The following is added to MN/DOT 2574.5:

C Unit Prices

The Department will pay the following unit prices for Soil preparation l items in the absence of a Contract bid price:

Subsoiling.....$350.00 /acre ($853.65/hectare)
Soil Bed Preparation.....$200.00/ acre ($487.87/hectare)
Soil Tracking.....$134.00 /acre ($326.83/hectare)

2575 ESTABLISHING TURF AND CONTROLLING EROSION

REVISED 11/06/15

SP2016-245: MN/DOT 2575.5(L), "Payment Schedule" is modified as follows:

L Payment Schedule

The Department will pay for establishing and maintaining turf and controlling erosion on the basis of the following schedule:

Item No.:	Item:	Unit:
2575.501	Seeding	acre [hectare]
2575.502	Seed, Mixture ___, or (Species)	pound [kilogram]
2575.505	Sod, Type ___	square yard [square meter]
2575.511	Mulch Material, Type ___	ton [metric ton]
2575.513	Mulch Material, Type ___	cubic yard [cubic meter]
2575.515	Mulch Material, Type 4	square yard [square meter]
2575.518	Temporary Poly Covering	square yard [square meter]
2575.519	Disk Anchoring	acre [hectare]
2575.523	Erosion Control Blanket, Category ___*	square yard [square meter]
2575.525	Turf Reinforcement Mat, Category ___	square yard [square meter]

Item No.:	Item:	Unit:
2575.526	Compost Blanket	square yard [square meter]
2575.527	Shoulder Mulch Overspray	pound [kilogram]
2575.535	Water	M gallons [cubic meter]
2575.541	Mowing	acre [hectare]
2575.545	Weed Spraying	acre [hectare]
2575.547	Weed Spray Mixture	gallon [liter]
2575.555	Turf Establishment	lump sum
2575.560	Hydraulic ___ Tackifier	pound [kilogram]
2575.560	Hydraulic ___ Matrix	pound [kilogram]
2575.561	Hydraulic ___ Tackifier	square yard [square meter]
2575.561	Hydraulic ___ Matrix	square yard [square meter]
2575.570	Rapid Stabilization Method 1	acre [hectare]
2575.570	Rapid Stabilization Method 2	acre [hectare]
2575.571	Rapid Stabilization Method 3	M gallons [cubic meter]
2575.572	Rapid Stabilization Method 4	square yard [square meter]
2575.573	Rapid Stabilization Method 5	ton [metric ton]

* If maintenance applies, the Department will place the subnote, "Includes Maintenance" on the pay item shown in the summary of quantities on the plans.

The following is added to MN/DOT 2575.5:

M Unit Prices The Department will pay the following unit prices for temporary erosion control items in the absence of a Contract bid price:

Disc anchoring ..... $45.00/ acre ($110.00/ hectare)
Temporary Seed Mixtures
21-111, 21-112 or 21-113 ..... $1.25/ pound ($2.50 /kilogram)
22-111 ..... $2.00 /pound ($4.44/ kilogram)
Erosion Control Blanket
Category 3N ..... $1.80/square yard ($2.15/ square meter)
Category 4N ..... $2.10/square yard ($2.51/ square meter)
Rapid Stabilization
Method 1 ..... $465.00/acre ($1162.5/hectare)
Method 2 ..... $800.00/acre ($1976.75/hectare)
Method 3 ..... $726.00/M gallon ($149.5/cubic meter)
Method 4 ..... $1.84/sq yd ($2.20/square meter)
Hydraulic mulch $1.86/lb ($3.33/kilogram)
Hydraulic Stabilized Fiber Matrix $1.81/lb ($4.4/kilogram)
Hydraulic Reinforced Fiber Matrix $1.77/lb ($4.4/kilogram)
Water ..... $17.00/M gallon ($0.53/cubic meter)
Mowing ..... $160.00/ acre ($400.00/hectare)
Weed Spraying ..... $60.00 /acre ($150.00/hectare)

2575 TURF ESTABLISHMENT

Turf establishment shall be performed in accordance with the provisions of MN/DOT 2575, except as modified below:

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.

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 4 inches on all disturbed turf areas to be sodded and seeded in accordance with the provisions of MN/DOT 2105. 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 120 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 FRM 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 hydroseeder, unless otherwise approved by the Engineer.

G. 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.

H. Payment for sodding at the contract price per square yard shall include importing or salvaging and placing 4 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.

I. Payment for turf establishment shall include importing or salvaging and placing 4-inches of topsoil, shaping, or otherwise preparing the ground, seeding, fertilizing and hydromulching 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 3-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.

J. 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."

3137 COARSE AGGREGATE FOR PORTLAND CEMENT CONCRETE

REVISED 08/20/15

SP2016-252: MN/DOT 3137 is hereby modified as follows:

A. The first paragraph of MN/DOT 3137.2.D.2 shall be deleted and replaced with the following:

Provide coarse aggregate in accordance with 3137.2.D.1, "Coarse Aggregate for General Use," except as modified by Table 3137-2.

B. Table 3137-2 (h) of MN/DOT 3137.2.D.2 shall be deleted and replaced with the following:

h)	Absorption for Class B aggregate for all concrete bridge decks and bridge barrier	≤ 1.10

C. Table 3137-4 of MN/DOT 3137.2.E shall be deleted and replaced with the following:

Table 3137-4
Coarse Aggregate Designation for Concrete,
percent by weight passing square opening sieves

	Coarse Aggregate Designation					
	1	**2**	**3**	**4**	**7**	**8**
Sieve Sizes	**ASTM #467**	**ASTM #67***	**ASTM #7***	**ASTM #89**	**CA-70**	**CA-80**
2 in [50 mm]	100	-	-	-	-	-
1½ in [37.5 mm]	95 – 100	-	-	-	-	-
1 in [25.0 mm]	-	100	-	-	-	-
¾ in [19.0 mm]	35 – 70	90 – 100	100	-	-	-
5/8 in [16.0 mm]	10 – 30	20 – 55	40 – 70	-	100	-
½ in [12.5 mm]	-	-	90 – 100	100	85 – 100	-
⅜ in [9.5 mm]	10 – 30	20 – 55	40 – 70	90 – 100	50 – 100	100
No.4 [4.75 mm]	0 – 5	0 – 10	0 – 15	40 – 70	0 – 25	55 – 95
No.8 [2.36 mm]	-	-	-	5 – 30	-	-
No.16 [1.18 mm]	-	-	-	0 – 10	-	-
No.50 [300 µm]	-	-	-	0 - 5	-	0-5

*ASTM #67 and ASTM #7 Gradations are MN/DOT Modified.

3138 AGGREGATE FOR SURFACE AND BASE COURSES

REVISED 08/20/15

SP2016-252.1: MN/DOT 3138 is hereby modified as follows:

Add the following to MN/DOT 3138.2D Surfacing Aggregates:

(5) Provide aggregate with a minimum clay content of 3% and a Plasticity Index (PI) of 5 – 12. The requirements for PI and minimum clay content are met, if the bitumen content is 1% or greater, the material is composed of at least 25% recycled materials or is composed of at least 50% crushed quarry aggregate.

Add the following to MN/DOT 3138.3:

G Particle Size Analysis Laboratory Manual Method 1302
H Liquid Limit Determination Laboratory Manual Method 1303
I Plastic Limit Determination Laboratory Manual Method 1304

3236 REINFORCED CONCRETE PIPE

REVISED 08/20/15

SP2016-254: The provisions of MN/DOT 3236 are modified and/or supplemented with the following:

Manufacturers of reinforced concrete pipe may produce an alternate "offset joint" on the spigot end of the pipe. This type of offset joint is to be used with the profile or pre-lubricated pipe seal systems. See MN/DOT Standard Plate 3006.

3877 TOPSOIL MATERIAL

NEW WRITEUP 09/25/15

SP2016-256.1: MN/DOT 3877 is modified as follows:

Delete MN/DOT Table 3877-1 "Common Topsoil Borrow Requirements", and replace with the following:

Table 3877-1
Common Topsoil Borrow Requirements

Requirement	Range	Test Method
Material passing No. 4 in [4.75 mm]	≥ 85%	—
Clay	5% – 35%	ASTM D 422
Silt	5% - 70%	ASTM D 422
Sand & *Gravel	10% - 75%	ASTM D 422
Organic matter	3% – 15%	ASTM D 2974
pH	6.1 – 7.8	ASTM G 51
*Gravel shall be in the fine to medium range of particle sizes		

3760 INSULATION BOARD (POLYSTYRENE)

The provisions of MN/DOT 3760 are changed to read as follows:

A. Polystyrene Insulation

Polystyrene Insulating Board in this specification shall be rigid expanded polystyrene conforming to the material requirements of MN/DOT 3760 and intended for below grade installation. Insulation shall meet the following minimum requirements:

Compressive Strength at 10% Deformation	=	3.5 psi Min.
Water Absorption (ASTM C272)	=	less than 0.5% volume
Water Vapor Permeability (ASTM C355)	=	less than 1.0 Perm – inch

Thickness specified may be made up by layering 1 inch, 1-1/2 inch or thicker sheets provided the overlaying joints are offset from those below.

Insulation board shall be similar or equal to "DOW Styrofoam HI 40" or "Certifoam 40."

B. Placement of Polystyrene Insulation

This work shall consist of furnishing and installing 3 inch thick insulation board at the locations designated on the Contract Drawings. This work shall be performed in accordance with the Standard Details, the Contract Drawing and the Special Provisions, the applicable MN/DOT Standard Specifications, and the following:

Rigid insulation board shall be placed within the pipe encasement zone, 6 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 thicker, 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 6 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 6 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 6 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 2105 EXCAVATION, BACKFILL AND COMPACTION FOR UTILITIES.

C. Measurement and Payment

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 Standard Details. Compensation for insulation shall include all costs of extra trench excavation, overlap of insulation board, furnishing and placing granular backfill, and removal and disposal off the site of excess excavated material.

Payment will be made under Item 2504.604 3 inch Polystyrene Insulation at the Contract bid price per square yard, which shall be compensation in full for all costs incidental thereto including, but not limited to the extra trench excavation, furnishing and placing granular backfill and removal and disposal off the site of excess excavated material.

2016 Construction Standards
City of Duluth, Minnesota
Public Works & Utilities
Engineering Division
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