102.5 Bid Deposit.

No proposal shall be considered unless either (i) it is accompanied by a Bid Deposit of the character and amount described in the Advertisement for Bids or (ii) a Biennial bid bond in an amount and form acceptable to the City of Madison has been previously submitted.

Bid Deposits shall include a Bid Bond on the City of Madison Bid Bond form unless Biennial bid bond is on file with the City of Madison or unless the Bid Deposit is made by certified check. Failure to use this form may be considered as sufficient for rejection of the bidder as non-responsive.

Bid Deposits of unsuccessful bidders shall be returned following the award of the contract by the Common Council. Bid Deposit of the successful bidder shall be returned within forty-eight (48) hours following execution of the contract and bond as required.

102.9 Bidder's Understanding.

It is understood and agreed that the bidder, by careful examination, satisfy himself as to the nature and location of the work, the conformation of the ground, the character, quality and quantity of the materials to be encountered, the character of equipment and facilities needed preliminary to and during prosecution of the work, the general and local conditions, and all other matters which can in any way affect the work under this contract.

Bidders must satisfy themselves by such reasonable means as they may prefer as to the accuracy of the Engineer's estimates of quantities, and soil conditions, or otherwise, and shall not at any time after submission of a bid dispute such estimate of the Engineer, nor assert that there was any misunderstanding in regard to the nature or amount of the work to be done.

The City has endeavored to determine the location of existing utilities in the area of the work and so indicate on the appropriate drawings. The City makes no warranty as to the accuracy or completeness of such representations. It is understood and agreed that the cost of performing work in the vicinity of existing utilities indicated or reasonably inferable is included in the bid price.

No employee, agent or consultant of the City is authorized to make any representations as to the materials or workmanship involved, or the conditions to be encountered, and the Contractor agrees that no such statement or the evidence of any document or plan, not a part of this contract, shall constitute any grounds for claim as to conditions encountered. No verbal agreement or conversation with any employee, agent or consultant of the City, either before or after the execution of this contract, shall affect or modify any of the terms or obligations herein contained.

TAX EXEMPT STATUS: Effective with all contracts executed after January 1, 2016, the sales price from the sale, storage, use or other consumption of tangible personal property that is used in conjunction with a public works improvement for a tax exempt entity (including the City of Madison), is exempt from State sales tax. Said property must become a component of the project owned by the tax exempt entity and includes: any building; shelter; parking lot; parking garage; athletic field; storm sewer; water supply system; or sewerage and waste water treatment facility, but does not include a highway, street or road.

The contractor shall ensure that the exemption for sales and use tax available under Wis. Stat. Sec. 77.54(9m) applies where available. The contractor shall provide all necessary documentation as required by the State of Wisconsin and the City of Madison to comply with this exemption.

102.14 Ban the Box – Arrest and Criminal Background Checks (Sec. 39.07, MGO).

This provision applies to all prime contractors on contracts entered into on or after January 1, 2016, and all subcontractors who are required to meet prequalification requirements under MGO 33.07(7)(I), MGO as of the first time they seek or renew pre-qualification status on or after January 1, 2016. The City will monitor compliance of subcontractors through the pre-qualification process.

A. Definitions. For purposes of this section, "Arrest and Conviction Record" includes, but is not limited to, information indicating that a person has been questioned, apprehended, taken into custody or detention, held for investigation, arrested, charged with, indicted or tried for any felony, misdemeanor or other offense pursuant to any law enforcement or military authority.
"Conviction record" includes, but is not limited to, information indicating that a person has been convicted of a felony, misdemeanor or other offense, placed on probation, fined, imprisoned or paroled pursuant to any law enforcement or military authority.
"Background Check" means the process of checking an applicant's arrest and conviction record, through any means.

B. Requirements. For the duration of this Contract, the Contractor shall:

1. Remove from all job application forms any questions, check boxes, or other inquiries regarding an applicant's arrest and conviction record, as defined herein.

2. Refrain from asking an applicant in any manner about their arrest or conviction record until after conditional offer of employment is made to the applicant in question.

3. Refrain from conducting a formal or informal background check or making any other inquiry using any privately or publicly available means of obtaining the arrest or conviction record of an applicant until after a conditional offer of employment is made to the applicant in question.

4. Make information about this ordinance available to applicants and existing employees, and post notices in prominent locations at the workplace with information about the ordinance and complaint procedure using language provided by the City.

5. Comply with all other provisions of Sec. 39.08, MGO.

C. Exemptions: This section shall not apply when:

1. Hiring for a position where certain convictions or violations are a bar to employment in that position under applicable law, or
2. Hiring a position for which information about criminal or arrest record, or a background check is required by law to be performed at a time or in a manner that would otherwise be prohibited by this ordinance, including a licensed trade or profession where the licensing authority explicitly authorizes or requires the inquiry in question.

To be exempt, Contractor has the burden of demonstrating that there is an applicable law or regulation that requires the hiring practice in question, if so, the contractor is exempt from all of the requirements of this ordinance for the position(s) in question.

107.4(i) Insurance for the Construction of Buildings and Structures.

The Contractor shall purchase and maintain, property insurance written on a builder's risk "all-risk" policy form in the amount of the initial Contract sum, plus the value of subsequent Contract modifications and cost of materials supplied or installed by others, comprising total value for the entire project at the site on a replacement cost basis less the cost of sitework and demolition. Such insurance shall be maintained until the date in time that the City takes occupancy of the building or possession of the structure, unless otherwise agreed to in writing by Contractor and City. This insurance shall include interests of the City, the Contractor and subcontractors. This insurance does not include Contractor's or subcontractor's property which is not intended to be incorporated into the work such as tools, sheds, hoists, canvasses, tarpaulins, mixers, scaffolding, staging towers owned or rented, or similar property not expended in the completion of, or to become a permanent part of the installation of the work. This insurance includes new buildings, structures, and additions; it excludes remodeling, alterations, or renovation of existing buildings.

Such insurance shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and soft costs, including but not limited to additional interest costs, insurance, architect fees, engineering fees, contractor fees, legal and accounting fees, city staff costs, bond and permit fees, rental/lease costs and other administrative costs required as a result of such insured loss.

If the property insurance requires deductibles, the Contractor shall pay costs not covered because of such deductibles.

This insurance shall cover portions of the work stored off-site, and also portions of the work in transit. The Contractor shall carry sufficient all risk insurance on both the owned and leased equipment at the site of work and enroute to and from the site of work to fully protect Contractor. The Contractor shall require the same coverage of subcontractors. It is expressly understood and agreed that the City shall bear no responsibility for any loss or damage to such equipment.

Partial occupancy or use shall not commence until the insurance company or companies providing insurance have consented to such partial occupancy or use by endorsement or otherwise. The City and Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

109.9 Liquidated Damages.

Should the Contractor fail to complete the work within the time specified in the contract, or within such extra time as may have been allowed by extensions, there shall be deducted from any monies due or that may become due the Contractor, or in the event no monies are due, the Contractor shall pay to the City, the sum set forth in the following schedule for each and every day that the work shall remain uncompleted. This sum shall be considered and treated not as a penalty but as fixed, agreed and liquidated damages due the City from the Contractor by reason of inconvenience to the public, added cost of engineering and supervision, maintenance of detours and other items which have caused an expenditure of public funds resulting from the Contractor's failure to complete the work within the time specified in the contract. (reformat started new paragraph)

Liquidated damages shall be assessed at 40% of rates below, if the project has been surface paved and the only remaining work is restoration. The contractor shall maintain an acceptable rate of progress as determined by the Engineer. If the rate of progress is not acceptable, liquidated damages shall be assessed at the full rate as listed below.

Per Section 107.1 the maximum cumulative total time in which any residential property is completely without driveway access is twenty (20) calendar days. The City of Madison shall assess the contractor $100 per day per driveway until the access is re-established.

Per Section 107.7 or as modified in the contract special provisions, the contractor shall not restrict traffic during peak hours on streets with a functional classification of collector or arterial. The City of Madison shall assess the contractor $1000 per occurrence for working during peak hours.

Per Section 109.2 work hours shall be limited to 7:00 a.m. to 7 p.m. The City of Madison shall assess the contractor $1000 per occurrence for working before 7 a.m. or after 7 p.m.

The fixed, agreed and liquidated damages shall be assessed, unless otherwise specified, in accordance with the following schedule, which represents the City's estimate of damages at the time of contracting:

Contract Amount			
Contract Amount		**Daily Charge**	
From More Than	**To and Including**	**Calendar Day**	**Working Day**
$0	$50,000	$200.00	$350.00
50,000	100,000	375.00	750.00
100,000	300,000	480.00	960.00
300,000	500,000	670.00	1340.00
500,000	1,000,000	1055.00	1910.00
1,000,000	2,000,000	1355.00	2510.00
2,000,000	-----	1510.00	3320.00

110.6 Payment Withheld.

Notwithstanding any responsibility of the surety and the Contractor for the following matters, the City may withhold, or on account of subsequent discovered evidence, nullify the whole or a part of any certificate to such extent as may be necessary to protect itself from loss on account of:

1. Defective work not remedied.
2. Claims filed against the Contractor.
3. Failure of the Contractor to make payments ~~promptly~~ in a timely fashion to subcontractors or for laborers or material, in accordance with Wis. Stats 66.0135(3)(a).

204.3 Method of Measurement.

The quantity of Clearing or of Grubbing will be measured per inch diameter of tree or stump approximately 4-1/2 feet above the existing ground level but above the ground swell, and the diameter of the tree or stump shall be 1/3 of the measured circumference. The measurement for circumference and determination of diameter will be to the nearest full inch. Only trees or stumps in place, the circumference of which is nine (9) inches or more will be measured for payment.

Trees with multiple trunks shall be measured individually at each trunk approximately 4-1/2 feet above the existing ground.

Clearing and Grubbing will be measured separately, either by the station, square yard, inch-diameter or lump sum as the contract indicates.

By the Station

The city will measure Clearing and Grubbing by the full 100-foot station acceptably completed, measured along the roadway centerline or reference line with each full 100-foot station starting and ending at a +00 station. If 2 or more roadways occur, the city will measure along the centerline or reference line of each roadway. For divided highways, the city will extend measurement units for each roadway, in width, from 5 feet outside the grading limit of that roadway to a line mid-way between the reference lines or centerlines for each roadway.

The city will only include stations with a total of 12 inches or more of diameter determined as specified above. The city will include each station conforming to this criterion as a full station.

By the Square Yard

The city will measure Clearing and Grubbing by the square yard acceptably completed within the designated limits. The city will calculate the horizontal area bounded by the line of trunks cut or grubbed. The city will not measure outside the right of way limits or acquired easements. The city will include only areas containing trees or stumps with a 3-inch or greater diameter. The city will determine diameters as specified under above.

By the Inch-Diameter

The city will measure Clearing and Grubbing by the inch of diameter acceptably completed. The city will determine tree diameter by measuring the circumference approximately 4 1/2 feet above the existing ground level, but above the ground swell, and dividing by 3. The city will determine stump diameter, for stumps not resulting from the contractor's clearing operations, by computing the average diameter of the stump top. The city will include only those in-place trees or stumps with a 3-inch or greater diameter. The city will round circumference measurements and diameters to the nearest inch.

By the Lump Sum

Clearing and Grubbing shall be measured by the lump sum for the completed work.

ARTICLE 207 - SEEDING

207.2 Materials.

DELETE

207.2(c) Mulching Material.

Mulching material shall consist of any straw, hay, wood excelsior fiber or other suitable material of a similar nature which is substantially free of noxious weed seeds and objectionable foreign matter.

~~Asphalt material, if used, shall be an emulsified asphalt meeting the requirements for the Type SS-1 of the Specifications for the Emulsified Asphalt, AASHTO Designation: M 140.~~

ARTICLE 210 - EROSION CONTROL

210.1 Description.

ADD & DELETE

~~**210.1(a) Erosion Control Implementation Plan.**~~

~~Whenever a project requires erosion control permitting for land disturbance of 20,000 square feet or more or as required by the project plans and specifications the Contractor shall prepare and submit an Erosion Control Implementation Plan to the Construction Engineer. This plan shall be submitted at or before the preconstruction meeting for review and must be approved by the City Erosion Control Engineer prior to any land disturbance activities or beginning installation of erosion control measures. The Erosion Control Implementation Plan bid item shall include all work required to create, update, submit, obtain approval for, and initially field inspect an erosion control plan specific to the Contractor's proposed staging and planned methods of construction for the project. The individual erosion control measures necessary for construction of the plan shall be paid under the appropriate bid items.~~

~~The Contractor shall understand that a comprehensive phased plan showing the Contractor's approach to minimize the disturbed area at any given time is required to obtain approval of the Erosion Control Implementation Plan. The phasing shall consist of a minimum of two (2) phases for construction with no maximum number of phases. The Contractor shall not simply resubmit the erosion control plan provided with the plan set as what they intend to implement. Upon approval of the implementation plan it shall be provided to the WDNR, when applicable.~~
~~The Contractor shall supply a dewatering plan as part of the Erosion Control Implementation Plan. At a minimum the dewatering plan shall include the Contractor's methods, practices, and or devices to perform TYPE I or TYPE II Dewatering per Section 502.1(c) Dewatering in the City of Madison Standard Specifications for Public Works Construction and Wisconsin Department of Natural Resources (WDNR) SOC Technical Standard 1061 Dewatering. If TYPE II Dewatering is expected to be used at a rate in excess of 70 g.p.m. the dewatering plan shall also include a copy of any applicable WDNR permits.~~

~~Prior to beginning any land disturbing construction activities the Contractor shall install all required erosion control practices for the first phase of the approved Erosion Control Implementation Plan and an initial implementation inspection (performed by City Engineering staff) must approve the installation. Prior to proceeding with work on each subsequent construction phase the appropriate erosion control measures from the Erosion Control Implementation Plan shall be installed and the installation approved by the Construction Engineer.~~

210.1(a~~b~~) Erosion Control Inspection.

The Contractor shall complete an inspection of the erosion control practices on permitted projects with 20,000 square feet or more of land disturbance ~~or an Erosion Control Implementation Plan~~ within 24 hours of the end of any Friday, ~~or~~ Saturday or Holiday rain day exceeding 1/2" in total depth or as directed by the Construction Engineer. A rain day is defined as each 24-hour calendar day and shall be measured using a gauging station that shall be provided at the preconstruction meeting by City staff. The data from the rain gauging station shall be available on the internet to allow remote checking of the rain depth totals for each rain day. All weekly inspections and rain event inspections required during the work week (Monday-Friday) shall be completed by the City of Madison construction inspector.

Upon completion of the erosion control inspection the Contractor shall provide an email report indicating the status (Good, Failed, Maintenance Needed, etc) of each individual erosion control practice being used to the Construction Engineer or to the designated representative as identified at the preconstruction meeting. A digital photo or video and notation of the location of each individual erosion control practice requiring maintenance or repair shall be included in the inspection report. The inspection report shall be submitted and any needed maintenance or repairs completed by the Contractor within the same 24-hour period after the end of the rain day. The completed maintenance and repairs shall then be documented and a follow-up inspection report submitted within 24 hours following completion of the repairs. The follow-up inspection report shall include a summary of maintenance items by erosion control BMP maintenance pay item and digital photos or videos of each erosion control practice following maintenance or repair.

Erosion control inspections and reports that are completed more than 24 hours after the end of a rain day as defined above but not more than 48 hours will be paid at half the unit price. Any required erosion control inspection or inspection report that is completed more than 48 hours after the end of rain day or report due date will be assessed a penalty equal to one (1) day of liquidated damages per the table in Section 109.9 Liquidated Damages of these Standard Specifications.

The Contractor shall continue erosion control inspections on a project until a minimum of 70% vegetation establishment has been obtained or other permanent surface restoration has occurred as determined by the Construction Engineer (matting, pavement, sod, etc.).

210.1(b~~c~~) Construction Entrance, Street Construction Entrance Berm.

When required, either by the erosion control plan or the Construction Engineer, a Construction Entrance and/or Street Construction Entrance Berm shall be installed to provide mud tracking control at each construction access point to the project per WDNR Conservation Practice Standard 1057 - Stone Tracking Pad and Tire Washing. The Construction Entrance and Street Construction Entrance Berm bid items shall include the installation of entrances per Standard Detail Drawings 1.07 and 1.08 respectively, and WDNR Conservation Practice Standard 1057. Maintenance of the entrance, removal, restoration and/or repair of any disturbed or damaged area within the immediate limits of

the entrance (including the curb and gutter, sidewalk and pavement) shall also be considered incidental to the entrance bid items.

210.1(cd) Street Sweeping.

When required, either by the erosion control plan or the Construction Engineer, the Contractor shall perform street sweeping on all streets or paved surfaces affected by construction equipment, hauling or related construction activities that result in mud tracking or siltation. Street sweeping shall be completed as directed by the Construction Engineer and shall remove all loose material to the satisfaction of the Construction Engineer. Depending on site conditions, construction activities, and hauling methods utilized by the Contractor street sweeping may be required multiple times throughout the day with an absolute minimum that all streets are clean at the end of the work day.

210.1(de) Clear Stone Berm (Ditch Check), Street Construction Stone Berm.

When required, either by the erosion control plan or the Construction Engineer, a Clear Stone Berm (Ditch Check) and/or Street Construction Stone Berm shall be installed to reduce runoff velocities in areas of concentrated stormwater runoff flow. Clear Stone Berm (Ditch Check) and Street Construction Stone Berm shall be installed per Standard Detail Drawings 1.05 and 1.10 respectively, and WDNR Conservation Practice 1062 - Ditch Checks. Maintenance and removal of stone berms shall be considered incidental to their respective bid items.

210.1(ef) Silt Fence, Silt Sock, Erosion Bales.

When required, either by the erosion control plan or by the Construction Engineer, perimeter controls consisting of silt fence, silt sock or erosion bales shall be installed to protect down slope areas from silt laden runoff generated from disturbed work areas. Perimeter controls shall be installed per their respective WDNR Conservation Practice Standard (1055 for Erosion Bales, 1056 for Silt Fence, and 1071 for Silt Sock).

210.1(fg) Inlet Protection.

Inlet protection shall be used at both existing and new inlets that receive runoff from disturbed land areas. The type of inlet protection required at each structure shall be specified in the erosion control plan or determined by the Construction Engineer. Upon completion of the project and after the Construction Engineer has determined the site to be sufficiently stabilized all inlet protection shall be removed by the Contractor. Removal shall be completed prior to final acceptance of the project. Inlet protection shall be installed per WDNR Conservation Practice 1060 - Storm Drain Inlet Protection for Construction Sites.

Where Inlet Protection, Type D Hybrid is specified on the plans or by the Engineer the contractor may use the WDNR Inlet Protection Type D-M or WDNR Inlet Protection Type D-HR. All other inlet protection types specified are to match their corresponding WDNR inlet protection type.

210.1(gh) Clean Sump.

Clean Sump is the vactor removal of sediment that has accumulated in the sumps of Catchbasins constructed as part of the project. This work shall include but not be limited to removal of any sediments collected in the sump or on the erosion fabric, and disposal or reuse of the sediments at a location provided by the Contractor (this location shall be stable and have sufficient erosion control). The Construction Engineer shall have final determination if sump cleaning is required. If cleaning is required it shall be completed prior to final acceptance of the project.

210.1(hi) Polymer Stabilization.

Polymer Stabilization shall include placing a polyacrylamide soil stabilizer on bare ground to stabilize the area. This item shall be used as directed by the Construction Engineer to stabilize areas that are prone to erosion during construction. Note that this item is not intended to cover polymer to be included with all seeding (which shall be compensated as part of the seeding bid items) but shall cover supplemental polymer stabilization of erosion-prone areas during construction. Polymer shall be applied in conformance with WDNR Conservation Practice Standard 1050 - Land Application of Anionic Polyacrylamide.

210.1(ij) Erosion Matting.

When required, either by the erosion control plan or by the Construction Engineer, erosion matting shall be installed to reduce soil erosion caused by concentrated runoff or rainfall impact. The erosion mat supplied shall be one of the products listed on the PAL under the specified category, and shall conform to Wisconsin Department of Transportation requirements for the specified category.

210.1(jk) Terrace Restoration.

Terrace Restoration shall include the provision, placement and finish grading of a minimum thickness of 4” of topsoil and the restoration with Shade or Sun Terrace Mix as directed in the field. The seeding work shall conform to the specifications in Article 207 - Seeding.

In greenways and detention basin areas, a minimum thickness of six inches (6”) of topsoil shall be required.

ADD

210.1(k) Dust Control.

When required, either by the erosion control plan or the Construction Engineer, dust control shall be implemented in dry areas with exposed soils which may be exposed to wind or vehicular traffic. Dust control shall be applied in conformance with WDNR

Conservation Practice Standard 1068 – Dust Control on Construction Sites. Dust control is included as part of the project work performed.

210.1(l) Turbidity Barrier.

Turbidity Barrier shall be installed per WDNR Conservation Practice Standard 1069.

210.1(m) Silt Curtain.

Silt Curtain shall be installed per WDNR Conservation Practice Standard 1070.

210.3 Construction Methods.

ADD

210.3(c) Turbidity Barrier.

The Contractor shall be responsible for selecting construction methods & materials such that the Turbidity Barrier meets the WDNR Conservation Practice Standard 1069. The connection of the float to the post, pipe or channel shall be in such a manner to allow free vertical movement of the float with fluctuation of the water surface including wave action.

210.4 Method of Measurement.

ADD

210.4(e) Turbidity Barrier.

Turbidity Barrier shall be measured by the linear foot along the top of the float prior to installation.

210.4(f) Silt Curtain.

Silt Curtain shall be measured by the linear foot along the top of the float prior to installation.

210.5 Basis of Payment.

ADD

210.5(e) Turbidity Barrier.

Turbidity Barrier - Complete (BID ITEM 21093) shall be paid for at the contract unit price per linear foot, which price shall be full compensation for furnishing all materials; for constructing, reconstructing, erecting, re-erecting, maintaining, removal and any follow-up restoration; and for all labor, tools, equipment and incidentals necessary to complete the work. Half of the installed quantity shall be paid at the time of installation

and the remaining half shall be paid upon removal and any required incidental restoration is completed.

210.5(f) Silt Curtain.

Silt Curtain - Complete (BID ITEM 21094) shall be paid for at the contract unit price per linear foot, which price shall be full compensation for furnishing all materials; for constructing, reconstructing, erecting, re-erecting, maintaining, removal and any follow-up restoration; and for all labor, tools, equipment and incidentals necessary to complete the work. Half of the installed quantity shall be paid at the time of installation and the remaining half shall be paid upon removal and any required incidental restoration is completed.

ARTICLE 211 – TERRACE RAIN GARDEN

211.2 Materials.

The provisions of all materials necessary for the complete construction of the rain garden shall be included in the bid price.

211.2(a) Engineered Soil.

The soil mixture shall consist of a mixture of sand, and compost ~~and topsoil~~. The mix shall be designed to approximate the following percentages, by volume. The mix shall be free of rocks, stumps, roots, brush or other material over 1 inch in diameter. No other materials shall be mixed with the planting soil that may be harmful to plant growth or prove a hindrance to planting or maintenance.

~~Engineered Soil Component~~	~~% Composition by Volume~~
~~Sand~~	~~45-55%~~
~~Topsoil~~	~~10-15%~~
~~Compost~~	~~30-50%~~

Engineered Soil Component	% Composition by Volume
Sand	70-85%
Compost	15-30%

211.2(a)(1) Sand.

The sand used in the engineered soil mix shall meet the following gradation requirements:

1. Crushed & screened sandstone
2. 100% passing a #4 sieve
3. Maximum of 5% passing a #200 sieve

~~211.2(a)(2) Topsoil.~~

~~The topsoil component shall be a USDA classified sandy loam, loamy sand or loam texture. The topsoil component textural class shall be verified by a laboratory analysis or a professional acceptable to the jurisdiction having authority. The topsoil shall be pulverized prior to mixing with the other materials. No soil particle size over 1" diameter~~

~~shall be accepted and will require removal of all material from the site and a new mix being provided.~~

211.2(a)(2~~3~~) Compost.

The compost component shall meet the following requirements:

1. Particle Size – 98% of the compost shall pass through a 0.75-inch screen.
2. Physical Contaminants – Less than 1% combined glass, metal and plastic.
3. Organic Matter/Ash Content – At least 40% organic matter; less than 60% ash content.
4. Carbon to Nitrogen Ratio – 10-20:1 C:N ratio.
5. pH – Between 6 and 8.
6. Soluble Salts – Electrical conductivity below 10 dS m-1 (mmhos cm -1)
7. Moisture Content – Between 35% and 50% by weight.
8. Maturity – The compost shall be resistant to further decomposition and free of compounds, such as ammonia and organic acids, in concentrations toxic to plant growth.
9. Residual Seeds & Pathogens – Pathogens and noxious seeds shall be minimized.
10. Pathogens – The compost shall meet the Class A requirements for pathogens as specified in s. NR 204.07(6)(a), Wis. Adm. Code.
11. Other Chemical Contaminants – The compost shall meet the high quality pollutant concentrations as specified in s. NR 204.07(5)(c), Wis. Adm. Code.

211.2(a)(3~~4~~) 3-Inch Clear Stone.

Clear Stone shall conform to gradation no. 1, as specified in Section 401.1(b) – Materials.

211.2(a)(4~~5~~) Landscape Fabric.

Landscape fabric shall be 3oz or heavier and shall be resistant to ultraviolet degradation. Alternate materials, such as geotextile fabric, may be approved for installation by the Engineer. Alternate materials shall not be placed prior to approval from the Engineer.

401.1(a) Description.

This item shall consist of a dense compacted base course composed of two or more courses or layers of coarse aggregate, either crushed stone or crushed concrete, fine aggregate and surface or filler blended as necessary to produce an intimate mixture, of the required gradation and stability, constructed on the prepared foundation in accordance with the specifications and in conformity with the lines, grades, thickness and typical cross sections shown on the plans or established by the Engineer.

The crushed stone base course shall be placed on the same day as the existing stone base is removed.

The Contractor shall maintain a minimum of six (6") inches of stone base course (existing or new) on all portions of the roadway open to vehicle access. No additional compensation will be given for stone used to maintain the six (6") required for access.

Crushed stone base course shall be used for bringing temporary ramps to grade. This material shall be reused after ramp is removed.

402.2 Placing Asphalt Mixtures.

402.2(a) Description.

Asphalt mixtures shall not be placed when the air temperature approximately three (3) feet above ground at the site of the work, in the shade and away from the effects of artificial heat, is less than 40°F ~~for upper layer, 36°F for lower less than 3.25", or 32°F for lower layer greater than 3.25" except that lower layer and base course mixtures may be placed at a lesser temperature~~ unless approved by the Engineer in writing. Notify the engineer at least one business day before paving.

The contractor shall submit a cold weather paving plan outlining equipment changes when the air temperature is less than 40°F in the shade and away from the effects of artificial heat. Engineer written acceptance is required for the cold weather paving plan. Engineer acceptance of the plan does not relieve the contractor of responsibility for the quality of HMA pavement placed in cold weather.

~~The contractor should place HMA pavement for projects between April 15 and November 1 inclusive.~~

~~Asphalt mixtures shall not be placed during the calendar period between October 15th and May 1st of the next succeeding year, except with written approval or order of the Engineer. In the event of such approval or order, the conditions and restrictions as to placement set forth in the preceding paragraphs shall apply.~~ The fact that the Engineer does not grant such approval shall not be construed as substantiating an extension of contract time for the completion of the work. Whenever such approval to extend the paving season has been denied, the Contractor shall ramp all access structures, catchbasins and water valve castings, ends of pavements, and curb edges with asphalt material to facilitate maintenance of the pavement area during the suspension of paving operations. Prior to the installation of succeeding layers of asphalt pavement, all such ramping shall be removed as directed by the Engineer and disposed of by the Contractor. All costs of installing and removing such ramping shall be at the Contractor's expense.

~~When placing of asphalt paving mixtures is continued after November 1 October 15th, either at the request of the Contractor or with the Engineer's approval in order to complete the work to the stage required by the provisions of the contract, the asphalt paving work so performed will be construed to have been done at the Contractor's risk. Final inspection thereof will be deferred until May of the succeeding year. Prior to final acceptance of pavement so placed, the Contractor shall repair, restore or replace at no additional cost to the City and in a manner approved by the Engineer, all damage or defects in the asphalt paving which, in the opinion of the Engineer, are attributable to temperature and weather conditions which prevailed after October 15th or before May 1st, as the case may be.~~

Place asphaltic mixture only on a prepared, firm, and compacted base, foundation layer, or existing pavement substantially surface-dry and free of loose and foreign material. Do not place over frozen subgrade or base, or where the roadbed is unstable.

After all layers have been thoroughly compacted, they may be tested for smoothness by means of a fourteen (14) foot straightedge placed parallel to the center line of the pavement,

parallel to the grade line in each lane, and touching the surface. Ordinates measured from the face of the straightedge to the lower layer shall at no place exceed one-fourth (1/4) inch. Variations exceeding one-fourth (1/4) inch in the lower layer shall be corrected as directed by the Engineer. Ordinates measured from the face of the straightedge to the upper layer shall not exceed one-eighth (1/8) inch. For each variation in the upper layer greater than one-eighth (1/8) inch but less than one-fourth (1/4) inch, where directed by the Engineer, the area affected shall be removed and replaced with fresh upper layer mixture at the expense of the Contractor. If variations in the upper layer exceed one-fourth (1/4) inch, the entire area affected shall be removed and replaced with fresh upper layer mixture at the expense of the Contractor.

402.4 Asphalt Tack Coat.

Unless otherwise specified in the contract, or directed by the Engineer, the types and grades of asphalt materials and rates of applications in gallons per square yard shall conform to the following requirements:

1. The tack coat material shall be type MS-2, SS-1, SS-1h, CSS-1, or an approved modified emulsified asphalt.

2. For existing concrete or asphalt pavements, the rate of application shall be between 0.05 and 0.10 gallons per square yard.

Apply tack coat only when the air temperature is 32 F or more unless the engineer approves otherwise in writing. Before applying tack coat ensure that the surface is dry and reasonably free of loose dirt, dust, or other foreign matter. Do not apply if weather or surface conditions are unfavorable or before impending rains.

403.2 Grinding.

403.2(a) Description.

Grinding shall consist of “milling”, or “cold planning” the existing pavement surface to establish a new surface profile and cross section in preparation for an asphalt overlay. The surface after grinding shall have a grooved or ridged finish, uniform and resistant to raveling or traffic displacement. This textured surface shall have grooves of one-fourth (1/4) inch (+1/8”). The existing surface to be ground shall include asphalt pavement, concrete utility patches and small amounts of concrete pavement.

The grinding machine shall be a power operated, self-propelled machine, having a cutting drum with lacing patterns that will attain a grooved surface and produce grinding chips of less than two (2) inch in size. The grinding machine shall be equipped with a pressurized watering system for dust control. The equipment shall be of the type that has successfully performed similar work.

The Contractor shall use only approved grinders or milling machines for removing existing pavement failures so as not to disturb the existing subbase.

The cleaning equipment shall be of the type to efficiently remove all loosened material and load into trucks for hauling and spreading. Because of the nature of the streets to be ground and the traffic restrictions, a belt loader followed by a power sweeper and manual sweeping is most desirable. Flushing into the City’s storm sewer system as a means of cleanup will not be allowed.

The Contractor shall haul the grindings from the milling operation to the Badger Road and Sycamore Avenue Street Division facilities, or where directed by the Engineer. The grindings shall be stockpiled or tailgate spread as directed. When specified in the contract or directed by the Engineer, the Contractor shall dispose of any undesirable or excess grinding material. The Contractor shall furnish the Engineer a daily load count for the removed material.

Wedge cut grinding shall consist of grinding the existing pavement surface a minimum of four (4) feet wide at the existing concrete gutter. The edge of gutter end of the finished wedge cut shall match the depth of the new asphalt overlay with a minimum one and three-quarters (1-3/4) inches below the edge of existing concrete gutter. The center-line-of-street edge of the wedge cut shall be cut one-eighth (1/8) inch. This item shall also include scoring the existing pavement surface at locations specified by the Engineer. Ramping water valve boxes shall be considered incidental work to wedge cut grinding. ~~Ramping utility castings shall be paid for under with~~ **~~BID ITEM 40308 - RAMPING SAS.~~**

Full width grinding shall consist of grinding the existing pavement surface from edge to edge of gutter a minimum of one and three quarter (1.75) inch or as directed by the Engineer. Ramping water valve boxes shall be considered incidental work to full width grinding. ~~Ramping utility castings shall be paid for under with~~ **~~BID ITEM 40308 - RAMPING SAS.~~**

Base Patch grinding may be specified as the acceptable method to remove existing pavement and base failures as part of the work for base patch grinding. The Contractor shall grind patches to the width and length as marked in the field by the Engineer and recorded on the

standard walk sheets. The minimum width of patches for removal by grinding shall be six (6) feet. There will be no minimum length. Fill shall be an approved asphalt material. Any additional width or depth, unless approved by the Engineer, shall be at the Contractor's expense and restored to the designated width and depth of patch with asphalt lower layer material at no cost to the City.

There will be three (3) approved methods. Method #2 shall consist of 2" Grinding filled with 2" Asphalt Upper Layer material, Method #3 shall consist of 3-1/2" Grinding filled with 3-1/2" Asphalt Upper Layer material, Method #5 shall consist of 5" Grinding with 3-1/4" Asphalt Lower Layer material and 1-3/4" Asphalt Upper Layer material. Patches shall be started and completed in the same day.

Pavement joint grinding shall consist of grinding or saw cutting and removing the existing asphalt overlay to expose the base course joint as directed by the Engineer. The Contractor shall remove and dispose of all loose and deleterious material including broken concrete. The joint exposure shall be a minimum of eighteen (18) inches wide. Small or "mini" grinders are preferred for this work. The Contractor shall thoroughly clean and tack the exposed joint and place and compact the asphalt backfill material to one-half (1/2) inch above the existing asphalt surface. Any width greater than eighteen (18) inches shall be approved by the Engineer.

Grinding around utility castings to the depth of cut before and after encountering the castings shall be included in the area of the pavement surface ground. The Contractor may choose to remove the entire existing asphalt pavement around the castings where grinding is not completed and replace it with an asphalt mixture placed and compacted in three (3) inch lifts. The Contractor shall vertically cut the limits of area to be patched, mechanically compact the existing base course and tack the bottom and vertical edges before backfilling. All costs for the alternate to grinding around castings shall be considered incidental to grinding.

Any butt joint greater than one (1) inch shall be ramped with hot-mix asphalt material as directed by the Engineer. All castings exposed by grinding shall be ramped with hot-mix material before opening to traffic. Small or mini grinders are required for this work.

Ramping SAS shall consist of cleaning the surface area around the casting, tacking the entire surface area to be wedged, ~~and~~ placing hot mix asphalt mixture compacted to a depth within one-quarter (1/4) inch of the top of the adjusted casting and to a minimum radius width of one (1) foot for each one-half (1/2) inch of adjusted vertical height, and removal of ramping or as directed by the Engineer.

403.2(b) Measurement and Payment.

Wedge cut grinding shall be measured by the square yard of pavement surface ground measured from the edge of concrete gutter to a maximum of four (4) feet from the edge of gutter. The depth of cut shall be determined by measuring to the top of the ridges by placing a five (5) foot straight edge perpendicular to the grooving pattern. On wedge cuts, widths of grinding greater than four (4) feet shall be at the Contractor's expense. Widths less than four (4) feet shall be measured by the square yard of actual area of pavement surface ground. The Contractor shall grind all butt joints eight (8) foot wide and to a depth of one (1) inch, or as directed by the Engineer. Any butt joints ground greater than one (1) inch shall be ramped

with approved material as directed by the Engineer. All costs for ramping butt joints shall be considered incidental to grinding.

Full width grinding shall be measured by the square yard of actual pavement ground to a minimum depth of one (1) inch. Any additional depth of existing pavement removed to obtain the depth necessary to allow for the proposed overlay shall be considered incidental to full width grinding. Any butt joints ground greater than one (1) inch shall be ramped with approved material as directed by the Engineer. All costs for ramping butt joints shall be considered incidental to grinding.

The unit prices bid for Full width and wedge cut grinding shall ~~will~~ be paid for at the contract unit price bid for Full width and wedge cut grinding respectively, which price shall be full compensation for grinding the existing pavement surface including around utility castings, disposal of material, for street cleaning and for all equipment, tools, labor and incidentals necessary to complete the work in accordance with this contract. Ramping water valve boxes shall be considered incidental work to wedge cut grinding and full width grinding. ~~Ramping utility castings shall be paid for under with~~ **~~BID ITEM 40308 - RAMPING SAS.~~**

Base patch grinding shall be measured by the square yard for patches ground to the width and length as marked in the field by the Engineer.

The unit price for base patch grinding area, measured as provided above, shall be paid for at the contract unit price per square yard for the specific Method of Base Patch Grinding, which price shall be full compensation for grinding and disposal, backfilling with asphalt material as provided above and for all labor, tools, equipment and incidentals necessary to complete the work.

Pavement joint grinding shall be measured in lineal feet and paid for at the contract unit price bid for pavement joint grinding.

The unit price bid for pavement joint grinding shall include all costs for grinding or saw cutting, removal and disposal of the existing asphalt overlay to expose the base course joint, cleaning and tacking the joint, furnishing and placing backfill material, finishing and protecting, and for all labor, tools, equipment and incidentals necessary to complete the work.

Ramping SAS shall be measured as units of each. ~~and~~

~~paid for at the contract unit price bid.~~ The unit price bid for ramping SAS shall include all costs for cleaning and tacking the surface to be wedged, supplying, placing, ~~and~~ compacting hot mix asphalt mixture and removal as described above including finishing and protecting, and for all labor, tools, equipment and incidentals necessary to complete the work.

403.4 Undercut.

403.4(a) Description.

If base problems are encountered, undercut may be required. ~~Undercut of depths up to 1' shall be measured in square yards. Depths over 1' shall be paid as an additional undercut for each (undercut excavation – 1' in depth).~~ Excess pulverized material may be used for backfilling the undercut areas, placed in 6" lifts and compacted.

Where directed by the Engineer, crusher run (Breaker) shall be used for backfilling undercut areas placed in six (6) inch lifts and compacted. Placement of crusher run shall be paid under **BID ITEM 20219 - BREAKER RUN.**

403.4(b) Method of Measurement.

Undercut shall be measured by ~~area in square yards~~ cubic yards in its original position, computed by the method of average end areas.~~of surface excavated.~~

403.4(c) Basis of Payment.

The ~~square yard area~~ cubic yard volume for undercut, measured as provided above, shall be paid for at the contract unit price per ~~square yard~~ cubic yard, which price shall be full compensation as provided above and in accordance with Article 201 Excavation Cut of the Standard Specifications.

403.12 Adjust Access Structure Casting - Resurfacing.

403.12(a) Description.

Castings having an opening of twenty-four (24) inches or less shall be considered access structure castings. Adjusting castings shall consist of raising the frame to final grade. Castings shall be installed 1/4 inch below the final grade. Castings that are 3/4 inch, or more, below the final grade shall be repaired. The entire opening in the pavement around the access structure frame shall be sawcut where designated by the Engineer. The entire opening in the pavement around the access structure frame shall be backfilled with slurry. No disturbed or excavated material shall be used as backfill. The mix design for the slurry shall be as follows (rates are per cubic yard of slurry mix):

Water	25 gallons
Torpedo Sand	1350 pounds
3/4 Max. Aggregate	2050 pounds
Cement	50 pounds
Fly Ash (Type C)	100 pounds

Type “M” air entrained mortar shall be used for adjustment to the required elevation.

Castings shall be protected from traffic for a minimum of thirty-six (36) hours after pouring. Protection and ramping of casting with hot mix asphalt shall comply with Section 403.1.

Adjusting access structure castings includes removing the existing casting, all existing adjusting blocks and bricking to a sound brick or block base, and installing new adjusting blocks or bricking to the required elevation. New adjusting blocks and bricking shall be solid concrete.

Where designated by the Engineer, the Contractor shall remove existing castings and replace them with new frames and covers furnished by the City of Madison.

Adjustment shall be limited to nine inches. If adjustment greater than nine inches is required, the contractor shall be paid REBUILD ACCESS STRUCTURE TOP – RESURFACING

403.12(b) Method of Measurement.

Adjustment of Access Structure Casting shall be measured as units of each.

403.12(c) Basis of Payment.

The adjustment of access structure castings, measured as provided above, shall be paid for at the contract unit price per each. Which price shall include full compensation for sawcutting, removing the existing access structure casting and frame, removing all existing adjusting blocks and bricking to a sound brick or block base, installing new adjusting blocks or two (2) inch adjusting rings to the required elevation, for excavating, backfilling with slurry, for disposal of removed material, for furnishing all materials except castings and frames supplied by The City of Madison, for hauling new and existing castings, for placing, finishing,

ramping for protection and for all labor, tools, equipment and incidentals required to complete the work.

403.13 Adjust Catchbasin Casting - Resurfacing.

403.13(a) Description.

Castings having an opening with an inside dimension of over twenty-four (24) inches shall be considered catchbasin castings. Adjusting catchbasin castings shall consist of raising the frame to final grade. Castings shall be installed 1/4 inch below the final grade. Castings that are 3/4 inch, or more, below the final grade shall be repaired. The entire opening in the pavement around the access structure frame shall be sawcut where designated by the Engineer. The entire opening in the pavement around the access structure frame shall be backfilled with slurry. No disturbed or excavated material shall be used as backfill. The mix design for the slurry shall be as follows (rates are per cubic yard of slurry mix):

Water	25 gallons
Torpedo Sand	1350 pounds
3/4 Max. Aggregate	2050 pounds
Cement	50 pounds
Fly Ash (Type C)	100 pounds

Type “M” air entrained mortar shall be used for adjustment to the required elevation.

Castings shall be protected from traffic for a minimum of thirty-six (36) hours after pouring. Protection and ramping of casting with hot mix asphalt shall comply with Section 403.1.

Adjusting catchbasin castings includes removing the existing casting, all existing adjusting blocks and bricking to a sound brick or block base, and installing new adjusting blocks or bricking to the required elevation. New adjusting blocks and bricking shall be solid concrete.

Where designated by the Engineer, the Contractor shall remove existing castings and replace them with new frames and covers furnished by the City of Madison.

The finished top elevation of castings in the paved area of streets shall be set with a string line at least forty (40) feet long set over the casting parallel to the street direction at the proposed finished grade of the street.

Adjustment shall be limited to nine inches. If adjustment greater than nine inches is required, the contractor shall be paid REBUILD ACCESS STRUCTURE TOP – RESURFACING

403.13(b) Method of Measurement.

Adjustment of Catchbasin Casting shall be measured as units of each.

403.13(c) Basis of Payment.

The adjustment of catchbasin castings, measured as provided above, shall be paid for at the contract unit price per each. Which price shall include full compensation for sawcutting, removing the existing catchbasin casting and frame, removing all existing adjusting blocks and bricking to a sound brick or block base, installing new adjusting blocks to the required elevation, for excavating, backfilling with slurry, for disposal of removed material, for

furnishing all materials except castings and frames supplied by The City of Madison, for hauling new and existing castings and frames, for placing, finishing, ramping for protection and for all labor, tools, equipment and incidentals required to complete the work.

403.14 Adjust Inlet Casting, Type "H" - Resurfacing.

403.14(a) Description.

This item shall consist of adjusting the inlet castings to a new final grade. Such adjustment shall include sawcutting, removing the existing inlet casting, removing existing adjusting blocks or brick to a sound brick or block or concrete base and installing new bricks or blocks using type "M" air entrained mortar, or concrete if approved by Engineer to the required elevation. New adjusting blocks and bricking shall be solid concrete. ~~Install concrete floor.~~ The concrete curb and gutter removed along with inlet adjustment shall be marked by the Engineer prior to removal and paid for at the unit price bid for concrete curb and gutter. The disturbed area behind the new curb and gutter shall be back filled with acceptable fill material, topsoil, seed and mulched. The disturbed area in front of the curb & gutter shall be backfilled and compacted with crushed stone. Inlet castings removed and replaced to the same grade for the Contractor's convenience or as directed by the Engineer shall be considered as incidental to other items.

Where designated by the Engineer, the Contractor shall remove existing castings and replace them with new frames and covers furnished by the City of Madison.

403.14(b) Method of Measurement.

Adjustment of type "H" inlet castings shall be measured as units of each.

403.14(c) Basis of Payment.

The adjustment of inlet castings, measured as provided above, shall be paid for at the contract unit price per each. Which price shall include full compensation for sawcutting, removing the existing inlet casting, removing the existing adjusting blocks or bricks, ~~installing concrete floor,~~ new bricks or blocks and inlet casting to the required elevations; for excavating; for disposal of removed material; for furnishing all materials except castings and frames supplied by The City of Madison, for hauling new and existing castings and frames; for backfill, topsoil, seed and mulch; for placing, finishing and protecting; and for all labor, tools, equipment and incidentals necessary to complete the work.

403.15 Adjust Inlet Casting, “Tub” Type - Resurfacing.

403.15(a) Description.

This item shall consist of sawcutting and removing the existing tub inlet casting, removing existing adjusting blocks, bricks or loose concrete to a sound concrete base. Install a concrete floor and a new “H” inlet casting to grade using such adjustments as; field pour walls, pre-cast box, or adjustment rings with a maximum of 4”(inches) of adjustment rings. Adjustments shall be made using type “M” air entrained mortar, or concrete if approved by Engineer to the required elevation. The concrete curb and gutter removed along with the inlet adjustment shall be marked by the Engineer prior to removal and paid for at the unit price bid for curb and gutter. The disturbed area behind the new curb and gutter shall be back filled with acceptable fill material, topsoil, seeded and mulched. The disturbed area in front of the curb & gutter shall be backfilled and compacted with crushed stone. Inlet castings removed and replaced to the same grade for the Contractor’s convenience or as directed by the Engineer shall be considered as incidental to other items. Refer to S.D.D. 5.7.11

Where designated by the Engineer, the Contractor shall remove existing castings and replace them with new frames and covers furnished by the City of Madison.

403.15(b) Method of Measurement.

Adjustment of “tub” type inlet castings shall be measured as units of each.

403.15(c) Basis of Payment.

The adjustment of “tub” type inlet castings, measured as provided above, shall be paid for at the contract unit price per each. Which price shall include full compensation for sawcutting, removing the existing inlet casting, removing the existing adjusting blocks or bricks, installing concrete floor, new bricks or blocks and inlet casting to the required elevations; for excavating; for backfilling and compacting; topsoil, seed and mulch; for disposal of removed material; for furnishing all materials except castings and frames supplied by The City of Madison, for hauling new and existing castings and frames; for backfill, topsoil, seed and mulch; for placing, finishing and protecting; and for all labor, tools, equipment and incidentals necessary to complete the work.

Part IV - Pavements

403.16 Adjust Valve Casting, Method #1 - Resurfacing, Adjust Valve Casting, Method #2 - Resurfacing, Install Adjustable Water Box, Method #3 - Resurfacing

403.16(a) Description.

The Contractor shall adjust water or gas valve castings to final grade by the following three methods as directed by the Engineer:

The Contractor shall furnish and install new screw type adjusting valve castings (top section risers with lids and, as needed, middle section extensions) at all existing water valve locations within the project limits ~~locations designated by the Engineer~~. Refer to Articles 702 and 704 for applicable material and construction requirements for valve castings. In the event any existing base section/bonnet castings are determined to be damaged or in need of replacement, Madison Water Utility will furnish the casting for that section only.

If required, ramping valve castings with HMA shall be incidental to this bid item.

Adjust Valve Casting, Method #1

Valve casting adjustment shall consist of loosening the existing casting. The casting shall be set to proper grade by turning the top casting. If asphalt material is removed it shall be a minimum of 1’ on either side of the casting and replaced with approved asphalt material compacted in place.

If the existing casting has been set in concrete the Contractor shall be paid one additional unit price bid for Adjust Valve Casting, Method #1. This work shall consist of removing the existing concrete to a sound base and back filling and compacting 1-1/2” crushed stone, level with the bottom of the existing asphalt, then ramping with compacted asphalt material.

When the Engineer directs the Contractor to replace or add a casting extension and the depth of excavation necessary to do this work exceeds 24” inches, the Contractor shall be paid one additional unit price bid for Adjust Valve Casting, Method # 1. The area that is excavated shall be back filled and compacted with 1-1/2” crushed stone. This does not apply to replacing a casting top or lid. Any disturbed or excavated material shall not be used as back fill.

Adjust Valve Casting, Method #2

Adjusting monument castings and valve castings, when directed by the Engineer shall consist of raising the castings to final grade. The entire opening around the monument casting or valve casting shall be back filled with a slurry mix and shall be protected from traffic for a minimum of thirty-six (36) hours after pouring. The casting shall be ramped with asphalt material. Any disturbed or excavated material shall not be used as back fill.

The mix design for the slurry shall be as follows (rates are per cubic yard of slurry mix):

Water	25 gallons
Torpedo Sand	1350 pounds
3/4 Max. Aggregate	2050 pounds

Cement	50 pounds
Fly Ash (Type C)	100 pounds

Type “M” air entrained mortar shall be used for adjustment to the required elevation.

Install Adjustable Valve Water Box, Method #3

The contractor shall furnish and install screw type, height adjustable, cast iron valve box risers.

Refer to Articles 702 and 704 for applicable material and construction requirements for valve castings. ~~Contractor furnished adjustable valve box riser shall be model number VB2667, VB2668, VB2669, or VB-2670 as manufactured by Sigma Corporation or approved equal. Casting shall be produced from gray cast iron to ASTM Class 25 standards.~~

Installation shall consist of removing valve box cover, removing debris from threaded valve box top casting, threading adjustable valve box riser into top casting and setting to specified grade, replacing valve box cover.

403.16(b) Method of Measurement.

Adjustment of valve castings shall be measured as units of each as completed according to Method #1, Method #2 or Install Adjustable Valve Water Box as directed by the Engineer.

403.16(c) Basis of Payment.

The adjustment of valve castings, measured as provided above, shall be paid for at the contract unit price per each. Which price shall include full compensation for loosening casting, removing asphalt or concrete material, setting casting to grade, backfilling and compacting with crushed stone, adding an extension, backfilling with a slurry mix, ramping casting with asphalt material and protection of casting as described in Method #1, Method #2 or Install Adjustable Valve Water Box for furnishing all labor, tools, material, equipment and incidentals necessary to complete the work.

403.19 Rebuild Inlet - Resurfacing.

403.19(a) Description.

This item shall include sawcutting and removal of the old inlet, “tub” type or type “H”, and constructing a new “H” inlet when required. Locations for this item shall be marked by the Engineer prior to removal. It is anticipated that all of these inlets will require pouring the inlet box and floor in place according to the standard detail drawing 5.7.7 ~~5.7.11.~~ Reconnection of leads shall be considered incidental to “Rebuild Inlet” and shall include repair of leads damaged from inlet removal. Rebuilds using pre-cast will be made at the discretion of the Engineer. Casting shall be placed to final grade using type “M” below grade mortar mix and air-entrained additives shall be considered incidental to this item. Any “HH” inlet rebuild shall be paid as one additional unit price bid for Rebuild Inlet.

The concrete curb and gutter removed along with inlet rebuild shall be marked by the Engineer prior to removal, and paid for at the unit price bid for concrete curb and gutter. The disturbed area behind the new curb and gutter, including inlet, shall be back filled with acceptable fill material, topsoil, seed and mulched. Disturbed area in front of the curb & gutter shall be backfilled and compacted with crushed stone

Any inlets abandoned shall be paid as Rebuild Inlet - Resurfacing and include removal of inlet, removal of any necessary pipe, sealing the resulting hole or opening, and back filling and compacting excavated area.

403.19(b) Method of Measurement.

Rebuild Inlet shall be measured as units of each.

403.19(c) Basis of Payment.

Rebuild inlet measured as provided above shall be paid for at the contract price per each, which price shall be full compensation for sawcutting, removal of old casting; installing pre-cast or poured in place inlet box and floor; reconnecting leads; repair of damaged leads; adjustment of existing or City furnished casting; pipe removal; pipe plug; disposal of material; backfill and compaction; topsoil; seed; mulch; furnishing all materials; placing; finishing; protecting and for all labor, tools, equipment and incidentals required to complete the work.

ARTICLE 501 – GENERAL

501.3 Inspection and Testing.

501.3(d) Storm Sewer Main.

The following section applies to corrugated polyethylene with smooth inner liner and corrugated polyvinyl chloride storm pipe as described in Section 504.2 - Materials of these Specifications.

At the request of the Engineer, pipe 8-inches and larger shall be tested for acceptance with an approved go/no-go mandrel after the pipe has been installed and the backfill compacted, and other underground utilities within close proximity have been installed and backfilled but before paving is constructed. For acceptance, the mandrel must pass through the entire section between sewer access structures or other structures in one pass when pulled by hand without the use of excessive force.

The City shall supply a testing mandrel in conformance with the specifications of Standard Detail Drawing 5.1.1, Mandrel Detail, and the specifications of this subsection. The Contractor shall furnish the equipment and labor for making this acceptance test. The mandrel shall be of a shape similar to that of a true circle enabling the gauge to pass through a satisfactory pipeline with little or no resistance. The mandrel shall be of a design to prevent it from tipping from side to side and to prevent debris build-up from occurring between the channels of the adjacent fins or legs during operation. Each end of the core of the mandrel shall have fasteners to which the pulling cables can be attached. The mandrel shall have nine various sized fins or legs of appropriate dimensions for various diameter pipes. Each fin or leg shall have a permanent marking that states its designated pipe size and percent deflection allowable.

For PVC storm pipe the diameter of the mandrel shall be equal to ninety ~~five~~ two point five (92.5~~5~~) percent of the base inside diameter of the pipe. The Contractor shall furnish the engineer a table showing the base inside diameter and the five (5) percent deflection mandrel dimension for each pipe diameter called for in the plans. The base inside diameter shall be the minimum pipe inside diameter derived by subtracting the statistical tolerance package (defined below) from the pipe's average inside diameter.
~~For corrugated PVC pipe: Average inside diameter = average inside diameter.~~

~~Tolerance package = $(A2 + B2 + C2)^{1/2}$~~

~~Where: A = outside diameter tolerance (ASTM 949) for corrugated PVC pipe.~~

~~B = excess wall thickness tolerance = 0 for corrugated PVC pipe.~~

~~C = out-of-roundness tolerance (ASTM 949) for corrugated PVC pipe.~~

For ~~HDPE~~ non RCP storm sewer pipe, the following size, 9 point ~~mandrells~~mandrels shall be used by the Contractor for testing:

Nominal Size	Mandrel Size
6 inch Diameter	5.52 inches
8 inch Diameter	7.36 inches
10 inch Diameter	9.21 inches
12 inch Diameter	11.04 inches
15 inch Diameter	13.80 inches
18 inch Diameter	16.57 inches
24 inch Diameter	22.08 inches

These ~~mandrells~~mandrels shall be provided by the ~~City~~Contractor.

Any section of completed pipe failing to pass this deflection test shall be repaired or replaced and retested at the Contractor's expense. If base course, pavement, concrete, landscaping, seeding, matting, curb gutter, sidewalk, or driveways have been placed over the pipe, removal and replacement of those items shall also be done at the contractor's expense.

501.6(c) Sanitary Sewer Access Structures.

Reconstruct Bench and Flowline(s) shall include the reconstruction of an existing sanitary sewer access structure bench and flowline(s) to accommodate changes in pipe sizes, alignments and/or grades of the incoming and outgoing pipes when it is determined by the Engineer that the existing structure shall remain in place. All work on the ~~bench or~~ flowline within six (6) inches of the inside wall shall be included to connecting the pipe to the SAS. Work shall be done such that the structure and structure floor remain structurally sound after the reconstruction. If it is determined either during a tap or a reconstruction of the bench and flowline(s) that the structure does not have a solid, structurally sound floor, the work shall include the placement of a new structure floor payable under Rebuild Bench & Flowlines. Rebuilding Bench & Flowlines shall include excavating one foot minimum below the invert of the outgoing pipe, placement of a six (6) inch minimum compacted granular material base, and placement of a new poured concrete floor. All work shall be measured and paid for as each completed unit. Finished flowlines shall have a smooth troweled finish. Brushed flowlines will not be accepted.

ARTICLE 502 – TRENCH EXCAVATION, BEDDING, AND BACKFILL

502.1 Description.

502.1(d) Bedding of Sewer Pipes.

The bedding, or foundation, for sewer pipes shall be constructed to prevent settlement of the pipes and to avert excessive pressure on the pipes in order to avoid rupture, leakage or deformation of the pipes. Unless otherwise specified in the Special Provisions of the contract, all sanitary and storm sewer pipes, including sanitary sewer laterals and storm sewer leads, shall be constructed with the type of bedding that is specified for the type of pipe installed, as shown on the Standard Detail Drawings 5.2.1 and 5.2.1a, Storm and Sanitary Sewer Beddings.

The width of the bedding shall be equal to the width of the trench. The depth of the bedding shall extend from an elevation at least six (6) inches below the bottom of the pipe to an elevation at least twelve (12) inches above the top of the pipe. All bedding shall be mechanically compacted, including crushed stone and washed gravel.

Sand or limestone screenings used for bedding shall conform to the following gradation:

Passing 3/4” sieve	100%
Passing #200 sieve	0-10%

Washed gravel and crushed stone used for bedding shall conform to the following gradation:

Passing 1” sieve	100%
Passing 1/2” sieve	35-60%
Passing #200 sieve	0-10%

Backfill material shall consist of angular crushed rock meeting the following criteria:

100% passing 1-1/2” sieve
</= 15% passing #4 sieve
</= 25% passing 3/8” sieve
</= 12% passing #200 sieve

Washed gravel or crushed stone shall be used for all pipe sizes over ten (10) inches in diameter, and for smaller sizes when directed by the Engineer. With the approval of the Engineer, the maximum size of the washed gravel or crushed stone may be increased, and screened crushed stone may be substituted for washed gravel.

502.1(e) Backfilling Excavations and Compaction of Backfill.

Unless otherwise provided, all trenches and excavations shall be backfilled immediately after the sewers and appurtenances have been constructed therein. In covering the sewers and filling around structures, the backfill material shall be brought up evenly on all sides so that no unbalanced pressure is brought to bear upon the pipe and masonry.

The Contractor shall be required to backfill all excavations to the original ground elevation unless otherwise specified in the contract or ordered by the Engineer. In the event of a shortage of material to perform this work, including replacement as may be required by rock excavation or removal of boulders, the Contractor shall provide the necessary material at no additional cost to the City.

Walking or working on the completed pipe sewers, except as may be necessary in compacting and backfilling, shall be prohibited until the trench has been backfilled to an elevation at least two (2) feet above the top of the pipe. No trucks, vehicles, or other equipment shall be allowed within the limits of the trench prior to the completion of the backfilling operations, unless authorized by the Engineer for compaction or other purposes.

Backfill material hauled to the project shall be dumped along the top of the trench beyond the reach of slides and placed in the trench with the proper backfilling equipment. Backfill material may be dumped directly into the trench from trucks when the amount of material to be dumped is controlled by partially opening the tailgates, and only when authorized by the Engineer.

Trenches shall be hand backfilled to an elevation at least one (1) foot above the top of the pipe. The material for this portion of the backfill shall not contain stones, or hard or frozen lumps of earth. For plastic, Type II, Type III, and Type IV sewer pipes, this material shall be the same classification as the bedding. The equivalent of hand backfill may be accomplished by lowering a clam bucket or material to a point immediately above and approximately one (1) foot from the sewer and slowly releasing the fill; for reinforced concrete pipe ~~or corrugated metal pipe~~, the material may be deposited on a slope, equal to the angle of repose of the material, and allowed to flow progressively forward in such a manner as to avoid impact on the pipe and to avoid uneven pressures on either side of the pipe which may disturb its grade or alignment. Backfill material shall not be taken from trench walls below an elevation of two (2) feet above the top of the pipe. The remainder of the trench shall then be filled carefully in a manner satisfactory to the Engineer. The compaction sections are detailed in Standard Detail Drawing 5.2.2, Typical Trench Compaction & Standard Detail Drawing 5.2.3, Typical Trench Compaction (Greenway/Park).

All ~~corrugated metal culverts~~Type II, Type III, and Type IV storm sewer shall be hand backfilled and mechanically tamped to an elevation at least one (1) foot above the top of the culvert in accordance with S.D.D. 5.2.1 and 5.2.1a. Extreme care shall be taken so as to assure complete filling and compaction under the culvert and between the culvert and the walls of the trench. If trucks or other heavy equipment used on the project are to travel over the newly installed culvert, then the Contractor shall place a minimum cover

of twelve (12) inches of fill over the culvert to protect it during this period. This protective layer of fill shall be thoroughly mechanically compacted.

In the event that excavations have been sheathed or braced, the Contractor shall carefully draw and remove the sheathing and bracing in a manner which will not disturb the completed work. All openings left in removing sheathing and bracing shall be carefully filled with approved backfill material and properly compacted.

The backfilling of structures shall conform to the requirements specified in Section 301.8 - Protection of the Concrete of these Specifications.

The backfilling of tunnels and shafts for tunneling and jacking operations shall be in accordance with the requirements specified in the contract. Where not specified in the contract, such backfilling shall be as directed by the Engineer.
Where the grade of the sewer is such that, in the opinion of the Engineer, the top surface of the sewer shall require protection, an embankment of earth or other material, satisfactory to the Engineer, shall be constructed over the sewer by the Contractor. The height of the embankment shall be one (1) foot above the top of the pipe unless otherwise specified or directed by the Engineer. The width at the top of the embankment shall be not less than two (2) feet wider than the external width of the sewer. The sides of the embankment shall slope from the top of the embankment to the existing ground surface in a ratio of not less than two (2) feet horizontally to one (1) foot vertically. The material used to construct the embankment shall be such surplus material excavated from trenches as shall be approved by the Engineer. Such selected material shall be furnished and placed in the embankment by the Contractor at no extra cost to the City. Should more material be needed to complete the embankment than can be obtained from surplus material excavated, such material shall be furnished by the Contractor, and will be paid for as provided herein. The material shall be compacted as provided in Subsection 202.3(b) – Standard Compaction of these Specifications.

All material used for backfilling trenches and other excavations shall be subject to the approval of the Engineer. Unless otherwise specified or directed by the Engineer, the Contractor shall backfill trenches and other excavations with materials excavated in the course of the work. Whenever specified in the contract or directed by the Engineer, trenches and other excavations shall be backfilled with Select Fill. Vegetation and stones or fragments of broken rock in excess of six (6) inches in any dimension shall not be included in the backfill. In the event the Engineer rejects the excavated materials for backfilling due to the character of the material, including excess moisture content, gradation, composition, frozen material, or for whatever cause, the Contractor shall backfill the trenches and other excavations in the specified manner with Select Fill. In the event of lack of moisture in the backfill materials, the Contractor shall add water in quantities deemed necessary to secure the required compaction. In the event the excavated materials contain excess moisture, the Contractor shall, as directed by the Engineer:

1. Suspend all work on the project for that period of time as may be necessary to allow the backfill materials to dry sufficiently prior to backfilling and compacting the backfill material, during which time work days shall not be charged against the Contractor, or

2. Replace the excavated materials, in whole or in part, with Select Fill.

Where the moisture content of the excavated materials is such that drying or adding water is necessary prior to backfilling and compaction, the Contractor may furnish acceptable materials for the backfill and dispose of the excavated materials, all at no additional cost to the City.

Select Fill for backfilling trenches and other excavations shall be material as defined in Subsection 202.2(b) – Select Fill of these Specifications and shall be measured and paid as defined in Subsection 502.2(g) – Select Backfill for Sewer of these Specifications. Excess excavated material resulting from the above work may be used in backfilling other trench areas, unless the material is declared unsuitable for backfill by the Engineer, in which case the material shall be considered surplus material and shall be disposed of by the Contractor at no additional cost to the City.

Unless otherwise specified or directed by the Engineer, the backfill in all trenches and excavations shall be mechanically compacted in such a manner as to thoroughly consolidate the backfill material and not injure or disturb the pipe or other structure. The compaction of the backfill material shall be in accordance with the following requirements:

1. The material for the backfill shall be deposited, spread and leveled, as herein before provided, in layers generally not exceeding twelve (12) inches in thickness before compaction, except that when the material being compacted is of a granular nature and the compacting equipment is adaptable for the purpose, the thickness of the layer may be increased to a maximum of twenty-four (24) inches provided the required density is obtained. Each layer of the spread and leveled material shall be compacted, by means of suitable compaction equipment, to not less than the specified density before the succeeding layer is placed.

2. All Pipe Trenches shall be compacted in conformance of Standard Detail Drawings 5.2.2 Typical Trench Compaction and 5.2.3 Typical Trench Compaction (Greenway Park). Compaction of the backfill material shall not begin until the depth of the backfill material is two (2) feet above the top of the pipe. In the case of structures, compaction of the backfill material shall begin with the placing of the first layer of backfill material. Backfills of three (3) feet or less in depth below the proposed or existing subgrade shall be compacted to at least ninety-five (95) percent of maximum density for their full depth.

   In city right of ways or as called for by the construction engineer, backfills over three (3) feet in depth below the proposed or existing subgrade shall have the top

three (3) feet below the proposed or existing subgrade compacted to not less than ninety-five (95) percent of maximum density, and those portions more than three (3) feet below the proposed or existing subgrade shall be compacted to at least ninety (90) percent of maximum density.

In greenways and parks, in accordance to Standard Detail Drawing 5.2.3, backfills over three (3) feet in depth below the proposed or existing subgrade shall be compacted to at least ninety (90) percent of maximum density. If the proposed pipe is located horizontally within 15' of an existing or proposed asphalt or concrete surface, then the pipe compaction shall be completed in conformance of Standard Detail Drawing 5.2.2.

3. The maximum density shall be determined in accordance with the Standard Method of Test for the Moisture-Density Relations of Soils, ASTM Designation: D 1557, Method D, with replacement of the fraction of material retained on 3/4-inch sieve with No. 4 to 3/4-inch material. The density of compacted backfill material shall be determined in accordance with the Test for Density of Soil-in-Place by the Sand-Cone Method, ASTM Designation: D 1556, the Test for Density of Soil and Soil-Aggregate in Place by Nuclear Methods, ASTM Designation: D 2922, or by other approved methods.

4. In the event the material in the density sample differs in percentage of aggregate retained on a No. 4 sieve from that in the sample upon which maximum density was determined, the maximum density shall be adjusted in accordance with approved procedure.

5. The foregoing density requirements will not apply to portions of backfills constructed of materials which, because of numerous large stones or high percentages of material retained on the No. 4 sieve, cannot in the determination of the Engineer be accurately tested in accordance with the above procedures for determining maximum or in place dry density.

Whenever the work of installing sewers takes place during cold weather, the specifications for trench compaction above shall be followed if practicable. If the specified compaction cannot be achieved, and the Engineer directs that the work may not be suspended until more favorable weather conditions exist, then the following procedures shall be followed:

1. All frozen material in the trench shall be removed before beginning the day's work. As a method to achieve this, trenches shall be closed overnight.

2. Materials shall be unfrozen when being compacted.

3. The material shall be compacted in six (6) inch lifts in a manner normally done during warm weather construction and to a minimum density of ninety (90) percent compaction below the three (3) foot depth.

4. If the top three (3) feet of material does not meet ninety-five (95) percent compaction, then pit run sand (hauled in if necessary) shall be compacted in the normal manner using six (6) inch lifts.

5. The Engineer will have tests performed as necessary to provide uniformity of compaction.

6. As a guideline, construction should cease when the temperatures are too cold to achieve the above. At least 15°F and rising is a reasonable temperature if it is not extremely windy.

ARTICLE 504 - STORM SEWER PIPES, APRON ENDWALLS AND OTHER STORM WATER CHANNELS

504.2 Materials.

There shall be four types of storm sewer pipe. The type and location of each pipe type to be used shall be called for by the engineer on the plan set. The pipe types shall be as follows:

Type I: Reinforced Concrete Pipe

When a material type is specified or called out as a "Type I" or "RCP" on plans and specifications, the pipe supplied shall be of a type of pipe as follows:

Reinforced concrete pipe, fittings, and accessories, labeled as "RCP" on the plans, shall conform to the requirements of the Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe, ASTM C 76. Reinforced concrete elliptical pipe, fittings and accessories, labeled as "HERCP" on the plans, shall conform to the requirements of the Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe, ASTM C 507. Unless otherwise specified, reinforced concrete culvert and storm drain shall be Class III (ASTM C 76) and reinforced concrete elliptical culvert and storm drain shall be Class HE-III (ASTM C 507).

Joints for storm sewer pipe shall be designed for the use of rubber gaskets, flexible plastic gaskets, cold plastic sewer joint compound, external sealing bands, or a combination of the above. Unless otherwise specified, circular reinforced concrete pipe shall be installed with rubber gasket joints, flexible plastic gaskets, cold plastic sewer joint compound, external sealing bands, or a combination of the above, at the Contractor's option.

Rubber gaskets shall conform to the requirements of the Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets, ASTM C 443. Flexible plastic gaskets shall conform to the requirements of the Specification for Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets, Type B Flexible Plastic Gaskets, AASHTO M 198. Cold plastic sewer joint compound shall be SealTight Cold Plastic Sewer Joint Compound as manufactured by W.R. Meadows, Inc., or approved equal. External sealing bands shall be Mac Wrap External Joint Collars as manufactured by Mar-Mac Manufacturing Company, Inc., or approved equal.

Where sections of Type I storm sewer are joined to apron endwalls external sealing bands shall be used on the endwall joint and the two joints closest to the endwall. Bands shall be Mac Wrap External Joint Collars as manufactured by Mar-Mac Manufacturing Company, Inc., or approved equal. Joint collar shall be installed per manufacturer's recommendations.

Type II: Pavement Storm

Type I storm sewer shall be allowable for use as Type II storm sewer but no additional payment shall be made by the City for Type I usage.

~~Per ASTM D2321-14 Type II storm sewer may only be used in conditions that allow for a minimum cover of twenty four (24) inches. If depth of storm sewer is revised to a depth where minimum cover is not met the City may change pipe type to Type I storm sewer at no additional cost to the City.~~

Backfill material shall consist of angular crushed rock meeting the following criteria:

100% passing 1-1/2" sieve
</= 15% passing #4 sieve
</= 25% passing 3/8" sieve
</= 12% passing #200 sieve

When a material type is specified or called out as "Type II" or "Storm Sewer Pipe" on plans and specifications, the pipe supplied shall be of a type of pipe as follows

Materials

Type II Storm Sewer shall be Polypropylene compound for pipe and fitting. Production shall be impact modified copolymer meeting the material requirements of ASTM F2736, Section 4, ASTM F2881, Section 5 and AASHTO M330, Section 6.1, for the respective diameters. Pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2736 and AASHTO M330.

The polypropylene compound shall be an impact modified copolymer and shall conform to the specifications in this subsection. Pipe shall meet all the requirements of ASTM F2736 Standard Specifications for Polypropylene (PP) Corrugated Pipe. The pipe shall consist of a smooth interior with a corrugated exterior and have a minimum pipe stiffness of 46 psi. Pipe Joints shall be water-tight per ASTM F2736. Water tight joints shall meet a 10.8 laboratory test per ASTM D 3212 and utilize a bell and spigot design with a gasket meeting ASTM F477. Fittings supplied by the manufacturers other than the supplier of the pipe shall not be permitted without the approval of the Engineer.

Installation

Construction methods shall conform to section 504.3 of City of Madison Standard Specifications and in accordance with Standard Detail Drawing 5.2.1A. All bedding shall be installed per Standard Detail Drawing 5.2.1. Additionally all Type II storm sewer shall be installed with adherence to all methods and recommendations in ASTM D2321-14.

All bedding and backfill shall conform to 502.1(d) Bedding of Sewer Pipes.

For the calendar year of 2016 it is the intention of City Engineering to mandrel test all Type II storm sewer pipe.

At the request of the Engineer, pipe 12-inches and larger shall be tested for acceptance with an approved go/no-go mandrel not less than thirty (30) days after the pipe has been installed, the backfill compacted, and other underground utilities within close proximity (such as water main) have been installed and backfilled but before paving is constructed. For acceptance, the mandrel must pass through the entire section between sewer access structures in one pass when pulled by hand without the use of excessive force.

The Contractor shall supply a testing mandrel in conformance with the specifications of Standard Detail Drawing 5.1.1, Mandrel Detail, and the specifications of this section. The Contractor shall furnish the equipment and labor for making this acceptance test. The mandrel shall be of a shape similar to that of a true circle enabling the gauge to pass through a satisfactory pipeline with little or no resistance. The mandrel shall be of a design to prevent it from tipping from side to side and to prevent debris build-up from occurring between the channels of the adjacent fins or legs during operation. Each end of the core of the mandrel shall have fasteners to which the pulling cables can be attached. The mandrel shall have nine various sized fins or legs of appropriate dimensions for various diameter pipes. Each fin or leg shall have a permanent marking that states its designated pipe size and percent deflection allowable. The diameter of the mandrel shall be equal to ninety-two point five (92.5) percent of the base inside diameter of the pipe. The Contractor shall furnish the engineer a table showing the base inside diameter and the seven point five (7.5) percent deflection mandrel dimension for each pipe diameter called for in the plans. The base inside diameter shall be the minimum pipe inside diameter derived by subtracting the statistical tolerance package (defined below) from the pipe's average inside diameter.

For Type II, the following size, 9 point mandrels shall be used by the Contractor for testing:

Nominal Size	Mandrel Size
12 inch Diameter	11.04 inches
15 inch Diameter	13.80 inches
18 inch Diameter	16.57 inches
24 inch Diameter	22.08 inches

Any section of completed pipe failing to pass this deflection test shall be replaced and retested at the Contractor's expense. If base course, pavement, concrete, landscaping, seeding, matting, curb gutter, sidewalk, or driveways have been placed over the pipe, removal and replacement of those items shall also be done at the contractor's expense.

Where a new plastic pipe is being tapped into a new or existing concrete pipe or concrete structure the contractor shall field core the structure or pipe and provide a Core-n-T, Core-n-Seal boot, or approved equal to connect the new pipe to the new or existing pipe or structure as detailed in Standard Detail Drawing 5.7.31, Flexible Pipe to SAS Connector. Where the connection is being made to an existing plastic pipe, a preformed fitting, from the manufacture of the existing plastic pipe, shall be utilized. The work under this item shall include all necessary work to provide the field core and all necessary fittings.

Joint Performance.

Pipe shall be joined with a gasketed integral bell & spigot joint meeting the requirements of ASTM F2736 or F2881, for the respective diameters.

Joints and pipe shall be watertight according to the requirements of ASTM D3212. Spigots shall have gaskets meeting the requirements of ASTM F477. Gasket shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.

Joints shall have a reinforced bell with a polymer composite band installed by the manufacturer.

Where Type II storm sewer is joined to Type I storm sewer External sealing bands shall be used. Bands shall be Mac Wrap External Joint Collars as manufactured by Mar-Mac Manufacturing Company, Inc., or approved equal. Joint collar shall be installed per manufacturer's recommendations.

Where sections of Type II storm sewer are joined to apron endwalls External sealing bands shall be used on the endwall joint. Bands shall be Mac Wrap External Joint Collars as manufactured by Mar-Mac Manufacturing Company, Inc., or approved equal. Joint collar shall be installed per manufacturer's recommendations.

Fittings.

Fittings shall conform to ASTM F2736, ASTM F2881 and AASHTO M330, for the respective diameters. Bell & spigot connections shall utilize a spun-on, welded or integral bell and spigot with gaskets meeting ASTM F477. Bell & spigot fittings joint shall meet the watertight joint performance requirements of ASTM D3212. Corrugated couplings shall be split collar, engaging at least 2 full corrugations.

Type III: Storm Sewer Pipe

When a material type is not specified and a pipe is called out as "Type III" or~~a~~ "Storm Sewer Pipe" on plans and specifications, the pipe supplied shall be of a type of pipe as follows excluding metal storm pipes.

All pipe and fittings not covered by this specification shall be approved by the Engineer seven (7) days prior to the bid letting.

At the request of the Engineer, pipe 12-inches and larger shall be tested for acceptance with an approved go/no-go mandrel not less than thirty (30) days after the pipe has been installed, the backfill compacted, and other underground utilities within close proximity (such as water main) have been installed and backfilled but before paving is constructed. For acceptance, the mandrel must pass through the entire section between sewer access structures in one pass when pulled by hand without the use of excessive force.

The Contractor shall supply a testing mandrel in conformance with the specifications of Standard Detail Drawing 5.1.1, Mandrel Detail, and the specifications of this section. The Contractor shall furnish the equipment and labor for making this acceptance test. The mandrel shall be of a shape similar to that of a true circle enabling the gauge to pass through a satisfactory pipeline with little or no resistance. The mandrel shall be of a design to prevent it from tipping from side to side and to prevent debris build-up from occurring between the channels of the adjacent fins or legs during operation. Each end of the core of the mandrel shall have fasteners to which the pulling cables can be attached. The mandrel shall have nine various sized fins or legs of appropriate dimensions for various diameter pipes. Each fin or leg shall have a permanent marking that states its designated pipe size and percent deflection allowable. The diameter of the mandrel shall be equal to ninety-two point five (92.5) percent of the base inside diameter of the pipe. The Contractor shall furnish the engineer a table showing the base inside diameter and the five (5) percent deflection mandrel dimension for each pipe diameter called for in the plans. The base inside diameter shall be the minimum pipe inside diameter derived by subtracting the statistical tolerance package (defined below) from the pipe's average inside diameter.

For non RCP Type III storm sewer pipe, the following size, 9 point mandrels shall be used by the Contractor for testing:

Nominal Size	Mandrel Size
12 inch Diameter	11.04 inches
15 inch Diameter	13.80 inches
18 inch Diameter	16.57 inches
24 inch Diameter	22.08 inches

Any section of completed pipe failing to pass this deflection test shall be replaced and retested at the Contractor's expense. If base course, pavement, concrete, landscaping, seeding, matting, curb gutter, sidewalk, or driveways have been placed over the pipe, removal and replacement of those items shall also be done at the contractor's expense.

504.2(k) Metal Apron Endwalls for Corrugated Metal Pipe and Pipe-Arches.

Metal apron endwalls for corrugated metal pipe and pipe-arches shall be manufactured in accordance with the pertinent requirements specified in Subsection 504.2(pe) - Corrugated Metal Pipe of these Specifications. Apron endwalls shall be in accordance with the designs, dimensions, and details shown on the Standard Detail Drawing 5.4.1, Apron Endwalls for Pipes and Pipe Arches.

504.2(l) Joint Ties.

Joint ties shall be installed on any pipe run having an installation slope ~~beginning or ending in an apron endwall~~greater than 20% grade that is constructed with ~~reinforced concrete pipe or horizontal elliptical reinforced concrete pipe of any size~~ type I or type II pipe. Ties shall be installed at the endwall joint and sufficient joints so that a minimum of 25' of pipe length is tied regardless of pipe type. ~~at the last two (2) joints in accordance with designs, dimensions, and details shown on Standard Detail Drawing 5.4.6.~~

Joint ties shall consist of external sealing bands. Bands shall be Mac Wrap External Joint Collars as manufactured by Mar-Mac Manufacturing Company, Inc., or approved equal. Joint collar shall be installed per manufacturer's recommendations.

504.2(m) Storm Sewer Electronic Markers.

Storm Sewer Electronic Marker Balls shall be provided where non-metallic storm sewer pipe is installed in the public Right of Way, and where no access or inlet structures are available on the surface to allow the pipe to be visually located. Storm Sewer Electronic Markers shall meet the specifications of Article 503 for sanitary sewer.

504.2(n) Precast Reinforced Concrete Box Culvert.

~~All precast storm sewer boxes shall be constructed in accord with ASTM C-850.~~

Type IV: Driveway Culvert Storm

When a material type is not specified and a pipe is called out as a "Type IV" or "Driveway Culvert Storm" on plans and specifications, the pipe supplied shall be of a type of pipe as follows.

504.2(o) Steel Spiral Rib Pipe.

Steel spiral rib pipe supplied shall conform to AASHTO M36 and M274. Unless otherwise specified on the plan or in the special provisions, the pipe thickness shall be 16-gauge.
The pipe shall have rerolled annular ends. The joint band shall have a continuous corrugation that matches the rerolled annular pipe end, and O-ring gaskets shall be provided at all joints. Joints shall meet soil tightness requirements of AASHTO 26.4.2.4(e).

504.2(p) Corrugated Metal Pipe.

The pipe, fittings and accessories shall be of corrugated metal and shall conform to the requirements of the Specification for Corrugated Metal Culvert Pipe, AASHTO M 36. Where corrugated metal pipe is installed on railroad property which is occupied by tracks, or which may be occupied by tracks at any time in the future, it shall conform to AREA "Specifications for Corrugated Metal Culverts". Where asphaltic coating or paving is specified, the materials shall conform to the requirements of the Specification for Asphalt Coated Corrugated Metal Culvert Pipe and Pipe-Arches, AASHTO M 190.

504.2(q) Type I, II, or III storm sewer pipe.

504.3 Construction Methods.

504.3(c) Joints

~~The joint ties shall be installed in accordance with the Standard Detail Drawing 5.4.6, Concrete Pipe Joint Ties.~~

For Type II and Type II Storm Sewer Pipe, pipe shall be joined with a gasketed integral bell & spigot joint meeting the requirements of ASTM F2736 or F2881, for the respective diameters.

Where Type II storm sewer is joined to Type I storm sewer External sealing bands shall be used. Bands shall be Mac Wrap External Joint Collars as manufactured by Mar-Mac Manufacturing Company, Inc., or approved equal. Joint collar shall be installed per manufacturer's recommendations.

Where sections of Type II and Type III storm sewer are joined to apron endwalls External sealing bands shall be used on the endwall joint. Bands shall be Mac Wrap External Joint Collars as manufactured by Mar-Mac Manufacturing Company, Inc., or approved equal. Joint collar shall be installed per manufacturer's recommendations.

Joints and pipe shall be watertight according to the requirements of ASTM D3212. Spigots shall have gaskets meeting the requirements of ASTM F477. Gasket shall be

installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.

Joints shall have a reinforced bell with a polymer composite band installed by the manufacturer.

Fittings shall conform to ASTM F2736, ASTM F2881 and AASHTO M330, for the respective diameters. Bell & spigot connections shall utilize a spun-on, welded or integral bell and spigot with gaskets meeting ASTM F477. Bell & spigot fittings joint shall meet the watertight joint performance requirements of ASTM D3212. Corrugated couplings shall be split collar, engaging at least 2 full corrugations.

The following outlines specifications for new pipe to new pipe and new pipe to existing pipe connections.

1. New Pipe to New Pipe.

Jointing materials shall conform to the requirements specified in Section 504.2 – Materials of these Specifications, for the type of pipe being installed.

Joints shall not be made until the pipe is in the trench and set to true line and grade. Lengths of pipe which are joined together outside of the trench shall be removed from the project immediately.

Prior to making joints, the jointing surfaces shall be inspected for chips, cracks, or other defects in the joints and jointing materials. The jointing surfaces shall be carefully cleaned and lubricated with a vegetable lubricant or a lubricating adhesive. Lubricant shall be applied to both the bell and spigot surfaces of the joint. The lubricant shall be that recommended by the gasket manufacturer for the particular type of gasket being installed.

Care shall be taken when shoving or pulling the pipes together in order not to damage the pipe or the joints and jointing materials. The pipes shall be in proper alignment and to the proper grade prior to applying the pressure necessary to make the joint.

Rubber gaskets for reinforced concrete storm sewer pipe shall be assembled as follows:

- When air temperature is below 32°F, gaskets shall be applied one and one-half (1-1/2) hours before installation of the pipe.

- When air temperature is above 32°F, gaskets shall be applied fifteen (15) minutes before installation of the pipe.

The temperature referred to pertains to the prevailing air temperature at the point of application of the gaskets. This shall be taken to mean the air temperature, either indoor

or outdoor, at the time and place the gaskets and cement are being applied to the pipe. It does not refer to the temperature in the trench, or of the bonding cement, or of the pipe.

In making mechanical joints, the bolts shall be installed with the heads in reverse direction. The nuts shall be turned on only as far as they can be by using the wrench with one hand, with no extensions on the wrench to give greater leverage. Care shall be taken not to over-tighten the bolts. The bolts shall be tightened equally and diametrically in order to apply the proper pressure on the gasket and joint.

2. New Pipe to Existing Pipe.

A concrete collar or compression coupling shall be required at the junction of a new pipe to an existing pipe as specified on the plan set or as required in the field by the Engineer. The joints shall be clean and may require sawcutting the existing pipe for a clean edge. If the Contractor for his/her convenience deems it more suitable to remove the existing pipe to a full joint, the additional pipe required to connect the new pipe is to be the Contractors responsibility and shall not be compensated.

The concrete collar shall be constructed per Standard Detail Drawing 5.4.5, Concrete Collar and may include a change in horizontal or vertical direction. The compression coupling shall be constructed per Standard Detail Drawing 5.3.3, Coupling Details and shall not include a horizontal or vertical defection between the two pipes.

504.4 Measurement and Payment.

504.4(c) Apron Endwalls.

Apron endwalls shall be measured separately as units of each of the various types, classes and sizes of each installed.

The contract price shall include furnishing all materials necessary to perform the work; excavation; installation and removal of sheeting and bracing; disposal of surplus material from the excavation; backfilling the excavation and compaction of the backfill material; embankment over apron endwalls using surplus material from the excavation; bedding the apron endwalls, laying the apron endwalls; jointing and sealing of joints between storm sewer pipes and apron endwalls; encasement, where specified; cleaning out the apron endwalls; restoring the site; and all other work incidental to the installation of apron endwalls.

All required joint ties and collars required to connect storm sewer pipe to Apron Endwalls shall be incidental to Apron Endwall.

504.4(d) Joints.

All new pipe to new pipe joints shall be included in the sewer item as specified in Section 504.4 – Measurement and Payment.

Concrete Collars required for new pipe to existing pipe joints shall be measured and paid as each completed unit as installed in the field. Concrete collars shall not be measured as a separate item when included in another item such as a Storm Sewer Tap. This item shall only be measured and paid where specifically called for in the plan or as needed to resolve unforeseen circumstances encountered in the field.

Compression Couplings required for new pipe to existing pipe joints shall be measured and paid as each completed unit as installed in the field.

Joint collars and ties are ~~ties~~ required for apron endwalls as specified in Subsection 504.2(l~~t~~) – Joint Ties of these Specifications shall be considered as incidental to the cost of the apron endwall. All other joint ties shall be measured and paid for each joint requiring ties.

504.4(e) Tracer Wire & Box.

Tracer Wire & Box shall be paid in accord with 503.4(b)3.

ARTICLE 507 – SEWER STRUCTURES

507.2 Castings.

ADD

507.2(b) Sewer Access Structures.

The following lists of Neenah Foundry castings are acceptable for City construction and are further detailed in Standard Detail Drawing 5.7.16 & 5.7.16A, SAS Frame and Cover. Substitutions shall be approved by the Engineer prior to delivery to the job site.

1.	R-1550	Heavy-duty R-1050 frame, w/logo lid 1550-0054, nine (9) inch high, non-rocking sewer access structure frame and Type "B" non-rocking self-sealing sewer access structure lids with concealed pick holes. EJ Co. 1078Z frame, w/logo lid 1078ATGS shall be considered an approved equal.
2.	R-1689	Heavy-duty, w/logo lid 1550-0054, four (4) inch high, non-rocking sewer access structure frame and Type "B" non-rocking self-sealing sewer access structure lids with concealed pick holes. EJ Co. 1078Z1 frame, w/ logo lid 1078ATGS shall be considered an approved equal.
3.	R-1916C	Heavy-duty, sewer access structure frame and self-sealing lid with Type "F" locks and concealed pick holes and 41" anchor holes.

507.2(d) Inlets.

The following lists of Neenah Foundry castings are acceptable for City construction and are further detailed in the Standard Detail Drawings. Substitutions shall be approved by the Engineer prior to delivery to the job site.

1.	R-3067 -7004	Heavy-duty curb inlet frame, curb box with two (2) inch radius and "Dump No Waste - Drains to Lake" logo. EJ Co. 7030Z1-T1 frame, curb box and "Dump No Waste – Drains to Lakes" logo, shall be considered an approved equal. Grates: Neenah Foundry Type R, Type V, Type VB. EJ Co. Type M5, M6, M7. For use with Type "H" Inlets in Type 'A', Type 'B' or Type 'H' Concrete Curb and Gutter.
2.	R-3067 -7009	Heavy-duty curb inlet frame, slanted curb box with openings. EJ Co. 7030Z1-T7 frame and slanted curb box with openings shall be considered an approved equal.

		For use with Type “H” Inlets in Type ‘A’ Mountable Concrete Curb and Gutter. **Note: Grates to be denoted in construction plans.**
3.	R-3067-7000	Casting to be used when an existing “H” inlet is located at a new or proposed driveway location. In this application, the curb head section of the casting shall be removed from the existing inlet and replaced with this "plate" casting. This allows the existing inlet frame to be used without removal and replacement of the existing curb & gutter section surrounding the inlet to replace with our standard driveway casting R-3290-A. **Note: Casting number provides frame and grate.**
4.	R-3067-C	Narrowed Casting (no casting in the curb head area) to be used as an alternate to R-3067-7000 in drive way areas. EJ Co. 7030Z2 frame shall be considered an approved equal. **Note: Casting number provides frame and grate.**
5.	R-3290 -A	Heavy-duty curb inlet frame and custom grate. No curb box required. For use with Type “H” Inlets in Driveway Section Type ‘A’ Concrete Curb and Gutter. EJ Co. 7034Z-M frame and grate shall be considered an approved equal. **Note: Casting number provides frame and grate.**

507.3 Construction Methods.

507.3(d) Sewer Connections.

2. Storm Sewer.

Storm Sewer Tap

Shall include all work, materials and incidentals required to connect a new pipe of the size and type specified in the contract to an existing structure or pipe. The pipe being used shall be paid separately under the appropriate item. The new connection shall be made in a workmanship like manner to assure the structural integrity of the tapped structure or pipe once the connection is made. A Storm Sewer Tap/Connection shall be completed in accord with the type of pipe material being connected and the type of material being connected to.

Private Storm Sewer Reconnects & Laterals

All private storm sewer reconnects ~~Type 1 Private Reconnect -~~ shall include all work necessary to reconnect private storm sewer ~~pipes (that already daylight at curb line~~

~~including but not limited to curb cuts, existing pipe and grates)~~ to newly constructed storm sewer inlets or other structures. This bid item shall include all materials necessary to make the private storm sewer connection, including pipe and couplings as necessary. All pipe used in the reconnection of private storm sewer drains shall be either PVC or RCP material, and shall be similar in size to the existing private storm pipe, and shall be incidental to the work. Under no circumstances shall an existing, private storm sewer pipe be reduced in size. The Contractor shall not abandon any private storm sewer pipe without written approval of the property owner served by this pipe.

Existing private storm sewer that is connected to an existing structure shall be reconnected. All work to reconnect shall be included in the price of the new structure.

Reconnections shall be defined as:
Type 1 – Existing private storm sewer that already ~~daylights at~~ extends to the curb line that ~~does not~~ may require pipe horizontal/vertical realignment including but not limited to curb cuts, existing pipe, grates and scuppers.

Type 2 – Existing private storm sewer that does not extend to the curb line including but not limited to goosenecks and flumes. Work under this item may include extending the pipe and horizontal/vertical realignment.

~~Type 3 – Existing private storm sewer that requires realignment to connect to a proposed storm sewer inlet or structure.~~

~~Type 2 Private Reconnect - shall include all work necessary to reconnect private storm sewer pipes (that do not extend to the curb line including but not limited to scuppers and goosenecks) to newly constructed storm sewer inlets or other structures. This bid item shall include all materials necessary to make the private storm sewer connection, including pipe and couplings as necessary. Work under this bid item shall also include all work, materials, and incidentals necessary to reroute, from the property line, the private storm line, as shown on the plan set. Pipe bedding and select backfill required by the realignment, shall all be considered incidental to this bid item. All pipe used in the reconnection of private storm sewer drains shall be either PVC or RCP material, shall be similar in size to the existing private storm pipe, and shall be incidental to the work. Under no circumstances shall an existing, private storm sewer pipe be reduced in size. The Contractor shall not abandon any private storm sewer pipe without written approval of the property owner served by this pipe. Surface repairs shall be paid as separate items.~~

Private Storm Sewer Lateral - shall include all work necessary to install a new storm lateral from newly constructed storm sewer inlets or other structures to the near property line. This bid item shall include all materials necessary to install the private storm sewer connection, including pipe and couplings as necessary to the new storm sewer and capped at the property line. An electronic marker ball shall be installed at the capped end location and paid as a separate bid item to the lateral installation.

New Pipe Connections

Where a new reinforced concrete pipe is being tapped into ~~an~~ new or existing concrete structure or pipe the connection shall be made in a workmanship like manner to assure the structural integrity of the tapped structure or pipe once the connection is made. It is required, and this item includes, the use and provision of a concrete collar to complete and seal the connection between the existing structure or pipe and the new pipe. The work completed shall be in accord with Standard Detail Drawing 5.7.32, Storm Sewer Tap Detail.

Where a new plastic pipe is being connected into ~~an~~ new or existing concrete pipe or concrete structure the contractor shall field core the existing structure or pipe and provide a Core-n-T, Core-n-Seal boot, or approved equal to connect the new pipe to the existing pipe or structure as detailed in Standard Detail Drawing 5.7.31, Flexible Pipe to SAS Connector. Where the connection is being made to an existing plastic pipe, a preformed fitting, from the manufacture of the existing plastic pipe, shall be utilized. The work under this item shall include all necessary work to provide the field core and all necessary fittings.

When a new private connection is being made to the public system all construction shall comply with the conditions above, and shall additionally utilize Table 3 - Private Connections to determine if a new structure rather than a tap/connection shall be required.

507.4 Measurement and Payment.

507.4(e) Sewer Taps.

Sanitary Sewer Taps and Storm Sewer Taps shall be measured as a completed unit as installed in the field.

The contract price shall include furnishing all materials, including required fittings and accessories necessary to perform the work, and all other work incidental to the installation of a Sewer Tap.

507.4(f) Sanitary Sewer Cleanouts.

Sanitary Sewer Cleanouts shall be measured as a completed unit as installed in the field.

The contract price shall include furnishing all materials, including required fittings and accessories necessary to perform the work, and all other work incidental to the installation of a Sanitary Sewer Cleanout.

507.4(g) External Sewer Access Structure Joint Seal.

External Sewer Access Structure Joint Seal shall be measured as each joint of sanitary sewer structure sealed as described above.

The contract prove shall include furnishing all materials, including required fittings and accessories, necessary to perform work and work incidental to the installation of and External Sewer Access Structure Joint Seal.

507.4(h) Private Reconnects and Storm Sewer Laterals.

Private storm sewer reconnects (Type 1, ~~and~~ Type 2, Type 3) and private storm sewer laterals shall be measured as a completed unit as installed in the field.

Part VII - Water Mains and Service Laterals

ARTICLE 701 - GENERAL

701.1 Definition.

(1) Whenever the term “Engineer” is used with respect to water main or water service lateral construction, it shall be understood to include the General Manager of the Madison Water Utility and all duly authorized representatives thereof.

(2) All other definitions as described in Article 101.

701.2 General.

(1) Unless otherwise ordered by the Engineer, specified in the Contract Documents or shown on the approved drawings, conform to the requirements of the Specifications herein. In case of discrepancy, conform to the hierarchy as described in Article 104.

701.3 Emergency Contact.

(1) Furnish the Engineer with a local telephone number where a duly authorized representative can be contacted in case of an emergency at night or on weekends.

ARTICLE 702 - MATERIALS

702.1 General.

(1) Conform to the requirements specified herein for the type and class of material named. The Engineer reserves the right to reject any materials not meeting these Specifications as being defective.

(2) Prior to use, obtain approval in writing from the Engineer for any proposed substitutions of equivalent material.

(3) Ensure that the manufactured year of all materials is the current or previous year.

(4) Inspect all materials when delivered to the job site. Promptly remove from the worksite any materials that are rejected by the Engineer due to cracks, flaws, or other defects. The City will not be held liable for project delays that occur due to rejected materials.

(5) Unload, haul, and distribute all materials near their respective point of installation. Unload any City-furnished pipes and accessories in an area that is deemed acceptable to the Engineer as accessible and convenient to the job site. Handle the materials with care to avoid damage. Do not drop or bump materials against the ground.

702.2 Equipment.

(1) Ensure that all equipment and tools necessary for performing any specified work are satisfactory to design, capacity, and mechanical condition for the purposes intended.

(2) Repair, improve, replace and/or supplement any equipment which is not maintained in full working order, or which as used is inadequate to obtain the results prescribed by the Contract Documents.

(3) Use of any unpowered hand tools is considered incidental.

702.3 Ductile Iron Water Main & Accessories.

702.3.1 Ductile Iron Pipe:

(1) Ductile iron pipe and accessories shall conform to the requirements of American National Standard for Ductile Iron Pipe, Centrifugally Cast, for Water (ANSI/AWWA C151/A21.51 - latest revision).

(2) Pipe requirements:

1. Class 52 ductile iron.
2. Cement lined.
3. Push-on joint.
4. Furnished with all necessary accessories.
5. Bonding straps to provide electrical conductivity ~~without field welding~~.

702.3.2 Gaskets:

(1) Gaskets shall conform to the requirements of American National Standard for Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings (ANSI/AWWA C111/A21.11 - latest revision).

(2) Gasket Requirements:

1. Plain rubber gaskets.
2. Restrained-joint locking gaskets.
    i. Use restrained joint locking gaskets when electing to *or* are otherwise required to meet thrust-restraint requirements by means of restrained-joint pipe.
    ii. Restrained-joint locking gaskets must be certified as compliant for use with the furnished pipe material by the pipe manufacturer.

702.3.3 Polyethylene Encasement:

(1) Polyethylene encasement materials shall conform to the requirements of the American National Standard for Polyethylene Encasement for Ductile Iron Pipe Systems (ANSI/AWWA C105/A21.5 - latest revision).

(2) Polyethylene Encasement Requirements:

1. 8-mil thickness (minimum).
2. Furnish in either tube or sheet form.

702.4 Fittings & Accessories.

702.4.1 Mechanical Joint Fittings:

(1) Mechanical joint fittings are to conform to the requirements of American National Standard for Ductile Iron and Gray Iron Fittings, 3-inch through 48-inch, for Water (ANSI/AWWA C110/A21.10 - latest revision).

(2) Mechanical Joint Fitting Requirements:

1. Class 250 mechanical joint pipe fittings.
2. Cement lined.
3. All bells.
4. Entire fitting tarred.
5. Conductive mechanical joint (no lead)
6. Furnished with all necessary accessories (rubber gaskets, flanges, bolts, etc.).

702.4.2 Mechanical Joint Restraints:

(1) EBAA Iron Inc. - MEGALUG® Series 1100, or approved equal.

702.4.3 Nuts and Bolts:

(1) Comply with AWWA C111/A21.11. - latest revision.

(2) Ensure that bolts are of sufficient length such that a minimum of ½-inch of threads are exposed beyond the end of the nut when tightened.

(3) Refer to the following table for the numbers, diameters, and lengths of bolts to be used:

Pipe Diameter (inches)	No. of Bolts Required	Bolt Diameter (inches)	Bolt Length (inches)	Bolt Length for MEGALUG® (inches)
3	4	5/8	3	3-1/2
4	4	3/4	3-1/2	4
6	6	3/4	3-1/2	4
8	6	3/4	4	4-1/2
10 - 12	8	3/4	4	4-1/2
14	10	3/4	4-1/2	5
16 - 18	12	3/4	4-1/2	5
20	14	3/4	4-1/2	5

702.4.4 Solid Sleeves:

(1) Class 52 ductile iron.

702.4.5 Repair Sleeves:

(1) Repair sleeves may only be used when solid sleeves will not fit over existing pipe without major modification, such as significant grinding of pipe.

(2) Allowable Repair Sleeves:

1. Rockwell 441.
2. Ford FCI Bolted Flex Coupling.
3. Powerseal 3501.

702.5 Services and Stops & Accessories.

702.5.1 Service Laterals:

(1) 2-inch diameter and smaller laterals:

1. Type K soft copper tubing.
2. Straight length sections for 1½ -inch and 2-inch sizes.

(2) 4-inch diameter and larger laterals:

1. Class 52 ductile iron pipe in accordance with Section 702.3.1 – Ductile Iron Pipe.

2. ~~See Article 702 – Ductile Iron Water Main & Accessories.~~

702.5.2 Saddles:

(1) Saddles are required at:

1. All 1-½-inch and 2-inch service lateral taps.
2. All service lateral taps on PVC, HDPE, or CIPP-lined water mains.

(2) Approved saddles:

1. Ford Series 202B double strap brass saddle.
2. A.Y. McDonald - Series 3825 saddles (double strap).

702.5.3 Couplings:

(1) Couplings shall be copper-to-copper fittings.

(2) Compression couplings are only permitted when reconnecting existing copper tubing to new copper tubing.

(3) Allowable couplings:

1. Mueller: H15400 / Hl5405 / H5403 / P15403.
2. Ford: C44-33 / 44 / 66 / 77.

702.5.4 Corporation Stops & Service Fittings:

(1) 1-inch diameter Corporation Stops:

1. Mueller H – 9971.

(2) 1½-inch and 2-inch diameter Corporation Stops:

1. Mueller H – 10003.

(3) 1-inch diameter Service Fitting (1/8 bends):

1. Mueller H – 15485.

(4) 1½-inch and 2-inch diameter Service Fittings (1/8 bends):

1. Mueller H – 15470.

(5) Supply all Service Fittings (1/8 bends) with a fiber gasket.

702.5.5 Curb Stops:

(1) 1-inch diameter Curb Stops:

1. Mueller H1502-2.

(2) 1 ½-inch and 2-inch diameter Curb Stops:

1. Mueller H15201.

702.5.6 Curb Boxes:

(1) Ensure that all curb boxes are complete, with covers marked “WATER.”

(2) Curb Box Assemblies shall include the following:

1. Brass screws.
2. 2½-inch new style flush fit cover.
3. 54-inch rods and guide rings.
4. 2½-inch screw type shaft.
5. 37-inch bottom section.
6. 29-inch top section.
7. 16-inch center section.

(3) 1-inch diameter Curb Boxes:

1. Bingham and Taylor 94 F.

(4) 1½-inch and 2-inch diameter Curb Boxes:

1. ~~Tyler or~~ Bingham and Taylor or East Jordan valve box per ~~(Standard Valve Box). See valve box material requirements of Article 704~~ Section 704.6 – ‘Furnish & Install Water Valve’.
2. No rods or rings.

702.6 Disinfection Chemicals.

(1) Dry chemicals:

1. Chloride of Lime.
2. HTH.
3. Pittchlor.
4. Or equal (65 % available Chlorine), granular form only.

(2) Liquid:

1. Only to be used with Engineer’s written authorization.
2. Sodium hypochloride.

ARTICLE 703 - CONSTRUCTION METHODS

703.1 General.

(1) Construct water main and appurtenances in accordance with AWWA C600 - latest revision except when otherwise required in these Specifications.

(2) In case of discrepancy between these Specifications and the approved drawings and/or Contract Documents, conform to the hierarchy as described in Article 104.

(3) All existing and new water valves are to remain visible and accessible at all times.

(4) Valves and hydrants may only be operated in the presence of, and with the authorization of the Engineer.

(5) Work done in the vicinity of any tree located in City property or public right-of-way is to be done in accordance with Article 107 of these Specifications.

(6) Conform to the requirements of Article 203 of these Specifications for all existing pipes, structures, attached parts, and connections that are approved by the Engineer to be removed.

(7) Utility trench patches are to be done in accordance with the requirements of Article 502 of these Specifications and the Standard Detail Drawings.

(8) Utility line openings, as required in the Contract Documents or as ordered by the Engineer, are to be done in accordance with Article 508 of these Specifications.

703.2 Installation Tolerance.

(1) Do not install new water main and appurtenances without field-staked line and grade. Install water main and appurtenances to the line and grade depicted on the approved drawings.

(2) Allowable installation tolerance:

1. Horizontal: 0.1 feet.
2. Vertical: 0.1 feet.

(3) Work performed without line and grade, beyond the allowable installation tolerance, or Extra Work performed without authority, will be considered unauthorized and may not be measured or paid. The Violation consequences for unauthorized work are subject to Article 105 and Article 703 – ‘Repairs and Alterations'.

(4) The lines, grades, locations, and dimensions shown on the plans are subject to adjustment by the Engineer during construction per Article 105. It shall be understood that the elevations for water mains as shown on the drawings are subject to revisions to accommodate field conditions as necessary. The Engineer reserves the right to adjust profile grades within 2-feet of the elevations shown on the approved drawings without adjustment in compensation.

(5) Before installing any proposed variance from the approved drawings, obtain authorization in writing from the Engineer per Article 703 - ‘Repairs and Alterations’ and Article 105 of these Specifications.

703.3 Repairs and Alterations:

(1) This section covers:

1. Emergency repairs of the water system.
2. Proposed alterations of the water system.
3. Unauthorized tampering of the water system.
4. Proposed deviations from the approved water main construction drawings or Contract Documents.

703.3.2 Requirements:

(1) Per Madison General Ordinance Section 13.205, make no unauthorized alterations to the water system. Only when properly authorized to proceed may any work on the water system occur.

(2) When authorized, this work is subject to but not limited to the following requirements:

1. Perform all work in accordance with these Specifications.
2. Safeguard and protect all Madison Water Utility facilities at all times.
3. Do not operate valves or hydrants without direction from the Water Utility Inspector.
4. Provide proper water shut-off notification to affected customers in accordance with these Specifications.
5. Perform all field-cuts with an approved mechanical pipe cutter or power saw. All field-cuts shall be made straight, true, and without damaging the pipe.
6. Concrete encasement pipe repairs are not permitted. Concrete encasement for other purposes, such as a concrete collar, requires written approval from the Engineer.
7. Perform a complete clean-up of the work area and completely restore all disturbed surfaces to original condition, or better.

703.3.3 Notice and Approval of Work:

(1) For anticipated repair work, including the raising or facing of hydrants, notify the Engineer a minimum of 2-working days prior to the proposed beginning of such work.

(2) To propose an alteration of the existing system or a deviation from the approved water main construction plan or Contract Documents, submit the request in writing a minimum of 3-working days prior to when work will be needed. The variance request shall include a sketch that effectively depicts the proposed revision. The Engineer will review the request and respond within 3-working days.

(3) Emergency repairs or planned work may be authorized by the Engineer with less notice or verbal approval at their discretion.

703.3.4 Violation Consequences:

(1) Be subject to a forfeiture per Madison General Ordinance Section 13.205 for each day or partial day of violation.

(2) Unauthorized work may not paid for by the City and may be ordered to be removed or replaced at the Contractor's expense as specified in Article 105.

(3) Risk loss of prequalification status with the City of Madison.

(4) Be liable for all damages, claims, lawsuits, and/or other associated costs including Water Utility costs for labor, equipment and materials.

703.4 Excavation.

(1) Construct water mains and appurtenances in open trenches and in a manner to protect the pipe and appurtenances from unusual stresses at all times.

(2) When permitted by the Engineer in writing, water mains may be installed by tunneling and/or jacking methods in lieu of open trenching. Prepare and submit to the Engineer in writing, the details of construction including a bore pit plan and according to Article 703 – 'Repairs and Alterations'.

703.4.1 Trench Excavation:

(1) All excavation, sheeting, shoring and bracing shall be done in accordance with the latest edition OSHA regulations and any additional requirements specified in the Plans or Contract Documents.

(2) Provide all sheeting, bracing and/or shoring necessary to protect the work, existing property, utilities, pavement, etc., and to provide safe working conditions in the trench. All costs of sheeting, bracing and/or shoring is considered incidental to any work which necessitates it.

(3) When not in use, remove sheeting and bracing, unless permission to leave in-place has been given in writing by the Engineer.

(4) Excavate trenches in conformity with the required alignment and grades as shown on the drawings and as laid out in the field by the Engineer.

(5) Remove all vegetation and topsoil along the trench line to the width of the proposed trench before beginning excavation.

(6) Deposit material excavated from the trench on the sides of the trenches and excavations, beyond the reach of slides. Transport material to spoil banks as an alternative.

(7) Properly dispose of surplus material at no additional cost to the City. Surplus material includes but is not necessarily limited to:

1. Vegetation from the trench line.
2. Excavated rock or cobbles in excess of 6-inches in diameter.
3. Boulders (per Article 704).

4. All other material from excavation not needed or suitable for backfilling trenches.

(8) For water main construction, the width of the trench shall be such as to leave a clear space of not less than 6-inches between the earth wall, or the supporting sheeting or bracing where such is used, and the sides of the pipe. The trench width established by this pipe clearance, measured at the spring line, shall be applicable to that portion of the trench from 1-foot above the top of the pipe to the bottom of the trench.

(9) On streets opened to traffic, on restricted easements, and other specified locations, minimize the width of the trench at the ground surface to the extent possible to accommodate the pipe installation and any necessary sheeting or bracing.

(10) The Engineer reserves the right to limit the extent of excavation depending on the nature of the soil and other conditions.

(11) As ordered by the Engineer due to trees, fences, buildings, shrubs, etc., dig trenches by hand.

703.4.2 Excavation in Poor Soils:

(1) If, in the opinion of the Engineer, an artificial foundation is necessary because of the nature of the excavated material, excavate the unsuitable material and replace with suitable specified material to produce an acceptable pipe foundation.

(2) The undercut depth shall be as directed by the Engineer but shall be a minimum of 1-foot below the bottom of the pipe. Any work involved in forming a satisfactory foundation at depths of 1-foot or less below the bottom of pipe will be considered to be incidental to the work.

(3) Backfill this portion of the trench with specified approved bedding material and mechanically compact the select fill prior to laying the pipe. Limit the width of the trench excavation to the outside diameter of the pipe plus 2-feet, plus the amount necessary for sheeting and/or bracing.

(4) Excavation beyond the allowable 1-foot shall be considered undercut and will be paid as specified for undercut.

703.4.3 Dewatering:

(1) In accordance with Part V of these Specifications, remove by pumping, bailing, or otherwise, any water that may accumulate or be found in the trenches and other excavations.

(2) Form all dams, flumes or other works necessary to keep the trenches or excavations entirely clear of water while the water mains and their appurtenances are being installed.

(3) Direct all water from excavations, so as not to flow over or damage private or public property.

(4) All costs of dewatering are considered to be incidental to the associated work.

703.4.4 Removal of Conflicting Utility Pipes:

(1) Abandoned utilities which conflict with new water main installations are to be removed from the trench and properly disposed of. Utility pipes to be removed that are in the same trench as new water main will not be additionally compensated, and are considered to be part of the new pipe installation. This applies to any abandoned pipe or conduit that is identified on the plans for removal, or any unidentified abandoned pipe or conduit that is smaller than 10 inches in

diameter. Removal of unidentified abandoned pipe or conduit that is 10 inches in diameter or larger will be considered as Extra Work.

(2) If the utility to be removed ends along a pipe run, as opposed to ending at a structure, end the removal with a saw cut of the existing pipe and plug the remaining end(s) as directed by the Engineer. Refer to bid item “Pipe Plug for Water Main Installation” for applicable practice.

703.4.5 Trench Bottom:

(1) The trench bottom must be true and even to fully support the bedding material and the pipe along its entire length.

(2) As necessary, remove and replace poor subgrade materials, including loose sand, in accordance with Section 703.4.6, Excavation in Poor Soils.

703.4.6 Bell Holes:

(1) Provide holes for pipe bells at each joint.

(2) Holes should be no larger than necessary for joint assembly, including installing the required overlaps for polyethylene encasement, and assurance that the pipe will lay flat within the trench.

703.4.7 Excavation in Poor Soils:

(1) If, in the opinion of the Engineer, an artificial foundation is necessary because of the nature of the excavated material, excavate the unsuitable material and replace with suitable specified material to produce an acceptable pipe foundation.

(2) The undercut depth shall be as directed by the Engineer but shall be a minimum of 1-foot below the bottom of the pipe. Any work involved in forming a satisfactory foundation at depths of 1-foot or less below the bottom of pipe will be considered to be incidental to the work.

(3) Backfill this portion of the trench with specified approved bedding material and mechanically compact the select fill prior to laying the pipe. Limit the width of the trench excavation to the outside diameter of the pipe plus 2-feet, plus the amount necessary for sheeting and/or bracing.

(4) Excavation beyond the allowable 1-foot shall be considered undercut and will be paid as specified for undercut.

703.4.8 Dewatering:

(1) In accordance with Part V of these Specifications, remove by pumping, bailing, or otherwise, any water that may accumulate or be found in the trenches and other excavations.

(2) Form all dams, flumes or other works necessary to keep the trenches or excavations entirely clear of water while the water mains and their appurtenances are being installed.

(3) Direct all water from excavations, so as not to flow over or damage private or public property.

(4) All costs of dewatering are considered to be incidental to the associated work.

703.4.9 Removal of Conflicting Utility Pipes:

(3) Abandoned utilities which conflict with new water main installations are to be removed from the trench and properly disposed of. Utility pipes to be removed that are in the same trench as new water main will not be additionally compensated, and are considered to be part of the new pipe installation. This applies to any abandoned pipe or conduit that is identified on the plans for removal, or any unidentified abandoned pipe or conduit that is smaller than 10 inches in diameter. Removal of unidentified abandoned pipe or conduit that is 10 inches in diameter or larger will be considered as Extra Work.

(4) If the utility to be removed ends along a pipe run, as opposed to ending at a structure, end the removal with a saw cut of the existing pipe and plug the remaining end(s) as directed by the Engineer. Refer to bid item "Pipe Plug for Water Main Installation" for applicable practice.

703.5 Temporary Support.

(1) Under no circumstances shall new water main pipe be used to support any underground facilities, structures or any other objects. If new water main pipe is used for support, the pipe will be rejected, tagged by the City as rejected pipe, and will be immediately removed from the job site. The rejected pipe shall not be used on any other City projects.

(2) Construction of pipe supports and utility line supports shall conform to the latest edition OSHA regulations and the requirements of Article 508 of these Specifications.

703.5.1 Temporary Water Main Support:

(1) Temporarily support water mains whenever 12 or more lineal-feet of main is exposed for a period of 48-hours or longer. Exposure may be perpendicular, parallel or at any angle to an opening or trench.

(2) Submit a support plan designed and stamped by a State of Wisconsin Licensed Professional Engineer to the Engineer a minimum of 2 working days before the exposure is anticipated to occur.

(3) The Engineer reserves the right to require immediate temporary support of any exposed pipe in the case of a justifiable concern for the integrity of the pipe, worksite or public safety.

(4) The Engineer reserves the right to pressure test or re-test any pipe which has been subjected to temporary support. In the event of a failed test, correct any defects until the pipe passes pressure testing at no additional cost to the City.

703.6 Backfilling and Compaction.

703.6.1 Pipe Bedding and Cover:

(1) Properly construct water pipe bedding material in the trench pipe zone to prevent settlement of pipes and/or fittings and to avert excessive pressure on the pipes. As depicted in Standard Detail Drawing 7.01 – Typical Water Pipe Trench, the pipe zone extends from the trench bottom, located at least 6-inches below the bottom of the pipe, to the top of the cover material, located at least 12-inches above the top of pipe.

(2) Install water pipe bedding and cover material in accordance with the following requirements:

1. Bedding material shall be either washed gravel, clear stone, limestone screenings or sand, in meeting the requirements of Section 502.1(d) of the Standard Specifications. Crushed stone is not acceptable bedding material for water pipes unless authorized by the Engineer.

2. Prior to laying the pipe, place at least 6-inches of compacted bedding material to form the base of the pipe zone. Compact to at least 95% maximum density.

3. Prepare bell holes, as necessary, in accordance with Section 703.4.5 of the Standard Specifications.

4. After the water main has been laid, place bedding material to the spring line of the pipe and manually chuck/work material around the base of the pipe to form a secure pipe foundation. Use of mechanical compaction equipment is not permitted while forming the pipe foundation. Use caution to avoid damaging the pipe and/or the polyethylene encasement.

5. After the pipe foundation is formed, place bedding material to the top of the pipe zone, located 12-inches above the top of pipe (minimum). Compact bedding and cover material using a hand-operated mechanical compactor to a minimum of 95% maximum density.

703.6.2 Trench Backfill Requirements:

(1) Backfill trenches and excavations immediately after the water main and appurtenances have been installed and placement of the bedding and cover material has completed.

(2) Close trenches at the end of every day.

(3) Backfill to the original surface elevation or otherwise specified elevation. In the event of a shortage of material to perform this work, including replacement as may be required by rock excavation or removal of boulders, provide the necessary fill material at no cost to the City.

(4) Except as may be necessary in compacting and backfilling, do not walk or work on installed pipe until the trench has been backfilled to an elevation at least 2-feet above the top of the pipe. Do not take backfill material from trench walls below an elevation 2-feet above the top of pipe.

(5) Evenly place backfill material so that no unbalanced pressures are placed upon the water system. Backfill material may be dumped directly into the trench from trucks when the amount of material to be dumped is controlled by proper equipment.

(6) Deposit, spread and level backfill material in layers not exceeding 12-inches in thickness before compacting. Compact each layer to the density specified herein before placing the succeeding layer. When the material being compacted is of a granular nature and the compacting equipment is adaptable for the purpose, the thickness of the layer may be increased to a maximum of 24-inches at the Engineer's discretion, provided the required compaction density is obtained.

(7) Only use heavy equipment in the trench for compaction or other purposes if the pipe is adequately protected and the Engineer approves. Trucks, vehicles, or other equipment are not allowed within the limits of the trench prior to the completion of the backfilling operations.

(8) Dump imported backfill material along the top of the trench beyond the reach of slides. Do not store imported material such that it increases the stresses on the trench section.

(9) Carefully draw and remove any required sheathing and bracing such that it will not disturb the completed work. Carefully fill and compact any voids created by the removal of sheathing and bracing with approved backfill material.

(10) Backfilling of structures shall be done in accordance with Article 301 – 'Protection of the Concrete'.

(11) Whenever possible, backfill trenches and other excavations with materials excavated during the course of the work.

(12) Do not include vegetation, stones, or fragments of broken rock in excess of 6-inches in any dimension in the backfill.

(13) Note that the Engineer may reject material due to:

1. Unacceptable moisture content.
2. Unacceptable gradation or composition
3. The presence of frozen material.

(14) Remove all rejected materials from the site.

703.6.3 Compaction Requirements:

(1) Mechanically compact backfill layers in trenches and excavations to thoroughly consolidate the material to the density specified and to not damage or disturb the pipe or other structures.

(2) See Section 703.6.1 – Pipe Bedding and Cover, for compaction requirements of the bedding and cover material in the pipe zone of the trench.

(3) Begin mechanical compaction of the trench zone backfill material when the depth of the backfill material is 2-feet above the top of the pipe. (In the case of structures, begin compaction of the backfill material with the placing of the first layer of backfill material). The Engineer will perform compaction testing as necessary to verify uniformity of compaction.

(4) Compaction Density Requirements:

1. From 2-feet over the pipe to within 3-feet of the bottom of subgrade:

   A minimum of 90% of maximum density.

2. Within 3-feet of the bottom of subgrade:

   A minimum of 95% of maximum density.

(5) Determine maximum density in accordance with the Standard Method of Test for the Moisture-Density Relations of Soils, ASTM Designation: D 1557, Method D, latest revision. Replace the fraction of material retained on a ¾-inch sieve, with No. 4 to ¾-inch material.

(6) Determine the density of compacted backfill in accordance with one of the following: Test for Density of Soil-in-Place by the Sand-Cone Method, ASTM Designation: D 1556, latest revision, or Test for Density of Soil and Soil-Aggregate in Place by Nuclear Methods, ASTM Designation: D 2922, latest revision.

(7) In the event that the material in the density sample differs in percentage of aggregate retained on a No. 4 sieve from that in the sample upon which maximum density was determined, adjust the maximum density in accordance with approved procedures.

(8) In the event of inadequate moisture in the backfill materials, add water as necessary to obtain the required compaction.

(9) Whenever the work of installing water pipes takes place during freezing weather, follow the specifications for trench compaction above, if practicable. If the specified compaction cannot be achieved, and the Engineer determines that the work may not be suspended until more favorable weather conditions exist, proceed as follows:

1. Remove all frozen material in the trench at the beginning of the day's work.
2. Do not compact frozen materials.
3. Compact material in 6-inch maximum lifts.
4. Compact to densities specified herein.

(10) If the top 3-feet of material does not meet 95% of maximum density, remove the material and place Select Fill using 6-inch maximum lifts and compact to 95% of maximum density.

(11) As a guideline, no construction will be permitted when the temperatures are too cold to achieve the specified compaction of the backfill. Ensure that temperatures are at least 15ºF and rising, with winds less than 10 mph, before considering working in freezing conditions.

703.6.4 Embankments:

(1) Where the grade of the water main is such that the top surface of the pipe requires protection, construct an embankment over the pipe.

1. Embankment height:

   Specified by the Engineer and adequate to provide proper protection.

2. Embankment width:

   Minimum of 2-feet wider than the external diameter of the pipe at the top.

(2) Embankment side slopes:

(3) A ratio of not less than 2-feet horizontal to 1-foot vertical from the top of the embankment to the existing ground surface.

(4) Use surplus acceptable excavated material or, if required, furnish other approved material for embankment construction. Placing and constructing the embankment over the pipe is incidental.

(5) If imported material is required by the Engineer to complete the embankment over the pipe, only the authorized imported fill quantities will be paid for as provided herein.

(6) Compact embankment material as required in Article 202 – 'Standard Compaction'.

703.7 Connecting to Existing Water Mains.

(1) There are three types of connections to existing mains:

1. A plug-removal connection is a connection that requires the removal of a slip or mechanical joint plug from an existing fitting or the end of a water main. Perform all work associated with the plug removal connection per Article 704 - 'Cut-In or Connect-To Existing Water System'.

2. A cut-in connection is a connection that requires the installation of a new fitting or valve in an existing water main. Perform all work associated with the cut-in connection per Article 704 - 'Cut-In or Connect-To Existing Water System'. Cut-in connections to HDPE water mains shall also be constructed in accordance with Article 704 - 'Horizontal Directional Drill Pipe'.

3. A live-tap is a connection in which the main is tapped under pressure and in-service while a tapping valve is installed by the City. Furnish the ditch as necessary for the City to make the tap and perform the associated cut-off and cap of the existing water main per Article 704 'Furnish Excavation and Ditch for Live Tap'. Isolate and depressurize all live-tap connections on any PVC, HDPE and CIPP-lined water mains prior to providing the ditch to the City.

703.8 Water Main Shutoffs.

(1) Do not interrupt water service without prior notification to all affected residents and property owners. Ensure that all street-facing and/or visible entrances and all addresses of multi-unit properties are included separately in the notification distribution.

(2) With notification distributions, it is recommended to include a request to avoid using water fixtures, faucets or water-sensitive appliances during the service interruption, and then opening an outside spigot or cold water faucet on the lowest level of the property after service has been restored.

(3) When requested and furnished by the Engineer, post terrace signs as part of the notification distribution. Carefully remove and return all posted terrace signs to the Engineer upon completion of the service interruption.

(4) In the case of an emergency or an unplanned shut-off, notify all affected residents and property owners during or immediately after the water is turned off.

(5) Minimum requirements for all planned shut-offs:

1. Provide 2 working days notice to affected water users.

2. The shut-off may not begin earlier than 8:00 AM.

3. The shut-off may not exceed 8-hours.

(6) In the event a planned shut-off is anticipated to require more than 8-hours, re-notify all affected water users prior to the expiration of the time limit listed on the original notification.

(7) Perform all shut-offs as proposed in the Contract Documents. The proposed shut-offs are provided for reference purposes to aide planning connection point isolation and preparing water

user notification lists for planned outages. Propose any alternative connection methods which differ from the proposed shut-off in accordance with Article 703 – 'Repairs and Alterations'.

(8) Obtain prior authorization from the Engineer and be responsible for all valve turnings. Be properly equipped at all times for doing such work.

(9) Any water service or plumbing problems which arise as a result of either planned or emergency water main shutoffs or any associated work, are the Contractor's responsibility to promptly resolve at no cost to the City or Madison Water Utility.

(10) To reduce the likelihood of draining private water systems and/or associated private plumbing problems, it is required to close all service valves and/or curb stops on all 1.5-inch or larger laterals prior to removing the main from service.

(11) Additionally, it is required to close all service valves and/or curb stops at properties without accessible hose spigots or other outside plumbing connections.

703.9 Mechanical Joint Pipe and Fittings.

(1) A mechanical pipe joint is made by compressing a rubber gasket between a bell, cast on the end of one pipe, and a gland that slides along the plain end of the pipe to be joined. The joints are tightened using nuts and bolts.

(2) Assemble mechanical joints in accordance with AWWA C600 – latest revision.

(3) Restrained joints using MEGALUG® Series 1100 or approved equal mechanical joint-restraint retainer glands shall have bolts tightened in accordance with the manufacturer's installation specifications.

(4) Before slipping the gland and the gasket onto the plain end for joint assembly, lubricate both the gasket and the plain end of the pipe with an approved pipe lubricant meeting the requirements of ANSI/AWWA C111/A21.11 - latest revision.

(5) Place the gland on the plain end with the lip extension toward the joint, followed by the gasket with the narrow edge toward the joint. Insert the pipe into the bell and press the gasket firmly and evenly into the gasket recess in the bell keeping the joint straight during assembly. Push the gland toward the bell and center it around the pipe, with the flange lip against the gasket. Insert bolts and hand tighten nuts. Deflect pipe after assembly, but before tightening bolts.

703.10 Thrust Restraint.

(1) Provide thrust restraint for all fittings by one of two methods:

1. A combination of concrete thrust blocking and mechanical joint restraint.

2. A combination of push-on restrained joint pipe, or other approved restrained joint pipe, and mechanical joint restraint.

(2) Regardless of the restraint method employed, restrain all mechanical joints using MEGALUG® Series 1100 or approved equal retainer glands installed per the manufacturer recommendations and additionally include concrete blocking at all hydrant installations, cut-in connections, branch tee connections and live-tap connections, per Standard Detail Drawing 7.13 ~~7.03(A)~~.

703.10.1 Concrete Thrust Blocking:

(1) Where concrete blocking serves as the thrust restraint method, block all hydrants and fittings, except vertical down bends, per the required bearing area in the table below and the Standard Detail Drawing 7.13 ~~7.03(A)~~. Block vertical down bends per Standard Detail Drawing 7.14 ~~Detail 7.03(B)~~. Restrain per Standard Detail Drawing 7.15 ~~Detail 7.03(C)~~ only where specified or approved by the Engineer.

Required Undisturbed Bearing Area of Concrete Thrust Blocking (Square Feet)					
Fitting Size(In)	**Tee, Wye, Hydrant, Plug or Cap**	**90º Horizontal Bend, Plugged Cross or Tee (Plugged on Run)**	**45º Horizontal Bend**	**22-1/2º Horizontal Bend**	**11-1/4º Horizontal Bend**
4	0.9	1.3	0.7	0.4	0.2
6	2.1	3.0	1.6	0.8	0.4
8	3.8	5.3	2.9	1.5	0.4
10	5.9	8.3	4.5	2.3	1.2
12	8.5	12.0	6.5	3.4	1.8
16	15.1	21.3	11.5	6.0	3.2
20	23.6	33.3	18.0	9.4	4.9
24	33.9	48.0	26.0	13.5	7.1
30	53.0	75.0	40.6	21.1	11.1
Note: Listed areas are based on a test pressure of 150 psi and an allowable soil bearing pressure of 3,000 pounds per square foot. To compute bearing areas for different test pressure, use the following equation: Bearing area = (Test Pressure ÷ 150) x (Table Value)					

(2) Concrete thrust blocking must be at least two-feet thick over the entire bearing area.

(3) On hydrants and fittings requiring less than 4-square feet bearing area use either cast-in place concrete or solid concrete blocks placed between the appurtenance and the undisturbed wall of the trench. Fill all voids with compacted clear stone or screenings.

(4) For fittings requiring 4-square feet bearing area or greater, use only cast-in-place concrete meeting the requirements of Article 301 of these Specifications and a minimum strength of 3,000 psi at 7-days. Protect the concrete from freezing for a minimum of 24-hours after placement.

(5) Do not perform pressure testing within 72-hours of pouring the thrust block. A 9-bag concrete mix may be authorized by the Engineer upon request.

(6) Do not extend the concrete blocking beyond the joint. Protect all nuts and bolts from the concrete during pouring so they can be removed without damaging the thrust block.

(7) Do not backfill over thrust restraint blocking until it has been inspected by the Engineer. If backfilling takes place prior to the inspection of the blocking, the Engineer may require the blocking to be re-exposed for inspection at no additional cost to the City.

703.10.2 Joint Restraint:

(1) Where joint restraint serves as the thrust restraint method, with the exception of vertical bends, restrain all push-on joints within the lengths specified in the 'Required Joint Restraint Distance from Fitting' table below. Restrain vertical bends per Standard Detail Drawing ~~7.10~~ 7.16.

(2) Restrain push-on joints with the pipe manufacturer's approved joint restraint locking gasket per Article 702.

(3) Restrain all mechanical joints per Article 702 and Article 703 – 'Mechanical Joint Pipe and Fittings'.

REQUIRED JOINT RESTRAINT DISTANCE FROM FITTING (FEET)								
FITTING TYPE	**4-IN**	**6-IN**	**8-IN**	**10-IN**	**12-IN**	**16-IN**	**20-IN**	**24-IN**
TEE: RUN OR CROSS: PLUGGED	10	10	10	10	10	20	20	20
TEE: BRANCH	10	10	10	10	10	10	10	10
CAP/PLUG ON DEAD END	30	45	60	70	80	110	140	160
90° HORIZONTAL BEND	10	15	20	25	25	30	40	50
45° HORIZONTAL BEND	5	10	10	10	15	15	20	25
22.5° HORIZONTAL BEND	5	5	5	5	10	10	10	15
11.25° HORIZONTAL BEND	3	3	3	3	5	5	5	5
REDUCER: SIZE x 4"	-	25	45	60	75	100	130	150
REDUCER: SIZE x 6"	-	-	25	45	60	90	120	145
REDUCER: SIZE x 8"	-	-	-	25	45	80	110	135
REDUCER: SIZE x 10"	-	-	-	-	25	65	100	125
REDUCER: SIZE x 12"	-	-	-	-	-	50	85	115
REDUCER: SIZE x 16"	-	-	-	-	-	-	50	90
REDUCER: SIZE x 20"	-	-	-	-	-	-	-	50
HYDRANT	RESTRAIN ALL JOINTS ON HYDRANT LEAD							
NOTES: SOIL TYPE = GM (SILTY GRAVELS & GRAVEL/SILT/SAND MIXES) DEPTH OF BURY = 6-FT SAFETY FACTOR = 1.5 TRENCH TYPE = 4 TEST PRESSURE = 150 PSI								

703.10.3 Alternate Restraint Methods:

(1) For locations where the Engineer determines one of the two approved restraint methods will not provide adequate thrust restraint or is impractical, the Engineer may require an alternate means of restraint. Alternate thrust restraint methods include those shown in Standard Detail Drawings ~~7.02~~ 7.15 and ~~7.03(C)~~ 7.17. Alternate thrust restrain methods are to be used only when specifically authorized.

(2) Requirements:

1. Where pipe is used for an anchor, provide a sufficient length to fully restraint the fitting.
2. When using threaded rod for restraint use ¾-inch 304 stainless steel threaded rod with stainless steel nuts and washers.

(3) The contractor may propose alternate restraint methods in accordance to Article 703 – 'Repairs and Alterations'.

703.11 Polyethylene Encasement.

(1) Encase all ductile iron pipe, joints, and fittings in polyethylene wrap installed per the requirements of the American National Standard for Polyethylene Encasement for Ductile Iron Pipe Systems (ANSI/AWWA C105 - latest revision) and the manufacturer's requirements. All cuts and repairs to the polyethylene wrap shall be in accordance with ANSI/AWWA C105 and the manufacturer's requirements.

(2) Install polyethylene encasement with a minimum overlap of 1-foot at all joints. Tape the polyethylene wrap every 3-feet and at joints to prevent soil from coming into contact with the pipe.

(3) Carefully place backfill material to prevent tears and punctures in the polyethylene encasement. Promptly repair any tears and punctures per the manufacturer's recommended procedures.

(4) When connecting to or tapping into existing or new polyethylene encased pipe, wrap two or three layers of tape completely around the pipe at the connection/tap location. Mount the tapping machine on the taped area and make the tap directly through the tape and polywrap. Install the corporation stop and inspect the area for damage, repair prior to backfilling, as necessary.

(5) Consult the Engineer if it is determined that a proposed connection may not be performed as described above. Upon authorization, repair or replace any polyethylene wrap which was cut away to allow for the connection or tap. Include the required overlap and taping requirements as described herein.

703.12 Copper Service Laterals.

(1) Provide and install saddles on all 1-1/2-inch and 2-inch services and at all service lateral taps on new or existing PVC, HDPE, or CIPP-lined water mains. Use a standard valve box in lieu of a curb box, with no rod or rings required, for all 1-1/2-inch and 2-inch services.

(2) Use a pipe cutter to cut all copper tubing. Hacksaws or other such devices to cut copper tubing are not permitted.

(3) Excavate and expose the area on the water main for new service connections, as noted on the drawings or as otherwise instructed by the Engineer. Maintain a separation distance of at least 18-inches between adjacent service taps and between a service tap and a pipe joint or fitting. Locate the tap on the upper half of the main at a 45º angle from the vertical plane, perpendicular to the water main and on the side of the main to which the service extends.

(4) Tap the water main and install the corporation stop using a tapping machine specifically designed to tap water main under pressure. No other method of tapping the water main will be allowed. Repair and replace any cut or removed polyethylene encasement following the tap to ensure that the water main is fully protected.

(5) After the tap has been made and the corporation stop and bend have been inserted, loop the copper tubing out and then back toward the main, then back away from the main to form the shape of a vertical "S". Ensure that the "S" loop is of sufficient size so that it uses a minimum of

2-feet of copper tubing. Ensure that the highest portion of the loop is not higher than the top of the water main.

(6) Lay the service flat to the property line or otherwise indicated point of termination. Provide a minimum of 6-feet of cover below finished grade.

(7) Place at least 1-foot of approved bedding material around the copper service pipe. The bedding material is considered incidental to the cost of backfilling the service lateral trenches. Protect all laterals and appurtenances from damage when backfilling. Stones 3-inches in diameter or larger are not allowed within 18-inches of the copper service. Backfill containing rocks 3-inches or larger may not be placed around curb boxes.

(8) Restore any disturbed terrace or turf areas associated with the lateral installation work. Any terrace or turf restoration work is considered incidental to any work associated with service laterals.

(9) Coordinate with property owners to allow for flushing service laterals both prior to and immediately after any work impacting a service. Resolve any problems with property owners, including but not limited to problems regarding discolored water or low/no water flow. See Section 703.8 'Water Main Shutoffs' for additional information.

(10) Repair any damage to new or existing service laterals, curb stops or curb boxes resulting from adjacent excavations located within 5-feet of the water lateral at no cost to the City.

703.12.1 Discovery of Lead Service Laterals:

(1) If discovered, replace any active lead service laterals with new copper service laterals. Notify the Engineer immediately upon discovery of any active lead service laterals. Do not proceed with the service replacement work until authorized by the Engineer.

(2) Coordinate the replacement of lead service laterals with the property owner and the property owner's plumber. Assume that the property owner may have delays in making the connection to the new copper service. To the extent practical, plan for up to 14 calendar days where the excavation at the curb stop may have to remain open while the old service remains in use. Protect and maintain all excavations throughout this delay with attention to public safety. No additional compensation will be considered due to the impact of this delay or the failure to coordinate with the impacted property owner or plumber.

(3) If authorized by the Engineer, to meet project schedule requirements or weather constraints, the new copper service may be temporarily connected to the existing lead service.

703.13 Disinfection.

(1) Conform disinfection of materials, procedures and requirements to AWWA C651 – Standard for Disinfecting Water Mains - latest revision, except as otherwise required herein.

(2) Prevent dirt, mud, muddy water, or other foreign matter from entering the pipe or fittings during installation.

(3) Furnish and install a watertight plug for all open ends of pipe and fittings whenever work is temporarily stopped, including during work breaks or overnight. Failure to properly plug and

protect the pipe during construction may result in additional costs to for all work and materials necessary for cleaning pipes and fittings contaminated during construction.

(4) Deposit the following amounts of Calcium Hypochlorite (HTH or approved equal - 65% available chlorine by weight) in each 20-foot length of pipe:

Pipe Diameter (inches)	Amount of HTH or approved equal required (ounces)
4	1
6	2
8	3-1/2
10	5-1/2
12	7
16	14

(5) The Engineer reserves the right to require any pipe or fittings to be swabbed cleaned prior to lowering into the trench. When swabbing is required, disinfect the subject material by swabbing or soaking thoroughly with a 10:1 (water:bleach) solution.

703.14 Flushing.

(1) Flush out the highly-chlorinated disinfection water after meeting the required contact time. The City will execute the water main flushing. Provide labor to assist the Engineer with valve turning for the duration of the flushing operation.

(2) The discharge volume is estimated to be three times the volume of water contained in the section of main to be flushed. Estimates in CCF (100 cubic feet) calculated as:

$$V = 3 * \left[\frac{(3.14) * D^2 * L}{400} \right]$$

Where:

$V = Flush\ Volume\ in\ CCF$

$D = Pipe\ Diameter\ in\ Feet\ (see\ below)$

$L = Pipe\ Length\ in\ Feet$

$D\,(in)$	$= D\,(ft)$
6	0.50
8	0.67
10	0.83
12	1.00
14	1.16
16	1.33
18	1.50
20	1.67
22	1.83
24	2.00

(3) Flushing segments may not to exceed 1,200-feet in length unless authorized by the Engineer.

(4) Prior to the City arriving on-site to execute the flush, prepare the flushing discharge point to ensure a consistent flushing velocity of at least 2.5-feet per second. Required discharge flow and openings shall be obtained in accordance with the requirements of AWWA C-651 - Table 3, latest revision, except where specified otherwise herein.

(5) Required minimum flow rates and discharge openings for flushing water lines:

Required Flow Rates and Openings to Flush Water Lines [1]

Pipe Diameter (inches)	Min. Flow Rate Required for Flushing (gpm)	Number of 2" Taps [2]	Number of 2 1/2" Fire Hydrant Outlets[1]
4	100	1	1
6	200	1	1
8	400	1	1
10	600	Not permitted	1
12	900	Not permitted	2 (or, 1 4½" outlet)
16	1,600	Not permitted	2 (or, 1 4½" outlet)

[1] With 40 psi pressure in the main, with the fire hydrant flowing to atmosphere, a 2½" fire hydrant outlet will discharge approximately 1,000 gpm; and a 4½" fire hydrant outlet will discharge approximately 2,500 gpm.

[2] Number of taps on pipe based on discharge through 5 feet of galvanized iron pipe with one 90° elbow.

(6) Discharge to the stormwater sewer system whenever possible. Discharge to the sanitary sewer system may be permitted only when no other option exists.

(7) Discharge to Storm Sewer System:

1. Inform the Engineer, in writing, of the intent and means to flush water main to the storm sewer a minimum of 2-working days prior to the proposed scheduled flush.
2. Note that the Engineer will schedule the next available flushing crew to perform the flush.
3. Note that all discharge to the storm sewer will be de-chlorinated by the Engineer.

(8) Discharge to Sanitary Sewer System:

1. Inform the Engineer, in writing, of the intent and means to discharge flushing water to the sanitary sewer system.
2. Verify with the Engineer that other discharge options are unavailable.
3. With the consent of the Engineer, obtain a permit for approval to discharge flushing water to the sanitary sewer system from the City of Madison Engineering Department.
4. The Engineer will schedule flushing operations no sooner than 2 working days from the time the permit is requested (the timeframe for permit approval is 2 working days).
5. Obtain permit approval in advance of flushing operations.
6. The Water Utility will pay all costs associated with the sanitary sewer discharge permit.

(9) To obtain a sanitary discharge permit, call City Engineering at (608) 267-1995 and provide the following information:

1. Contractor contact information.
2. Requested time and date of discharge.
3. Diameter and length of the water main to be flushed.
4. Estimated discharge volume.
5. Location of the proposed sanitary access structure.

(10) Do not exceed the permit-approved flushing rate.

(11) Do not flush to any location other than the permit-approved sanitary access structure.

(12) Proceed with flushing until the Engineer deems the flushed sections of water main to be adequately de-chlorinated.

(13) In cases where, for example, a downstream lift station is located, the Engineer may require a vac-truck be provided at no additional cost to ensure that the station is not overwhelmed by discharge.

(14) Vac-truck assistance and all other on-site assistance (outside of the standard flushing operations) provided by the Engineer, City of Madison Engineering Department, or Madison Metropolitan Sewer District will be billed on a time and material basis.

(15) In the event that the permit limit on discharge rate to the sanitary sewer is such that using the sanitary sewer would require extensive time, or the flushing operation would be determined to be ineffective, the Engineer may require an alternative flushing plan at no additional cost to the City.

703.15 Testing.

(1) Newly installed water mains shall undergo water quality testing and hydrostatic pressure testing prior to final acceptance by the City. The mains may also be tested for electrical conductivity through the joints. Repairs or replacement of any defective work is to be done at no additional cost to the City.

703.15.1 Conductivity Testing:

(1) Complete all backfilling and obtain approval of the hydrostatic pressure tests prior to performing conductivity testing. The Engineer is to be witness and verify all conductivity testing procedures, test section lengths, and results.

(2) Testing of the first section of pipe installed may be required by the Engineer to demonstrate that the pipe is being installed in an acceptable manner.

(3) Furnish approved testing equipment. Perform test while the newly installed main is at normal operating pressure with all air expelled.

(4) Repair or replace any defective areas noted during the conductivity testing to the satisfaction of the Engineer. Any required repairs or replacement shall be done at no cost to the City.

(5) When the connection to the existing system is not made with a valve, test on the existing section of main to the first available valve(s) to determine the condition of the system. Alternatively, provisions may be made to test the work separately (prior to connection to the existing system), with the Engineer's approval.

(6) Make connections for the test at fire hydrants or valves:

(7) Hydrant connection requirements:

1. In the open position with the caps on during the test.
2. Clamp the cable to the hydrant standpipe and flange bolt.
3. Do not use the hydrant-operating nut as a terminal during the test.

(8) Where hydrants or valves are not available, connections will be made to straps welded directly to the pipe.

(9) Use a length of insulated wire that can reach from one connection to the other (the "external circuit"). Testing the external circuit may be conducted ~~two~~ three ways.

(10) Method One:

1. Measure the resistance of the external circuit with an ohm-meter and record this number prior to testing the pipe length.
2. Hook the external circuit wire to the new main as previously described and take a new measurement with the same ohmmeter.
3. In an electrically continuous length of main, the total resistance measured should be just slightly more than that of the external circuit – generally no more than 2-3 ohms. Instances of the measured total resistance measured being significantly greater, equate to evidence of defective electrical contact in the pipe.
4. Isolate and correct defective segments, if required. Re-test until the requirements are met.

(11) Method Two:

1. Display conductivity by the reactivity of "tester" devices, such as a low-wattage light bulb with a battery. Any such equipment will be subject to approval of the Engineer.
2. Hook the external circuit wire to the new main as previously described and connect the external circuit to the tester.
3. Instances of non-reactivity in the tester equate to evidence of defective electrical contact in the pipe.
4. Isolate and correct defective segments, if required. Re-test until the requirements are met.

(12) Method Three:

1. Conductivity may be verified through the use of an energized underground utility locating device, which successfully demonstrates all newly installed lines are located correctly and the location signal is continuous along the entire length of the line.

703.15.2 Water Quality Testing:

(1) Perform water quality testing procedures to AWWA C651 – Standard for Disinfecting Water Mains - latest revision, except as otherwise required herein.

(2) Test water main after a section has been installed and the trench is backfilled. Test sections are not to exceed 1,200-feet in length. A separate test is to be performed for each branch of main.

(3) Assist the Engineer in slowly filling the new main from an uncontaminated source by operating the necessary valves. DO NOT operate any valves under any circumstances, except as directly instructed to do so, by and in the presence of the Engineer.

(4) Loosen one nozzle cap per hydrant to allow air pockets to dissipate along the full length of the pipe segment being filled.

(5) Hold the chlorinated water in the newly installed main for a minimum of 48-hours. Upon commencement of the 48-hour period, schedule flushing and sampling activities with the Engineer.

(6) The Engineer will collect and submit samples for bacteriological testing. The newly installed system will not be put into service until the Engineer receives a safe bacteriological sample result from the certified lab.

(7) If a sample receives an unsafe test result, schedule with the Engineer to have the main flushed and sampled two additional times, occurring at least 24-hours apart.

(8) If either of the two follow-up samples collected do not pass the test, disinfect the main again per AWWA C651 and the chlorinated water again held in the pipe for a minimum of 48-hours.

(9) Following the 48-hour holding period, assist the Engineer with flushing the line again and re-sampling.

(10) Repeat this process, at no additional cost to the City, until a safe sample is received from the City’s designated testing lab. Cover all costs incurred by the Engineer, including any labor and material.

703.15.3 Hydrostatic Pressure Testing.

(1) Hydrostatically pressure test all new water main, including hydrants, in accordance with the AWWA Standard for Installation of Ductile Iron Water Main (AWWA C600 - latest revision).

(2) After the main has been declared bacteriologically safe by the designated testing lab, and following the installation of service laterals on new private development work, or as soon thereafter convenient for the Engineer, conduct a hydrostatic pressure test. On street reconstruction projects, pressure test mains prior to making any water service lateral connections. All pressure tests shall be witnessed and verified by the Engineer.

(3) Expel all air from the pipe prior to the engineer’s arrival to witness the start of the pressure test. If hydrants or blow-offs are not available at high points, make the necessary taps at high points to expel the air and insert plugs after the air is expelled.

(4) Hydrostatic Pressure Test Requirements:

1. Maximum test segment length of 1,200-feet.
2. 150 psi test pressure (minimum).
3. Minimum duration of 2-hours.
4. Test pressure may not drop below 125 psi at any point during the pressure test.

(5) The Engineer reserves the right to install a locking mechanism at the test gage or install direct-connect pressure recorders for the test.

(6) Higher pressures and shorter durations may be considered upon request.

(7) Longer test segment lengths may be considered upon request.

(8) Use only clean, disinfected containers and equipment to add make-up water at the end of the pressure testing. to return to the original starting pressure of the test. Refill measurements are to be done with a graduated container, measured in ounces.

(9) The Engineer reserves the right to require make-up water be added at any point during the pressure test if the test pressure drops more than 5 psi during the test, which restarts the 2-hour testing duration. Furnish all equipment, labor, and supplies necessary to apply pressure to the pipeline in a manner satisfactory to the Engineer.

(10) The testing allowance (allowable makeup water) shall be no greater than as calculated in the formula:

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

L = Gallons per hour

S = Length of test main in feet

D = Diameter of pipe in inches

P = Average pressure in pounds per square inch during testing

(11) When testing against closed metal-seated valves, an additional testing allowance per closed valve of 0.0078 gph per inch of nominal valve size is permitted.

(12) If the pipe line fails the pressure test, locate the leak and repair it to like-new condition. The proposed repair method is to be reviewed by the Engineer and result in an end product that is equal to, or better than new construction.

(13) Following location and repair of the leak, repeat the pressure test until a satisfactory result is obtained. All costs associated with retesting the pipe line is considered to be incidental.

703.16 Finishing Work and Maintenance.

(1) Repair any structures or other features damaged during construction, including but not limited to:

1. Concrete, asphalt, and gravel pavements.

2. Stone flagging or paving.
3. Sidewalks, curbs and gutters.
4. Culverts.
5. Fences.

(2) Rebuild or re-lay all surfaces properly to the original line and grade in accordance these Specifications, or in the absence of applicable specifications, to original condition.

(3) Prior to final acceptance by the Engineer, clean and grade the project area. Final payment will be withheld until such work is completed in a manner satisfactory to the Engineer

(4) Maintain all repaired, restored, or replaced surfaces until final acceptance of the project by the City.

(5) Repair, restore or replace all failures occurring during the guarantee period at no cost to the City.

703.17 Final Inspection.

(1) Final inspection will not be scheduled until:

1. Repair, replace or adjust valve boxes, curb boxes and hydrants. The use of cheaters or other extensions to reach finished grade is not permitted.
2. Repair or replace any other features disturbed or damaged by construction activities.
3. All applicable finish work and maintenance is complete.
4. All water system testing is satisfactorily completed.

(2) When satisfied that all work is complete, notify the Engineer and schedule a walk through final inspection at least two working-days ahead of paving.

(3) Complete the final inspection with the Engineer, reviewing all project records and paperwork for completeness.

(4) Make the necessary repairs or corrections of any noted deficiencies, before final payment is made.

703.18 Water Utility Construction Services.

(1) Supplemental construction services provided by the Engineer include:

1. Water main filling.
2. Flushing.
3. Testing.
4. Live-tap installations.

(2) Schedule services as follows:

1. Between the hours of 7:00 AM and 3:00 PM.
2. Monday through Friday.

(3) Requests for supplemental construction services occurring outside of the approved hours will be subject to any associated overtime charges being billed.

(4) Do not schedule live-tap installations to occur outside of the approved hours.

(5) The Engineer reserves the right to decline any supplemental construction services which are requested to occur outside of the approved hours.

(6) Upon request, the Engineer may authorize the Contractor to fill water mains. Do not proceed with filling water mains unless authorization by the Engineer has been obtained in writing.

ARTICLE 704 – BID ITEMS, MEASUREMENT AND PAYMENT

704.1 General.

(1) Visit the site prior to bidding and become familiar with the existing conditions. It will be the responsibility of the Contractor to work with the utilities located in the right of way to resolve conflicts during the construction process.

(2) Prices for the various items include all means to complete the work as specified, such as (but not limited to):

1. Equipment.
2. Tools.
3. Materials.
4. Labor.
5. Related incidentals.

(3) The Water Utility will furnish tapping valves, tapping sleeves, and one valve box for all pressurized taps 4-inches or larger. With this one exception, the Water Utility will not furnish any materials to the Contractor unless specifically stated in the Contract documents.

(4) Only work that is completed and accepted in accordance with the terms of these Specifications and the Contract Documents will be measured for payment.

704.2 Bid Items.

(1) Note that all requirements of Articles 701-704 and these Specifications, Standard Detail Drawings, and Contract Documents are applicable to all bid items as described or otherwise considered incidental. Include the costs of all required work in the unit prices that were bid in the Contract Documents, unless specifically noted otherwise.

(2) This includes any sections of a bid item listed as “(Vacant)”.

(3) In the event of conflicting information within these Specifications, the bid items govern.

704.3 Furnish & Install Pipe & Fittings.

4-Inch, Bid Item 70001; 6-Inch, Bid Item 70002; 8-Inch, Bid Item 70003; 10-Inch, Bid Item 70004; 12-Inch, Bid Item 70005; 16-Inch, Bid Item 70006; 20-Inch, Bid Item 70007; 24-Inch, Bid Item 70008.

704.3.1 Description:

(1) Furnish, install and test new water main and fittings. Work for this item also includes:

1. Thrust restraints.
2. Temporary flushing devices (blow-offs and/or temporary hydrants).
3. Polyethylene encasement.
4. Temporarily raising or lowering existing water services.
5. Exposing existing water main to verify location and depth.
6. Placing imported select fill in trench excavations.
7. Disposal of excess excavated material.
8. Concrete and asphalt pavement removal.
9. Restoring the site.

704.3.2 Materials:

(1) Refer to Article 702 and this section.

(2) All materials necessary to perform the work, including:

1. Pipe and accessories.
2. Fittings and accessories.
3. Sleeves, clamps, tie rods, plugs.
4. Thrust blocking and/or restrained-joint gaskets.
5. Polyethylene encasement.
6. Bedding material to cover the pipe.

(3) Temporary blow-off devices:

1. Plastic tubing or other flexible tubing materials are not permitted.
2. Terminate blow-off device at least 2-feet above ground with a ball valve and a 2 ½ -inch brass NST fire-hose connection.

704.3.3 Construction:

(1) Refer to Article 703 and this section.

(2) Pipe Laying and Bedding:

1. Pipes with a minimum of 6-feet and a maximum of 7-feet of cover from final grade.
2. For line or grade adjustments of 24-inches or less, use offsets in lieu of bend fittings.
3. Inspect all pipe and fittings for damage and cleanliness prior to lowering into the trench. Any costs due to the repair of damaged valves and hydrants caused by sand or silt in the pipe will be assessed.
4. Never roll or push the pipe into the trench from the bank. Always lower the pipe into the trench using mechanical equipment.
5. Do not place chlorine in a pipe during installation that will not be filled and flushed within 45 days of installation.

(3) Slip Joints:

1. A slip joint is made by compressing a rubber gasket between a bell cast in the end of one pipe and the plain end of the pipe to be joined.
2. Assemble in accordance with AWWA C600 - latest revision, including:
3. Thoroughly clean the groove and the bell socket of the pipe or fitting, and the plain end of the mating pipe.
4. Using a clean gasket of the proper design for the joint to be assembled, make a small loop in the gasket and insert it in the socket, making sure the gasket faces the correct direction and that it is properly seated.
5. Apply lubricant to the gasket and plain end of the pipe in accordance with ANSI/AWWA C111/A21.11 - latest revision. Only use lubricant supplied by the pipe manufacturer.
6. Be sure that the plain end of the pipe is beveled, as square or sharp edges may damage or dislodge the gasket and cause a leak.
7. Push the plain end into the bell of the pipe, keeping the joint straight while pushing.
8. Deflect the pipe as required only after the joint is assembled.
9. Connect the bonding straps after the pipe is in place to ensure conductivity across the joint.

704.3.4 Method of Measurement:

(1) Measured by length, in feet, to the nearest half foot for each size (diameter) of pipe installed.

(2) Measured along the centerline of the pipe, from center to center of valves and fittings.

(3) No deductions from the measured lengths for fitting installations.

704.3.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70001	FURNISH AND INSTALL 4 INCH PIPE & FITTINGS	L.F.
70002	FURNISH AND INSTALL 6 INCH PIPE & FITTINGS	L.F.
70003	FURNISH AND INSTALL 8 INCH PIPE & FITTINGS	L.F.
70004	FURNISH AND INSTALL 10 INCH PIPE & FITTINGS	L.F.
70005	FURNISH AND INSTALL 12 INCH PIPE & FITTINGS	L.F.
70006	FURNISH AND INSTALL 16 INCH PIPE & FITTINGS	L.F.
70007	FURNISH AND INSTALL 20 INCH PIPE & FITTINGS	L.F.
70008	FURNISH AND INSTALL 24 INCH PIPE & FITTINGS	L.F.

(2) Payment for temporary flushing hydrants and/or blow-offs will be considered only if subsequently required as a result of plan revisions issued by the Engineer:

1. A payment of $1,500.00 will be made for any authorized temporary flushing hydrant.
2. Any hydrant used for temporary flushing purposes may not become a permanent fixture anywhere in the system.
3. A payment of $500.00 will be made for any 2-inch or larger blow-off device.
4. Temporary hydrants or blow-offs resulting from a plan revision must be reviewed by the Engineer for payment considerations.

(3) Additional Fittings, where authorized, are to be paid or credited as follows:

DESCRIPTION	UNIT	PRICE
4-INCH FITTING	EACH	$575.00
6-INCH FITTING	EACH	$705.00
8-INCH FITTING	EACH	$950.00
10-INCH FITTING	EACH	$1,075.00
12-INCH FITTING	EACH	$1,200.00
16-INCH FITTING	EACH	$2,150.00
20-INCH FITTING	EACH	$2,685.00

(4) Total fitting quantity to be balanced out by any fittings identified on the plan set to be furnished and installed, but that were not furnished and installed.

(5) Additional tee fittings:

1. Paid or credited as 1½ fittings.

(6) Additional offset and cross fittings:

1. Paid or credited as 2 fittings.

(7) Additional cap or plug fittings:

1. Paid or credited as 1/4 fittings.

704.4 Horizontal Directional Drill Pipe.

8-Inch, Bid Item 70010; 10-Inch, Bid Item 70011; 12-Inch, Bid Item 70012; 16-Inch, Bid Item 70013; 20-Inch, Bid Item 70014; 24-Inch, Bid Item 70015.

704.4.1 Description:

(1) Furnish, assemble, install and test horizontal directional-drilled water pipe and fittings. Work for this item also includes:

1. Excavating boring pits and other trenches. Backfilling and compacting said excavations.
2. Exposing existing water mains to verify location and depth.
3. Installing tracer wire, joint adapters, bracing, plugs and other accessories.
4. Hard-rock drilling.
5. Disposing of surplus material.
6. Restoring the work area.

704.4.2 Materials:

(1) Refer to Article 702 and this section.

(2) High-Density Polyethylene (HDPE), as described herein, is the approved standard pipe material for Horizontal Directional-Drilling pipe installations.

1. If proposing to use pipe material other than HDPE for directional-drilling, submit full material specifications to the Engineer for review per Article 703 – 'Repairs and Alterations.'
2. Any proposed alternative material needs to have been used on a minimum of five similarly sized horizontal directional-drilling projects within the last three years to be considered.

(3) HDPE Pipe Requirements:

1. In compliance with AWWA C906 – latest edition, ASTM F714 – latest edition.
2. 200 psi pressure rating.
3. DR-11 dimension ratio.
4. Match inside diameter as closely as practical to the inside diameter of the connection pipe.
5. Outside diameters shall be Ductile Iron Outside Diameter (DIOD).
6. Comply with the requirements of the Safe Drinking Water Act and certified as suitable for drinking water by ANSI/NSF Standard 61.
7. Identified as water with either a factory installed co-extruding longitudinal blue stripe in the pipe or blue underground warning tape with "Caution Buried Water Line Below" imprinted on it, placed 2-feet above the new pipe.

8. Cuts or gouges in the HDPE pipe, per ASTM F585 are acceptable up to 10% of the wall thickness. Cut out and remove any pipe sections where cuts or gouges are greater than 10% of the wall thickness and butt fuse the ends.

(4) Joining HDPE pipe to HDPE pipe *or* HDPE fittings:

1. Thermal butt fusion.

2. Thermal butt fusion is to be executed in accordance with the requirements of the pipe and/or fitting manufacturer. Equipment used to execute the thermal butt fusion joints shall be furnished or approved by the pipe and/or fitting manufacturer.

~~(5) HDPE pipe joints to valve joints *or* ductile iron pipe:~~

~~1. HDPE mechanical joint adapter with restraining device (Electrofusion Flex Restraint) and a concrete collar (cast in place). Concrete collars are to meet specifications of Article 703 – 'Thrust Restraint' and the Standard Detail Drawings.~~

(6) Mechanical Joint Adapters:

1. Join HDPE pipe to mechanical joint bells in accordance with the requirements of ANSI/AWWA C111/A21.11.

2. Mechanical joint adapters shall be certified to meet the requirements of ANSI/AWWA C901 and C906 requirements (latest revisions).

3. Thermal butt fusion is required at joints between mechanical joint adapters and HDPE pipe.

(7) Tracer Wire:

1. Galvanized or stainless steel.

2. ¼-inch diameter braided cable.

3. 2,000-lb minimum breaking strength.

4. Protective PVC coating (to resist corrosion and damage during installation).

704.4.3 Construction:

(1) Refer to Article 703 and this section.

(2) Prior to bidding, become familiar with anticipated subsurface and existing field conditions that will affect the location of the bore pits and the lengths and depths of the pipe installation, as well as any equipment, tools and materials required to keep the necessary installation within the limits identified on the drawings.

(3) The Contract Documents represent the best information available with regard to anticipated field conditions; however, any provisions necessary for encountering hard-rock drilling are to be included and are considered incidental to the installation.

(4) Exposing existing water mains to verify location is considered incidental to the installation.

(5) Submit a horizontal directional-drilling plan, sequence of work, and drilling schedule to the Engineer for review prior to commencing work. At a minimum, include:

1. Detailed site plan drawing which depicts location and size of boring pits and staging areas.
2. Proposed sequence and schedule of HDD operations.
3. Method of controlling and monitoring and recording the bore location, accuracy, and depth.
4. Drilling mud storage, handling and contingency plan.
5. Any other applicable details regarding how the work will progress and be controlled.

(6) The Engineer will review the precision of the installed pipe. For gross misalignment, the Engineer reserves the right to require that the pipe be reinstalled at no cost to the City. Maintain liability for all costs associated with modifying to easements due to HDPE installation alignment errors. Pipe installation accuracy requirements:

1. Horizontal accuracy of +/- 3-feet.
2. Vertical accuracy of plus 6-inches and minus 3-feet.

(7) Perform pipe joining with personnel trained by the thermal fusion equipment manufacturer in the use of the equipment for thermal butt fusion/electro-fusion of HDPE pipe.

(8) Do not proceed with installation of the pipe until mechanical end seals are securely installed.

(9) Do not make ductile iron connections to the fused HDPE adaptors on the same day the HDPE pipe was installed. Allow 24- hours for initial contraction of the HPDE pipe upon removal of the installation pull force loads.

(10) Install tracer wire along the full length of the pipe. Bring the tracer wire up to finish grade at each end of the bore inside a valve box to allow access for future use. Securely clamp or weld the tracer wire to the valve box. Center the valve box over the mechanical joint transition fitting.

704.4.4 Method of Measurement:

(1) Measured by length in feet, to the nearest half-foot for each size (diameter) of pipe installed.

(2) Measured along the centerline of the pipe from center-to-center of valves and fittings.

(3) No deductions will be taken from the measured lengths for fitting installations. No additions to the length of the pipe will be given due to misalignment of the bore.

704.4.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70010	HORIZONTAL DIRECTIONAL DRILL 8 INCH PIPE	L.F.
70011	HORIZONTAL DIRECTIONAL DRILL 10 INCH PIPE	L.F.
70012	HORIZONTAL DIRECTIONAL DRILL 12 INCH PIPE	L.F.
70013	HORIZONTAL DIRECTIONAL DRILL 16 INCH PIPE	L.F.
70014	HORIZONTAL DIRECTIONAL DRILL 20 INCH PIPE	L.F.
70015	HORIZONTAL DIRECTIONAL DRILL 24 INCH PIPE	L.F.

(2) Valve boxes required for tracer wire endpoints are considered to be incidental to this bid item.

704.5 Furnish & Install Casing.

18-Inch, Bid Item 70020; 20-Inch, Bid Item 70021; 24-Inch, Bid Item 70022; 30-Inch, Bid Item 70023.

704.5.1 Description:

(1) Install steel or reinforced concrete casing pipes for water mains.

704.5.2 Materials:

(1) Refer to Article 702 and this section.

(2) Steel Casing Pipe:

1. Minimum yield strength of 35,000 psi.
2. Minimum wall thickness:

Pipe Diameter (inches)	Wall Thickness (inches)
18	0.31250
20	0.34375
24	0.37500
30	0.46875

(3) Reinforced Concrete Pipe:

1. Class V minimum.

(4) Carrier Pipe:

1. US Pipe TR-Flex, or equivalent.

(5) Casing fill:

1. Silica sand or pea gravel.

704.5.3 Construction:

(1) Prior to installation of the pipe casing, perform required ULOs to verify the location of surrounding utilities and structures. Provide utility location information to the Engineer for review and approval of any adjustments in casing installation line or grade, in writing.

(2) Install per the approved drawings to an accuracy of +/- 1% or +/- 2-feet, whichever is less.

(3) Install the pipe casing by traditional open trench construction wherever applicable.

(4) For untrenched installation of the pipe casing, install by dry auger boring and jacking methods.

(5) Requirements:

1. Borehole diameter to be essentially the same as the outside diameter of the casing.
2. Auger is to remain inside the casing at all times.

3. Pressure-grout the annular space around the casing if the auger is pushed ahead of the casing.
4. Pressure grout voids as they develop.
5. Pressure-grout any spaces greater than approximately 1-inch from the outside of the casing.
6. Provide a steerable front section of casing to allow vertical grade adjustments.
7. Provide a water level or other means to monitor the grade elevation of the auger casing.
8. Water jacking for excavation of the soil is not permitted.

(6) Provide a boring and jacking plan to the Engineer for review and approval prior to commencing work.

(7) Connect adjacent lengths of steel pipe by continuous, circumferential, field butt-welding in accordance with AWWA C206.

(8) Install carrier pipe on line and grade through the casing pipe.

(9) Install approved casing spacers at the required distances (see Standard Detail Drawings).

(10) Fill the annular space between the casing and carrier pipe with specified sand or gravel material.

(11) Take care to ensure that developed thrust pressures do not disturb existing utilities in or around the bore pit area.

(12) Properly dispose of excess material off-site.

704.5.4 Method of Measurement:

(1) Measured by length in feet, to the nearest half foot for each size (diameter) of casing installed.

(2) Measured along the centerline, from end to end of the casing.

704.5.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70020	FURNISH AND INSTALL 18 INCH CASING	L.F.
70021	FURNISH AND INSTALL 20 INCH CASING	L.F.
70022	FURNISH AND INSTALL 24 INCH CASING	L.F.
70023	FURNISH AND INSTALL 30 INCH CASING	L.F.

704.6 Furnish & Install Water Valve.

4-Inch, Bid Item 70030; 6-Inch, Bid Item 70031; 8-Inch, Bid Item 70032; 10-Inch, Bid Item 70033; 12-Inch, Bid Item 70034; 16-Inch, Bid Item 70035; 20-Inch, Bid Item 70036.

704.6.1 Description:

(1) Furnish and install water main valves and associated accessories. Work for this item also includes, but is not limited to:

1. Mechanical joint restraint:
2. Valve boxes and box extensions.
3. Valve box adjustments.

704.6.2 Materials:

(1) Refer to Article 702 and this section.

(2) Valves 12-inches and smaller - Requirements:

1. Resilient Wedge Gate Valves.
2. Meets the requirements of AWWA C509- latest revision.
3. Supplied with mechanical joints.
4. Supplied with conductive mechanical joint (no lead) gaskets.
5. Open to the left.
6. Non-rising stem.
7. O-ring packing.
8. 2-inch square operating nut.
9. Acceptable models include:

Brand	Model
Kennedy	K4571 or equal
Mueller	A2360 or equal
Clow	F6100 or equal
AFC	Series 500 or equal – *OR* – Series 2500 or equal

(3) Valves 16-inches and larger - Requirements:

1. Rubber Seated Butterfly Valves.
2. Meets the requirements of AWWA C504 - latest revision.
3. Supplied with mechanical joints.
4. Supplied with conductive mechanical joint (no lead) gaskets.

5. Open to the left.
6. Acceptable models include:

Brand	Model
Kennedy	B4500 or equal
Mueller	B3211-20 or equal

(4) Valve boxes:

1. Bingham and Taylor cast-iron, size “DD”, 50-inches to 70-inches.
– OR –
East Jordan 8550/8560/6800 cast-iron (CL35B), 51-inches to 73-inches.
2. Three piece screw type.
3. No. 6 round base.
4. 5-1/4-inch shaft.
5. With stay-put covers marked “WATER.”.
6. Valve box covers/lids shall be smooth, round, standard drop in lids without grooves or ridges (Bingham and Taylor L1-5 model, or equal).

(5) Valve Box Alignment Devices:

1. All valves shall be supplied with a Gate Valve Adaptor as manufactured by Adaptor Inc., or equal.
2. Metal frame
3. Supplied with ¾-inch rubber gasket.
4. Sized to fit the brand of valve being supplied.

(6) Valve Box Extensions:

1. Tyler, or equal
2. Screw type
3. 5-1/4-IN shaft
4. No. 58 - 12-IN long,
5. No. 59 - 18-IN long,
6. No. 60 - 26-IN long.

704.6.3 Construction:

(1) Refer to Article 703 and this section.

(2) Prior to installation, inspect all valves and associated accessories for:

1. Cracks or other handling damages.
2. Verification of bolt tightness.
3. Opening direction and number of turns to open.
4. Freedom of operation.
5. Cleanliness of valve ports, especially seating surfaces.

(3) Set and join valves and associated accessories to the pipe with mechanical joints per Article 703.

(4) Always install valves in the closed position to prevent foreign material from causing damage.

(5) Adjust valves following installation so they operate easily and properly.

(6) A valve box is required at every valve installation. Valve box installation requirements:

1. Ensure that the valve box does not transmit shock or stress to the valve.
2. Center the valve box over the valve operating nut using the valve box alignment device in accordance with Standard Detail Drawing 7.06 – Water Valve Box Alignment.
3. Verify valve box alignment with a plumb bob centered on the operating nut. The box must be centered over the nut within the allowable tolerance of ¾-inch.
4. Valve boxes located on sloped surfaces of 3% or greater may not allow for alignment verification as described above and shall be visually assessed with the operation of a centered, unrestricted valve key.
5. Set the box cover ¼-inch to ½-inch below the finished surface.
6. Verify that there is adequate adjustment in the valve box to reach proper grade without the use of "cheaters," "non-threaded risers," or "drop-in" extensions – only threaded, screw-type valve box components are permitted.
7. Reset any valve boxes that have shifted so they are plumb and centered over the valve at any time throughout construction, and until formal acceptance of the project by the Engineer.

704.6.4 Method of Measurement:

(1) Measured by each completed unit.

704.6.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70030	FURNISH AND INSTALL 4-INCH WATER VALVE	EACH
70031	FURNISH AND INSTALL 6-INCH WATER VALVE	EACH
70032	FURNISH AND INSTALL 8-INCH WATER VALVE	EACH
70033	FURNISH AND INSTALL 10-INCH WATER VALVE	EACH
70034	FURNISH AND INSTALL 12-INCH WATER VALVE	EACH
70035	FURNISH AND INSTALL 16-INCH WATER VALVE	EACH
70036	FURNISH AND INSTALL 20-INCH WATER VALVE	EACH

704.7 Furnish and Install Hydrant / Salvage Existing Hydrants.

Bid Item 70040.

704.7.1 Description:

(1) Furnish and install fire hydrants and associated thrust restraints. Adjust hydrant as necessary.

(2) Prepare a proper drain field for the hydrant.

(3) Decommission and salvage existing fire hydrants as designated on the plans.

(4) Restore all disturbed terrace or turf areas.

704.7.2 Materials:

(1) Refer to Article 702 and this section.

(2) Hydrant requirements:

1. Hydrants are required to have “breakaway” capability
2. Acceptable models include:

Brand	Model
AFC Waterous	Pacer WB-67
Mueller	Super Centurion A423

(3) Nozzle requirements:

1. Side nozzles: Two at 2½-inch diameter.
2. Pumper nozzle: One at 4½-inch diameter.
3. National Standard threads.
4. Chains attaching the caps to the hydrant.
5. Embossed with the word OPEN and an arrow showing that the hydrant opens left.
6. Valve opening: 5¼-inch with National Standard operating nut shape.
7. Painted red with blue nozzle caps – Waterous color M4152 (Houston Blue), or equal.
8. 360-degree top rotation.
9. “Dry top” operating threads to be sealed when open.
10. 6-inch mechanical joint bottom connection with conductive mechanical joint (no lead) gasket and necessary accessories.

(4) Upper valve plate requirements:

1. Brass with a brass-to-brass foot valve.

(5) Drain valve facing requirements:

1. Furnish hydrant with plastic drain valve facing (otherwise, drain tube/drain valve assembly).

(6) Operating nut requirements:

1. One-piece operating nut.

(7) Reflective locating device:

1. “Hydra-Finder” manufactured by RoDon Corp.

(8) Extensions: Per manufacturer’s recommendations.

704.7.3 Construction:

(1) Refer to Article 703 and this section.

(2) Ensure that the Engineer is present whenever:

1. A hydrant is to be set.
2. A hydrant has been set, prior to backfilling.
3. A hydrant extension is to be installed.
4. A hydrant is to be disassembled for adjustment or maintenance.

(3) Be responsible for the proper operation of all hydrants on the project until the City formally accepts the water mains, and the warranty period has expired.

(4) Unless directed otherwise, set all hydrants so the back of the hydrant is 8-feet from the associated property line.

(5) Ensure that the hydrant is set so the bury-line is not below finished grade and not more than 3-inches above finished grade.

(6) The base of the hydrant barrel may not exceed a depth of 9-feet below finished grade.

(7) Hydrant extensions:

1. Extensions may be necessary to bring the bury-line to finish grade.
2. Notify the Engineer at least 2 working days prior to installing an extension.
3. Coordinate with the Engineer to have the extension furnished.
4. When an extension becomes necessary as a result of Engineer-ordered grade adjustments during construction or plan revisions issued by the Engineer, the City will furnish the extension and the installation labor.
5. When an extension is necessary as a result of negligence, or when the planned depth is greater than the available hydrant length, supply an approved extension. Do not install the extension until the Engineer is present.
6. No more than 1 hydrant extension will be permitted per hydrant installation.

7. Note that any subsequent adjustments to the hydrant elevation, including any extra fittings needed to meet these requirements, are considered incidental to the hydrant installation.

(8) Restrain the full length of hydrants lead from the tee on the water main to the hydrant, including the hydrant valve and any associated fittings, with mechanical joint restraints. Push-on pipe joints are not permitted along the hydrant lead unless there is a continuous pipe dimension on the lead longer than the full-length of a new pipe. Under that condition, an approved joint-restraint locking gasket is required at the joint.

(9) Install a 4-inch x 8-inch x 16-inch solid concrete masonry unit, laid flat, in the excavation to provide a firm base for the hydrant. If a hydrant lead valve is designated on the plans, also install a 4-inch x 8-inch x 16-inch solid concrete masonry unit, laid flat, in the excavation to provide a firm base for the valve.

(10) Install solid concrete or poured concrete thrust blocking against undisturbed soil behind the base of the hydrant in accordance with Article 703 of these Standard Specifications.

(11) Set the hydrant in a truly vertical position and securely brace it until backfilling is complete.

(12) Rotate the hydrant so that the small nozzles are parallel to the curb line.

(13) Use 1-inch washed stone as backfill around the lower portion of the hydrant. Take special care to keep the weep holes/drain holes in the hydrant elbow open to allow drainage.

(14) Cover the stone backfill with 6-mil polyethylene, or suitable geotextile fabric, to prevent loose dirt from filling in the voids in the stones.

(15) Backfill the remainder of the excavation with approved material and compact evenly in lifts not exceeding 12-inches. Ensure that the pressure of the backfill on the stem is evenly distributed.

(16) Restore all disturbed turf areas associated with the hydrant installation.

(17) Salvaging existing hydrants (incidental when designated on plans):

1. Do not proceed with hydrant abandonments until the existing water main has been abandoned.

2. For screw type hydrants:

    (i) Unscrew the hydrant with chain tongs (or like), and remove the high stock, and salvage for the Engineer.

    (ii) Remove the frost case and salvage for the Engineer.

3. For non-screw type hydrants:

    (i) Excavate to the bottom of the hydrant and disassemble/disconnect it from the hydrant lead.

    (ii) Remove the hydrant and salvage for the Engineer.

4. Backfill the remaining opening/excavation with existing material and compact.

5. Use select fill material if there is not enough approved existing backfill material.

6. Restore all disturbed turf areas associated with the hydrant abandonment.
7. Hydrants that are damaged due to negligence will not be paid.
8. Hydrants damaged during this work will be billed $635.00 by the Engineer.

704.7.4 Method of Measurement:

(1) Measured by each completed unit.

704.7.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70040	FURNISH, INSTALL AND SALVAGE HYDRANT	EACH

704.8 Relocate Hydrant.

Bid Item 70041.

704.8.1 Description:

(1) Remove and relocate existing fire hydrants.

704.8.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant)

704.8.3 Construction:

(1) Refer to Article 703 and this section.

(2) If the hydrant lead valve is adequately restrained to the water main tee:

1. Shut off the hydrant lead valve and excavate as necessary along the hydrant lead.
2. Add or remove fittings, extending or shortening the hydrant lead as shown on the drawings or as ordered by the Engineer, to properly install the hydrant in accordance with Article 704 – 'Furnish & Install Hydrant'.

(3) If the hydrant does not have a valve, or if the valve is not adequately restrained to the main:

1. Shut off the water main after coordinating with the Engineer.
2. Excavate along the hydrant lead and cut the lead.
3. Install valve per Article 704 and securely restrain the new valve back to the water main tee.
4. Return the water main to service as soon as practical and safe.
5. Add or remove fittings, extending or shortening the hydrant lead as shown on the drawings or as ordered by the Engineer to properly install the hydrant in accordance with Article 704 – 'Furnish & Install Hydrant'.

(4) Backfill and compact the excavation to an elevation 6-inches below the finished grade of the street terrace in accordance with Article 704 – 'Furnish & Install Hydrant'.

(5) Restore all disturbed turf areas associated with the hydrant relocation/installation.

704.8.4 Method of Measurement:

(1) Measured by each completed unit.

704.8.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70041	RELOCATE HYDRANT	EACH

704.9 Furnish & Install Water Service Laterals.

1-Inch, Bid Item 70050; 1½-Inch, Bid Item 70051; 2-Inch, Bid Item 70052.

704.9.1 Description:

(1) Install new copper service laterals and related accessories. Work for this item also includes:

1. Tapping the water main and installing or repairing polyethylene water main encasement.
2. Installing the associated service lateral fittings and curb box.
3. Adjusting the new curb box relative to finished grade.
4. Removing any existing curb stops/curb boxes inside the excavated service ditch.
5. Placing imported select fill in trench excavations.
6. Disposal of excess excavated material.
7. Restoration of disturbed terrace or turf areas.

704.9.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant)

704.9.3 Construction:

(1) Refer to Article 703 and this section.

(2) Whenever possible, install the curb stop on the service at a point 8-feet from the property line.

(3) Install a 4-inch x 8-inch x 8-inch solid concrete masonry unit, laid flat, in the excavation to provide a firm base for the curb stop.

(4) Adequately wrap the curb stop with polyethylene wrap to prevent debris from entering or impacting the operability of the curb stop.

(5) Install the curb box vertically over the curb stop so that after the service is backfilled to final grade, a key may be placed on the rod of the curb stop and it may be operated easily.

(6) Set curb boxes 1-inch below ~~flush with~~ the finished ground elevation when located in unpaved areas.

(7) Set curb boxes ¼-inch below finished grade when located in paved areas.

(8) Do not locate curb boxes in curb, sidewalk, driveways, or within 5-feet of the base of trees.

(9) When backfilling new service lateral trenches:

1. Place a 2-inch x 4-inch board next to each curb or valve box in the terraces.
2. Ensure that the board is at least 4-feet long, with at least 2-feet buried and 2-feet exposed.

(10) Following installation, open the corporation stop and the curb stop, and flush out the service lateral. Once flushed, securely install a plug or copper end cap to keep rocks and dirt out of the lateral.

(11) Leave the corporation stop open.

(12) Restore any disturbed terrace or turf areas associated with the lateral installation. The restoration is considered incidental to the service lateral work.

(13) Install 2-inch rigid insulation at all storm sewer crossings and areas with less than 5-feet of cover.

(14) Flexible tubular insulation, with equivalent R-value, is acceptable in areas where tunneling or other existing utilities restrict the use of rigid insulation boards. See Section 704.17 – Furnish and Install Insulation for material requirements.

(15) Installation of insulation is considered for payment separately under Bid Item 70101 – Furnish and Install Insulation.

704.9.4 Method of Measurement:

(1) Measured by each completed unit.

704.9.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70050	FURNISH AND INSTALL 1 INCH SERVICE LATERALS	EACH
70051	FURNISH AND INSTALL 1½ INCH SERVICE LATERALS	EACH
70052	FURNISH AND INSTALL 2 INCH SERVICE LATERALS	EACH

704.10 Replace Service Lateral.

1-Inch, Bid Item 70053; 1½-Inch, Bid Item 70054; 2-Inch, Bid Item 70055.

704.10.1 Description:

(1) Abandon existing service lateral and replace it with a new service lateral. Typically a result of:

1. Tree ordinance restrictions (see Article 107).
2. Utility conflicts, or driveway approach/pavement conflicts.
3. Broken curb stops or damage to the existing copper tubing on the existing lateral.
4. The request of the Engineer.

704.10.2 Materials:

(1) Refer to Article 702 and this section.

704.10.3 Construction:

(1) Refer to Article 703 and this section.

(2) Allow for any services designated for replacement on the plans to first be reexamined by the Engineer in order to determine the necessity for replacement and evaluate alternatives.

(3) Alternatives to the indicated total replacement may include a combination of:

1. Extending/reconnecting a service lateral per Article 704.
2. Disconnecting/reconnecting a service lateral per Article 704.
3. Replacing a curb stop/box per Article 704.

(4) If the Engineer determines the existing service lateral shall be replaced, abandon the existing service lateral and install a new service lateral in accordance to Article 704 – 'Furnish & Install Water Service Lateral'.

704.10.4 Method of Measurement:

~~(1)~~ Measured by each completed unit. ~~length in feet along the centerline of the service lateral at the surface, from the center of the water main to the center of the curb stop.~~

~~(2) If the Engineer relocates a curb stop due to conflict, tail extensions beyond the curb stop will be paid along the centerline of the service lateral at the surface from the curb stop to the property service connection.~~

704.10.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70053	REPLACE 1-INCH COPPER SERVICE LATERAL	EACH
70054	REPLACE 1½-INCH COPPER SERVICE LATERAL	EACH
70055	REPLACE 2-INCH COPPER SERVICE LATERAL	EACH

704.11 Reconnect Service Lateral.

1-Inch, Bid Item 70056; 1½-Inch, Bid Item 70057; 2-Inch, Bid Item 70058.

704.11.1 Description:

(1) Connect-to and extend existing water service laterals otherwise cut off and shorten, existing copper water service laterals and connect the lateral to the new water main. Restore any disturbed terrace areas, as necessary.

704.11.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant)

704.11.3 Construction:

(1) Refer to Article 703 and this section.

(2) Extend and reconnect lateral:

1. Excavate to expose the existing water main at the existing service connection.
2. Cut-off the service pipe at the exposed location.
3. Couple the disconnected end of the service with a new service of the designated size.
4. Extend the new copper lateral to the new water main and connect the new service tubing to the corporation stop on the new water main.

(3) Disconnect and reconnect lateral:

1. Excavate to expose the existing service lateral at the location of the new water main crossing.
2. Cut-off the service tubing at the exposed crossing location.
3. Couple the disconnected end of the service tubing with a new service of the designated size.
4. Reconnect the modified service length to the corporation stop on the new water main.

704.11.4 Method of Measurement:

(1) Measured by each completed unit.

704.11.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70056	RECONNECT 1-INCH SERVICE LATERAL	EACH
70057	RECONNECT 1½-INCH SERVICE LATERAL	EACH
70058	RECONNECT 2-INCH SERVICE LATERAL	EACH

704.12 Cut-In or Connect-To Existing Water System.

Bid Item 70080.

704.12.1 Description:

(1) Cut-In Connection consists of all means and methods, equipment, tools, labor, and incidentals necessary for making a plug-removal connection or a cut-in connection to existing water mains, including any necessary water-tight capping of existing water mains associated with the work.

704.12.2 Materials:

(1) Refer to Article 702 and this section.

704.12.3 Construction:

(1) Refer to Article 703 and this section.

(2) Excavate and expose the existing water main to a point 18-inches below the bottom of the pipe at the proposed location of the plug-removal connection or cut-in connection.

(3) Shut off all valves required to isolate the exposed pipe segment. Be responsible and properly equipped for valve-turning at all times while doing such work.

(4) Place a water pump at the bottom of the excavation for dewatering, as needed. When cutting out sections of pipe proceed slowly and ensure dewatering efforts prevent the water level within the excavation from rising above the invert elevation of the exposed pipe.

(5) Before placing new pipe and fittings on the exposed end of the existing fitting or the cut-off end of the existing pipe, disinfect the new fitting or valve by swabbing or soaking thoroughly with a 10:1 (water:bleach) solution.

(6) Fasten new fittings to existing fittings or ductile iron pipes as described in Article 703. For connections to existing cast iron or other existing pipe materials, secure the new pipe or fitting with threaded rods in accordance with the Standard Detail Drawings.

(7) All cut-in connections and tee branch connections require concrete thrust restraint in addition to mechanical joint restraint. See Article 703 and the Standard Detail Drawings for concrete thrust restraint requirements.

(8) For cut-in connections or as otherwise necessary, secure the disconnected end of the existing pipe with either a pipe plug or a cap fitting, as approved by the Engineer. Place standard thrust blocking between the end of the existing pipe and the new fitting, unless specified otherwise in the Contract Documents or as directed by the Engineer.

704.12.4 Method of Measurement:

(1) Measured by each completed unit.

704.12.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70080	CUT-IN OR CONNECT TO EXISTING WATER SYSTEM	EACH

704.13 Furnish Excavation and Ditch for Live Tap.

Bid Item 70081.

704.13.1 Description:

(1) Excavate and prepare the ditch for the City to perform a live-tap connection on an existing water main. Upon completion of tap, cut-off and cap the existing water main.

704.13.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.13.3 Construction:

(1) Refer to Article 703 and this section.

(2) Prepare a suitable work area in the ditch for the Engineer to perform the live-tap:

(3) Expose the water main across the full width of the ditch.

(4) Provide at least 1-foot of clear space around the circumference of the exposed water main.

(5) Locate and identify the proposed tap location in the ditch and adjust as necessary to maintain a distance of at least 18-inches from the nearest joint.

(6) Provide at least a 4-foot-wide clear working area, extending at least 6-feet perpendicular from the main at the location of the live-tap.

(7) Upon completion of the live-tap by the City, cut-off and cap the existing water main in accordance to Article 704 - 'Cut Off Existing Water Main'. The cut-off and cap work associated with the live-tap is incidental to the work and will not be paid separately.

(8) Upon completion of the live-tap by the City, install concrete thrust restraint opposite the tap in addition to the mechanical joint restraint required at the tap connection. See Article 703 and the Standard Detail Drawings for concrete thrust restraint requirements.

704.13.4 Method of Measurement:

(1) Measured by each completed unit.

704.13.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70081	FURNISH EXCAVATION AND DITCH FOR LIVE TAP	EACH

704.14 Cut Off Existing Water Main.

Bid Item 70082.

704.14.1 Description:

(1) Abandon and plug a segment of existing water main by "cutting it off" from the active water system. The work also includes securely capping or plugging the cut end of the active main.

704.14.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.14.3 Construction:

(1) Refer to Article 703 and this section.

(2) Prior to proceeding with the cut-off, perform the required water main shut-off notifications.

(3) When authorized to proceed, isolate and shut-off the existing water main.

(4) Cut of the water main at the location designated for abandonment.

(5) Install a concrete pipe plug in the end of the existing main which is to be abandoned.

(6) On the end of the water main which is to remain in-service:

1. Install a restrained mechanical joint cap over the cut end of the existing water main, or within 2-feet of a fitting or live-tap.

2. Otherwise, install a restrained mechanical joint plug fitting into a new or existing fitting located at the end of the main.

(7) If the water main cut off work is intended to remove and replace an existing fitting, valve, or segment of pipe, cut off as designated, remove the existing material and replace it with the new fittings and/or the lengths of pipe and solid sleeves necessary to reconnect to the existing main.

(8) Disinfect any associated materials by swabbing methods in accordance to Article 703.

704.14.4 Method of Measurement:

(1) Measured by each completed unit.

704.14.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70082	CUT OFF EXISTING WATER MAIN	EACH

704.15 Abandon Water Valve Box.

Bid Item 70090.

704.15.1 Description:

(1) Abandon valve boxes within the project limits that are set upon valves no longer in service.

(2) Place the abandoned valve in the closed position prior to abandoning the box.

(3) Completely remove the valve box whenever possible.

704.15.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.15.3 Construction:

(1) Refer to Article 703 and this section.

(2) Proceed with work only after the existing water main has been abandoned.

(3) Remove the top casting of the valve box to a point at least 3-feet below the final elevation, and then backfill the opening.

704.15.4 Method of Measurement:

(1) Measured by each completed unit.

704.15.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70090	ABANDON WATER VALVE BOX	EACH

704.16 Abandon Water Valve Access Structure.

Bid Item 70092.

704.16.1 Description:

(1) Abandon all designated water valve access structures or manholes within the project limits.

(2) If the valve is to remain active, install a valve box.

704.16.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.16.3 Construction:

(1) Refer to Article 703 and this section.

(2) Remove the existing casting and the structure walls.

(3) If concrete is in contact with a main and/or valve that is to remain in service, and removal of the structure may damage the existing piping system, the Engineer may instead require that the structure walls be removed to a depth of 3-feet below finished grade.

(4) If the existing valve is to remain in use, remove and replace the water valve access structure with a valve box per Article 704.

(5) Use select fill as additional backfill material if there is not enough approved existing material.

704.16.4 Method of Measurement:

(1) Measured by each completed unit.

704.16.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70092	ABANDON WATER VALVE ACCESS STRUCTURE	EACH

704.17 Furnish and Install ~~Styrofoam~~ Insulation.

Bid Item 70101.

704.17.1 Description:

(1) Install rigid board or tubular insulation ~~Styrofoam~~ to insulate water mains and/or water service laterals.

(2) Pipe insulation is required when:

1. The top of water main or service lateral has 5-feet of cover or less.
2. The water main or service lateral crosses below storm sewer.
3. When otherwise specified on the drawings or as directed by the Engineer.

704.17.2 Materials:

(1) Refer to Article 702 and this section.

(2) Rigid Board ~~Styrofoam~~ insulation requirements:

1. Thickness: 2-inch (minimum).
2. Minimum strength: 25 psi.
3. High-density polystyrene board as manufactured by Dow Chemical Co., or equal.
4. 4-foot by 8-foot sheets.

(3) Tubular Insulation for Service Laterals:

1. Tubular elastomeric cellular insulation, per ASTM C-534, Type 1, Grade 1
2. Tubular polyethylene/polyolefin cellular insulation, per ASTM C-1427, Type 1
3. R-Value shall be comparable to rigid board insulation.
4. Match the interior diameter of preformed insulation tube to the diameter of the service lateral.
5. Wrap tape around the insulation tube at 3-foot intervals to secure the insulation prior to installation.

704.17.3 Construction:

(1) Refer to Article 703 and this section.

(2) After pipe installation, ~~backfill~~ place bedding material and compact ~~the trench~~ to a level 6-inches above the top of pipe. Place insulation board in the trench centered over the pipe on a level surface in order to provide proper support for the insulation.

(3) Following installation of the ~~Styrofoam~~ insulation, place and compact the remaining bedding/cover material to the top of the pipe zone, at least 12-inches above the top of pipe, and then backfill and compact the remainder of the trench.

(4) Tubular insulation may be used in certain circumstances, such as tunneling laterals, which restrict the placement of rigid board insulation. See Section 704.9 - Furnish & Install Water Service Laterals for additional information.

704.17.4 Method of Measurement:

(1) Measure along the center of the pipe at the surface, by length in feet of pipe effectively insulated.

704.17.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70101	FURNISH AND INSTALL ~~STYROFOAM~~ INSULATION	L.F.

704.18 Landscape Restoration for Water Main.

Bid Item 70102.

704.18.1 Description:

(1) Restore turf areas disturbed from water main installation, including all incidentals necessary to restore the terrace or turf area to grade, such as topsoil and seeding, are included herein.

704.18.2 Materials:

(1) Refer to Article 702 and this section.

(2) Topsoil: See Article 202 of these Specifications.

(3) Seeding: See Article 207 of these Specifications.

704.18.3 Construction:

(1) Refer to Article 703 and this section.

(2) Do not begin placing topsoil until all disturbed areas have been graded to match the original surface grades or to the otherwise specified lines and grades, considering the topsoil depth.

(3) Place and spread topsoil uniformly to a depth of at least 6-inches, unless specified otherwise.

(4) Clean topsoil off of sidewalks, paths, curbs, and roadways prior to the end of each working day.

(5) Protect adjacent stormwater structures during placement of topsoil. The Engineer reserves the right to order the installation of curb and field inlet sediment barriers to be constructed in accordance with Article 210 of these Specifications.

(6) Water the restoration areas immediately after seeding. Keep the areas moist by watering or sprinkling until the perennial grass seed covering the entire disturbed terrace area has germinated and grown to a minimum height of 2-inches. Reseed any bare patches.

(7) Place mulch on all seeded areas within 3 days of completing the seeding. Do not mulch during high wind conditions. Maintain the mulched areas and repair any areas damaged by wind, erosion, traffic, or other causes until the turf is firmly established.

(8) When ordered by the Engineer, dust-proof the patch by sprinkling it with a water and calcium chloride mixture in accordance with Article 107 of these Specifications.

704.18.4 Method of Measurement:

(1) Measured by length in feet, to the nearest half foot, along the trench centerline at the surface.

704.18.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70102	TERRACE RESTORATION FOR WATER MAIN	L.F.

(2) Additional compensation will be at the rate stated in Article 107 for providing any dust proofing.

704.19 Water Valve Access Structure.

Bid Item 70103.

704.19.1 Description:

(1) Furnish and install a 6-foot (inside diameter) water valve access structure with steps and casting. The work also includes preparing the foundation for the structure and tapping the water main.

704.19.2 Materials:

(1) Refer to Article 702 and this section.

(2) Adjustment rings and castings: Conform to Articles 503 and 507.

(3) The water valve access structure has a flat top with an offset opening and a standard access structure frame and non-rocking cover.

(4) See Standard Detail Drawing 7.07 for additional material details.

704.19.3 Construction:

(1) Construction of concrete valve access structures is to be done in accordance to the requirements Standard Detail Drawings 7.07 and Article 507 of these Specifications.

(2) Center the water valve access structure over the valve.

(3) Place clear gravel and stones up to 3-inches as a base for the structure.

(4) Place an 8-inch or larger concrete block under the valve to provide support.

(5) Provide appropriate openings in the structure and the support ring so that the structure is not resting on the water main.

(6) Install a 1-inch tap on each side of the valve.

704.19.4 Method of Measurement:

(1) Measured by each completed unit.

704.19.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70103	WATER VALVE ACCESS STRUCTURE	EACH

704.20 Adjust Water Valve Box.

Bid Item 70104.

704.20.1 Description:

(1) Furnish a new top casting with a lid and adjust all existing water valve boxes within the project limits to a tolerance between¼-inch to ½-inch below finished grade. If necessary or as required, furnish and replace damaged or non-functioning existing lower valve box sections.

704.20.2 Materials:

(1) Refer to Article 702 and this section.

(2) Refer to Article 704 – 'Furnish & Install Water Valve' and this section.

704.20.3 Construction:

(1) Refer to Article 703 and this section.

(2) Refer to Article 704 'Furnish & Install Water Valve' and this section.

(3) Excavate and expose the existing water valve boxes to the depth needed to install a new top casting with a new lid, center the valve box over the operating nut and adjust the valve boxes to finished grade. If the valve operating nut is not exposed due to mud and/or debris, remove the material to expose the operating nut to ensure the valve box is centered and aligned properly.

(4) Extensions or replacement valve box materials may be required and will be paid as listed below.

(5) Leave all valve boxes centered over the valve operating nut and free of dirt and debris.

704.20.4 Method of Measurement:

(1) Measured by each completed unit.

704.20.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70104	ADJUST WATER VALVE BOX	EACH

(2) In the event that additional materials are needed during construction, full-payment for furnishing and installing the additional materials will be made as follows:

DESCRIPTION	UNIT	PRICE
TOP CASTING WITH LID	EACH	$100.00
BOTTOM SECTION	EACH	$100.00
NO. 6 BASE	EACH	$100.00
BOX ALIGNMENT DEVICE	EACH	$150.00
12-INCH EXTENSION	EACH	$100.00
18-INCH EXTENSION	EACH	$100.00
24-INCH EXTENSION	EACH	$100.00

(2) Adjustment of new valve boxes is incidental to valve box installations and will not be paid.

704.21 Pipe Plug for Water Main Installation.

Bid Item 70105.

704.21.1 Description:

(1) Furnish and install a concrete mix on each end of abandoned pipes that were removed due to an existing grade conflict during the installation of new water facilities.

(2) This bid item applies only to pipes which are 10-inches in diameter or larger. Pipe plugs applied to pipes less than 10-inches in diameter are considered incidental to the related work, and will not be compensated in this bid item.

704.21.2 Materials:

(1) Refer to Article 702 and this section.

(2) Concrete mix can be either:

1. A pre-approved bag mix.
2. Pre-mix from a concrete supplier.

704.21.3 Construction:

(1) Refer to Article 703 and this section.

(2) Excavate and expose the conflicting abandoned pipe.

(3) Cut out a segment of the pipe that is large enough for clearance of the concrete mix on the open ends, and for the new water main to pass through.

(4) Using a concrete mix on the open ends of the abandoned pipe, form a tight seal so as not to allow dirt or water to enter the pipe.

704.21.4 Method of Measurement:

(1) Measured as a completed unit for each pipe end plugged.

704.21.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70105	PIPE PLUG FOR WATER MAIN INSTALLATION	EACH

704.22 Rock Excavation.

Bid Item 70106.

704.22.1 Description:

(1) Rock excavation applies to the removal of hard solid rock in ledges, bedded deposits, un-stratified masses, conglomerate deposits or any other material so firmly cemented as to present characteristics of solid rock.

(2) If determined by the Engineer that such material is so hard or so firmly cemented that it is not practical to excavate and remove such material with a power shovel, it shall be thoroughly and continuously drilled and blasted prior to removal.

(3) Power shovels, as referred to above:

1. A modern track mounted power shovel or backhoe.
2. Not less than ¾-cubic yard manufacturer's rated capacity.
3. Have adequate power and good running condition.
4. Used by an experienced operator.

(4) Rock excavation also applies to all stone/rock necessary to be removed having a volume of ~~1-cubic yard (27 cubic feet)~~ 2 cubic yards or more. Removal of plain or asphalt-bound bases or surface courses of macadam, gravel, or broken stone are not considered rock excavation.

704.22.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.22.3 Construction:

(1) Refer to Article 703 and this section.

(2) Remove enough rock to provide clearance below and on each side of all pipe, valves and fittings. Clearance requirements:

1. At least 6-inches for nominal pipe sizes 24-inches or smaller
2. At least 9-inches for nominal pipe sizes 30-inches or larger.

(3) The width of rock excavation is limited to the outside diameter of the pipe plus 2-feet.

(4) Upon completion of the rock excavation, refill that portion of the trench with select fill and mechanically compact the fill material prior to laying the pipe. The pipe is required to have uniform bearing along its entire length and never shall be laid directly on rock.

704.22.4 Method of Measurement:

(1) Field-measure and compute the rock excavation volume in cubic yards (neat-line volumes).

(2) The vertical measurement extends from the surface of the rock to an elevation of 6-inches below the bottom invert of the water main.

(3) The vertical measurement for valve access structures extends from the surface of the rock to an elevation of 8-inches below the bottom invert of the valve access structure (up to ten 10-feet deep). The measurement extends 12-inches below the bottom invert of the valve access structure if it is over 10-feet deep.

(4) Horizontal measurements are limited to the outside diameter of the pipe or outside width of the structure, plus two 2-feet.

(5) Boulders measuring up to ½-cubic yard are considered incidental to excavation removal. Boulders up to 2-cubic yards in volume may be considered for payment under the Boulder Removal bid item, if authorized by the Engineer. Boulders measuring 2-cubic yards or more in volume are considered for payment under the Rock Removal bid item and. These boulders are to be measured individually. The volume of each boulder computed from average dimensions taken in three directions.

(6) No measurement of excessive excavation.

704.22.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70106	ROCK EXCAVATION	C.Y.

704.23 Removal of Excess Amounts of Boulders.

Bid Item 70107.

704.23.1 Description:

(1) Boulders are considered to be naturally occurring rocks that have a dimension greater than 12-inches in one or more faces.

(2) Remove any and all boulders encountered regardless of number.

(3) Removal of boulders up to ½-cubic yard in volume is considered incidental regardless of the quantity encountered.

(4) When deemed by the Engineer that the amount of boulders encountered on a project is excessive, additional payment will be covered under this item.

704.23.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.23.3 Construction:

(1) Refer to Article 703 and this section.

(2) (Vacant).

704.23.4 Method of Measurement:

(1) Payment for this item must be authorized by the Engineer.

(2) Boulders under 1-cubic yard in volume are to be measured by truck volume.

(3) Boulders over 1-cubic yard in volume are to be measured individually. Measure by taking the average dimensions in three directions.

704.23.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70107	REMOVAL OF EXCESS AMOUNTS OF BOULDERS	C.Y.

(2) In the absence of a bid item, a payment of ~~$6.00~~ $20.00 per cubic yard of small boulders (up to 1-cubic yard in volume) hauled from the project may be added to the Contract Documents, when authorized by the Engineer.

(3) Additionally, a payment of $50.00 per cubic yard of large boulders (between 1-cubic yard and 2-cubic yards in volume) hauled from the project may be added to the Contract Documents, when authorized by the Engineer.

(4) Excessively large boulders (over 2-cubic yards in volume) are considered to be, and paid under, the Rock Excavation Bid Item.

704.24 Additional Excavation.

Bid Item 70108.

704.24.1 Description:

(1) Refer to Article 703.4 and this section.

(2) Additional excavation applies to:

1. Additional excavation areas specifically depicted on the Construction Drawings and/or described in the Contract Documents.
2. Additional excavation extending beyond the allowable 2-foot allowance as a result of grade adjustments and/or adjusted excavation requirements ordered by the Engineer.
3. No compensation will be considered for over-excavation done for convenience.
4. Note that additional excavation extending beyond the allowable 1-foot allowance as a result of artificial foundation construction in poor soils ordered by the Engineer is considered to be undercut and shall be paid for under the "Undercut" bid item.

704.24.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.24.3 Construction:

(1) Refer to Article 703 and this section.

(2) (Vacant).

704.24.4 Method of Measurement:

(1) Field-measure and compute the authorized additional excavation volume in cubic yards (neat-line volumes).

(2) Maximum allowed measured width:

(3) The outside diameter of the pipe/structure, plus 2-feet, plus the amount necessary for sheeting and bracing.

704.24.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70108	ADDITIONAL EXCAVATION	C.Y.

(2) No payments for over-excavation done for convenience or without the Engineer's consent.

704.25 Undercut.

Bid Item 70109.

704.25.1 Description:

(1) Undercut is defined as any work involved in removing unsuitable materials and forming a satisfactory foundation at depths greater than 12-inches below the water main where identified on the drawings and/or specifications, and other areas where the Engineer approves the undercut in writing.

(2) All work associated with forming a stable and satisfactory foundation at depths of twelve 12-inches or less below the bottom of the pipe is considered incidental and will not be considered as undercut.

704.25.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.25.3 Construction:

(1) Refer to Article 703 and this section.

(2) (Vacant).

704.25.4 Method of Measurement:

(1) Field-measure and compute the undercut volume in cubic yards (neat-line volumes).

(2) Maximum measured width: The outside diameter of the pipe or outside dimension of the bottom of the structure, plus 2-feet, plus the amount necessary for sheeting and bracing.

704.25.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70109	UNDERCUT	C.Y.

704.26 Adjust Water Service Box.

(No Bid Item).

704.26.1 Description:

(1) Adjust existing water service boxes within the project limits to match the finished grade as shown on the plans or directed by the Engineer.

704.26.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.26.3 Construction:

(1) Refer to Article 703 and this section.

(2) Excavate and expose the existing water service boxes to the depth needed to adjust the valve boxes to finished grade.

(3) Apply extensions as required.

(4) Leave all service boxes centered over the curb stop and free of dirt and debris.

704.26.4 Method of Measurement:

(1) Measured by each completed unit.

704.26.5 Basis of Payment:

(1) Paid as follows:

AMOUNT PAID	DESCRIPTION	UNIT
$100.00	ADJUST WATER SERVICE BOX	EACH

(2) Adjustments to new service boxes are incidental to their installation, and will not be paid under this item.

704.27 Furnish and Install Curb Box.

(No Bid Item).

704.27.1 Description:

(1) Provide all labor and materials necessary to install new curb boxes where existing curb boxes are damaged, or otherwise in need of replacement as authorized in writing by the Engineer.

704.27.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.27.3 Construction:

(1) Refer to Article 703 and this section.

(2) Install the curb box vertically over the curb stop so that after the service is backfilled to final grade, a key may be placed on the rod of the curb stop and it may be operated easily.

(3) Set curb boxes 1-inch below ~~flush with~~ the finished ground elevation when located in unpaved areas.

(4) Set curb boxes between ¼-inch below finished grade and flush with the finished when located in paved areas.

704.27.4 Method of Measurement:

(1) Measured by each completed unit.

704.27.5 Basis of Payment:

704.27.6 Paid as follows:

AMOUNT PAID	DESCRIPTION	UNIT
$350.00	FURNISH AND INSTALL CURB BOX	EACH

704.28 Furnish and Install Curb Stop.

(No Bid Item).

704.28.1 Description:

(1) Provide all labor and material necessary to install new curb stops where existing curb stops are damaged, or otherwise in need of replacement as authorized in writing by the Engineer. Installations of curb boxes are not included in the scope of this pay item.

704.28.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.28.3 Construction:

(1) Refer to Article 703 and this section.

(2) Install curb stops on the designated service lateral at a point 8-feet from the property line, unless specified otherwise or ordered by the Engineer.

(3) Install a 4-inch x 8-inch x 8-inch solid concrete masonry unit, laid flat, in the excavation to provide a firm base for the curb stop.

(4) Adequately wrap the curb stop with polyethylene wrap to prevent debris from entering or impacting the operability of the curb stop.

(5) Do not locate curb stops in curb, sidewalk, driveways, or within 5-feet of the bases of trees.

704.28.4 Method of Measurement:

(1) Measured by each completed unit.

704.28.5 Basis of Payment:

(1) Paid as follows:

AMOUNT PAID	DESCRIPTION	UNIT
$500.00	FURNISH AND INSTALL CURB STOP	EACH

704.29 Abandon Existing Curb Box.

(No Bid Item).

704.29.1 Description:

(1) Abandon all water service curb boxes within the project limits that are connected to laterals no longer in service, as shown on the plans or directed by the Engineer.

704.29.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.29.3 Construction:

(1) Refer to Article 703 and this section.

(2) Proceed with the work only after the existing water service lateral has been abandoned.

(3) Remove the top casting to a point ~~three~~ 2-feet below the final elevation.

(4) Restore the terrace area as necessary.

704.29.4 Method of Measurement:

(1) Measured by each completed unit.

704.29.5 Basis of Payment:

(1) Paid as follows:

AMOUNT PAID	DESCRIPTION	UNIT
$100.00	ABANDON EXISTING CURB BOX	EACH

(2) Note that only curb boxes that fall outside of new service excavations will be paid.