



**STANDARD SPECIFICATIONS
FOR
WATER AND SANITARY SEWER CONSTRUCTION**

CITY OF ARLINGTON, TEXAS

Adopted by Ordinance No. 97-124

Revised on June 6, 2016

LIST OF CHANGES

The following list of changes represent changes as of June 6, 2016 to the City of Arlington Water Utilities Department's Standard Specifications for Water and Sanitary Sewer Construction Adopted by Ordinance No. 97-124.

SPECIFICATION BOOK TITLE PAGE

Revised 06/04/15

PART B - MATERIALS AND EQUIPMENT

SECTION B 2 - CONCRETE PRESSURE PIPE AND FITTINGS	Revised 05/01/15
SECTION B 7 - POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE	Revised 06/04/10
SECTION B 9 - FIRE HYDRANTS	Revised 08/27/15
SECTION B 10 - GATE VALVES AND TAPPING SLEEVES AND VALVES	Revised 06/04/15
SECTION B 15 - DUCTILE IRON FITTINGS	Revised 06/04/15

PART C - CONSTRUCTION AND INSTALLATION SPECIFICATIONS

SECTION C 1.8 - CONSTRUCTION WATER	Revised 06/06/16
SECTION C 3 - EXCAVATION, EMBEDMENT, AND BACKFILL	Revised 06/04/15
SECTION C 11 - INSTALLATION OF DUCTILE IRON FITTINGS	Revised 06/04/15
SECTION C 13 - GATE VALVE AND TAPPING SLEEVE AND VALVE INSTALLATION	Revised 06/04/15
SECTION C 28 - CCTV INSPECTION OF SANITARY SEWER MAINS	Revised 06/06/16

PART D - STANDARD DETAILS

All Standard Details have been revised, including additions and revisions.

Revised 02/16/12

<u>FIGURE</u>	<u>DESCRIPTION</u>	
1.....	Valve Detail with Box and Concrete Pad	Revised 01/15/16
2.....	Fire Hydrant and Concrete Splash Pad	Revised 06/18/15
4.....	Water Line Markers for Mains in Undeveloped Areas	Revised 06/18/15
7.....	Blow Off Detail	Revised 06/18/15
10.....	1" Water Service for 1" and 3/4" Outlets	Revised 06/06/16
11.....	Rehabilitation of Existing and Construction of Bullhead Install	Revised 10/25/12
12.....	2" Water Service Detail for 2" & 1.5" Outlets	Revised 06/06/16
13.....	Typical Meter Vault and Appurtenances	Revised 06/18/15
14.....	Detector Check & Meter	Revised 01/15/16
15.....	6" Thru 10" Double Detector Backflow Preventer Assembly	Deleted 01/15/16
15A.....	6" Thru 10" Double Check Detector Assembly - Buried	Revised 06/06/16
15B.....	2 1/2" Thru 12" Double Check Detector Assembly - Outdoor	Revised 01/15/16
15C.....	2 1/2" Thru 12" Double Check Detector Assembly - Indoor	Revised 01/15/16
15D.....	Premise Isolation RPZ BPA 3/4" thru 2" - Indoor	Revised 01/15/16
15E.....	Premise Isolation RPZ BPA 3/4" thru 2" - Outdoor	Revised 01/15/16
15F.....	Premise Isolation RPZ BPA 3/4" thru 2" - Outdoor Small	Revised 01/15/16
15G.....	Irrigation 3/4" thru 2" BPA	Revised 01/15/16
15H.....	Above Ground BPA Site Placement - Property Line	Revised 01/15/16
15I.....	Above Ground BPA Site Placement - Building Line	Revised 01/15/16
15J.....	Fire Line BPA Site Placement - Property Line	Revised 01/15/16
16.....	Cast In Place Sanitary Sewer Manhole	Revised 04/24/13
17.....	Precast Concrete Sanitary Sewer Manhole	Revised 06/18/15
18.....	Inside Drop Manhole	Revised 06/06/16
19.....	Outside Drop Manhole	Revised 06/18/15
20.....	Standard Manhole Frame & Cover Detail	Revised 06/06/16
21.....	Watertight Manhole Frame & Cover Detail	Revised 06/06/16
25.....	Existing Street Backfill & Repair	Revised 06/18/15

- 27.....Project Sign
- 28.....Concrete Encasement

Revised 06/18/15
Revised 06/18/15

PART E - LIST OF APPROVED MATERIALS

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Removed 11/10/98

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SEE CITY OF ARLINGTON WEBSITE

<http://www.arlington-tx.gov/water/water-sewer-specs-details/>

PART A
GENERAL PROVISIONS

A 1 DEFINITIONS

A 1.1 GENERAL

The following words and expressions, or pronouns used in their stead, shall wherever they appear in this Contract, be construed as follows, unless a different meaning is clear from the context:

- a. Addendum: A supplement to the Contract Documents issued in writing prior to the receipt of bids.
- b. Agreement: See Contract.
- c. Advertisement: All of the legal publications pertaining to the work contemplated or under contract. Also called Notice to Bidders.
- d. Bid: The offer of proposal of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed. Also called Proposal.
- e. Bidder: Any person, firm, or corporation submitting a Bid for the Work.
- f. Bonds: Bid, performance, payment, maintenance bonds and other instruments of security, furnished by Contractor and his surety in accordance with the Contract Documents.
- g. Calendar Day: A calendar day is any day of the week or month, no days being excepted.
- h. Change Order: A written order to the Contractor authorizing and directing an addition, deletion or revision in the work within the general scope of the Contract Documents, or authorizing an adjustment in the contract price or the contract time. The change order must be approved prior to the construction taking place. Any work done by the Contractor prior to the approval of the change order will be done at the Contractor's risk.
- i. City: The City of Arlington, Texas, a municipal corporation, authorized and chartered under the Texas State Statutes, acting by and through its governing body or its City Manager or his/her duly authorized representatives. The terms City and Owner are synonymous.
- j. Completion Time or Contract Time: The time set forth in the Contract for the performance of the Work contracted. The time may be expressed as calendar days, working days or as a specific date of completion.
- k. Contract or Contract Documents: The written contracts covering the performance of the work. The Contract or Contract Documents include the advertisement,

instructions to bidders, special provisions, standard specifications and details, proposal, drawings, any supplemental changes or agreements pertaining to the work or materials therefore, and bonds, as well as additional documents incorporated by reference in the above.

- l. Contract Drawings: The Contract Drawings are the drawings or reproductions therefrom showing in detail the location, dimension and position of the various elements of the project, including such profiles, typical cross sections, layout diagrams, working drawings, preliminary drawings and such supplemental drawings as the City may issue to clarify other drawings or for the purpose of showing changes in the work hereinafter authorized by the City. The plans are usually bound separately from other parts of the Contract Documents, but they are a part of the Contract Documents just as though they were bound therein.
- m. Contractor: The individual, partnership, firm, corporation, association or organization, or any combination thereof identified as such in the Contract, acting directly or through agents, employees, or authorized representatives who are liable and responsible for the acceptable performance of the work and for the payment of all legal debts pertaining to the work.
- n. Contract Price: The total monies payable to the Contractor under the terms and conditions of the Contract Documents. When used in such context, it may also mean the unit price of an item of work under the contract terms.
- o. Contract Work: Everything expressly or implicitly required to be furnished and done by the Contractor by any one or more parts of the Contract Documents, except "extra work" as hereinafter defined; it being understood that, in case of any inconsistency between any part or parts of this Contract, the Owner shall determine which shall prevail in accordance with Section A 3.
- p. Directed, Required, Approved, and Words of Like Import: Whenever they apply to the work or its performance, the words "directed," "required," "permitted," "ordered," "designated," "established," "prescribed," and words of like import used in the contract, specifications, or upon the drawings, shall imply the direction, requirement, permission, order, designation, or prescription of the City; and "approved," "acceptable," and words of like import shall mean approved by or acceptable to the City.
- q. Director of Utilities: The Director of the City of Arlington Utilities Department or duly authorized assistants, agents, engineers, inspectors, or superintendents, acting within the scope of the particular duties entrusted to them.
- r. Engineer: The term Engineer means the Engineer or a duly authorized representative. The Engineer shall be understood to be the Water Utilities Engineer, and nothing contained in the Contract Documents shall create any contractual or agency relationship between the Engineer and the Contractor.

- s. Equal or Approved Equal: Materials, articles, or methods which are of equal or higher quality than those specified or shown on the drawings, subject to approval by the City and as otherwise defined under MATERIALS AND WORKMANSHIP, A.3.8.
- t. Extra Work: Work other than that which is expressly or implicitly required by the Contract Documents at the time of the execution of the Contract.
- u. Final Acceptance: Acceptance by the City of Arlington of the water or sanitary sewer upon the expiration of the maintenance bond period and after the correction of any deficiencies.
- v. Final Inspection: Inspection of all work under the contract as soon as practicable after the work is completed.
- w. Flow Line: The flow line of a pipe shall be the lowest interior portion of the pipe in which flow will occur.
- x. Initial Acceptance: Approval of the suitability of a facility to be connected to the City of Arlington water and/or sanitary sewer system as indicated by tests for leakage and effectiveness of disinfection and compliance with the specifications as required and approved by the Public Works Inspector, Water Utilities Engineer and Field Operations Representative. This initial acceptance does not constitute final acceptance which is subject to the correction of deficiencies prior to the conclusion of the two (2) year maintenance bond period. Initial acceptance shall include all adjustments required and the effectiveness of disinfection shall be verified prior to approval. The two (2) year maintenance period will begin upon completion of the final inspection or payment of the final estimate whichever is later.
- y. Inspector: Any representative of the Owner designated to inspect the Work.
- z. Notice: Written notice effective the date of the postmark thereon, or if hand delivered, effective the date of hand delivery.
- aa. Notice of Award: A written notice by City to the apparent successful Bidder stating that upon compliance with the conditions precedent to be fulfilled by him/her within the time specified, City will execute and deliver the Agreement to him/her.
- bb. Notice to Proceed: A written notice given the Contractor fixing the date on which the Contract Time will commence to run and on which the Contractor shall start to perform his obligations under the Contract Documents.
- cc. Other Contractors: Any Contractor, other than the Contractor or his/her subcontractors, who has a direct contract with the City for work on or adjacent to the site of the Work.

- dd. Owner: The City of Arlington. See City.
- ee. Owner's Representative: The Engineer or other duly authorized assistant, agent, engineer, inspector, or superintendent acting within the scope of their particular instructed duties.
- ff. Plans: See Contract Drawings.
- gg. Product Data: Illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate a material, product, or system for some portion of the work.
- hh. Proposal: See Bid.
- ii. Proposal Guaranty: A cashier's check on any State or National bank or acceptable bidder's bond in the amount of not less than five percent (5%) of the total amount of the bid to the City of Arlington by the Contractor. See A2.6.
- jj. Samples: Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.
- kk. Shop Drawings: All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by Contractor, a Subcontractor, manufacturer, supplier or distributor and which illustrate the equipment, material or some portion of the Work.
- ll. Site: The area upon or in which the Contractor's operations are carried on, and such other areas adjacent thereto as may be designated as such by the City.
- mm. Special Provisions: The special clauses setting forth conditions or requirements peculiar to the specified project involved, supplementing the Standard Specifications, and taking precedence over any conditions or requirements of the Standard Specifications with which they are in conflict.
- nn. Specifications: The Specifications is that section or part of the Contract Documents which sets forth in detail the requirements which must be met by all materials, construction, workmanship, equipment and services in order to render a completed and useful project and includes these General Provisions. Whenever reference is made to Standard Specifications, regulations, requirements, statutes, etc., such referred to documents shall become a part of the Contract Documents just as though they were embodied therein.
- oo. Standard Specifications: The Standard Specifications for Water and Sewer Construction for the City of Arlington, Texas, adopted by the City Council Ordinance No. 97-124, latest edition, this book.

- pp. Subcontractor: Any persons, firm, or corporation, other than employees of the Contractor, who or which contracts with the Contractor to furnish, or actually furnished, labor, or labor and materials, or labor and equipment, at or about the site.
- qq. Sureties: The corporate bodies which are bound by such bonds as are required. Said sureties engaged to be responsible for the entire and satisfactory fulfillment of the Contract, and for any and all requirements as set out in the Specifications, Contract or Plans.
- rr. The Work: All labor and services including the furnishing of materials, tools, equipment and construction supplies required by the Contract Documents to be performed by the Contractor to produce the necessary construction, and that part of the construction which has been performed.
- ss. Working Day: A day not including Saturdays, Sundays, or any of the following holidays: New Year's Day, Martin Luther King Day, Presidents' Day, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Thanksgiving Friday, Christmas Eve, and Christmas Day, in which weather or other conditions, not under the control of the Contractor, will permit construction of the principal units of the work for a period of not less than seven (7) hours between 7:00 a.m. and 6:00 p.m. unless otherwise restricted in the Contract.

A 1.2 ABBREVIATIONS:

Wherever the abbreviations defined herein appear in the Contract Documents, the intent and meaning shall be as follows:

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ANSI	American National Standards Institute
API	American Petroleum Institute ASA American Standards Association
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing Materials
AWS	American Welding Society
AWWA	American Water Works Association
Asph.	Asphalt
Ave.	Avenue
Blvd.	Boulevard

C.	Centigrade
cfs	Cubic Foot per Second
CI	Cast Iron
CO	Cleanout
Conc.	Concrete
Corr.	Corrugated
CTB	Cement Treated Base
CTS	Cement Treated Sand
C.Y.	Cubic Yard
Cu.	Cubic
DI	Ductile Iron
Ea.	Each Elev. Elevation
F.	Fahrenheit
Ft. or '	Foot
Gal.	Gallon
g.p.m.	Gallons per Minute
HTH	Calcium Hypochlorite
I.D.	Inside Diameter
In. or "	Inches
Lin.	Linear
L.F.	Linear Foot
Lb.	Pound
mg/l	Milligrams per liter
mgd	Million Gallons Per Day
MH	Manhole
Max.	Maximum
Min.	Minimum
NGVD	National Geodetic Vertical Datum
NSF	National Sanitation Foundation
No.	Number
O.D.	Outside Diameter
O.S.H.A.	Occupational Safety and Health Act

P.I.	Plasticity Index
ppm	Parts per Million
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
R.	Radius Reinf. Reinforced
ROW	Right-of-Way
S.Y.	Square Yard
Sq.	Square
Std.	Standard
TNRCC	Texas Natural Resources Conservation Commission
TU	Texas Utilities
TXDOT	Texas Department of Transportation
Vol.	Volume
V/mil.	Volts/mil thickness
Yd.	Yard

A 2 PROPOSAL REQUIREMENTS AND CONDITIONS AND AWARDS

A 2.1 PREQUALIFICATION OF BIDDERS

All bidders on any City of Arlington project must be prequalified and approved by the City of Arlington Water Utilities Department prior to the opening of bids. All prospective bidders, not on the City of Arlington "Accepted Bidders' List," must obtain the appropriate forms from the City of Arlington and submit the fully completed forms to the Director of Utilities, P. O. Box 231, Arlington, Texas 76004-0231, at least ten (10) working days prior to the date of the bid opening. It will be each bidders responsibility to assure that they are on the "Accepted Bidders List" at least three (3) working days prior to the bid opening date. Bids received from bidders not on the "Accepted Bidders' List" prior to the time of the bid opening will be returned unopened.

A 2.2 PROPOSAL FORM

The City will furnish bidders with proposal forms, which will state the general location and description of the contemplated work and which will contain an itemized list of the items of work to be done or materials to be furnished and upon which bid prices are asked. The proposal form will provide for entering the amount of proposal guaranty as described in A.2.6.

A 2.3 QUANTITIES IN PROPOSAL FORM

The quantities of the work and materials set forth in the proposal form or on the plans approximately represent the work to be performed and the materials to be furnished and are for the purpose of comparing the bids on a uniform basis. Payment will be made to the Contractor only for the actual quantities of work performed or materials furnished in accordance with the plans and specifications, and it is understood that the quantities may be increased or decreased as hereinafter provided, without in any way invalidating the bid prices.

A 2.4 EXAMINATION OF PLANS, SPECIFICATIONS, AND SITE OF THE WORK

Bidders are advised that the plans, specifications, and other documents on file as stated in the advertisement shall constitute all the information which the City will furnish. Bidders are required, prior to submitting any proposal, to read the specifications, the proposal, the contract and bond forms carefully; to visit the site of the work; to examine carefully local conditions; to inform themselves by their independent research, tests, and investigations of the difficulties to be encountered and judge for themselves the accessibility of the work and all attending circumstances affecting the cost of doing the work or time required for its completion; and obtain all information required to make an intelligent proposal. No information given by the City, its Engineer, or any official thereof, other than that shown on the plans and contained in the specifications, proposals and other documents, shall be binding upon the City. Bidders shall rely exclusively upon their own estimates, investigations, tests and other data which are necessary for full and complete information upon which the proposal may be based. By filing their bid all bidders represent and warrant that they have prepared their bid in accordance with the specifications, with full knowledge and understanding of the terms and provisions thereof; that they have reviewed, studied and examined the bid prior to the signing and filing of same; and

that they were cognizant of the terms of their proposal, verified their calculations, found them to be correct, and agree to be bound thereby.

A 2.5 PREPARATION OF PROPOSAL

The bidder shall submit his proposal on the forms furnished, and it shall be submitted bound with the remainder of the Contract Documents. All blank spaces in the form shall be correctly filled-in, and the bidder shall state the prices both in words and numerals for which they propose to do the work contemplated or furnish the material required. Such prices shall be written in ink distinctly and legibly. If the proposal is submitted by an individual, his/her name must be signed by the individual or their duly authorized agent. If the proposal is submitted by a firm, association or partnership, the name and address of each member must be given and the proposal signed by a member of the firm, association, or partnership, or person duly authorized. If the proposal is submitted by a company or corporation, the company or corporate name and business must be given, and the proposal signed by an official or duly authorized agent. Powers of Attorney authorizing agents or others to sign proposals must be properly certified and must be in writing and submitted with the proposal. The proposal shall be executed in ink. It is understood and agreed that the proposal may not be withdrawn once the bids have been opened.

A 2.6 PROPOSAL GUARANTY

No proposal will be considered unless it is accompanied by a Cashier's check on any State or National Bank, or acceptable Bidder's Bond, payable unconditionally to the City of Arlington. The Cashier's check or Bidder's Bond shall be in the amount of not less than five percent (5%) of the total amount of the bid. The proposal guaranty is required by the City as evidence of good faith and as a guarantee that if awarded the contract, the bidder will execute the contract and furnish the required bonds within twelve (12) working days after official notice of acceptance of proposal or pay the damages as set forth hereinafter. The said Bidder's Bond shall be conditioned that if the proposal is withdrawn after the bids have been opened or the Contractor refuses to execute the contract in accordance with his proposal, the Contractor and the surety shall become liable to the City for the amount of the Bidder's Bond. If a Bidder's Bond is used, the surety thereon shall designate an agent acceptable to the City to whom requisite notices may be delivered and upon whom service of process may be had.

In the event a Cashier's check is submitted along with the proposal of the bidder and the Contractor does not execute the contract within twelve (12) days after award of said contract or withdraws his/her bid after bids have been opened, the City shall be entitled to the proceeds of such check.

A 2.7 FILING OF PROPOSALS

No proposal will be considered unless it is filed at the place and within the time limit for receiving proposals as stated in the advertisement. Each proposal shall be in a sealed envelope, plainly marked with the word "Proposal," and the name or description of the project as designated in the "Advertisement." Proposals shall be submitted bound with the remainder of the Contract Documents.

A 2.8 WITHDRAWING PROPOSALS

Proposals filed with the City can be withdrawn or withdrawn, modified, and redeposited up to ten (10) minutes prior to the time set for opening proposals. Request for nonconsideration of proposals must be made in writing addressed to the City prior to the time set for opening proposals. After other proposals are opened and publicly read, the proposal for which nonconsideration is properly requested may be returned unopened. The proposal may not be withdrawn after the bids have been opened, and the bidder, in submitting the same, warrants and guarantees that his/her bid has been carefully reviewed and checked and that it is in all things true and accurate and free of mistakes and that such bid will not and cannot be withdrawn because of any mistake committed by the bidder.

A 2.9 OPENING PROPOSALS

The proposals filed with the City will be opened at the time stated in the advertisement and publicly read aloud and shall thereafter remain on file until the award of the contract. Any proposal received after the advertised time of the bid opening will be returned to the bidder unopened.

A 2.10 IRREGULAR PROPOSALS

Proposals will be considered irregular if they show any omissions, alterations of form, additions, conditions not called for, unauthorized alternate bids or irregularities of any kind. However, the City reserves the right to waive any irregularities and to make the award in the best interests of the City.

The bidder or Contractor shall not take advantage of any error in the bidding or Contract Documents including but not limited to anything mentioned in the Specifications and not shown on the Drawings, or shown on the Drawings and not mentioned in both. In case of any apparent difference between the Drawings and Specifications or any other apparent error which the bidder or Contractor may discover, he/she shall refer the matter at once to the City as to which, in accordance with the intent of the Contract Documents, shall govern. The City shall have the right to correct any error discovered.

A 2.11 REJECTION OF PROPOSALS

The City reserves the right to reject any or all proposals, and all proposals submitted are subject to this reservation. Reasons proposals may be rejected include, but are not limited to:

- a. Proposal received after the time limit for receiving proposals as stated in the advertisement.
- b. Proposal containing any irregularities.
- c. Unbalanced value of any items.

- d. Bidder not prequalified by City prior to bid opening.

A 2.12 DISQUALIFICATION OF BIDDERS

Bidders may be disqualified and their proposals not considered for any of the following specific reasons before or after the bid opening:

- a. Reason for believing collusion exists among the bidders.
- b. Reasonable grounds for believing that any bidder is involved or interested in more than one proposal for the work contemplated.
- c. The bidder being involved or interested in any claim or litigation against or involving the City.
- d. The bidder's Surety being involved or interested in any litigation or claim against or involving the City.
- e. The bidder being in arrears on any existing contract or having defaulted on a previous contract.
- f. The bidder's Surety being in arrears on any existing contract.
- g. Lack of competency as revealed by the financial statement, experience and equipment, questionnaires, unsatisfactory work on previous projects, etc., of bidder or bidder's Surety.
- h. Incomplete work which in the judgment of the City will prevent or hinder the prompt completion of additional work if awarded.
- i. Failure by bidder to comply with equipment specifications in their entirety or submission by bidder of an unsatisfactory "letter of exception."
- j. Lack of responsiveness or responsibility of the bidder.
- k. Lack of responsiveness or responsibility of the bidder's Surety.
- l. Proposals which are obviously unbalanced.
- m. Unbalanced value of any bid items.
- n. More than one proposal from an individual, a firm or partnership or an association of the same or different name or any combination of the foregoing will not be considered.
- o. Failure to execute a previous contract awarded to the bidder or the required bonds.

A 2.13 CONSIDERATION OF CONTRACT

After proposals are opened, the proposals will be tabulated for comparison on the basis of the bid prices and quantities shown in the proposal. Until final award of the contract, the City reserves the right to reject any or all proposals, to waive technicalities, and to re-advertise for new proposals, or proceed to do the work otherwise in the best interests of the City.

A 2.14 AWARD OF CONTRACT

The award, if made, will be within sixty (60) working days after the opening of bids, but in no case will the award be made until after investigations are made as to the responsibilities of the bidder to whom it is proposed to award the contract. The City shall give a work order (Notice to Proceed) to the Contractor, advising that the contract has been accepted and that the Contractor shall begin work within twelve (12) working days from date of work order. The work order may be dated as of the date on which the award is made by the City.

A 2.15 RETURN OF PROPOSAL GUARANTY

The City will return the proposal guaranties accompanying all proposals within twelve (12) working days after opening except for the two apparent low proposals. The two apparent low proposal guaranties will be retained by the City until the required contract and bonds have been executed, after which they will be returned.

A 2.16 SURETY BONDS

With the execution and delivery of the contract the Contractor shall furnish and file with the City in the amounts set forth in Section A 3 of these Specifications and the Special Provisions the required surety bonds. Such surety bonds shall be in accordance with the provisions of Chapter 2253 of V.T.C.A. Government Code as amended.

A 2.17 EXECUTION OF CONTRACT

The person or persons, partnership, company, firm, association, or corporation to whom a contract is awarded shall, within twelve (12) working days after receipt of the Notice of Award, sign and return the necessary Contract Documents to the City.

A 2.18 FAILURE TO EXECUTE CONTRACT

The failure of bidder to execute the contract or the required statutory bonds shall constitute a breach of the proposal, and the City may annul the award and collect on the Proposal Guaranty. In the event the City should readvertise for bids, the defaulting Contractor shall not be eligible to bid.

A 3 GENERAL CONDITIONS

A 3.1 CORRELATION AND INTENT OF DOCUMENTS

- a. General: The Contract Documents are complementary and what is called for by any one shall be as binding as if called for by all. The intent of the documents, unless otherwise specifically provided, is to produce complete and finished work. No verbal conversation, understanding, or agreement with any officer or employee or agent of the City, either before or after the execution of the Contract, shall affect or modify any of the terms, conditions, or obligations contained in the Contract Documents.
- b. Contract Drawings and Specifications: The City will furnish the Contractor, without charge, such copies of the Contract and any Supplemental Drawings and Specifications reasonably necessary for the proper execution of the work. At least one copy of all Drawings and Specifications shall be accessible at all times to the City. The Plans, these Specifications, the Proposal, the Special Provisions and all supplementary documents are intended to describe a complete work and are essential parts of the Contract. A requirement occurring in any of them is binding. In cases of discrepancies, figures and dimensions shall govern over scaled dimensions; Plans shall govern over Specifications; Special Provisions shall govern over both general and standard specifications and plans.
- c. Priority of Contract Documents: In case of conflict between Contract Documents, priority of interpretation shall be in the following order: Signed agreement (or contract), performance and payment bonds, special provisions (or conditions), advertisement for bids (or invitation to bidders, or request for proposals), project (or contract) drawings, these Standard Specifications for Water and Sewer Construction in the City of Arlington, Texas, standard drawings, referenced specifications, and proposal.
- d. Supplemental Drawings and Specifications: In order to carry out the intent of the Contract Documents and to assist the Contractor in performing his work, the City, after the execution of the Contract, may by Supplemental Drawings, Specifications, or otherwise, furnish additional instructions, enlarged scales, additional, or revised details, as may be necessary for construction purposes. All such Supplemental Drawings, Specifications, or instructions are intended to be consistent with the Contract Documents, true developments thereof, and reasonably inferable therefrom. Therefore, no extra costs will be allowed by the City on a claim that particular Supplemental Drawings, Specifications, or instructions differ from the requirements of the Contract Documents, incurring extra costs, unless the Contractor has first brought the matter, in writing, to the City's attention for proper adjustment, and the City has approved such adjustments and cost, before proceeding with the work covered by such. If the City shall decide that there is no departure from the requirements of the Contract Documents, the Contractor shall then proceed with the work as shown, specified, or directed. If the City shall decide that extra work is involved, the City will so modify the Supplemental Drawings, Specifications, or instructions to eliminate the extra work, or cause a City written change order to be issued.

- e. Errors and Corrections in Drawings and Specifications: The Contractor shall not be allowed to take advantage of any manifest errors, omissions, or discrepancies in the Drawings or Specifications, as full instruction will be issued by the City for correction in accordance with the original intent of the Contract Documents. In case of any errors, omissions, or discrepancies in the Drawings or Specifications, the Contractor shall promptly submit the matter to the City who, in turn, shall promptly make a determination and issue the necessary instructions in writing. Any adjustment by the Contractor without this determination and instructions shall be at the Contractor's own risk and expense. The work is to be made complete as intended by the Contract Documents.

- f. Existing Structures: The Plans show the approximate locations of surface and subsurface structures. However, the locations of many gas mains or lines, water mains or lines, conduits, sewers, underground electric, cable television, etc., are unknown, and the City assumes no responsibility for failure to show any or all these structures on the Plans or to show them in their exact location. It is mutually agreed such failure will not be considered sufficient basis for claims for additional compensation for extra work or for increasing the pay quantities in any manner whatsoever, unless the obstruction encountered is such as to necessitate changes in the lines or grades, or requires the building of special work, provisions for which are not made in the Plans and Proposal, in which case the provisions in these Specifications for extra work shall apply.

A 3.2 CONTRACTOR'S WARRANTIES AND UNDERSTANDING

- a. General: In consideration of, and to induce the award of this Contract, the Contractor represents and warrants:
 - (1) That the Contractor is financially solvent and sufficiently experienced and competent to perform the work;
 - (2) That the facts stated in the Proposal and the information given by the Contractor pursuant to the Contract are true and correct in all respects;
 - (3) That the Contractor has read, understands, and complied with all the requirements set forth in the Contract;
 - (4) That the Contractor is familiar with and understands all laws and regulations applicable to the work;
 - (5) Unless otherwise specifically provided for in the Contract Documents, the Contractor shall do all the work and shall furnish all the tools, equipment, machinery, materials, labor and appliances except as herein otherwise specified, necessary or proper for performing and completing the work required by this Contract, in the manner and within the time herein prescribed; and
 - (6) By executing the Contract, the Contractor represents that the Contractor has visited the site of work, is fully familiar with the local and on-site conditions under which the work

is to be performed and has correlated the observation with the requirements of the Contract Documents. In addition, the Contractor represents that the Contractor is satisfied as to sub-surface conditions at the site of the work. Information, data, and representations contained in the Contract Documents pertaining to the conditions at the site, including sub-surface conditions, are for information only and are not warranted or represented in any manner to accurately show the conditions at the site of the work. The Contractor agrees that the Contractor will make no claims for damages, additional compensation, or extension of time against the City because of encountering actual conditions in the course of the work which vary or differ from conditions in information contained in the Contract Documents.

b. Surety Bonds: With the execution and delivery of the Contract, the Contractor shall furnish and file with the City in the amounts herein required, the following surety bonds; such surety bonds shall be in accordance with the provisions of Chapter 2253 V.T.C.A. Government Code as amended.

- (1) Performance Bond: A good and sufficient bond in an amount equal to 100 percent of the approximate total amount of the Contract, as evidenced by the Proposal, guaranteeing the full and faithful execution of the work and performance of the Contract for the protection of the City in accordance with the Contract Documents.
- (2) Payment Bond: A good and sufficient bond in an amount equal to 100 percent of the approximate total amount of the Contract, as evidenced by the Proposal, guaranteeing the full and proper protection as provided by law of all those claimants supplying labor and material in the prosecution of the work provided for in said Contract.
- (3) Maintenance Bond: A good and sufficient bond in an amount equal to 100 percent of the approximate total amount of the Contract, as evidenced by the Proposal or otherwise guaranteeing the full and proper maintenance of the work for a period of two (2) years from the date of initial acceptance by the City or up to five (5) years if specifically set forth in the Contract Documents.
- (4) Sureties: No sureties will be accepted by the City who are now in default or delinquent on any bonds or who are interested in any litigation or claim against or involving the City. All bonds shall be made on forms furnished and shall be executed by not less than one (1) corporate surety authorized to do business in the State of Texas and acceptable to the City. Each bond shall be executed by the Contractor and the surety.
- (5) Bankruptcy of Surety: If the surety on any bond furnished by the Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the project is located, or if such bond is revoked by the surety, the Contractor shall within five (5) days thereafter substitute another bond and surety, both of which shall be acceptable to the Owner.

A 3.3 CONTRACTOR'S RESPONSIBILITIES

- a. Performance of the Work: In addition to those matters elsewhere expressly made, the Contractor shall have the full and direct responsibility for the performance of the work under this Contract and for any act or neglect of the Contractor, their agents or employees. The Contractor shall bear all losses, if any, resulting on account of the amount and character of the work, or because the conditions under which the work must be done are different from what were estimated or anticipated by the Contractor, or because of weather, floods, elements, or other causes.
- b. **Indemnification**: **The Contractor shall and does agree and contract to indemnify, defend and hold harmless the City of Arlington (Owner) from any and all damages, loss or liability of any kind whatsoever, by reason of injury to property or third persons occasioned by any error, omission or negligent act of the Contractor, its officers, agents, employees, invitees, or other persons for whom it is legally liable with regard to the performance of this agreement, and the Contractor will, at his cost and expense, defend and protect the City of Arlington (Owner) against any and all such claims and demands. The Contractor does hereby agree and contract to waive all claims, release, indemnify, defend and hold harmless the City of Arlington (Owner) and all of its officials, officers, agents, and employees, from and against any and all claims, losses, damages, suits, demands or causes of action, and liability of every kind including all expenses of litigation and/or settlement, court costs and attorneys fees for injury or death of any person or for loss of, damages to, or loss of use of any property, arising out of or in connection with the performance of this contract. Such indemnity shall apply whether the claims, losses, damages, suits, demands or causes of action arise in whole or in part from the negligence of the City of Arlington (Owner), their officers, officials, agents or employees. It is the express intention of the parties hereto that the indemnity provided for in this paragraph is indemnity by the Contractor to indemnify and protect the City of Arlington (Owner) from the consequences of the City of Arlington's (Owner) own negligence, whether that negligence is a sole or concurring cause of the injury, death or damage.**
- c. Contractor's Liability: The mention of any specific responsibility or liability of the Contractor in this Section A 3.3 or in any part of the Contract Documents shall not be construed as a limitation or restriction upon the general responsibility or liability imposed on the Contractor by the Contract Documents. The Contractor shall carefully study and compare the Contract Documents and shall at once report to the City any error, inconsistency, or omission discovered. The Contractor shall perform no portion of the work at any time without Contract Documents, or, where required, approved shop drawings, product data, or samples for such portion of the work.
- d. Supervision and Construction Procedures: The Contractor shall supervise and direct the work, using his best skill and attention. The Contractor shall be solely responsible for all construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the work under the Contract. The Contractor's foreman shall not be a "working foreman." The foreman will be allowed to operate equipment or do manual labor in the event

of sickness or absence until replacements can be added to the work force for a maximum of 20% of the contract time. The Contractor shall be responsible to the City for the acts and omissions of employees, subcontractors and their agents, and employees, and other persons performing any of the work under a contract with the Contractor. The Contractor shall not be relieved from any obligations to perform the work in accordance with the Contract Documents either by the activities or duties of the City in its administration of the Contract, or by inspections, tests or approvals required or performed by persons other than the Contractor.

- e. Labor and Materials: Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for the proper execution and completion of the work, whether temporary or permanent and whether or not incorporated or to be incorporated in the work. The Contractor shall, at all times, enforce strict discipline and good order among employees and shall not employ on the work any unfit person or anyone not skilled in the task assigned. The Contractor shall provide and maintain equipment in good working condition at all times. Any equipment having defects which cause unnecessary damage to the job site and/or the surrounding areas shall be repaired or removed from the site within 24 hours of the notification of the deficiency by the Engineer.
- f. Progress Schedule: The Contractor, immediately after being awarded the Contract, shall prepare and submit for the City's information an estimated progress schedule for the work. The progress schedule shall be related to the entire project to the extent required by the Contract Documents and shall provide for expeditious and practicable execution of the work. The progress schedule shall be updated upon request by the Owner.
- g. Prosecution of the Work: The Contractor shall begin the work to be performed under this Contract not later than the date specified in the work order and shall conduct the work in such a manner and with sufficient equipment, material and labor as is necessary to insure its completion within the time limit. It is the intent of this Specification to provide a continuous construction operation without delay except as occasioned by unforeseeable causes beyond the control and without the fault or negligence of the Contractor, and it will be the Contractor's responsibility to execute the work in the most expeditious manner. Work shall be done only during the regular and commonly accepted and prescribed working hours. No work shall be done nights, Sundays, or regular holidays, unless permission is given by the City. The rate of progress shall be such that the whole work will be performed and the premises cleaned in accordance with the Contract within the time limit established in the Contract, unless an extension of time is made in the manner hereinafter specified.
- h. Record Drawings: The Contractor shall keep one (1) record copy of all specifications, drawings, addenda, modifications, and shop drawings at the site in good order and annotated to show all changes made during the construction process. These drawings shall be available to the Engineer and the City and shall be delivered to the City upon completion of the project.

A 3.4 COMPLIANCE WITH LAWS

The Contractor shall fully comply with all local, state, and federal laws, ordinances, and regulations applicable to this Contract and the work to be done hereunder. The Contractor shall secure and pay for all permits and licenses necessary for the execution of the work and shall fully comply with all their terms and conditions. It is the intent that all work required under this Contract comply with all requirements of law, regulation, permit or license. If the Contractor finds that there is a variance, it shall be immediately reported to the City for resolution.

A 3.5 PROTECTION OF WORK AND OF PERSONS AND PROPERTY

- a. Protection of Work: During performance and to the date of final acceptance, the Contractor shall be under absolute obligation to protect the finished and unfinished work against any damage, loss, or injury. In event of such damage, loss, or injury, the Contractor shall promptly replace or repair such work, whichever the City shall determine to be preferable. The obligation to deliver finished work in strict accordance with the Contract prior to final acceptance shall be absolute and shall not be affected by the City's approval of or failure to prohibit means and methods of construction used by the Contractor.

- b. Protection of Persons and Property: The Contractor shall have the responsibility to provide and maintain all warning devices and take all precautionary measures required by law to protect persons and property while said persons or property are approaching, leaving, or within the work site or any area adjacent to said work site. No compensation will be paid to the Contractor for the installation or maintenance of any warning devices, barricades, lights, signs, or any other precautionary measures required by law for the protection of persons or property. The Contractor shall assume all duties owned by the City to the general public in connection with the general public's immediate approach to and travel through the work site and the area adjacent to said work site. Where the work is carried on in or adjacent to any street, alley, sidewalk, public right-of-way, or public place, Contractor's shall at their own cost and expense provide such flaggers and watchpersons and furnish, erect, and maintain such warning devices, barricades, lights, signs, and other precautionary measures for the protection of persons or property as are required by law. The Contractor's responsibility of providing and maintaining flaggers, watchpersons, warning devices, barricades, signs and lights, and other precautionary measures shall not cease until the project shall have been accepted by the City. If the City discovers that the Contractor has failed to comply with the applicable federal and state or local law (by failing to furnish the necessary flaggers, warning devices, barricades, lights, signs, or other precautionary measures for the protection of persons or property), the City may order the Contractor to take such additional precautionary measures as required by law to be taken to protect persons and property. In addition, the Contractor will be held responsible for all damages to the work and other public or private property due to the failure of warning devices, barricades, signs, lights, or other precautionary measures in protecting such property. Whenever evidence is found of such damage, the City may order the damaged portion immediately removed and replaced by and at the cost and expense of the Contractor. All barricades and warning signs and warning devices shall be as set forth in the City of Arlington Work Area Traffic Control Manual, as amended.

A 3.6 PROTECTION FOR LABOR AND MATERIALS AND THIRD PARTIES

The Contractor shall pay all indebtedness of the Contractor or any subcontractor which may become due to any person, firm, or corporation having furnished labor, materials, or both in the performance of this Contract. It shall be the responsibility of each person, firm, or corporation claiming to have furnished labor, materials, or both, in connection with this Contract, to protect the individual or its interests in the manner prescribed by applicable laws of the State of Texas. The City may increase retainages or withhold retainages when the City finds lawful claims for damage to person or property of Third Parties are pending against the Contractor, and the Contractor is not in good faith negotiating to resolve such claims.

A 3.7 INSURANCE

The Contractor shall purchase and maintain such insurance as will protect the Contractor from claims set forth below and which may arise out of or result from the Contractor's operations under the Contract, whether such operations be by the Contractor or by any subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- a. Claims under workers' or workmen's compensation, disability benefit, and other similar employee benefit acts;
- b. Claims for damages because of bodily injury, occupational sickness or disease, or death of employees;
- c. Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- d. Claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the Contractor, or (2) by any other person;
- e. Claims for damages, other than to the work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom; and
- f. Claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle.

The insurance required shall be written for not less than any limits of liability specified in the Special Provisions, or required by law, whichever is greater.

The insurance required shall include contractual liability insurance applicable to the Contractor's obligations under Section A 3.3.

Certificates of Insurance acceptable to the City and on the Accord form shall be filed with the City prior to commencement of the work. These certificates shall contain a provision that

coverages afforded under the policies will not be suspended, voided, canceled or reduced in coverage until at least thirty days' prior written notice has been given to the Director of Utilities of the City. The Certificate of Insurance shall also show that the City has been named as an additional insured on all applicable policies.

Additional insurance coverages and amounts may be required by the Special Provisions. The insurance company must also be duly authorized to transact that class of insurance in the State of Texas.

Workers' Compensation and Employers' Liability Coverage: The insurer shall agree to waive all rights of subrogation against the City, its officials, employees and volunteers for losses arising from the activities under the Contract.

A 3.8 MATERIALS AND WORKMANSHIP

- a. General: Unless otherwise expressly provided in the Contract Drawings or Specifications, the work shall be performed in accordance with the best modern practice with materials and workmanship of the highest quality for the particular purpose. The City shall judge and determine the Contractor's compliance with these requirements.
- b. Materials: Where materials, equipment, or articles are specified by a particular brand, or name of a proprietary product, or "approved equal," the City shall decide the question of equality of other materials, equipment, or articles specified by reference to the number of a specific standard, except as limited to type, class, or grade, or modified in such reference. The standards referred to, except as modified in the Specifications, shall have full force and effect as though printed in full therein.

The Contractor shall be free to secure the approved materials, equipment, and articles from sources selected by the Contractor; however, Contractor agrees to use diligent efforts to purchase all goods and services from Arlington businesses whenever such goods and services are comparable in availability, quality, and price. However, if the City determines that the work will be delayed or adversely affected in any way because a selected source of supply cannot furnish a uniform product in sufficient quantity and at the time required and a suitable source does exist, or the product is not suitable for the work, the City shall have the right to require the original source of supply changed by the Contractor. The Contractor shall have no claim for extra cost or damage because of this requirement.

The Contractor warrants to the City that all materials and equipment furnished under this Contract will be new unless otherwise specified, and that work will be good quality, free from faults and defects, and in conformance with the Contract Documents. All work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. If required by the City, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. This warranty is not limited by the provisions of the following paragraphs.

- c. Workmanship: The Contractor shall promptly correct all work rejected by the City as defective or as failing to conform to the Contract Documents whether observed before or after substantial completion and whether or not fabricated, installed, or completed. The Contractor shall bear all costs of correcting such rejected work including compensation for additional services made necessary thereby.

If, after the approval of final payment and prior to the expiration of two (2) years thereafter, or such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents, any work that is found to be defective shall be repaired by the Contractor at the Contractor's own expense within five (5) days after written notice has been given by the Owner. Should the Contractor fail to make the repairs within five (5) days thereafter, the Owner may make the necessary repairs and charge the cost of same to the Contractor without giving any notice to the Contractor. In the case of an emergency, brought about by defective work of the Contractor, the Owner may proceed immediately to make the necessary repairs and charge the cost of same to the Contractor without giving any notice to the Contractor. The Contractor shall furnish a maintenance bond to be effective for two (2) years or longer after the approval of final payment or such other period of time as specified by the Contract Documents as part of this guarantee.

The Contractor shall remove from the site all portions of the work which are defective or non-conforming and which have not been corrected unless removal is waived by the City.

A 3.9 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

Shop Drawings are drawings, diagrams, schedules and other data specifically prepared for the Work by the Contractor or any Subcontractor, Manufacturer, Supplier or Distributor to illustrate some portion of the Work.

Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate a material, product, or system for some portion of the work.

Samples are physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.

The Contractor shall review, approve, and submit, with reasonable promptness and in such sequence as to cause no delay in the Work or in the Work of the City or any separate Contractor, all Shop Drawings, Product Data, and Samples required by the Contract Documents.

By approving and submitting Shop Drawings, Product Data, and Samples, the Contractor represents that the Contractor has determined and verified all materials, field measurements, and field construction criteria related thereto, or will do so, and that the Contractor has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

The Contractor shall not be relieved of responsibility for any deviation from the requirements of the Contract Documents by the Engineer's approval of Shop Drawings, Product Data, or Samples unless the Contractor has specifically informed the Engineer in writing of such deviation at the time of submission, and the Engineer has given written approval to the specific deviation. The Contractor shall not be relieved from responsibility for errors or omissions in the Shop Drawings, Product Data, or Samples by the Engineer's approval thereof.

The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, or Samples, to revisions other than those requested by the Engineer on previous submittals.

No portion of the Work requiring submission of a Shop Drawing, Product Data, or Sample shall be commenced until the submittal has been approved by the Engineer. All such portions of the Work shall be in accordance with approved submittals.

A 3.10 MEANS AND METHODS OF CONSTRUCTION

a. Unless otherwise expressly provided in the Contract Drawings or Specifications, the means and methods of construction shall be such as the Contractor may choose; subject, however, to the Owner's right to prohibit means and methods proposed by the Contractor which in the City's judgment:

- (1) Will constitute a hazard to the work, or to persons or property, or will violate express requirements of applicable laws or ordinances;
- (2) Will cause unnecessary or unreasonable inconvenience to the public;
- (3) Will not produce finished work in accordance with the requirements of the Contract Documents; or
- (4) Will not assure the work to be completed within the time allowed by the Contract.

The City's approval of the Contractor's means or methods of construction, or the City's failure to exercise their right to prohibit such means or methods, shall not relieve the Contractor's obligation to accomplish the result intended by the Contract; nor shall the exercise of such right to prohibit create a cause of action for damages.

Where the Contract Drawings or Specifications do not require the use of specific means or methods of construction, the Contractor shall submit the proposed plan of procedure to the City sufficiently in advance to permit a reasonable time for determining the adequacy and safety of the proposed plan.

Failure to submit the proposed plan within a reasonable time agreed to by the City and the Contractor shall not create a cause of action for damages for the resulting delay in the work or be a cause for extension of time by the City for completion of the work.

- b. Sanitary Provision: The Contractor shall establish and enforce among employees such regulations in regard to cleanliness and disposal of garbage and waste as will tend to prevent the inception and spread of infections or contagious diseases and to prevent effectively the creation of a nuisance about the work on any property either public or private, and such regulations as are required by the City shall be put into immediate force and affect by the Contractor. The necessary sanitary conveniences, including, but not limited to, portable restrooms for the use of laborers on the work, properly secluded from public observation, shall be constructed and maintained by the Contractor in such a manner and at such points as will be approved by the City, and their use shall be strictly enforced by the Contractor. All sanitary laws and regulations of the State of Texas and the City of Arlington shall be strictly complied with.

- c. Public Convenience and Safety: Materials stored about the work site shall be so placed, and the work shall at all times be so conducted, as to cause no greater obstruction to the traveling public than is considered necessary by the City. The Contractor shall make provisions by bridges or otherwise at all cross streets, highways, sidewalks, and private driveways for the free passage of pedestrians and vehicles, provided that where bridging is impracticable or unnecessary in the opinion of the City, the Contractor may make arrangements satisfactory to the City for the diversion of traffic and shall, at the Contractor's own expense, provide all material and perform all work necessary for the construction and maintenance of roadways and bridges for the diversion of traffic. Sidewalks must not be obstructed except by special permission. The materials excavated, and the construction materials or plant used in the construction of the work, shall be placed so as not to endanger the work or prevent free access to all fire hydrants, water valves, gas valves, manholes for the telephone, telegraph signals or electric conduits, sanitary sewers, and cable television conduit.

The City reserves the right to remedy any neglect on the part of the Contractor relative to the public convenience and safety which may come to its attention, after twenty-four hours' notice in writing to the Contractor, save in cases of emergency, when it shall have the right to remedy any neglect without notice; and in either case, the cost of such work done by the City shall be deducted from monies due or to become due the Contractor. The Contractor shall notify the City when any street is to be closed or obstructed. The Contractor shall, when directed by the City, keep any street or streets in condition for unobstructed use by emergency services. Where the Contractor is required to construct temporary bridges or make other arrangements for crossing over ditches or streams, Contractors' responsibility for accidents shall include the roadway approaches as well as the structures of such crossings.

Where the work passes over or through private property, the City will provide such right-of-way. The Contractor shall notify the proper representatives of any public utility, corporation, or any company or individual, not less than forty-eight hours in advance of any work which might interfere with the operation of their property along or adjacent to the Work. The Contractor shall be responsible for all damage or injury to property of any character by reason of any negligent act or omission on the part of the Contractor, or agents, or at any time due to defective works or materials, or due to the failure to reasonably or properly prosecute

the work or as otherwise provided by Contract, and said responsibility shall not be released until the work shall have been completed or accepted. When and where any such damage or injury is done to public or private property on the part of the Contractor, the Contractor shall restore or have restored at the Contractor's own cost and expense such property to a condition similar or equal to that existing before such damage was done, by repairing, rebuilding, or otherwise restoring as may be directed, or the Contractor shall make good such damage or injury in a manner acceptable to the property Owner or the Engineer. In case of failure on the part of the Contractor to restore such property or make good such damage or injury, the City may, upon forty-eight hours written notice, under ordinary circumstances, and without notice when a nuisance or hazardous condition results, proceed to repair, rebuild, or otherwise restore such property as may be determined necessary, and the cost thereof will be deducted from any monies due or to become due the Contractor under the Contract.

A 3.11 SUPERINTENDENCE BY CONTRACTOR

The work under this Contract shall be under the direct charge and superintendence of the Contractor. Except where the Contractor is an individual and gives personal superintendence to the work, the Contractor shall provide a competent superintendent or general foreman on the work at all times during progress with full authority to act. The Contractor shall also provide an adequate staff for the coordination and expediting of the work.

The superintendent and staff shall be satisfactory to the City. The superintendent or general foreman shall not be changed during the Contract except with the written consent of the City or unless the superintendent or general foreman proves unsatisfactory to the Contractor and ceases to be employed by the Contractor.

If the superintendent should be or become unsatisfactory to the City, the superintendent shall be removed by the Contractor upon written direction of the City.

A 3.12 EMPLOYEES

The Contractor shall employ only competent, efficient workers and shall not use on the work any unfit person or one not skilled in the work assigned. The Contractor shall at all times maintain good order among employees. Whenever the City shall inform the Contractor in writing, that, in its opinion, any employee is unfit, unskilled, disobedient, or is disrupting the orderly progress of the work, such employees shall be removed from the work and shall not again be employed on it. Under urgent circumstances, the City may orally require immediate removal of an employee for cause, to be followed by written confirmation.

A 3.13 WORKING AREA

a. General: The Contractor shall confine equipment, storage of materials, and construction operations to the area shown on the Contract Drawings or stated in the Specifications, prescribed by ordinance, laws, or permits or as may be directed by the City, and shall not unreasonably encumber the site or public right-of-way with construction equipment, plant, or materials.

Such area shall not be deemed for the exclusive use of the Contractor. Other Contractors of the City may enter upon and use such portions of the area and for such times as determined by the City that are necessary for all purposes required by their contracts. The Contractor shall give to such other Contractors all reasonable facilities and assistance to the end that the work on this and the other contracts will not be unduly or unreasonably delayed. Any additional grounds desired by the Contractor for personal use shall be provided at the Contractor's own cost and expense.

Upon completion of the work and before initial acceptance and final payment will be made, the Contractor shall clean and remove from the site of the work surplus and discarded materials, temporary structures, and debris of every kind. The Contractor shall leave the site of the work in a neat and orderly condition equal to that which originally existed. Surplus and waste materials removed from the site of the work shall be disposed of at proper, safe and legal locations.

b. Construction Stakes: The City will, on City contracts only, furnish and set all lines, grades, bench marks, centerlines and measurements necessary to the proper prosecution and control of the work contracted for under these Specifications. The City will furnish the Contractor with all necessary information relating to the lines and grades. Such stakes or markings as the City may establish either for its use or the Contractor's guidance shall be preserved by the Contractor until authorized by the City to remove same. The Contractor will be charged for the cost of replacing stakes which have been disturbed by the construction operation. All construction staking for subdivisions, private projects, etc., shall not be the responsibility of the City but shall be the responsibility of the Developer, the Design Engineer, or the Contractor.

A 3.14 OTHER CONTRACTORS

The City may award other contracts for additional work on this project, or contiguous thereto, and the Contractor shall fully cooperate with such other Contractors and shall coordinate and fit the work to be done hereunder to such additional work as may be directed by the City. At the time of bidding, prospective bidders will be advised of other planned contract work which is expected to affect the work area. The Contractor shall not commit or permit any act which will interfere with the performance of work by any other Contractor.

Upon receiving written notice from the Contractor that another Contractor is failing to coordinate their work with the work under this Contract as directed by the City, the City will promptly investigate the charges and take such necessary action as the situation may require. However, the City shall not be liable to the Contractor for damages suffered through failure of another Contractor to carry out the directions of the City.

A 3.15 OWNER'S RIGHT TO SUSPEND WORK

Reasons for Suspension: The City shall have the right by written order to require the Contractor to suspend the whole or part of the work whenever, in the judgment of the City, such suspension is required:

- (1) In the interest of the City generally (for convenience);
- (2) Due to Government controls or orders which make performance of the Contract temporarily impossible or illegal;
- (3) To coordinate the work of the various Contractors engaged on this project;
- (4) To expedite the completion of the entire project even though the completion of this particular Contract may be thereby delayed;
- (5) Because of weather conditions unsuitable for prosecution of the work;
- (6) Because the Contractor is proceeding contrary to Contract provisions;
- (7) Because health and safety issues are not properly addressed.

The written order of the City to the Contractor shall state the reasons for suspending the work and the anticipated periods for such suspension. Upon receipt of the City's written order, the Contractor shall suspend the work covered by the order and shall take such means and precautions as may be necessary to properly protect the finished and partially finished work, the unused materials, and the uninstalled equipment. Work shall not again be resumed on that part of the work ordered suspended until ordered by the City in writing to do so, and then shall be resumed promptly.

A 3.16 USE OF COMPLETED PORTIONS OF WORK

The City may, after written notice to the Contractor, take over and use any completed portion of the work prior to the final completion and initial acceptance of the entire work included in the Contract, and notwithstanding that the time allowed for final completion has not expired. The Contractor shall not object to, nor interfere in any way with, such occupancy or use after receipt of the City's written notice. Immediately prior to such occupancy and use, the City will inspect such portion of the work to be taken over and will furnish the Contractor a written statement of the work, if any, still to be done on such part. The Contractor shall promptly thereafter complete such unfinished work to permit occupancy and use on the date specified in the City's written order, unless the City shall permit specific items of work to be finished after the occupancy and use by the City.

A 3.17 DELAYS AND EXTENSION OF TIME

- a. General: The Contractor shall be entitled to an extension of time as provided herein only when claim for such extension is submitted to the City in writing by the Contractor within seven days from and after the time when any alleged cause of delay shall occur, and then only when such time is approved by the City. In adjusting the Contract time for the completion of the project, unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to inability to obtain supplies and materials, acts of God, acts of the public enemy, acts of the City, fires, floods, epidemics,

quarantine restrictions, strikes, freight embargoes, unusually severe weather conditions, or delays of subcontractors due to such causes may be taken into consideration. If the satisfactory execution and completion of the Contract should require work and materials in greater amounts or quantities than those set forth in the Contract; and/or more time for completion than the anticipated time, work, and/or materials of this work, then the Contract time shall automatically be increased in the same proportion as the cost of the additional work bears to the cost of the original work contracted for. No allowances will be made for delays or suspension of the prosecution of the work due to the fault of the Contractor.

- b. **Failure to Complete on Time:** Time is of the essence in this Contract. Since time is of the essence, the City has established the time required to complete this project. For each calendar day that any work shall remain uncompleted after the time specified in the Contract, or the increased time granted by the City, ordered after the Contract is signed, the sum per day given in the Contract Special Provisions entitled Time for Completion and Liquidated Damages, will be deducted from the monies due the Contractor. The sum of money thus deducted for such delay, failure, or non-completion is not to be considered as a penalty, but shall be deemed, taken and treated as reasonable liquidated damages, since it would be impracticable and extremely difficult to fix the actual damages resulting from additional engineering, inspection services, and other additional work caused by such delay.

A 3.18 CHANGE OR MODIFICATION OF CONTRACT

- a. Increased or Decreased Quantities of Work: The City reserves the right to make changes in the quantities of the work as may be considered necessary or desirable, and such changes shall not be considered as waiving or invalidating any conditions or provisions of the Contract or Bond. The Contractor shall perform the work as altered, whether increased or decreased, and no allowances will be made for anticipated profits.

The City reserves the right to decrease the work under this contract.

Payment to the Contractor for the Contract items will be made for the actual quantities of work performed and material furnished at the unit prices set forth in the Contract, except as provided hereinafter.

When the quantity of work to be done or of materials to be furnished under any item of the Contract is more than 125 percent of the quantity stated in the Contract and greater than five percent of the total Contract cost, then either party to the Contract, upon demand, shall be entitled to negotiate for revised consideration on that portion of work above 125 percent of the quantity stated in the Contract.

Any revised consideration will be paid for as is hereinafter provided. The foregoing notwithstanding, the total original contract amount shall not be increased more than twenty-five (25) percent unless allowed by law.

- b. Alteration of Plans and Specifications: The City reserves the right to make such changes in the Plans and Specifications and in the character of the work as may be necessary or desirable to insure completion in the most satisfactory manner, provided such changes do not materially alter the original Plans and Specifications or change the general nature of the work as a whole. Such changes shall not be considered as waiving or invalidating any condition or provision of the Contract and Bond.

- c. Extra Work: When any work is necessary for the proper completion of the project and for which no prices are provided in the Proposal and Contract, the Contractor shall do such work, but only when and as **ordered in writing** by the City or its Engineer. Payment for extra work will be made as hereinafter provided.

A 3.19 METHODS FOR DETERMINING ADJUSTMENTS IN CONTRACT PRICE

Changes, if any, in the Contract price, either additive or subtractive, by reason of a change or modification in the Contract ordered in writing by the City, shall be limited to the amount stated in the written order. Changes in price shall be determined by one or more of the following methods, the City having the right to select the method or methods used:

- a. By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- b. By unit prices stated in the Contract Documents or subsequently agreed upon;
- c. By cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- d. By the methods provided below:

If none of the methods set forth in a., b., or c. above is agreed upon, the Contractor, provided he/she receives a written order signed by the City, shall promptly proceed with the work involved. The cost of such work shall then be determined by the City on the basis of the reasonable expenditures and savings of those performing the work attributable to the change. In such case, above, the Contractor shall keep and present, in such form as the City may prescribe, an itemized accounting together with appropriate supporting data for inclusion in a Change Order. Unless otherwise provided in the Contract Documents, cost shall be limited to the following: cost of materials, including cost of delivery; cost of labor, including social security, old age and unemployment insurance, and fringe benefits required by agreement or custom; workers' compensation insurance; bond premiums; rental value of equipment and machinery; and the additional costs of supervision and field office personnel directly attributable to the change. The amount of credit to be allowed by the Contractor to the City for any deletion or change which results in a net decrease in the Contract sum will be the amount of the actual net cost. When both additions and credits covering related work or substitutions are involved in any one change, the allowance for overhead and profit shall be figured on the basis of the net increase, if any, with respect to that change.

A 3.20 DISPUTED WORK, DETERMINATION, OR ORDER

If the Contractor is of the opinion that (a) the work necessary or required to accomplish the result intended by this Contract, or (b) any work ordered to be done as Contract work by the City, is extra work or additional work and not Contract work, or (c) any determination or order of the City violates the terms and provisions of this Contract, the Contractor shall promptly, either before proceeding with such work or complying with such order or determination, notify the City in writing of their contentions with respect thereto and request a final determination thereof.

Such determination of the City shall be given in writing to the Contractor. If the City determines that the work in question is extra work and not Contract work, or the determination or order complained of required performance by the Contractor beyond that required by the Contract or violates the terms and provisions of the Contract, thereupon the City shall cause either (a) the issuance of a written order covering the extra work as provided for in Section A 3.18 hereof, or (b) the determination or order complained of be rescinded or so modified so as to not require performance beyond that required, by or so as not to be in violation of the terms and provisions of the Contract.

If the City determines that the work in question is Contract work and not extra work, or that the determination or order complained of does not require performance by the Contractor beyond that required by the Contract or violate the terms and provisions of the Contract, the City will direct the Contractor to proceed, and the Contractor must promptly comply. However, in order to reserve the Contractor's right to claim compensation for such work or damages resulting from such compliance, the Contractor must, within twenty (20) calendar days after receiving the City's determination and direction, notify the City in writing that the work is being performed or that the determination and direction is being complied with under protest.

If the Contractor fails to so appeal to the City for a determination or, having so appealed, should the Contractor thus fail to notify the City in writing of the protest, the Contractor shall be deemed to have waived any claim for extra compensation or damages therefore. No oral appeals or oral protests, no matter to whom made, shall be deemed even substantial compliance with the provisions of the Section.

A delay of the Contractor due to the City's failure to secure right-of-way at the time required or because of a conflict of a utility with the work will not be a cause for damages sustained by the Contractor but may be a cause for extension of Contract time. If the Contractor shall claim to be sustaining damages by reason of any acts or omissions of the City, its officers, or employees, the Contractor shall within ten (10) calendar days after such acts or omissions occur, notify the City in writing, except that if claim is not given within ten (10) calendar days of its commencement, the claim will be considered only for a period commencing five (5) calendar days prior to the receipt by the City of the notice thereof. Within ten (10) calendar days after the date of notification or within such additional time as may be granted in writing by the City upon the Contractor's written request therefore, the Contractor shall submit to the City verified detailed statements of the damages sustained together with documentary evidence of such damages. On

failure of the Contractor to fully comply with the foregoing provisions, such claims shall be deemed waived and no right to recover on such claims shall exist.

In addition to the foregoing statements, the Contractor shall, upon notice from the City, produce for examination at the Contractor's office, by the representatives of the City, all books of record, showing all acts and transactions in connection with or relating to or arising by reason of the matter in dispute. At such examination, a duly authorized representative of the Contractor may be present.

Unless the aforesaid statements shall be made and filed within the time aforesaid and the aforesaid records submitted for examination, the City shall be released from all claims arising under, relating to, or by reason of this Contract, except for the sums to be due under the provisions of this Contract. It is further stipulated and agreed that no person has power to waive any of the foregoing provisions and that in any action against the City to recover any sum in excess of the sums to be due under or by reason of this Contract, the Contractor must allege in a written complaint and prove, at the trial, compliance with the provisions of this section.

In connection with the examination provided for herein, the City upon demand therefore, will also produce for inspection by the Contractor such records as the City may have with respect to such disputed work or work performed under protest pursuant to order of the City except those records and reports which may have been prepared for the purpose of determining the accuracy and validity of the Contractor's claim, or which are confidential by law.

A 3.21 PERFORMANCE OF EXTRA OR DISPUTED WORK

While the Contractor or subcontractor is performing extra work in accordance with the Owner's written order, the cost of which is to be determined by method set forth in Section A 3.19d. hereof, or is performing disputed work or complying with a determination or order under protest in accordance with Section A 3.20 hereof, then in each case the Contractor shall daily furnish the City's representative at the site with three copies of verified statements showing:

- a. The name and number of each worker employed on such work or engaged in complying with such determination or order, the character of work each is doing and the wages paid, including the rate and amount of payroll taxes and contributions for unemployment insurance and federal social security; and
- b. The nature and quantity of any materials, plant, or construction equipment furnished or used in connection with the performance of such work or in complying with such determination or order; and from whom purchased or rented.

A copy of such statements will be signed by the City's representative, noting thereon any items in question, and will be returned to the Contractor within two (2) working days after submission. This signature shall not be construed as the City's agreement and acceptance of items not questioned since all items are subject to subsequent review and audit by City representatives.

The Contractor and subcontractors, when required by the City, must also produce for inspection and audit by designated City representatives, any and all books, vouchers, records, daily job diaries and reports, canceled checks, etc., showing the nature and quantity of labor, materials, and equipment actually used in the performance of the work, and the amounts expended therefore, and the costs incurred for insurance premiums and other items of expense directly chargeable to such work. The Contractor must permit the City's representatives to make extracts therefrom or copies thereof as may be desired. Failure of the Contractor to comply strictly with these requirements shall constitute a waiver of all or part of any claim for extra compensation on account of the performance of such work.

A 3.22 THE CITY'S REPRESENTATIVE

- a. General. The work under this Contract shall be under the general direction of the City's Representatives and shall be subject to the representative's determination, direction, and approval, except where the determination, direction, or approval of someone other than the City's Representative is expressly called for herein.

Without implying any limitation upon the power of the City's Representative, and in addition to those matters elsewhere delegated to the City's Representative and expressly made subject to the representative's determination, direction, or approval, the City's Representative shall have the authority and power:

- (1) To determine the amount, kind, quality, and acceptability of the work to be paid for hereunder, and to reject such work which does not conform to the Contract requirements;
- (2) To determine all questions in relation to the work, to interpret the Contract Drawings, Specifications, and Bulletins, and to resolve all patent inconsistencies or ambiguities therein;
- (3) To amplify the Contract Drawings and Specifications, add explanatory information, and furnish supplemental drawings and specifications consistent with the intent of these Contract Documents;
- (4) To make changes in the work as deemed necessary provided that the general character of the work as a whole is not materially affected thereby; such changes shall be made in writing;
- (5) To determine the adequacy of the Contractor's construction methods, plant, and facilities;
- (6) To require the application of the Contractor's forces to any portion of the work without extra compensation, or the work temporarily stopped without extra compensation when, in his/her judgment, such may be necessary to assure proper performance of the Contract;

- (7) To determine how the work of this Contract shall be coordinated with the work of other Contractors engaged simultaneously on the project of which this Contract is a part, including the power to temporarily stop the work; and
- (8) The rights reserved to the City in this Section A 3.22 are for the protection of the City and to insure full performance by the Contractor, subcontractors, employees and agents of the duties imposed upon the Contractor by the provisions of this Contract and shall not excuse or relieve the Contractor from any of the duties, responsibilities and obligations under the Contract including, but not limited to, the absolute obligation to safely perform the work and to indemnify and save harmless the City as provided in Section A 3.3.
- b. City's Representatives. Where the Contract Documents provide that the determinations, directions, or approvals shall be made by the City or "City's Representatives," this shall mean acting directly or through duly authorized representatives acting within the limit of authority delegated to them. Any determination, direction, or approval of such authorized representatives shall be subject to review by the City's Representative.
- c. City's Representative Final Determinations. The City's Representative's determinations shall be final, relative to the proper performance of the work and the materials used, and the Contractor is bound thereby.

It is hereby covenanted and agreed between the two parties of the Contract that the City's Representative shall review and determine all disputes, controversies, or claims of either party in relation to the Contract or its performance. Such determination shall be made in writing by the City's Representative within a reasonable time and shall be final and conclusive upon both the Contractor and the City. It is further covenanted and agreed between the two parties to the Contract that the determination by the City's Representative shall be a condition precedent to the right of any legal action at law or in equity that either party may have against the other.

A 3.23 INSPECTION AND TESTS

- a. General. The Contractor shall furnish the City with every reasonable facility for determining whether or not the work performed was in accordance with the requirements and intent of the Plans and Specifications. Any work done (except excavation) or materials used without suitable supervision or inspection by the City may be ordered removed and replaced at the Contractor's expense.
- b. Removal of Defective and Unauthorized Work. All work which has been rejected or condemned shall be repaired, or if it cannot be repaired satisfactorily, it shall be removed and replaced at the Contractor's expense. Defective materials shall be immediately removed from the site of work. Work done without line and grade having been given, work done beyond the lines or not in conformity with the grades shown on the Plans or as given, save as herein provided, work done without proper inspection, or any extra or other work done without written authority and prior agreement in writing as to prices, shall be done at the Contractor's risk. Such work will be considered unauthorized and, at the option of the City, may not be

measured and paid for, and may be ordered removed at the Contractor's expense. Upon failure of the Contractor to repair satisfactorily or to remove and replace, if so directed, rejected, unauthorized, or condemned work or materials immediately after receiving notice from the City, the City will, after giving written notice to the Contractor, have the authority to cause defective work to be remedied or removed and replaced, or to cause unauthorized work to be removed and to deduct the cost thereof from any monies due or to become due the Contractor, or to change the Contractor therefor.

- c. Final Inspection for Initial Acceptance. The City will make inspection of all work included in the contract as soon as practicable after the work is completed and ready for initial acceptance. If the work is not acceptable to the City at the time of such inspection, the City will inform the Contractor as to the particular defects to be remedied before initial acceptance will be made.
- d. Samples and Tests of Materials. Initial testing of all materials, construction items, or products incorporated in the work will be performed at the direction and expense of the City, including initial compaction and density tests deemed necessary, unless otherwise provided in Contract.

In the event a material, construction item or product incorporated in the work fails to satisfy the minimum requirements of the initial test, appropriate testing will be made as directed by the City to determine the extent of the failure and to verify that the corrective measures have brought the item to Specification requirements. The cost of all testing necessary to determine the extent of the failure and the adequacy of the corrective measures will be the responsibility of the Contractor.

The failure of the City to make any tests of materials shall in no way relieve the Contractor of the responsibility of furnishing materials conforming to the Specifications.

The Contractor shall provide such facilities as the City may require for collecting and forwarding samples and shall not use the materials represented by the samples until tests have been made. The Contractor shall furnish adequate samples without charge.

The inspections and tests made by the City, its inspectors or its agents, will ordinarily be made without cost to the Contractor unless otherwise expressly specified in the Contract Documents. The Contractor shall furnish without additional cost to the City such materials for testing as may be reasonably necessary. Retesting after failure to pass tests will be at the expense of the Contractor. Should, however, the preparation or manufacture of the materials or equipment be at far distant or inaccessible points, or should it be separated into unreasonably small quantities, or widely distributed to an unreasonable extent, or should the percentage of rejected material or equipment be unreasonably large, the additional cost of such inspection and tests resulting therefrom shall be borne by the Contractor. The City shall judge what is extra inspection and shall determine the additional cost incurred thereby.

A 3.24 NO ESTOPPEL

The City, or any officer, or agent thereof, shall not be precluded at any time, either before or after final completion and final acceptance of the work and payment therefor, from:

- a. Showing the true and correct amount, classifications, quality, and character of the work done and materials furnished by the Contractor or any other person under this Contract, or from showing at any time that any determination, return, decision, approval, order, letter, payment, or certificate is untrue and incorrect, or improperly made in any particular specific or quantity, or that the work or the materials or any parts thereof, do not in fact conform to the Contract requirements; and
- b. Demanding the recovery from the Contractor of any over-payments made, and interest or such damages as the City may sustain by reason of the Contractor's failure to perform each and every part of this Contract in strict accordance with its terms; or both.

A 3.25 CITY'S RIGHT TO DECLARE CONTRACTOR IN DEFAULT

The work or any portion of the work under Contract shall be suspended immediately on written order of the City declaring the Contractor to be in default. Notice shall be given to the Contractor and shall be deemed Notice to Contractor's Surety whether actually sent or received by Contractor's Surety. The Contract may be terminated by the City for cause or causes, including but not limited to the following:

- a. Failure of the Contractor to start the work within twelve (12) working days from date of written notice by the City to begin the work;
- b. Substantial evidence that the progress of the work being made by the Contractor is insufficient to complete the work within the specified time;
- c. Failure of the Contractor to provide sufficient and proper equipment or construction forces for properly executing the work;
- d. Substantial evidence that the Contractor has abandoned the work;
- e. Substantial evidence that the Contractor has become insolvent, bankrupt, or otherwise financially unable to carry on the work;
- f. Deliberate failure on the part of the Contractor to observe any requirements of these Specifications or to comply with any orders given by the Engineer as provided for in these specifications;
- g. Failure of the Contractor to promptly make good any defects in materials or workmanship or any defects of any nature, the correction of which has been directed in writing by the City; and

- h. Substantial evidence of collusion for the purpose of illegally procuring a contract or perpetrating fraud on the City in the construction of work under Contract.

When the work is suspended for any of the causes itemized above or for any other cause or causes, the Contractor shall discontinue the work or such part thereof as the City shall designate, whereupon the sureties may at their option assume the Contract or that portion thereof which the City has ordered the Contractor to discontinue and may perform the same or may, with the written consent of the City, subcontract the same provided, however, that the sureties shall exercise their option, if at all, within two weeks after the written notice to discontinue the work has been served upon the Contractor and upon the sureties or their authorized agents. In case the sureties do not, within the hereinabove specified time, exercise their right and option to assume the Contract or that portion thereof which the City has ordered the Contractor to discontinue, then the City shall have the power to complete by contract or otherwise, as it may determine, the work herein described or such part thereof as it may deem necessary.

At the time work is suspended, the Contractor shall provide an accounting to the City of the work performed and the equipment, materials, supplies and other property on site. The Contractor shall not remove any materials, equipment, supplies or any other property from the site. The Contractor hereto agrees that the City shall have the right to take possession of or use any or all of the materials, plant, tools, equipment, supplies, and property of every kind provided by the Contractor for the purpose of the work and to procure other tools, equipment, and materials for the completion of the same and to charge to the account of the Contractor the expense of said contract or labor, materials, tools, equipment, and expenses incident thereto. The expense so charged shall be deducted by the City out of such monies as may be due or may at any time thereafter become due the Contractor under and by virtue of the Contract or any part thereof or to charge the Contractor for such amounts. The City shall not be required to obtain the lowest bid for the work of completing the Contract, but the expenses to be deducted shall be the actual cost of such work. In case such expense is less than the sum which would have been payable under the Contract if the same had been completed by the Contractor, then in such case the City may pay to the Contractor the difference in the cost, provided that the Contractor shall not be entitled to any claim for damages or for loss of anticipated profits. In case such expense shall exceed the amount which would have been payable under the Contract if the same had been completed by the Contractor, then the Contractor and sureties shall pay the amount of the excess to the City on notice from the City for excess due including any costs incurred by the City, such as inspection, legal fees, and liquidated damages. When any particular part of the work is being carried on by the City by Contract or otherwise under the provisions of this section, the Contractor shall continue the remainder of the work in conformity with the terms of the Contract and in such manner as not to hinder or interfere with the performance of workers employed as above provided by the City.

A 3.26 SUSPENSION BY COURT ORDER

The Contractor shall suspend such part or parts of the work ordered by the Court and will not be entitled to additional compensation by virtue of such court order.

A 3.27 SUBCONTRACTS

The Contractor shall not make any subcontract for performing any portion of the work included in the contract without notice to the Owner. This contract having been made pursuant to the bid submitted by the Contractor and in reliance with the Contractor's personal qualifications and responsibility, the Owner reserves the right to withhold approval of any subcontractor which the Owner deems would not be in the Owner's best interest.

The Contractor shall, as soon as practicable after signing the contract, submit a separate written notice to the Owner identifying each proposed subcontractor. Upon request of the Owner, the Contractor shall promptly furnish additional information tending to establish that any proposed subcontractor has the necessary facilities, skill, integrity, past experience and financial resources to perform the work in accordance with the terms and conditions of this contract. If the City determines that any proposed subcontractor is unacceptable, the City shall so notify the Contractor, who may thereupon submit another proposed subcontractor unless the Contractor decides to do the work. Disapproval by the City of any proposed subcontractor shall not provide a basis for any claim by the Contractor.

If an approved subcontractor fails to properly perform the work undertaken, the subcontractor shall be removed from the job upon request of the City, following notification to the Contractor in writing of the request for removal and the reasons therefor.

Each subcontract entered into shall provide that the provisions of the Contract shall apply to such subcontractor and their officers and employees in all respects as if the subcontractor and they were employees of the Contractor. The City's decision not to disapprove of any subcontract shall not relieve the Contractor of any of the responsibilities, duties and liabilities hereunder. The Contractor shall be solely responsible for the acts, omissions, negligence or defaults of subcontractors and of such subcontractor's officers, agents and employees, each of whom shall, for this purpose, be deemed to be the agent or employee of the Contractor to the extent of his subcontract.

The Contractor agrees to bind each subcontractor, and each subcontractor agrees to be bound by the terms of the Contract Documents insofar as applicable to the work. The Contractor and each subcontractor jointly and severally agree that nothing in the Contract Documents or otherwise shall create or be deemed to create any rights in favor of a subcontractor against the City ; nor shall be deemed or construed to impose upon the City any obligation, liability or duty to a subcontractor; or to create any contractual relation whatsoever between a subcontractor and the City.

As a matter of policy with respect to City of Arlington projects and procurements, City of Arlington also encourages the use, if applicable, of qualified contractors, subcontractors and suppliers where at least fifty-one (51%) of the ownership of such contractor, subcontractor or supplier is vested in racial or ethnic minorities or women. In the selection of subcontractors, suppliers or other persons in organizations proposed for work on this contract, the contractor agrees to consider this policy and to use its reasonable and best efforts to select and employ such company and persons for work on this contract.

The provisions contained herein shall likewise apply to any sub-subcontracts.

A 3.28 ASSIGNMENTS

The Contractor shall not assign, transfer, convey, or otherwise dispose of this Contract, or the right to execute it, or the right, title, or interest in it or any part thereof without the written approval of the City. The City will ordinarily not favorably consider an assignment, transfer, or conveyance of the Contract unless an exigency occurs which was not known or could not have been foreseen by the Contractor at the time of bidding.

The Contractor shall not assign, either legally or equitably, by power of attorney or otherwise, any of the monies due or to become due under this Contract or the Contractor's claim thereto without the prior written approval of the City.

The approval by the City of a particular assignment, transfer, or conveyance shall not dispense with such approval to any further or other assignments.

The approval of the City of any assignment, transfer, or conveyance shall not operate to release the Contractor or Surety hereunder from any of the Contract obligations, unless otherwise agreed by the parties with City's consent.

A 3.29 CLAIMS AGAINST CITY AND ACTION THEREON

No claim against the City for damages for breach of contract or compensation for extra work shall be made or asserted in any action or proceedings at law or in equity, unless the Contractor shall have strictly complied with all requirements relating to the giving of notice and information with respect to such claims all as hereinbefore provided.

A 3.30 CITY'S OFFICERS, EMPLOYEES, OR AGENTS

No claim whatsoever shall be made by the Contractor against any officer, employee, or agent of the City for, or on account of, anything done or omitted to be done in connection with this Contract.

A 3.31 PATENTS

The Contractor shall pay all royalties and license fees and shall hold and save the City and its officers, employees, and agents harmless from all liability of any nature or kind, including cost and expenses for, or account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the Contract, including its use by the City, unless otherwise specifically stipulated in the Contract Documents. In this respect the Contractor shall defend all suits or claims for infringement of any patent or license right. In the event that any claims, suit, or action at law or in equity of any kind, whatsoever, is brought against the City, or its officers, employees, or agents, involving any such patents or license rights, then the City shall have the right to,

and may, retain from any money due or to become due to the Contractor, such sufficient sum as is considered necessary to protect said City, or its officers, employees, or agents against loss, and such sum may be retained by the City until such claim or suit shall have been settled and satisfactory evidence to that effect shall have been furnished the City.

A 3.32 MONTHLY ESTIMATE, PARTIAL PAYMENTS, AND FINAL PAYMENTS

Between the twenty-fifth day and the last day of each month, the Contractor will make an approximate estimate of the value of the work done during the month under the Contract and submit the estimate to the City for processing. Whenever the said estimate or estimates of work done since the last previous estimate exceeds one hundred dollars (\$100.00) in amount, a percentage of such estimated sum will be paid the Contractor on or before the fifteenth day of the month next following. The monthly estimate may include acceptable non-perishable materials delivered to the work; such payment will be allowed on same percentage basis of the net invoice value as provided hereinafter.

The percent retained by the City will be ten (10) percent of contracts whose contract price estimate is less than \$400,000, and five (5) percent on all contracts whose contract price is \$400,000 or greater unless otherwise provided by the Contract Documents or Law.

The Contractor shall furnish to the City such detailed information as the City may request to assist the City in the verification of monthly estimates. It is understood that the monthly estimates will be approximate only, and all monthly estimates and partial payments will be subject to correction in the estimate rendered following the discovery of an error in any previous estimate. Such estimate shall not in any respect be taken as an admission of the City of the amount of work done or of its quality or sufficiency nor as an acceptance of the work or the release of the Contractor of any responsibility under the Contract.

Whenever the improvement provided for by the Contract shall have been completely performed on the part of the Contractor, a final estimate showing the value of the work will be prepared by the City as soon as the necessary measurements and computations can be made. All prior estimates upon which payments have been made are subject to necessary corrections or revisions in the final payment. The amount of this final estimate, less any sums that have been previously paid, deducted, or retained under the provisions of the Contract, will be paid the Contractor within thirty (30) calendar days after final inspection, provided the Contractor has furnished to the City satisfactory evidence that all sums of money due for any labor, materials, apparatus, fixtures, or machinery furnished for and used in the prosecution of the work, or that the person or persons to whom the same may respectively be due have consented to such final payment. The acceptance by the Contractor of the final payment as aforesaid shall operate as and shall be a release to the City from all claims or liabilities under the Contract for anything done or furnished or relating to the work under the Contract or for any act or neglect of said City relating to or connected with the Contract.

No interest shall ever be due on late payments.

A 3.33 PAYMENT WITHHELD

In addition to express provisions elsewhere contained in the contract, the Owner may withhold from any payment otherwise due the Contractor such amount as determined necessary to protect the Owner's interest, or, if it so elects, may withhold or retain all or a portion of any payment on account of:

- (a) unsatisfactory progress of the work not caused by conditions beyond the Contractor's control;
- (b) defective work not corrected;
- (c) Contractor's failure to carry out instructions or orders of the City or the City's representative;
- (d) a reasonable doubt that the contract can be completed for the balance then unpaid;
- (e) work or execution thereof not in accordance with the Contract Documents;
- (f) claim filed by or against the Contractor or reasonable evidence indicating probable filing of claims;
- (g) failure of the Contractor to make payments to subcontractor or for material or labor;
- (h) damage to another Contractor;
- (i) unsafe working conditions allowed to persist by the Contractor;
- (j) failure of the Contractor to provide work schedules as required by the Owner;
- (k) use of unqualified subcontractors; or
- (l) failure of the Contractor to keep current as-built record drawings at the job site, or to turn same over in completed form to the Owner.

When the above grounds are removed, payment shall be made for amount withheld because of them, and Owner shall never be liable for interest on any delayed or late payment.

A 3.34 SERVICE OF NOTICES

The Contractor's address in the Contract Documents will be the place where all notices, directions, or other communication may be delivered, or to which they may be mailed.

Notices, directions, or other communications to the Surety or Sureties on Contract Bonds shall be directed or delivered to the home office or to the agent or agents who executed the bonds on behalf of the Surety or Sureties.

Actual delivery of any such notice, direction, or communication to the aforesaid places or depositing it in a postpaid wrapper addressed thereto in any post office box regularly maintained

by the United States Post Office Department shall be conclusively deemed to be sufficient service thereof upon the above persons as of the date of such delivery or deposit.

The above addresses may be changed at any time by an instrument in writing executed and acknowledged by the party changing the address and delivered to the other party or parties.

Nothing herein contained shall, however, be deemed to preclude or tender inoperative the service of any notice, direction, or communication upon the above parties personally, or, if the Contractor be a corporation, upon any officer or director thereof.

A 3.35 UNLAWFUL PROVISIONS DEEMED STRICKEN

If this Contract contains any unlawful provisions not an essential part of the Contract and which shall not appear to have been a controlling or material inducement to the making thereof, such unlawful provisions shall be of no effect. Upon the application of either party, the unlawful part shall be considered stricken from the Contract without affecting the remainder of the Contract.

A 3.36 ALL LEGAL PROVISIONS INCLUDED

It is the intent and agreement of the parties to this Contract that all legal provisions of law required to be inserted herein, shall be and are inserted herein. However, if through mistake or oversight, any such provision is not herein inserted or is not inserted in proper form, then upon application of either party, the Contract shall be amended so as to strictly comply with the law and without prejudice to the rights of either party hereunder.

A 3.37 EQUAL EMPLOYMENT OPPORTUNITY

The Contractor shall not discriminate against any employee or applicant for employment because of race, age, color, religion, sex, ancestry, national origin, place of birth or disability. The Contractor shall take action to ensure that applicants are employed and treated without regard to their race, age, color, religion, sex, ancestry, national origin, place of birth or disability. This action shall include but not be limited to the following; employment, upgrading, demotion or transfer, recruitment or advertising; layoff or termination; rates of pay or other forms of compensation; and selection of training, including apprenticeship.

A. 3.38 INDEPENDENT CONTRACTOR

CONTRACTOR covenants and agrees that he or she is an independent Contractor and not an officer, agent, servant or employee of the CITY; that CONTRACTOR shall have exclusive control of and exclusive right to control the details of the work performed hereunder and all persons performing same, and shall be responsible for the acts and omissions of its officers, agents, employees, Contractors, subcontractors and consultants; that the doctrine of respondent superior shall not apply as between CITY and CONTRACTOR, its officers, agents, employees, Contractors, subcontractors and consultants, and nothing herein shall be construed as creating a partnership or joint enterprise between CITY and CONTRACTOR.

A. 3.39 HEADINGS

The headings of these specifications are for the convenience of reference only and shall not affect in any manner any of the terms and conditions hereof.

A 3.40 GOVERNING LAW

The Contract Documents shall be governed by the laws of the State of Texas and, if legal action is necessary to enforce the Contract documents, exclusive venue shall lie in Tarrant County, Texas.

PART B
MATERIALS & EQUIPMENT

B 1 GENERAL MATERIAL STANDARDS

B 1.1 GENERAL

This section of the specifications contains the detail specifications for all major materials which enter into the project and become a permanent part thereof. The specifications are intended to be so written that only new materials, not deteriorated from its original and manufactured state, of the best quality and grade will be furnished, that manufacturing procedures for the product be controlled with failure-preventative type processes, and that good workmanship will produce a first class product. The specifications are formulated to provide total performance of each product within the frame of its intended use and as such, every detail requirement of the controlling specification shall be met even though this necessitates selective upgrading of another. The fact that individual specifications may fail to be sufficiently complete in some detail will not relieve the Contractor of full responsibility for providing material of high quality under the total performance concept and to protect them adequately until incorporated into the system or structure. All pipe, fittings and appurtenances used for potable water applications shall be listed in the National Sanitation Foundation listing of approved materials.

B 1.2 SPECIFICATION REFERENCES

When reference is made in these specifications to a particular ASTM, AWWA, ANSI, AASHTO, ACI, NSF Standard or other specification, it shall be understood that the latest revision of such specification shall apply.

B 1.3 SUBSTITUTIONS

The specifications for materials set out the minimum standard of quality which the City believes necessary to procure a satisfactory project. No substitutions will be permitted until the Contractor has received written permission of the Engineer to make a substitution for the material which has been specified.

Where the term "or equal," or "or approved equal" is used, it is understood that if a material, product, or piece of equipment bearing the name so used is furnished it will be approved as the particular trade name was used for the purpose of establishing a standard of quality acceptable to the City. If a product of any other name is proposed for use, the Engineer's approval thereof must be obtained in writing before the proposed substitute is procured by the Contractor. Wherever the term "or equal" is used it is understood to mean "or approved equal." It shall be understood that the Contractor shall have the full responsibility of proving that the proposed substitution is, in fact, equal under the total balanced system concept required in Paragraph B 1.1.

B 1.4 SHOP DRAWINGS

The Contractor shall furnish shop drawings on all manufactured products, including concrete pressure pipe, gate valves, fire hydrants, etc., and furnish test certificates on items as required in the specifications under which they are purchased. If a product is installed before the Contractor receives an approved copy of the shop drawings from the City, the City may require that the

Contractor remove and reinstall the facility in a manner acceptable to the Engineer. Removal and reinstallation shall be at the expense of the Contractor.

Reproducible drawings of the finally approved shop drawings shall be furnished by the Contractor to the City, and reproducible drawings shall be furnished to the City upon completion of the project, correctly indicating any changes which have been made in the field.

B. 1.5 OPERATION AND MAINTENANCE MANUALS

The contractor shall provide when specified 2 (two) copies of operation and maintenance manuals for all manufactured equipment supplied. Manufactured equipment shall include the following: pumps, motors, valves, flow meters, fire hydrants, backflow preventers, instruments (electronic and mechanical), or any other device which required any type of cyclic maintenance. The O & M manuals shall be bound in a three ring binder and shall be tabbed by section. At a minimum the manual sections shall include but not be limited to:

Table of Contents

Theory of Operation

Warranty Information

Maintenance Cycles Required

Maintenance Materials Required (i.e. lubricants)

Spare Parts List

Schematic Drawings & Diagrams

B 2 CONCRETE PRESSURE PIPE AND FITTINGS

B 2.1 SCOPE

THIS MATERIAL SHALL NOT BE USED FOR NEW WATER LINE CONSTRUCTION, BUT IS INCLUDED FOR GUIDANCE FOR REPAIR, MAINTENANCE AND CONNECTION TO EXISTING WATER LINES.

This specification governs the manufacture of concrete pressure pipe for use primarily in water supply and distribution systems. Except as otherwise specified, the pipe and fittings shall be designed and manufactured in accordance with the following AWWA standards:

Standard Product

AWWA C301 "Manufacture of Prestressed Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids"

AWWA C303 "Concrete Pressure Pipe, Bar-Wrapped Steel Cylinder Type"

AWWA C304 "Design of Prestressed Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids"

B 2.2 PRODUCTS

Brief descriptions of the various types of concrete pressure pipe to be manufactured under this specification are as follows:

- a. Prestressed Concrete Lined Cylinder Pipe. This pipe has a welded sheet-steel cylinder, manufactured by the spiral or straight seam method, with steel joint rings welded to its ends. A core is then constructed which consists of lining the cylinder with concrete, either poured or centrifugally cast within the steel cylinder. High tensile strength prestressing wire is then wound around the outside of the steel cylinder at a predetermined stress and securely fastened at both ends. The core and wire are then covered with a Portland Cement mortar coating. Pipe joints are self-centering with a preformed rubber gasket designed so that the joint will be watertight under all normal service conditions.

This pipe is manufactured in accordance with AWWA C301. The minimum nominal joint length is sixteen (16') feet. Normally used sizes of this pipe are from sixteen (16") to sixty (60") inch diameters.

- b. Prestressed Concrete Embedded Cylinder Pipe. This pipe is similar to prestressed concrete lined cylinder pipe except that the core is composed of a steel cylinder embedded in concrete instead of a steel cylinder with only an inside lining of concrete.

This pipe is manufactured in accordance with AWWA C301. The minimum nominal joint length is sixteen (16') feet. Normally used sizes of this pipe are from forty-eight (48") to ninety-six (96") inch diameters.

- c. Bar-Wrapped Concrete Cylinder Pipe. This pipe consists of a welded sheet-steel or plate-steel cylinder manufactured by the spiral or straight seam method with the joint rings attached. A cement mortar lining is centrifugally cast inside the steel cylinder. A mild steel rod is spirally wrapped under measured tension on the steel cylinder, and a protective Portland Cement mortar concrete coating is applied to the outside of the cylinder and rod. This pipe is manufactured in accordance with AWWA C303. This pipe is normally furnished in joint lengths of twenty-four feet (24') to forty feet (40') with shorter length specials. Normally used sizes of this pipe are from ten inch (10") to sixty inch (60") diameters.

B 2.3 GENERAL REQUIREMENTS

- a. The type of pipe to be supplied shall be as shown on the plans and/or in the Special Provisions for each project.
- b. If requested by the City, the manufacturer shall submit a successful experience record in the design and construction of the type of concrete pressure pipe involved. Each type of pipe shall have the complete approval of the Underwriters' Laboratories, Inc., for the manufacture of the pipe specified and diameters up to ninety-six inches (96"). Pipe shall have NSF standard approval.
- c. The pipe manufacturer shall furnish a factory trained, job experienced field representative who shall visit the project at least weekly during the course of installation and be present at the unloading of the pipe at delivery to insure proper handling. They will also be subject to call by the Contractor or Owner to advise and assist with the solution of field problems.
- d. The City shall at all times have free access to the manufacturer's plant while production is in progress. The City may at any time refuse to accept pipe made when the plant is failing to follow the stipulations of the specifications in regard to workmanship, or failing in provisions to insure a uniform product coming within the permissible variations of the specifications as to size, thickness, position of reinforcing steel, and curing of pipe. The interior pipe surface shall be relatively smooth and free from pits, etc. No pipe with cracks in either the exterior or interior mortar coatings will be acceptable unless such cracks are minor hairline cracks as defined by the manufacturer.
- e. Where designated, joints shall be bonded using an approved electrical conducting material to insure continuity between sections of pipe for the application of cathodic protection measures in accordance with the latest industry standards. Bonding straps shall be provided past in-line valves to assure electrical continuity.
- f. Test stations shall be provided at the appropriate locations as indicated on the plans to insure proper bonding and effectiveness of cathodic protection measures.

- g. No cracks will be permitted in the lining of the pipe except for minor hairline cracks. Cracks in the vicinity of the spigot of prestressed pipe and those cracks in the vicinity of circumferential wrappers and outlets shall not be allowed, unless after inspection it is determined that they do not interfere with the performance of the pipe and they are accepted by the manufacturer so as to not void the warranty.

B 2.4 SHOP DRAWINGS

The Contractor shall furnish the City shop drawings of the pipe and fittings to be furnished which shall include a tabulated layout schedule referenced to plan stationing and grade lines as shown on the project drawings.

Such drawings shall be subject to the review of the City. Fabrication of pipe and fittings shall not commence until such review has been completed by the City or its authorized representative or such has been waived in writing. Three (3) copies of the preliminary drawings shall be submitted for approval. Six (6) copies of the final drawings will be required.

B 2.5 PRESSURE RATING

Unless otherwise noted on the plans or in the Special Provisions, all concrete pressure pipe shall be designed for 150 psi working pressure.

B 2.6 DESIGN STRESSES

Unless otherwise directed by the Engineer or required in the project specifications, design stresses shall conform to the requirements of AWWA C304 for prestressed pipe or the design appendix of AWWA Manual M9 for Bar-Wrapped Pipe.

B 2.7 FITTINGS AND SPECIALS

Fittings and specials shall comply in all respects with the requirements of AWWA C301 or AWWA C303 or AWWA C304 as applicable for the type and class of pipe required by the plans and project specifications.

B 2.8 INSULATION OF FLANGED OUTLETS

Flanged outlets shall be insulated at all points where external valves, pipe, fittings, etc., are connected to the line. The Contractor shall furnish an insulating flange kit, flange gaskets, insulating sleeves, and two (2) plastic washers for each bolt approved by the Owner or his/her representative.

B 2.9 BOLTS FOR FLANGED OUTLETS

Bolts, nuts, and washers for flanged outlet connections shall be carbon steel. After installation they shall be encased with mortar in a pipe diaper.

B 2.10 THREADED TAPS

Where taps are threaded, a brass or bronze bushing shall be used between the steel coupling affixed to the pipe and the corporation stop or other outlet device. The steel coupling shall be completely embedded in the pipe wall and covered with the mortar coating of the pipe. Nylon and galvanized bushings are not acceptable.

B 2.11 TUNNEL PIPE

Pipe for installation in tunnels or conduits shall have a minimum of two twenty-four (24") inch wide mechanically impacted mortar bands one and one-half (1½") inches thick placed at approximately the third points of each pipe length. The exterior of the joint recess of tunnel pipe shall be filled with an approved flexible pre-formed joint sealer.

B 2.12 TESTING

When requested, the manufacturer shall furnish an affidavit of compliance that all pipe and fittings comply with the applicable portions of the appropriate AWWA standard and that all tests required by the standard have been performed. Copies of the test reports required by Section 1.9 of either AWWA C301, AWWA C303, or AWWA C304 shall be made available to the City, upon request.

In addition, the City may, at its expense, retain the services of an independent testing laboratory to certify or monitor the testing performed by the manufacturer.

B 2.13 REJECTION

Pipe will be rejected for failure to meet any of the requirements of these specifications. Pipe delivered which does not comply with the requirements of Section B 2.3, and which has defects which cannot be repaired using normal acceptable methods shall be rejected and shall be immediately removed from the construction site.

B 3 ASBESTOS-CEMENT PRESSURE PIPE

B 3.1 SCOPE

THIS MATERIAL SHALL NOT BE USED FOR NEW WATER LINE CONSTRUCTION, BUT IS INCLUDED FOR GUIDANCE FOR REPAIR, MAINTENANCE AND CONNECTION TO EXISTING WATER LINES.

This specification governs the manufacture of asbestos-cement pressure pipe for water distribution systems. This pipe is composed of a mixture of Portland cement, silica, and asbestos fiber and is completely free of organic or metallic substances.

B 3.2 PRODUCTS

All asbestos-cement pipe and couplings shall comply with AWWA C400 and ASTM C269, Type II.

Standard pipe lengths shall be thirteen (13') feet. Up to ten percent (10%) of the total footage of any one size and class of pipe may be furnished in random lengths. The maximum outside diameters for the various sizes shall be limited to the following: 6"-7.60", 8"-9.62", 10"-12.12", and 12"-14.38".

To facilitate spotting of valves and fittings, short lengths may be furnished either machined overall (MOA) or machined each end (MEE). For ease of installation, the MOA may be made of PVC manufactured to the dimension of asbestos-cement pipe in the same pressure class as the pipe being furnished.

B 3.3 PRESSURE CLASS

Pipe six (6") inches in diameter shall be Class 200. Pipe eight inches (8") and larger in diameter shall be Class 150.

B 3.4 COUPLINGS

Couplings shall be of the sleeve type suitable for use with a rubber or rubber-type sealing gasket. The gaskets shall be furnished with each coupling and shall be the Nonoil Resistant type as set forth in ASTM D 1869, "Rubber Rings for Asbestos-Cement Pipe".

B 3.5 FITTINGS

Fittings will be ductile iron and shall be cement mortar lined inside with seal coat in accordance with ANSI A21.4 (AWWA C104). The outside coating will be in accordance with ANSI A21.6 (AWWA C106).

Fittings shall be either mechanical joint or push-on joint in accordance with Section B-15. Asbestos-cement to ductile iron or P.V.C. adapters will be used where required. Bolts for flange

connections shall be Type 304 stainless steel with nylon coated nuts and washers or silicon bronze nuts and washers.

B 3.6 APPROVALS

Asbestos-cement water pipe shall be approved by the Underwriter's Laboratory and shall be accepted by the State Fire Insurance Commission for use in water distribution systems in cities and towns of Texas.

Asbestos-cement water pipe shall also bear the seal of approval ("NSF" mark) of the National Sanitation Foundation Testing Laboratory for potable water pipe.

B 3.7 SERVICE CONNECTIONS

All service connections through two (2") inches shall be made using a factory made heavy tapped coupling with brass bushing which is threaded into the fitting body in combination with an epoxy seal. The outlets shall be AWWA taper thread for three-fourths (3/4") inch and one (1") inch. For two (2") inches taps, iron pipe threads (I.P.T.) shall be used. For service taps made at locations other than tapped couplings, a service clamp conforming to the requirements set forth in Section B 13 shall be used.

B 3.8 REJECTION

Asbestos-cement pipe may be rejected for failure to meet any of the requirements of this specification.

B 4A POLYVINYL CHLORIDE (PVC) WATER PIPE (4-inch through 12-inch Diameter)

B 4A.1 SCOPE

This specification governs the manufacture of unplasticized polyvinyl chloride (PVC) plastic pipe with integral thickened wall bells for water distribution systems in sizes four (4") inch through twelve (12") inch.

All pipe shall be Class 150 (DR 18) unless otherwise specified or shown on the plans.

All pipe shall meet or exceed the requirements of AWWA C900, latest revision, and have cast iron pipe outside dimensions.

B 4A.2 PRODUCTS

All pipe shall have a rubber ring joint. Provisions must be made for contraction and expansion at each joint with a rubber ring.

An integral thickened bell will be a part of each joint. Minimum thickness through the pipe bell and ring seating areas shall be as specified in AWWA C900 or AWWA C905, latest revision.

Pipe and fittings must be assembled with non-toxic lubricant.

Laying lengths shall be twenty (20') feet plus or minus (\pm) one (1") inch. All pipe shall have physical dimensions as shown in Table 1.

B 4A.3 FITTINGS

All fittings shall be mechanical joint or push-on joint iron fittings complying with Section B-15.

Bolts, nuts and washers used in flange and mechanical joint connections shall be high strength, low alloy steel similar to CORTEN or equal.

B 4A.4 TAPS

Service saddles shall be used for all taps. No direct tapped connections to PVC pipe will be allowed. Service saddles shall comply with Section B-13.

B 4A.5 APPROVALS

PVC water pipe shall be approved by the Underwriters' Laboratory and shall be accepted by the State Fire Insurance Commission for use in water distribution systems in cities and towns of Texas.

PVC water pipe shall also bear the seal of approval ("NSF" mark) of the National Sanitation Foundation Testing Laboratory for potable water pipe.

B 4A.6 TESTS

Each length of pipe shall be tested to two (2) times the pressure rating of the pipe for a minimum dwell of five (5) seconds.

To assure high quality extrusion, the pipe produced by each extrusion outlet shall be tested by the acetone immersion method at least every eight (8) hours.

B 4A.7 CERTIFICATION

When requested, the manufacturer will furnish certification that the pipe furnished meets all requirements of this specification.

B 4A.8 REJECTION

Pipe may be rejected for failure to meet any requirements of this specification.

B 4A.9 TABLE 1 - PVC WATER PIPE DIMENSIONS

Nominal Size (Inches)	Outside Diameter (Inches)	Class 150 (DR 18) Min. Wall Thickness (Inches)
4	4.80	0.267
6	6.90	0.383
8	9.05	0.503
10	11.10	0.617
12	13.20	0.733

B 4B POLYVINYL CHLORIDE (PVC) WATER PIPE (14-inch through 48-inch Diameter)

B 4B.1 SCOPE

This specification governs the manufacture of unplasticized polyvinyl chloride (PVC) plastic pipe with integral thickened wall bells for water distribution systems in sizes fourteen inch (14") through forty-eight inch (48").

All pipe shall be Pressure Rating 235 psi unless otherwise specified or shown on the plans.

All pipe shall meet or exceed the requirements of AWWA C905, latest revision, and have cast iron pipe outside dimensions.

B 4B.2 PRODUCTS

All pipe shall have a rubber ring joint. Provisions must be made for contraction and expansion at each joint with a rubber ring.

An integral thickened bell will be a part of each joint. Minimum thickness through the pipe bell and ring seating areas shall be as specified in AWWA C900 or AWWA C905, latest revision.

Pipe and fittings must be assembled with non-toxic lubricant.

Laying lengths shall be twenty (20') feet plus or minus (\pm) one (1") inch.

B 4B.3 FITTINGS

All fittings shall be mechanical joint or push-on joint or flanged ductile iron fittings complying with Section B-15.

Bolts, nuts, and washers used in flange and mechanical joint connections shall be high strength, low alloy steel similar to CORTEN or equal.

B 4B.4 TAPS

Service saddles shall be used for all taps. No direct tapped connections to PVC pipe will be allowed. Service saddles shall comply with Section B-13.

B 4B.5 APPROVALS

PVC water pipe shall be approved by the Underwriters' Laboratory and shall be accepted by the State Fire Insurance Commission for use in water distribution systems in cities and towns of Texas.

PVC water pipe shall also bear the seal of approval ("NSF" mark) of the National Sanitation Foundation Testing Laboratory for potable water pipe.

B 4B.6 TESTS

Each length of pipe shall be tested to four (4) times the class pressure of the pipe for a minimum dwell of five (5) seconds.

To assure high quality extrusion, the pipe produced by each extrusion outlet shall be tested by the acetone immersion method at the beginning of each production run for each size or when running conditions are changed that could affect extrusion quality.

B 4B.7 CERTIFICATION

When requested, the manufacturer will furnish certification that the pipe furnished meets all requirements of this specification.

B 4B.8 REJECTION

Pipe may be rejected for failure to meet any requirements of this specification.

B 5 DUCTILE IRON PIPE

B 5.1 SCOPE

This specification governs the manufacture of ductile iron pipe for water distribution systems and sewage collection systems.

B 5.2 PRODUCTS

All ductile iron pipe shall be asphaltic coated outside and manufactured in accordance with the latest revision of ANSI/AWWA C151/A21.51.

All pipe shall be new.

All ductile iron pipe for water service shall be cement mortar lined in accordance with the latest revision ANSI/AWWA C104/A21.4 and must be approved by the National Sanitation Foundation.

All ductile iron pipe and fittings for sanitary sewer service shall be internally lined with a virgin polyethylene coating complying with ANSI/ASTMD 1248 compounded with an inert filler and sufficient carbon black to resist ultraviolet rays during storage of the pipe and fittings. The polyethylene shall be bonded to the interior of the pipe or fitting by heat. All surface areas to be lined shall be blast cleaned comparable to the requirements of SSPC-SP6 or NACE #3. Polyethylene linings shall cover the inner surface of pipe and fittings extending from the spigot end to the gasket socket. Lining in pipe and in fittings shall be 40 mils nominal thickness.

B 5.3 PIPE WALL THICKNESS DESIGN

Ductile iron pipe shall be designed in accordance with the latest revision of ANSI/AWWA C150/A21.50, for a minimum 150 psi (or project requirements, whichever is greater) rated water working pressure plus a 100 psi minimum surge allowance and a 2 to 1 factor of safety and a service allowance of 0.08 inches. Minimum external earth load shall be calculated assuming a prism load and a minimum soil density of 120 pcf, or project requirements, whichever is greater. Minimum external live load shall be the AASHTO H-20, or project requirements, whichever is greater. Laying condition and depth of cover shall be in accordance with the plans.

B 5.4 JOINTS

Ductile iron pipe shall have either push-on joints, flanged or mechanical joints in accordance with ANSI A21.11 (AWWA C111) entitled "American National Standard for Rubber-Gasket Joints for Cast-Iron and Ductile-Iron Pressure Pipe and Fittings".

Bolts, nuts, and washers used in flange and mechanical joint connections shall be high strength, low alloy steel similar to CORTEN or equal.

B 5.5 FITTINGS

Dimensions, coatings, linings, joint types, etc., shall conform to Section B 15, Ductile Iron Fittings, of these specifications. Only ductile iron fittings shall be used on ductile iron pipe. All fittings must be approved by the National Sanitation Foundation.

B 5.6 APPROVAL

Ductile iron pipe shall be approved by the Underwriters' Laboratory and shall be accepted by the State Fire Insurance Commission for use in fire protection systems without penalty.

B 5.7 TESTS

All ductile iron pipe and fittings shall be tested in accordance with the applicable provisions of the specifications relating thereto.

B 5.8 REJECTION

Ductile iron pipe and fittings may be rejected for failure to meet any of the requirements of this specification.

B 6 VITRIFIED CLAY SEWER PIPE

THIS SECTION HAS BEEN DELETED.

B 7 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE

B 7.1 SCOPE

This specification governs the manufacture of unplasticized polyvinyl chloride (PVC) plastic gravity sewer pipe with integral wall bell and spigot joints for the conveyance of domestic sewage.

B 7.2 MATERIALS

- a. 4" through 15" Diameter: Pipe and fittings four inches (4") through fifteen inches (15") in diameter shall comply in all respects to ASTM D 3034 SDR 26 pipe and ASTM D 2412 with pipe stiffness of 115 psi.
- b. 18" through 36" Diameter: Pipe and fittings eighteen inches (18") through thirty-six (36") inches in diameter shall comply in all respects to ASTM F 679 and ASTM D 2412 with pipe stiffness of 115 psi.

B 7.3 JOINTS

Joints for the piping system shall be sealed with a rubber ring gasket and shall comply with ASTM D 3212. Gasket shall comply with ASTM F 477 and shall be of a composition and texture resistant to common ingredients of sewage and industrial waste, including oils and ground water, and which will endure permanently under the conditions imposed by this use.

B 7.4 FITTINGS

Fittings and accessories shall be manufactured and furnished by the pipe supplier or approved equal and have bell and/or spigot configuration identical to that of the pipe.

B 7.5 PIPE STIFFNESS

Minimum pipe stiffness at five percent (5%) deflection shall be one hundred fifteen (115) when calculated in accordance with ASTM D 2412.

B 7.6 CONNECTIONS

At manholes, rubber gasket water stops or Kor-N-Seal connectors as manufactured by NDC, Inc., Milford, New Hampshire, or equal will be used to provide a positive watertight connection. Fernco coupling devices, or approved equal, will be used to connect to existing pipelines.

B 7.7 MARKING

Each pipe shall be identified with the name of the manufacturer, nominal size, cell classification, ASTM designation, SDR ratio or pipe stiffness designation and manufacturer code.

B 7.8 REJECTION

Polyvinyl chloride (PVC) gravity sewer pipe and fittings may be rejected for failure to meet any of the requirements of this specification.

B 8 REINFORCED CONCRETE PIPE WITH RUBBER GASKET JOINTS

B 8.1 SCOPE

This specification governs the manufacture of reinforced concrete pipe with rubber gasket joints used for the conveyance of domestic sewage.

B 8.2 PRODUCTS

Reinforced concrete pipe manufactured under these specifications shall conform to ASTM C 76 or ASTM C 655 with modifications set forth in this specification. Rubber gasket joints shall conform to ASTM C 443.

B 8.3 MATERIALS

Aggregates for the concrete shall comply with the requirements of ASTM C 33 with the additional requirement that aggregate shall have a minimum of fifty percent (50%) of calcium carbonate equivalent.

B 8.4 PIPE DESIGN

Pipe furnished under this specification shall be designed for the required "D-Load" in accordance with ASTM C 655. Proof of design will be required if requested. Calculations shall be submitted for approval and shall be done in accordance with accepted ultimate strength design procedures or generally accepted empirical design procedures accepted by the City.

B 8.5 MANUFACTURE

All pipe shall be machine made by a process which will provide for uniform placement of zero slump concrete in the form and compaction by mechanical devices which will assure a dense concrete in the finished product.

The minimum laying length of each joint shall be six feet (6') for sizes up to and including fifteen inches (15") through seventy-eight inches (78"). Laying length requirements do not apply to bends, wyes, and other special fittings which may be required or for special radius pipe.

Pipe and fittings shall be steam cured in accordance with methods prescribed in ASTM C 76 or any other method or combination of methods approved by the City.

All steel reinforcement shall be in accordance with ASTM C 76 and shall be circular. The maximum permissible absorption shall be six and one-half percent (6.5%).

B 8.6 THICKWALL PIPE

The basic physical pipe dimensional design for thickwall pipe shall be identical to the next larger three inch (3") increment for standard pipe size, up through and including fifty-one inches (51").

It shall be the next six inch (6") increment for sizes fifty-four inches (54") and larger. The pipe shall be reduced internally to the inside diameter as specified on the plans.

The reinforcing steel shall be placed as required on the next larger size to provide an additional sacrificial lining of either one and one-half inches (1½") or three inches (3") of concrete cover over the reinforcing steel.

Proof of design in accordance with Section 6 of ASTM C 655 must be submitted to the City.

B 8.7 JOINTS

Connecting joints shall be made using a flexible watertight rubber-type compression gasket in accordance with ASTM C 361. The rubber gasket shall be the sole element of the joint depended upon to provide watertightness and shall be required to meet and be tested in accordance with ASTM C 443.

- a. Joint Design. The joint design shall consist of a bell or groove on one end of a unit of pipe and a spigot or tongue on the conic surfaces of the inside of the bell or groove, and the outer surfaces of the spigot or tongue shall be parallel and shall not be more than three (3) degrees for pipe sizes through fifteen (15) diameter nor more than two (2) degrees for larger sizes. The spigot or tongue shall be so shaped as to provide a groove within which the gasket will be largely confined when compressed. The joint shall be designed such that the gasket is not required to support the weight of the pipe.
- b. Rubber Gaskets. All rubber-type gaskets shall be of the round O-ring design and shall be extruded or molded and cured in such a manner that any cross-section will be dense, homogeneous, and free of porosity, blisters, pitting and other imperfections.

The rubber gasket shall be fabricated from a high grade rubber-like compound. All gaskets shall meet and be tested in accordance with ASTM C 443.

The gasket shall be a continuous ring which, when in position in the gasket seat on the spigot or tongue end of the pipe, shall not be stretched more than twenty-five percent (25%) of its original circumference.

- c. Tolerances. The joint design shall be such that the parallel surfaces upon which the gasket may bear during closure shall extend a distance of not less than one inch (1") from the edge of the gasket seat toward the outer edge of the bell when the joint is in a normal fully closed position.
- d. Deflection. The joint design shall provide for the deflection of a pipe unit by opening one side of the outside perimeter of the joint one-half inch (½") wider than the full "home" position without reducing its watertightness. Where greater deflections are required than provided by the joint design, beveled joints or elbows shall be provided.

- e. Approval. Joint designs and type of rubber gaskets shall be subject to approval by the Engineer prior to installation.

B 8.8 FITTINGS AND SPECIALS

All fittings and specials including all bends, tees, etc., shall be manufactured on machines and in the same manner as straight joint concrete pipe under these specifications except that joint lengths may be shorter than the minimum listed. The quality of the concrete, workmanship, and bell and spigot joint detail for rubber gasket joints will be subjected to the same requirements as straight joints of pipe.

B 8.9 MARKINGS

Each length of pipe shall bear the initials or name of the person, company, or corporation by whom manufactured, date of manufacture, and the class of pipe. The markings shall be indented or stenciled on the exterior or interior of the barrel near the bell and shall be plainly legible for purpose of identification.

B 8.10 INSPECTION

The City shall at all times have free access to the manufacturer's plant while production is in progress, and may at any time refuse to accept pipe made when the plant is failing to follow the stipulations of the specifications in regard to workmanship, or failing in provisions to insure a uniform product coming within the permissible variations of the specifications as to size, thickness, position of reinforcing steel, and curing of pipe. The City may reject pipe if adequate means and methods are not provided so as to insure the manufacture of a product of uniform high quality.

B 8.11 TESTING

The pipe shall be required to meet and be tested in accordance with ASTM C 76 or ASTM C 655 as applicable.

The connecting joints shall be subject to the hydrostatic tests set forth in ASTM C 443.

The rubber gasket shall be required to meet and be tested in accordance with ASTM C 443 or ASTM C 361.

B 8.12 REPAIRS

Repairs will be permitted as set forth in ASTM C 76 and/or ASTM C 655 except field repairs will only be allowed upon approval of the City's representative. If, in the opinion of the City's representative, repairs should not be made, the pipe section, fitting, etc., will be rejected and removed from the construction site. Once rejected, the pipe section, fittings, etc., may not be used on a City project.

B 8.13 REJECTION

The pipe may be rejected for having defects or failure to meet requirements as follows:

- a. Variations in dimensions exceeding the permissible variations prescribed.
- b. A piece broken out of the bell, spigot, or tongue or groove end of such size that the watertightness of the joint should be impaired.
- c. Any shattering or flaking of concrete or other conditions indicating any improper concrete mix.
- d. Lack of uniformity in placement of steel that might preclude all joints being typical of those tested.
- e. Cracks sufficient to impair the strength, durability, or serviceability of the pipe.
- f. Failure to conform with any of the specifications herein set forth or referenced.
- g. The complete absence of distinct web-like markings, which may be indicative of a deficiency of water in the concrete mix, from the external surface of the pipe made by any process in which the forms are removed immediately after the concrete has been placed unless specimens submitted for test that do not have such web-like markings shall have passed the physical tests required by these specifications.
- h. Failure of the pipe to go completely "home" due to binding of spigot against bell or tongue against groove.
- i. Failure to pass any of the tests required by these specifications.
- j. Joint sections with spalls, cracks, fractures, or other imperfections that could adversely affect the performance of the joint.

B9 FIRE HYDRANTS

B 9.1 SCOPE

This specification governs the manufacture of fire hydrants used in the water distribution system. Except for supplementary details, changes, or additions set forth herein, fire hydrants shall comply with ANSI/AWWA C502, "Dry-Barrel Fire Hydrants" (latest revision).

B 9.2 GENERAL

Fire hydrants shall be post type, dry-barrel with compression main valve closing with the line pressure. All hydrants shall be of the "traffic" type with easily replaceable frangible parts designed to break on traffic impact. Hydrants shall be designed for a working pressure of 250 psi.

B 9.3 SUPPLEMENTARY INFORMATION

- a. Main Valve Size. Five and one-fourth inches (5¹/₄") I.D. minimum.
- b. Inlet Connection. Six inch (6") mechanical joint or as otherwise shown on the contract drawings. Bolts, nuts, and washers used in flange and mechanical joint connections shall be high strength, low alloy, corrosion-resistant steel, similar to CORTEN or equal.
- c. Depth of Bury. The hydrant shall have a four foot (4') depth of bury, unless otherwise shown on the plans or called for in the contract documents. The maximum permissible depth of bury is six (6') feet.
- d. Barrel Sections. Hydrants shall have upper and lower barrel sections with the joint designed to be at least two inches (2") above finished grade. The fire hydrant shall have a safety flange or breakaway flange at the ground line as stipulated in ANSI/AWWA C502 (latest revision). The design shall permit rotation of the upper barrel to position the nozzles in any direction.
- e. Nozzles. The upper barrel shall include two (2) hose nozzles and one (1) steamer nozzle located on the same plane. All nozzles shall be equipped with cap chains and gaskets for all nozzle caps. Nozzle caps to have one inch (1") square nuts.
 1. Hose Nozzles. The two (2) hose nozzles shall be two and one-half inches (2¹/₂") I.D. with National Standard threads.
 2. Steamer Nozzle. The steamer nozzle shall be four inches (4") I.D. with the following characteristics: (Mueller Gage 4-482)
 - (a) Major Diameter - 4.982".
 - (b) Pitch Diameter - 4.820".
 - (c) Minor Diameter - 4.632".
 - (d) Root Diameter - 4.570".

- (e) Threads per Inch - 4
- f. Direction to Open. Left (counter clockwise)
- g. Operating Nut. The operating nut shall be one (1") inch square measured flat to flat and have a weather shield or weather seal.
- h. Color of Finish above Ground Line. If painted, two coats of aluminum over a shop prime coat. Other coatings shall be an inert, corrosion-resistant coating, similar to TGIC powder coating. The color shall be Federal Standard 595C FS17178 (aluminum). On private fire hydrants the bonnet shall be painted red with aluminum elsewhere.
- i. Stem. The union between the upper and lower stems shall be made by a breakable coupling. The design shall be such that excessive turning torque on the stems in either the opening or closing cycle is not transmitted to the weakened section of the coupling.
- j. Barrel Drain Outlet. The drain way shall be all bronze. Drain water shall not come in contact with the internal cast iron parts of the shoe while exiting the hydrant through the drain way.
- k. Main Valve. The main valve and seat ring shall be removable through the upper barrel from above ground. The main valve seat ring shall thread directly into a bronze insert.
- l. O-Rings. O-rings shall be furnished in lieu of stem packing.

B 9.4 APPROVAL

Only hydrants on the Arlington Water Utilities Approved Products Listing will be accepted. Approval is based on the following items, disqualification of product may occur at any time as a result of failure to comply with the following provisions.

- a. Drawings. Each manufacturer shall provide certified assembly drawings of the hydrant. Any proposed exceptions, changes, or modifications of design must be accompanied by new detailed drawings and statement of changes made. Failure to meet this requirement is sufficient cause for disqualification. Drawings furnished shall show principal dimensions, including metal thickness, construction details, and materials used.
- b. Affidavit of Compliance. An affidavit of compliance shall accompany each request for approval.
- c. Parts Availability. The manufacturer shall guarantee that all repair parts shall be delivered to the City within two (2) working days of request.

B 9.5 TESTS

The hydrostatic tests set forth in ANSI/AWWA C502, UL246, and FM1510 shall be fully met.

B 9.6 REJECTION

Failure to meet any of the requirements set forth in AWWA C502 or these specifications shall be cause for rejection.

B 10 GATE VALVES AND TAPPING SLEEVES AND VALVES

B 10.1 SCOPE

This specification governs the manufacture of resilient-seated gate valves and tapping sleeves and valves for use in the water supply and water distribution system. Except for supplementary details, changes, or additions set forth herein, gate valves and tapping valves shall conform to ANSI/AWWA C515, latest revision, for Water Supply Services.

B 10.2 GENERAL

All resilient-seated gate valves shall have ductile iron body, bonnet, and stuffing-box. The body, bonnet, and stuffing-box shall be epoxy coated, both interior and exterior. Epoxy shall be applied in accordance with ANSI/AWWA C-550 and be NSF 61 or NSF 372 certified, as applicable.

Wedges shall be made of ductile iron totally encapsulated in rubber with no iron exposed. The rubber shall be permanently bonded to the wedge per ASTM D429.

Valves shall be supplied with O-ring seals at all pressure retaining joints.

All valves, unless otherwise shown, shall be installed in the vertical position.

Each valve shall have the manufacturer name, pressure rating, and year in which it was manufactured cast into the body. Prior to shipment from the factory, each valve shall be tested by hydrostatic pressure equal to the requirements of ANSI/AWWA C515.

B 10.3 SUPPLEMENTARY INFORMATION

- a. **Bonnet Bolting.** Body bolts, studs, and nuts shall be stainless steel to meet the requirements of ASTM F593 (bolt) and F594 (nut).
- b. **Valve Ends.** Valves shall have push-on, flanged, or mechanical joint, or any combination as may be specified. Bolts, nuts and washers used in flange and mechanical joint connections shall be stainless steel.
- c. **Valve Stems and Nuts.** Valves shall be non-rising stem (NRS), opening by turning counter-clockwise and provided with a two (2) inch square operating nut constructed of ductile iron.

The stem shall be bronze/copper alloy with integral collar in full compliance with AWWA. All stems shall operate with bronze stem nuts independent of the wedge and stem. The stem shall have two (2) O-rings located above the thrust collar and one (1) O-ring below the thrust collar. Stem O-rings shall be replaceable with the valve fully open and subjected to full water pressure.

d. Hand Wheels and Operating Nuts.

1. All valves three inches (3") and larger in diameter shall be nut operated unless otherwise specified.
2. Hand wheels shall be furnished only when called for on the plans or in the contract documents.

e. Gearing. Spur gearing with gear cases shall be provided on all valves twenty-four inches (24") and larger.

f. Gear Cases. Gear cases shall be furnished on all geared valves and shall be of the extended type with ductile iron side plates. Stuffing boxes shall be located on top of the bonnet and shall be outside the gear case. Gear cases shall be lubricated and enclosed with O-rings at all shaft openings to prevent the entrance of water. Gear cases shall be cast iron.

g. Valve Stem Extensions. Where circumstances require that the gate valve operating nut be installed at a depth greater than six feet (6'), it shall be equipped with a non-rising extension stem. The extension shall be one and one-quarter inches (1¼") solid core steel with the upper operating nut welded to the stem. The upper operating nut on the extension shall be 4" to 12" below the valve box. This stem shall have a coupling sufficient so that it will attach securely to the operating nut of the valve. The upper end of the extension stem shall terminate in a square wrench nut. A four and one-half (4½") inch diameter steel plate, ¼" thick rock shield shall be welded to the stem two inches (2") below the bottom of the top operating nut.

B 10.4 TAPPING VALVES

Tapping valves shall conform to ANSI/AWWA C515 and these specifications. Approved resilient-seated gate valves will also be acceptable. In addition, tapping valves shall meet the following requirements:

- a. Tapping valves shall have oversize seat rings to permit entry of standard tapping machine cutters.
- b. In the open position, valve gates shall be clear of the ports so that the cutter will pass through without making contact with the gates.
- c. Valves shall have an inlet flange conforming to ANSI B16.1, Class 125, with a machined projection or recess to mate with tapping sleeve outlet flange to assure correct alignments.
- d. Valves shall have standard mechanical joint outlet end and shall be designed to fit any standard tapping machine.

B 10.5 TAPPING SLEEVES

- a. Tapping sleeves shall be of ductile iron construction, meeting ASTM A536. The two sections shall be bolted together with stainless steel bolts and nuts or approved equal
- b. Tapping sleeves shall be mechanical joint or hub end or dimensioned to secure proper fit on the type and class of pipe on which they are to be used.
- c. The branch outlet of the tapping sleeve shall be flanged.

B 10.6 APPROVAL

Only those manufacturers whose valves have been specifically approved by the Arlington Water Utilities Department can be used in the City's water system.

- a. **Drawings.** Each manufacturer of valves manufactured under these specifications shall have on file at the City a detailed drawing of each type and size of valve proposed to be furnished. Any exceptions, changes, or modifications or design must be accompanied by new detailed drawings and statement of changes made. Failure to meet this requirement is sufficient cause for disqualification. Drawings furnished shall show principal dimensions, including metal thickness, construction details, and materials used.
- b. **Affidavit of Compliance.** An affidavit of compliance to the effect that the valve complies in all respects to these specifications shall accompany each request for approval.
- c. **Experience Record.** No valve manufacturer will be considered which has not been regularly manufactured and in continuous use for at least ten (10) years in the United States. User references must be provided outlining products use for at least 5 years.
- d. **Field Evaluation.** The manufacturer shall provide a valve, at no cost to the City for a minimum one (1) year period of field evaluation and testing. The valve must perform in a manner acceptable to the City for the one (1) year trial period.
- e. **Parts Availability.** The manufacturer shall guarantee that all repair parts shall be delivered to the City within two (2) working days of request.

B 10.7 TESTS

All valves shall be tested by the manufacturer in accordance with ANSI/AWWAC515. Any leaking at the test pressure through any castings or between the bronze ring and the ductile iron body shall cause the casting to be rejected. No plugging or patching to stop leakage will be permitted.

B 10.8 REJECTION

Failure to meet any of the requirements set forth in ANSIAWWA C515 or this specification shall be cause for rejection.

- c. Tapping sleeves shall be mechanical joint or hub end or dimensioned to secure proper fit on the type and class of pipe on which they are to be used.
- d. The branch outlet of the tapping sleeve shall be flanged.

B 10.6 APPROVAL

Only those manufacturers whose valves have been specifically approved by the City's Standard Water/Wastewater Products Committee will be approved for use in the City's water system.

- a. Drawings. Each manufacturer of valves manufactured under these specifications shall have on file at the City a detailed drawing of each type and size of valve proposed to be furnished. Any exceptions, changes, or modifications or design must be accompanied by new detailed drawings and statement of changes made. Failure to meet this requirement is sufficient cause for disqualification. Drawings furnished shall show principal dimensions, including metal thickness, construction details, and materials used.
- b. Affidavit of Compliance. An affidavit of compliance to the effect that the valve complies in all respects to these specifications shall accompany each request for approval.
- c. Experience Record. No valve manufacturer will be considered which has not been regularly manufactured and in continuous use for at least ten (10) years in the United States. User references must be provided outlining products use for at least 5 years.
- d. Field Evaluation. The manufacturer shall provide a valve, at no cost to the City for a minimum one (1) year period of field evaluation and testing. The valve must perform in a manner acceptable to the City for the one(1) year trial period.
- e. Parts Availability. The manufacturer shall guarantee that all repair parts shall be delivered to the City within two (2) working days of request.

B 10.7 TESTS

All valves shall be tested by the manufacturer in accordance with AWWA C500 or C509. Any leaking at the test pressure through any castings or between the bronze ring and the cast iron body shall cause the casting to be rejected. No plugging or patching to stop leakage will be permitted.

B 10.8 REJECTION

Failure to meet any of the requirements set forth in AWWA C500, C509 or this specification shall be cause for rejection.

B 11 COMBINATION AIR VALVES

B 11.1 SCOPE

This specification governs the manufacture of combination air valves (air release and air vacuum) for use in the water supply and water distribution systems and shall conform to ANSI/AWWA C512, latest revision "Air Release, Air/Vacuum and Combination Air Valves for Water Works Service."

B 11.2 PRODUCTS

Air valves shall be combination air valves. These valves are designed to fulfill the functions of an air and vacuum valve to intake and exhaust large quantities of air and an air release valve to permit the escape of air accumulated in a pipe line of the high point when the line is under pressure and in operation. Combination air valves eight (8") inches and smaller shall be self-contained in one unit. Combination air valves larger than eight (8") inches may be a combination of the two valves.

B 11.3 MATERIALS

Valves shall have cast iron bodies and stainless steel floats. Seats shall be Buna-N synthetic rubber against bronze or stainless steel. All other internal parts such as float guides, bushings, baffle retaining screws, etc., shall be bronze or stainless steel.

B 11.4 INLETS

Inlets shall be threaded for two inch (2") valves. Three inch (3") valves may have either threaded or flanged inlets as shown on the contract drawings. Valves four inches (4") and larger shall have flanged inlets.

B 11.5 OPERATING PRESSURE AND TESTS

Valves shall be designed for an operating pressure of 200 psi and shall be tested to 150 percent of that pressure.

B 11.6 REJECTION

Air valves may be rejected for failure to conform to the requirements of this specification.

B 12 MISCELLANEOUS VALVES

B 12.1 SCOPE

The valves governed by this specification are the following:

- a. Flap Valves.
- b. Non-Slam Check Valves. (externally weighted)
- c. Swing Check Valves.

These valves shall be manufactured to swing check valves (internally weighted) as designated in the list of approved materials.

B 12.2 FLAP VALVES

Flap valves shall have a cast iron body and shall be composed of three (3) parts: frame, flap, and connecting hinge pin. The flap and frame shall have a solid bronze seat and gate rings that are mated and matched. The hinge pin shall be bronze.

The valves shall close when hanging at a slight angle from vertical.

B 12.3 NON-SLAM CHECK VALVES

Non-slam check valves shall be cast iron and designed for 150 psi working pressure. Valves shall be tested to 200 percent of working pressure. Non-slam check valves shall have solid bronze seat and gate rings, pivot pins, and pivot pin bushings.

B 12.4 SWING CHECK VALVES (Externally Weighted)

Swing check valves shall be fully bronze mounted with cast iron body. If so designated on the contract drawings, swing check valves will be furnished with spring and lever or lever and weight.

Swing check valves shall be for 150 psi working pressure and be tested to 200 percent of working pressure.

B 12.5 SWING CHECK VALVES (Internally Weighted)

Swing check valves shall be fully bronze or stainless steel mounted with cast iron or heavy steel body. All internally weighted check valves will be fusion bonded epoxy coated in accordance with AWWA C550.

Swing check valves shall be designed for 150 psi working pressure and be tested to 200 percent of working pressure.

B 12.6 REJECTION

Failure to meet any of the requirements set forth in this specification shall be cause for rejection.

B 13 SERVICE SADDLES

B 13.1 SCOPE

This specification governs the manufacture of bronze ductile iron and stainless steel service saddles used for tapping water service pipe under normal pressure.

B 13.2 PRODUCTS

Service saddles shall consist of a contoured saddle fastened to the pipe by one (1) "U" bolt for the single strap type and two (2) "U" bolts for double strapped clamps or by stainless steel bands. The saddle shall be sealed against the pipe with a neoprene or Buna-N gasket and shall have a heavy hub tapped with a corporation stop thread. Clamps shall be designed for 150 psi working pressure. Clamps for pipe four (4") inches and larger shall be of the double strap type while saddles for pipe smaller than four (4") inches may be of the single strap type.

B 13.3 SADDLE

- a. Shape. Saddles shall be shaped so as to provide a minimum 180 degree coverage around the pipe.
- b. Outlet. The saddle hub shall have a wall thickness of not less than one-half (1/2") inch including threads. The hub shall be tapped with corporation stop threads of the size specified. Threads shall be in accordance with AWWA C800.
- c. Material. Saddles shall be composed of bronze conforming to ASTM B 62, 304 stainless steel, or ductile iron conforming to ASTM 536. Ductile iron saddles shall be covered by a black nylon fused coating or epoxy coating approximately 10 to 12 mils in thickness, with approximate dielectric strength of 1,000 V/mil.
- d. Marking. The clamp casting shall be clearly marked by letters and numerals cast thereon showing the manufacturer's name as well as the size and type of pipe for which the clamp is designed.

B 13.4 STRAPS

- a. Shape. Bronze straps shall be formed flat on one (1) side to fit uniformly against the wall of the pipe. Rod diameter shall be not less than five-eighths (5/8") inch flattened to three-fourths (3/4") inch on one side. Straps shall be threaded for sufficient distance so that at least one-half (1/2") inch of the threads remain after the clamp is fully tightened on the pipe. Nuts shall be bronze of the same material as the saddle or straps and have minimum dimensions equal to or larger than heavy hexagon nuts. Stainless steel straps shall have a band at least inches (2") in width, and bolts, shall be Type 304 stainless steel with Type 304 stainless steel nuts and washers, or nylon coated nuts and washers, or silicon bronze nuts and washers.

- b. Material. Bronze straps shall be constructed of material conforming to ASTM B 98 or ASTM B 124. Stainless steel bands shall be Type 304 (18-8) stainless steel.

B 13.5 GASKETS

Gaskets shall be composed of neoprene or Buna-N rubber cemented to the saddle to facilitate installation.

B 13.6 TESTS

Each saddle shall be subjected to an air test to 85 psi while submerged in water by the manufacturer and shall show no evidence of leakage.

At the City's option, service clamps shall be subjected to a 300 psi hydraulic test and shall not leak or show signs of structural failure.

B 13.7 REJECTION

Failure to meet any of the requirements set forth in this specification shall be cause for rejection.

B 14 COPPER TUBING AND BRASS GOODS FOR WATER SERVICE CONNECTIONS

B 14.1 SCOPE

This specification governs the manufacture of seamless copper tubing and miscellaneous brass goods such as corporation stops, curb stops, couplings, unions, adapters, branch connections, etc., used to construct water service connections in the domestic water system, manufactured in accordance with ANSI/AWWA C800, latest revision, "Underground Service Line Valves and Fittings."

B 14.2 MATERIALS

- a. **Brass Goods.** Brass goods shall be all brass of 85-5-5-5 alloy, as defined in ASTM B 62, which has a normal composition of eighty-five percent (85%) copper and five percent (5%) each of tin, lead, and zinc, plus or minus one percent (1%).
- b. **Copper Tubing.** Copper tubing used for one inch (1") water service lines shall be Type K, Soft (Annealed). Copper tubing for two inch (2") water services shall be Type K Hard. All copper tubing shall conform to ASTM B 88, "Seamless Copper Water Tube," or Federal Specification WW-T-799. Two-inch (2") diameter service lines shall be straight lengths with compression fittings. For one-inch (1") water service lines, no joints will be allowed from the corporation stop to the curb stop.

All material used shall be approved by the National Safety Foundation.

B 14.3 PHYSICALS

- a. **Brass Goods.** Brass shall have a tensile strength of not less than 30,000 psi when tested in accordance with Figure 5 of ASTM B 208.

Fittings shall be designed for 200 psi working pressure. When subjected to hydrostatic test pressures one and one-half times (1½) working pressure or when subjected to a minimum of 85 psi air pressure while submerged in water, fittings shall not leak or show signs of structural failure.

Brass goods containing brass to brass moving parts shall be shipped prelubricated with a light fluid lubricant between moving parts. Lubricant shall remain fluid indefinitely, either in storage or in service.

- b. **Copper Tubing.** Copper tubing shall have a minimum ultimate tensile strength of 30,000 psi.

B 14.4 DESIGN FEATURES OF CORPORATION STOPS

Seating surfaces of the ground key type shall be tapered and shall be accurately fitted together by turning the key and reaming the body. Seating surfaces shall be lapped together using suitable

abrasives to insure accurate fit. The large end to the tapered surface of the key shall be reduced in diameter for a distance that will bring the largest end of the seating surface of the key into the largest diameter of the seating surface of the body. The taper seat in the body shall be relieved on the small end so that the small end of the key may extend through, to prevent wearing of a shoulder and to facilitate proper seating of the key. The stem end of the key, key nut, and washer shall be so designed that if the key nut be tightened to failure point, the stem of the key shall not fracture. The nut and the stem shall withstand a torque on the nut of at least three (3) times the manufacturer's recommended torque requirements.

Corporation stops shall be so designed as to rotate about the axis of the flow passageway within a circle of rotation small enough to properly clear the inside of any standard tapping machine of appropriate size.

Corporation stops shall be male AWWA thread on the inlet side and copper service thread on the outlet side and shall be used only for one-inch (1") taps.

B 14.5 DESIGN FEATURE OF CURB STOPS

The ball stop shall have a full port opening with straight-through flow, and Teflon coated, bronze ball with a minimum of 0.5 mil thickness coating. The operating stem shall be one piece construction. No roll pins will be allowed.

Plug type stop shall have full port opening with straight-through flow. Seating surfaces shall be brass (or Teflon coated brass) to rubber O-rings, providing positive pressure seal without mechanical means. Material for rubber O-rings should conform to requirements of ASTM D 200.

Inlet and outlet threads, of the types specified, shall conform to the applicable tables of AWWA C800, and threads shall be protected in shipment by a plastic coating or other equally satisfactory means.

The brass curb stop configuration shall be female iron pipe threaded on both ends. The maximum and minimum laying lengths for a three-quarter inch (3/4") curb stop are three and three-eighths inches (3-3/8") and three and one-half inches (3-1/2") respectively. The maximum and minimum laying lengths for a one inch (1") curb stop are three and three-quarter inches (3-3/4") and four and one-quarter inches (4-1/4") respectively. All curb stops shall be the less stop design.

B 14-6 DESIGN FEATURES OF FLANGED ANGLE VALVES

Flanged angle valves shall be of inverted key style with "O" ring gaskets. Inlet to be compression type with a Buna N beveled gasket. Compression nut shall have an approved restraining device to lock down on the copper tubing. Outlet shall be flanged for drop-in gaskets with bolt holes for either one and one-half inch (1 1/2") or two inch (2") meters. Design is to include lock wings and flow directional arrow.

B 14.7 DESIGN FEATURES OF FITTINGS

All castings shall be smooth, free from burrs, scales, blisters, sand holes, and defects of every nature. Nuts shall be smooth cast and shall have symmetrical hexagonal wrench flats. All thread fittings, of all types, shall have NPT threads, and male threaded ends shall be protected in shipment by a plastic coating or other equally satisfactory means. Compression tube fittings shall have a Buna N beveled gasket. Compression nut shall have an approved restraining device to lock down on the copper tubing.

B 14.8 TESTS

Copper tubing shall be tested for material, tensile strength, and expansion in accordance with the applicable ASTM specifications. Brass goods included in this section shall be tested in accordance with the applicable provisions of the specifications relating thereto.

B 14.9 REJECTION

Copper tubing and brass goods may be rejected for failure to meet any of the requirements of these specifications.

B 15 DUCTILE IRON FITTINGS

B 15.1 SCOPE

This specification governs the manufacture of ductile iron fittings, for use with the various types of water pipe used for the conveyance of domestic water.

B 15.2 PRODUCTS

All fittings shall comply with ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53, latest revision.

B 15.3 JOINTS

Joints for ductile iron fittings shall be in accordance with ANSI/AWWA C111/A21.11, latest revision.

- a. Mechanical Joint. The joint shall be furnished complete with accessories. All bolts used with mechanical joint connections shall be stainless steel.
- b. Push-On Joint. Push-on joints shall comply with ANSI/AWWA C111/A21.11.
- c. Flanged Joint. Flange dimensions, bolt hole pattern, and flange bolt size shall comply with ANSI/AWWA C111/A21.11. All bolts nuts, and washers used for flanged joints shall be stainless steel.
- d. Special Joint. Special end condition fittings using combinations of bells, spigots, mechanical, push-on, or special internally locked joints will be to dimensions in accordance with ANSI /AWWA C110/A21.10.

B 15.4 COATINGS AND LININGS

All ductile iron fittings shall have a standard cement mortar lining in accordance with ANSI/AWWA C104/A21.4 and ANSI/AWWA C110/A21.10.

All fittings shall be installed with a double layer of polyethylene wrap. Polyethylene encasement shall comply with ANSI/AWWA C105/A21.5.

B 15.5 APPROVAL

Only those manufacturers whose ductile iron fittings have been specifically approved by the Arlington Water Utilities Department can be used in the City's water system.

B 15.6 REJECTION

Ductile iron fittings may be rejected for failure to meet any of the requirements of this specification.

B 16 CAST IRON CASTINGS

B 16.1 SCOPE

This specification governs the manufacture of all commercially designed or City of Arlington designed cast iron castings. Specifically included are manhole rings and cover, cleanout castings with lids, valve boxes and covers, water meter covers, and meter box lids.

B 16.2 MATERIALS

Material used in the construction of casting shall conform to the ASTM requirements shown:

Material	ASTM	Grade
Gray Iron Castings	A 48	Class 30 minimum
Gray Iron Castings	A 126	Class B

All cast iron castings shall be manufactured in the United States.

B 16.3 WORKMANSHIP

Castings shall be of uniform quality and free from blow holes, porosity, hard spots, shrinkage defects, swells, cracks, or other injurious defects. All castings shall be free from fins, burrs, sand and slag. The surface of all castings shall be smooth and true to pattern.

All castings shall be stress relieved by shot blasting.

Surfaces shall be machined as indicated or where otherwise necessary to secure true flat surfaces. Covers and grates shall fit properly into frames and fit uniformly and solidly.

All manhole lids shall have pick bars.

B 16.4 COATINGS

All castings shall be painted with one coat of rust inhibitive coating as approved by the Engineer.

Where appropriate, castings shall be coated with hot or cold applied tar.

B 16.5 WATERTIGHT MANHOLE RINGS AND COVERS

All matching (bearing) surfaces of watertight manhole rings and covers shall be suitably machined so as to be free from any irregularities and shall incorporate a watertight gasket or "O" ring mounted in a retaining recess as standard design.

The manhole cover shall be held securely in place by stainless steel bolts and washers.

Watertight manhole covers shall be furnished with pick bars.

B 16.6 BOLTS, FASTENERS, SPRINGS, AND PLUNGERS

Where applicable, bolts, fasteners, springs, and plungers shall be as shown on the drawings or as described in the contract documents.

B 16.7 SUPPLEMENTARY INFORMATION

The City normally incorporates standard commercial design castings into project specifications. However, some castings are of special design, and specific dimensions, materials, characteristics, etc., are in the contract drawings or specific job specifications. Any castings to be substituted for products specified in Part E must first be approved in writing by the City of Arlington. All items must meet the specifications included herein and shall be interchangeable with the items specified.

B 16.8 REJECTION

Cast iron castings and/or appurtenances may be rejected for failure to meet any of the requirements of this specification.

B 17 POLYETHYLENE WRAP FOR DUCTILE IRON PIPE AND FITTINGS

B 17.1 SCOPE

These specifications govern the manufacture of polyethylene film to be used as a wrap to protect buried ductile iron pipe and fittings. Polyethylene wrap shall be used for all pipe, fittings and appurtenances to ductile iron water and sanitary sewer pipelines.

B 17.2 POLYETHYLENE FILM

Polyethylene encasement for ductile iron piping shall conform to ANSI/AWWA C105/A21.5, latest revision. The polyethylene film shall be eight (8) mils thick, with minimum flat tube widths as shown in Table 1 for the specified pipe sizes. The film shall be extracted from polyethylene resin, Type 1, Class C, Grade E-1, and as specified in ASTM D 1248, with the following characteristics:

Flow Rate - 0.4 maximum

Tensile Strength - 1,200 psi

Elongation - 300% minimum

Dielectric Strength - resistivity 800 volts per mil thickness, minimum

B 17.3 POLYETHYLENE TAPE

Polyethylene tube seams and overlaps may be wrapped and held in place by means of two (2") inch wide plastic backed adhesive tape with a minimum thickness of ten (10) mils. Maximum thickness shall be consistent with a pliable installation.

TABLE 1 - MINIMUM WIDTH OF FILM TUBE (FLAT WIDTH)

Nominal Pipe Size (Inches)	Flat Tube Width (Inches)
4	16
6	20
8	24
10	27
12	30
14	34
16	37
18	41
20	45
24	53

B 17.4 REJECTION

Polyethylene wrap may be rejected for failure to meet any of the requirements of this section.

B 18 SANITARY SEWER MANHOLE COMPONENTS

B 18.1 SCOPE

This specification governs the manufacture of components used for the construction of sanitary sewer manholes.

B 18.2 FOUNDATIONS AND INVERTS

Concrete for cast-in-place foundations and/or inverts for sanitary sewer manholes shall be Class "A" as defined in Section B 20, "Concrete," of these specifications.

Precast bases with formed inverts for watertight connection to precast reinforced concrete manhole sections will be permitted if manufacturing process and resultant product are approved by the City.

B 18.3 MORTAR

Mortar and/or grout used for invert finishing, grouting of ring and lid, etc., shall be composed of one (1) part cement to two (2) parts sharp sand.

B 18.4 PRECAST REINFORCED CONCRETE MANHOLE SECTIONS

Precast reinforced concrete manhole sections shall comply with ASTM C 478, "Precast Reinforced Concrete Manhole Sections," with the following additions:

- a. All pipe shall be machine made by a process which will provide for uniform placement of zero (0) slump concrete in the form and compaction by mechanical devices which will assure a dense concrete in the finished produce. However, reducer cones may be wet-cast.
- b. Aggregates shall comply with ASTM C 33 except that aggregate shall have a minimum of fifty percent (50%) calcium carbonate equivalent.
- c. Minimum wall thickness shall be as specified for Wall B in the "Class Tables" of ASTM C 76.
- d. Manholes shall use precast sections of the bell and spigot or tongue and groove design with trapped type preformed O-ring rubber gaskets conforming to ASTM C 443.
- e. Risers shall be available in standard lengths of one through six feet (1'-6') in increments of one foot (1').
- f. Manhole steps will not be furnished.

- g. Exterior surfaces shall be coated with two mop coats of Tnemec 450 Heavy Tnemecol or Koppers Bitumastic Super Service, black or an equivalent system approved by the Engineer.

B 18.5 CAST-IN-PLACE (MONOLITHIC) CONCRETE MANHOLES

Concrete for cast-in-place (monolithic) concrete manholes shall be Class "A".

Forms for cast-in-place (monolithic) concrete manholes shall provide a smooth interior surface. Forms shall provide for a minimum wall thickness of six inches (6") and a minimum inside diameter at the base of four feet (4'). The inside diameter at the top of the barrel shall not be less than twenty-six inches (26").

The exterior surfaces of the manhole shall be coated with two mop coats of Tnemec 450 Heavy Tnemecol or Koppers Bitumastic Super Service, black, or an equivalent system approved by the Engineer.

B 18.6 FRAMES AND COVERS

All manhole frames and covers shall be in accordance with Section B16, "Cast Iron Castings" All covers shall have pick bars. The seating surfaces shall be matched (machined) for smooth fit.

A double ring of one-half inch (1/2") GS/5 Precast Concrete Sealant, as manufactured by General Sealants, Inc., or CS102 Con Seal as manufactured by Concrete Sealants, Inc., shall be used to seal the frame to concrete and between all grade rings used in adjusting the manhole. The exterior of the grade rings and frame shall then be mortared.

Watertight rings and covers shall have machined matching surfaces with a watertight gasket held securely in place with stainless steel bolts and washers.

B 18.7 PIPE CONNECTIONS

Rubber boots shall be installed at all pipe penetrations of the manhole to Kor-N-Seal connectors as manufactured by NPC, Inc., Milford, New Hampshire, or equal, shall be used to provide a positive watertight connection for all precast manholes.

B 18.8 GRADE RINGS

Grade rings shall be solid (not split) type, reinforced in accordance with ANSI/ASTM C 478. Outside diameter shall be forty inches (40") and inside diameter shall be twenty-four inches (24"). Depths of sections used shall be maximum available to minimize number of joints. Minimum thickness of grade rings to be two inch (2").

B 19 EMBEDMENT MATERIALS

B 19.1 SCOPE

This specification governs the quality of materials used for foundation and embedment materials in the construction of water and sanitary sewer lines.

B 19.2 ROCK FOUNDATION

- a. Description. Rock foundation is used to create a stable trench bottom in wet unstable or "spongy" conditions. Rock foundation shall be composed of sound and durable particles of crushed limestone.
- b. Gradation. Sizes shall be well graded from passing the one (1") inch but retained on the seven-eighths inch (7/8") screen minimum size to a maximum size of five inches (5") in greatest dimension.
- c. Wear. The percent of wear shall not exceed thirty-five percent (35%) when tested in accordance with ASTM C 131.
- d. Deleterious Substances. Rock foundation shall contain not more than one percent (1%) by weight of organic matter, clays, loam, or pebbles and shall contain not more than five percent (5%) by weight of any one or combination of slate, shale, schist, or soft sandstone particles.

B 19.3 CRUSHED ROCK EMBEDMENT

- a. Description. Crushed rock embedment shall be composed of sound durable limestone particles. The standard gradation will be used with all pipes.
- b. Gradation.

STANDARD CRUSHED ROCK EMBEDMENT

Retained on 1 inch sieve	0 - 5%
Retained on 1/2 inch sieve	40 - 75%
Retained on No. 4 sieve.....	90 - 100%
Retained on No. 8 sieve.....	95 - 100%

Note: This gradation is for Gradation Size Number 4 as defined in ASTM C 33.

- c. Wear. The percent of wear shall not exceed thirty-five percent (35%) when tested in accordance with ASTM C 131.
- d. Deleterious Substances. Crushed stone embedment shall contain not more than one percent (1%) by weight of organic matter, clays, loam, or pebbles and shall contain not more than

five percent (5%) by weight of any one or combination of slate, shale, schist, or soft particles of sandstone.

B 19.4 GRANULAR EMBEDMENT

a. Description. Granular embedment material shall be free flowing sand or like material or mixed sand and pea gravel. This material may be an inferior grade of "pit run" sand, not normally considered satisfactory for construction purposes, and may be used directly from pits without processing. Granular embedment material shall be such that, when wet, it will not form mud or muck.

b. Gradation.

Retained on 2 inch sieve	0%
Retained on 1 inch sieve	0 - 10%
Retained on No. 40 sieve	0 - 40%
Retained on No. 100 sieve	90 - 100%

c. Plasticity. The plasticity index of the soil fraction passing the No. 40 sieve shall not be greater than two (2).

d. Deleterious Substances. Granular embedment material shall be free from large stones, clay, and organic material and shall be a relatively uniform material.

B 19.5 SELECT MATERIAL

Select materials will be defined as gravel, fine rock cuttings, sand, sandy loam or loam free of excessive clay. When wet, the material shall not form mud or muck.

B 19.6 CONCRETE FOR FOUNDATION, EMBEDMENT, AND/OR ENCASUREMENT

Portland Cement concrete used for pipe foundation, embedment, and/or encasement shall comply in all respects to the requirements set forth in Section 20, "Concrete," of these specifications. Concrete shall be Class "B".

B 19.7 REJECTION

Materials may be rejected for failure to meet any of the requirements of this section.

B 20 CONCRETE

B 20.1 SCOPE

This section governs all materials used and the handling, measuring, proportioning and mixing of such materials in producing concrete for structures or for incidental or miscellaneous construction.

B 20.2 PRODUCTS

Concrete shall be composed of Portland Cement, coarse aggregate, fine aggregate, admixtures as required, and water proportioned and mixed as hereinafter provided in these specifications.

Where the type or class of concrete is not shown on the plans or specifically designated in the specifications, concrete used shall be Class "A".

It is the intent of this specification to permit "ready mix," "central mix," or "transit mix" concrete. However, the Contractor will be required to submit evidence that the concrete to be furnished meets all requirements of these specifications including testing by an independent laboratory at the contractor's expense.

B 20.3 MATERIALS

- a. Cement. Portland Cement shall be Type I (Normal), Type II (Sulfate Resistant), or Type III (High Early Strength) in accordance with ASTM C 150. Unless otherwise shown, all cement used shall be Type I.
- b. Coarse Aggregate. Coarse aggregate shall consist of gravel or crushed stone meeting the requirement of ASTM C 33 "Concrete Aggregate." Coarse aggregate with a wear exceeding 40 when tested in accordance with ASTM C 131 will not be acceptable.
- c. Fine Aggregate. Fine aggregate shall be composed of natural sand, manufactured sand, or a combination thereof, conforming to ASTM C 33.
- d. Admixtures.
 1. Air Entraining Admixture. Air entraining admixtures shall conform with ASTM C 260. The total average air content shall be in accordance with American Concrete Institute 211.1.
 2. Water Reducing Admixture. Water reducing admixtures, if used, shall comply with ASTM C 494. They shall be accurately measured and added to the mix in accordance with the manufacturer's recommendations.

e. Water. Water for concrete shall be clean and free from injurious amounts of oil, acid, alkali, salt, organic matter, or other deleterious substances. Water from the City's mains is acceptable with no testing required.

f. Curing Materials.

1. Sheet Materials. Waterproof paper, polyethylene film, and white burlap-polyethylene film shall conform to ASTM C 171.
2. Curing Compound. Membrane curing compound shall conform to ASTM C 309. Curing compound shall either be Type 1, clear or translucent, or Type 2, white pigmented.

B 20.4 STORAGE OF MATERIALS

- a. Storage of Cement. Cement may be delivered in bulk or in bags which are marked plainly with the brand and name of manufacturer. Immediately upon receipt, cement shall be stored in a dry, weathertight and properly ventilated structure which excludes moisture. All storage facilities shall be subject to approval and shall be such as to permit easy access for inspection and identification. Sufficient cement shall be in storage to complete any pour of concrete started. In order that cement may not become unduly aged after delivery, records of delivery dates shall be maintained, and the Contractor shall use any cement which has been stored at the site for sixty (60) days or more before using cement of lesser age. No cement will be used which is lumped or caked, or has been stored more than ninety (90) days, or when the cement temperature exceeds one hundred seventy degrees (170) Fahrenheit.
- b. Storage of Aggregates. The handling and storage of concrete aggregate shall be such as to prevent the admixture of foreign materials. If the aggregates are stored on the ground, the sites for the stockpiles shall be grubbed, cleared of all weeds and grass, and leveled. The bottom layer of aggregate shall not be disturbed or used without recleaning.

Different sizes of aggregates shall be stored in such a manner as to prevent intermixing. Materials in all stockpiles shall be handled in such a manner that segregation of materials within the pile will be avoided and shall be built up in layers not over three (3') feet in depth. Should segregation occur, the aggregates shall be remixed to conform with the grading requirements. Unless otherwise authorized by the Engineer, all fine aggregates shall be stockpiled at least twenty-four (24) hours before mixing to reduce the free moisture content.

B 20.5 MEASURING OF MATERIALS AND MEASURING EQUIPMENT

All materials shall be measured separately and accurately and batches shall be uniform. The coarse and fine aggregate shall be measured, or weighed, loose and separately.

When volumetric proportioning is used, the Contractor shall furnish and use approved measuring boxes, pans, or mechanical devices which will give exact volumes of aggregates required for the several classes of concrete involved. Devices used shall be constructed and plainly marked so that the Engineer can conveniently and accurately check the exact quantity of each aggregate

being used in any or all batches. A bag of cement as packed by the manufacturer and weighing ninety-four (94) pounds will be considered as one (1) cubic foot. When proportion by weight is used, the capacity of the weighing equipment shall be adequate to permit required weighing of materials without delaying the production of the mixer. Scales to be used shall be approved by the Engineer and shall be certified in place.

Each scale installation shall be provided with standard fifty (50) pound test weights made of high quality cast iron, cast and finished in such a manner that no foreign material will adhere to the surface, and sealed in the manner prescribed by the United States Bureau of Standards. The minimum number of test weights required shall be of a weight equivalent to ten percent (10%) of the net load capacity of the scales to the nearest greater fifty (50) pounds, but in no case shall less than two (2) weights be furnished.

The device used for measuring the quantity of water shall indicate the quantity in gallons and fractions thereof. The operating mechanism shall regulate the quantity required for any given batch within one percent (1%), and the supply inlet shall be cut off automatically when water is being discharged into the mixer.

B 20.6 CONCRETE PROPORTIONS

- a. General. American Concrete Institute 211.1 shall be the basis for selecting the proportions for concrete made with aggregates of normal and high density and of workability suitable for usual cast-in-place structures.
- b. Mix Design. The Contractor shall be responsible for the design of concrete consistent with the minimum requirements of strength and proportions stated herein. The proportions of materials entering into mix to produce concrete of satisfactory quality shall be determined by laboratory tests prior to the beginning of concrete placement. Design shall be in accordance with ACI 211.1, "Recommended Practice for Selecting Proportions Concrete," subject to maximum water cement ratio, minimum cement content, and minimum strengths set forth herein.
- c. Workability. In general, the workability of any mix shall be that required for the specific placing conditions and method of placement. The concrete shall be of such workability that it can be worked readily into all corners and around reinforcing without segregation of materials or having free water collect on the surface. Compliance with specified slump limitations shall not necessarily designate a satisfactory mix. The Engineer may require changes in proportions at any time as necessary to obtain a mix having satisfactory properties. The slump tests will be made in accordance with ASTM Method of Test for Slump of Portland Cement Concrete, Designation C-143.

In no case shall the amount of coarse material be such as to produce harshness in placing or honeycombing in the structure when forms are removed.

B 20.7 CONCRETE CLASSIFICATION

The following table sets forth the classification of concrete used for water and sewer construction in the City of Arlington:

Class	f ^c 28-day psi	Cement Bags/ C.Y.	Max. Water Content (Gal./Bag)	Max. Slump (In.)	Max. Size Aggr. (In.)	Use
A	3,000	5	6.5	5	1-1/2	General. All reinforced concrete structures unless otherwise specified.
B	2,000	4	8.0	4	1-1/2	Blocking, Cradle Concrete Bedding.
C	3,600	6	6.0	4	1-1/2	General. Top Slabs direct traffic structures.
D	1,500	3	8.5	4	1-1/2	Concrete Backfill.

The maximum amount of coarse aggregate (dry loose volume) per cubic foot of finished concrete shall not exceed 0.82 cubic feet.

The maximum amount of water as set forth in the table of concrete classification is based on the assumption that the aggregates are in a saturated, surface dry condition. If additional water is required to obtain the desired slump, a compensating amount of cement will also be added. In no case will the maximum allowable water-content ratio be exceeded.

The concrete mix will be designed with the intention of producing concrete with compressive strengths equal to or greater than those shown when tested in accordance with ASTM C 39, "Compressive Strength of Cylindrical Concrete Specimens."

When tested at seven (7) days, concrete cylinders will have attained at least two-thirds (2/3) the required twenty-eight (28) day compressive strength in order for the strength of the concrete to be considered satisfactory.

B 20.8 MIXING CONDITIONS

- a. General. The concrete shall be mixed in quantities required for immediate use, and any concrete which is not in place within the time limits specified shall not be used. Retempering of concrete will not be permitted.
- b. Concrete Temperature. No concrete shall be placed when the temperature of the concrete to be placed is greater than ninety (90) degrees Fahrenheit or less than fifty (50) degrees Fahrenheit. The temperature of the concrete to be placed will be taken using a

thermometer immediately prior to placement with the point of measurement being in the chute or bucket.

- c. Cold Weather. No concrete shall be mixed without the approval of the City when the air temperature is at or below forty (40) degrees Fahrenheit (taken in the shade away from artificial heat) and falling. If authorized by the City, concrete may be mixed when the air temperature is at thirty-five (35) degrees Fahrenheit and rising. All cold weather concreting shall be done in accordance with ACI-306.
- d. Hot Weather. Hot weather is defined as any combination of hot air temperature, low relative humidity, and wind velocity that in the judgment of the Engineer would impair the quality of the concrete. All hot weather concreting shall be in accordance with ACI 305. Concrete shall be placed in the forms without the addition of any more water than required by the design (slump). No excess water shall be added on the concrete surface for finishing. Control of initial set of the concretes and extending the time for finishing operations may be accomplished with the use of an approved water-reducing and set retarding admixture as specified above.

Maximum time intervals between the addition of mixing water and/or cement to the batch and the placing of concrete in the forms shall not exceed the following:

Air or Concrete Temperature (whichever higher)	Maximum Time From Addition of Water to Placement
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Non-Agitated Concrete

Up to 80 degrees Fahrenheit.....	30 minutes
Over 80 degrees Fahrenheit.	15 minutes

Agitated Concrete

Up to 75 degrees Fahrenheit.	90 minutes
75 to 89 degrees Fahrenheit.	60 minutes
Over 90 degrees Fahrenheit (maximum permissible concrete temperature).	45 minutes

The use of an approved set-retarding admixture will permit the extension of the above time maximums by thirty (30) minutes, for agitated concrete only.

Under extreme hot temperature, wind, or humidity conditions, the City may require the use of the set-retarding agent, or may suspend concreting operations if quality of the concrete being replaced is not acceptable.

B 20.9 CURING

Careful attention shall be given to the proper curing of all concrete. Curing methods shall use sheet materials conforming to ASTM C 171 or membrane curing compound conforming to ASTM C 309. Membrane curing compound will not be used on surfaces to be rubbed or on which additional concrete is to be placed.

All concrete shall be cured as set forth in Section C 30.14.

B 20.10 REJECTION

Concrete may be rejected for failing to meet any of the requirements of this specification.

B 21 REINFORCING STEEL

B 21.1 SCOPE

This specification governs the manufacture of all reinforcing steel used in the construction of reinforced concrete.

B 21.2 PRODUCTS

Reinforcing steel manufactured under these specifications shall confirm to the following specifications of the American Society for Testing and Materials as follows:

- a. ASTM A 82, "Cold-Drawn Steel Wire for Concrete Reinforcement."
- b. ASTM A 185, "Welded Steel Wire Fabric for Concrete Reinforcement."
- c. ASTM A 615, "Deformed and Plain Billet-Steel Bars for Concrete Reinforcement."

B 21.3 MATERIALS

All bar reinforcement shall be Grade 60 open hearth, basic oxygen, or electric furnace new billet steel except that stirrups and tie bars may be Grade 40.

Wire for fabric reinforcement shall be cold-drawn from rods hot-rolled from open hearth, basic oxygen, or electric furnace billet steel.

B 21.4 STORAGE

Steel reinforcement shall be stored above the surface of the ground upon platforms skids, or other supports and shall be protected as far as practicable from mechanical injury and surface deterioration caused by exposure to conditions producing rust.

When placed in the work, reinforcement shall be free from dirt, paint, grease, oil, or other foreign materials. Reinforcement shall be free from injurious defects such as cracks and laminations.

Rust, surface seams, surface irregularities or mill scale will not be cause for rejection, provided the minimum dimensions, cross-sectional area, and tensile properties meet the physical requirements for the size and grade of steel specified.

B 21.5 BENDING

Reinforcement shall be bent cold and true to the shapes indicated on the plans. Bending shall preferably be done in the shop. Irregularities in bending shall be cause for rejection.

B 22 STREET AND PAVEMENT REPAIR MATERIALS

B 22.1 SCOPE

This specification governs the quality of materials used to repair streets or other pavements after the installation of water and sewer lines.

B 22.2 CONCRETE

Any Portland Cement concrete used for street or pavement repair shall comply in all respects to the requirements set forth in Item B 20, "Concrete," of these specifications for the class of concrete called for on the plans or set forth in the project documents.

B 22.3 CEMENT STABILIZED BACKFILL MATERIAL

- a. 2:27 Backfill or Cement Stabilized Sand. Backfill material designated as "2:27 backfill material" shall be a lean concrete mix containing two (2) sacks of cement per cubic yard of material. Aggregate used for 2:27 backfill material shall be a free flowing well-graded granular material passing a 1 - 1/2 inch screen and free from sticks, lumps, clay balls and organic matter. The 2:27 backfill material shall be poured wet or dry as directed by the City, and all 2:27 backfill shall be mixed in a concrete mixer of a type approved by the City.
- b. Cement Treated Base. Cement treated base shall consist of aggregate, cement, and water uniformly mixed in a central plant and hauled to the project site. Cement treated base shall have a minimum cement content by weight of four percent (4%) and a minimum compressive strength at 7 days of 300 pounds per square inch. If necessary, the minimum cement content shall be adjusted upward to provide the minimum required compressive strength.
- c. Storage and Use. Cement treated materials shall be placed in ditch the same day that they are mixed and/or delivered to the job site.

B 22.4 CRUSHED STONE BASE

- a. Description. Crushed stone base shall consist of stone, argillaceous limestone, calcareous clay particles, with or without stone, or conglomerate, and shall not contain thin or laminated pieces or an excess of shale, dirt, organic matter or other injurious materials.
- b. Gradation.

Retained on 1 - 3/4 in sieve.....	0%
Retained on No. 4 sieve.....	45 - 65%
Retained on No. 40 sieve	60 - 85%

Material passing the No. 40 sieve shall meet the following requirements when the test samples are prepared and tested in accordance with the applicable ASTM specifications:

The liquid limit shall not exceed forty (40). The plasticity index shall not exceed twelve (12).

- c. Abrasion. The material shall have a percentage of wear not exceeding forty (40) when tested in accordance with ASTM C 131.’

B 22.5 HOT MIX ASPHALTIC CONCRETE - COARSE GRADED BINDER COURSE

- a. Description. Coarse graded binder course hot mix asphaltic concrete used for street and pavement repair in the City of Arlington is identical to Type "A" hot mix asphaltic concrete as set forth in Item 340 of the 1993 edition of the Standard Specifications for Construction of Highways, Streets and Bridges adopted by the Texas Department of Transportation. This gradation is normally used as a "base" course on which a fine graded surface course is placed.

- b. Gradation.

Passing 1½ in. sieve.....	100%
Passing 1¼ in. sieve.....	95 - 100%
Passing 7/8 in. sieve,.....	70 - 90%
Passing ½ in. sieve,	50 - 70%
Passing No. 4 sieve,	30 - 50%
Passing No. 10 sieve,	20 - 34%
Passing No. 40 sieve,	5 - 20%
Passing No. 80 sieve,	2 - 12%
Passing No. 200 sieve	1 - 6%

The asphaltic material shall form three (3%) to six (6%) percent of the mixture by weight unless otherwise specified.

- c. Stability. The Hveem stability shall be not less than thirty-five (35).

B 22.6 HOT MIX ASPHALTIC CONCRETE - FINE GRADED SURFACE COURSE

- a. Description. Fine graded surface course hot mix asphaltic concrete used for street and pavement repair in the City of Arlington is identical to Type "D" hot mix asphaltic concrete as set forth in Item 340 of the 1993 edition of the Standard Specifications for Construction of Highways, Streets and Bridges adopted by the Texas Department of Transportation. This material is normally used as a "surface" course either on flexible base, concrete, or hot mix base courses.

- b. Gradation.

Passing ½ in. sieve	100%
Passing 3/8 in. sieve.....	85 - 100%
Passing No. 4 in. sieve,	50 - 70%
Passing No. 10 sieve,	32 - 42%

Passing No. 40 sieve, 11 - 26%
Passing No. 80 sieve, 4 - 14%
Passing No. 200 sieve 0 - 6%

The asphaltic material shall form from four (4%) to eight (8%) percent of the mixture by weight unless otherwise specified.

- c. Stability. The Hveem stability shall not be less than thirty-five (35).
- d. Tack Coat. The unit bid prices for coarse graded base course and fine graded surface course shall include the application of a tack coat to each layer of asphaltic concrete before the next layer is applied and a tack coat shall also be applied to any exposed asphalt or concrete edges that shall abut any hot mix asphaltic concrete. The tack coat shall be a liquid asphalt complying with the specifications of the Asphalt Institute for Type RC-70 or RS-1.

B 23 CASING PIPE FOR WATER AND SEWER CROSSINGS

B 23.1 SCOPE

This specification governs the manufacture of reinforced concrete pipe, corrugated metal pipe, and steel pipe used as casing pipe for water and sewer lines.

B 23.2 REINFORCED CONCRETE PIPE

Reinforced concrete pipe used for casing pipe shall conform to ASTM C 76. The pipe class shall be as shown on the project plans or set forth in the specifications. When not specified, the minimum pipe class used for casing pipe shall be Class III. The pipe joints shall be tongue and groove, but a rubber O-ring joint seal is not required for casing pipe.

B 23.3 CORRUGATED METAL PIPE

- a. Products. All corrugated metal pipe used for casing for water and sewer lines shall conform to AASHTO M 36. "Zinc Coated (Galvanized) Corrugated Iron for Steel Culverts and Underdrains." All pipe shall be Type I. Zinc coated iron or steel sheets used in the manufacture of the corrugated metal pipe shall conform to AASHTO M 218.
- b. Corrugations. Pipe corrugations may be either 2-2/3" x 1/2", 3" x 1", or 5" x 1".
- c. Metal Thickness. Unless otherwise specified on the plans or in the contract documents, pipe thirty-six (36") inches in diameter and smaller shall have a wall thickness not less than 0.064 inches (16 Gage), pipe forty-two (42") inches through fifty-four (54") inches in diameter shall have a minimum wall thickness of 0.079 inches (14 Gage), and pipe sixty (60") inches and larger in diameter shall have a minimum wall thickness of 0.109 inches (12 Gage).
- d. Couplings. Couplings bands shall be of the same base metal and have the same coating as the pipe. Bands shall have a minimum metal thickness of 0.064 inches (16 Gage) and shall have a minimum width of ten and one-half (10-1/2") inches.
- e. Pipe Coating. All corrugated metal pipe used for pipe casing shall be bituminous coated in accordance with AASHTO M 190. The pipe coating shall be Type A, and the minimum thickness of the coating shall be 0.05 inches measured on the crest of the corrugations.

B 23.4 STEEL PIPE

- a. Products. All steel pipe used for pipe casing for water and sewer lines shall conform to one of the following ASTM specifications:

ASTM Designation	Title
A 134	"Electric-Fusion (Arc) - Welded Steel Plate Pipe (sizes 16 in. and over)"

A 139 "Electric-Fusion (Arc) - Welded Steel Plate Pipe (sizes 4 in. and over)"

A 211 "Spiral-Welded Steel or Iron Pipe."

- b. Wall Thickness. All pipe shall be designed to have a wall thickness sufficient to sustain the maximum expected overburden as well as the concentrated live loads without deflecting the pipe in excess of five (5%) percent. However, steel casing with wall thickness less than 0.250 inches will not be acceptable in any circumstances.
- c. Joints. Steel pipe for casing installations may be shop fabricated in convenient section lengths for transportation to the job site. These sections shall be combined by field welding to provide a single casing assembly over the limits set forth in the plans. Such casing pipe butt welds shall be continuous and free of slag holes.
- d. Coatings. All steel pipe casing shall be cleaned and shop coated inside and out. A uniform bituminous coating at least 0.05 inches in thickness shall then be applied inside and out to the casing. Touch-up after field welding shall be equal to required shop coatings.

B 23.5 REJECTION

Casting pipe may be rejected for failing to meet any of the requirements of this specification.

B 24 MATERIALS FOR EROSION CONTROL

B 24.1 SCOPE

This specification governs the quality of materials used for permanent and temporary erosion control after the installation of water and sanitary sewer lines.

B 24.2 HYDROMULCHING

When water or sanitary sewer line construction is outside of proposed and/or existing pavement, the entire trench width shall be hydromulched after backfill and compaction operations have been completed. Areas outside the trench area which have been undermined by excavation or damaged during backfill operations shall also be hydromulched.

1. Description: Seeding shall consist of preparing and planting seed or a mixture of seed of the kind specified along and across such areas as may be designated on the plans and in accordance with these specifications.
2. Planting Season: All planting shall be completed between the dates specified for each type except when specifically authorized in writing by the Engineer. The seed planted shall be of a type specified with the mixture, rate and planting dates as follows:
 - (a) Type I: Bermuda Grass (hulled) 2 pounds per 1,000 square feet - March 15 through September 15.
 - (b) Type II: Mixture of Bermudagrass (unhulled) and Annual Rye Grass, 8 pounds per 1,000 square feet (Bermudagrass 2 pounds, Rye Grass 6 pounds) –September 15 through March 15.
3. Fertilizer:
 - (a) General: Fertilizer shall be a commercial product, uniform in composition, free flowing and suitable for application with approved equipment. Fertilizer shall be delivered to the project site in fully labeled original containers. Fertilizer which has been exposed to high humidity or moisture or has become caked or otherwise damaged, shall be rejected.
 - (b) Initial Planting Application: Fertilizer for the initial planting application shall be of an organic base containing by weight the following (or other approved) ratio of nutrients: 1-2-1 (N-P-K); also containing ten (10%) to fifteen (15%) percent sulfur in sulfate form and traces of iron and zinc as required and approved by the Engineer.
 - (c) Post Planting Application: Fertilizer for the post planting application shall be a chemical base fertilizer containing by weight the following ratio of nutrients: 3-1-2 (N-P- K). Thirty (30) days after planting, turfgrass areas shall receive an application of the specified fertilizer at the rate of one (1) pound of nitrogen per one thousand (1000) square feet.

4. Hydromulch:

- (a) Mulch will be manufactured from hardwoods only and will be refined specifically for turf hydromulch applications. Three approved mulches are manufactured by Conwed, Weyerhaeuser and Texas Fiber Co.
- (b) Following soil preparation, seed, fertilizer, mulch and water shall be mixed together and applied to the planting area in the following quantities and rates:

Item	Rate Per 1000 Square Feet
Turfgrass	Seed As specified above.
Fertilizer	9 pounds
Water	23 gallons
Mulch	46 pounds

- 5. Maintenance: Contractor will provide irrigation for at least 30 days after planting and for as much longer as necessary to provide a uniform stand of grass. A uniform stand of grass is defined as not less than 100 growing plants per square foot. Growing plants shall be defined as healthy grass plants of two blades or more at least 1½ inches tall. Growth shall be sufficient that at least one mowing is required before the grass areas are accepted by the Owner.
- 6. Replanting: All areas that do not produce a uniform stand of grass must be replanted and maintained until a uniform stand of grass is established.

B 24.3 EROSION CONTROL MATTING

In addition to hydromulch seeding, erosion control matting will be required where existing or proposed side slopes are 3:1 or steeper within natural channels, drainage ditches, channel banks or embankments; and in areas where the engineer determines that the soil is erodible. Depending upon the type of soil, steepness of the slope and the channel velocity, either Curlex Blankets (Regular or Hi-Velocity) or Enkamat (7010 or 7020) erosion control matting (or their equivalent) shall be placed upon the areas which have been hydromulch seeded.

B 24.4 SILT FENCING

- 1. Material - The fabric should conform to the following properties, as determined by the Federal Highway Administration Task Force 25 Guidelines, as measured in the weakest direction:

Test Designation	Topic	Average Roll Minimum Value
ASTM D 4632	Grab Strength	90 lbs. @ 12"/min.
ASTM D 4632	Grab Elongation	15% @ 12"/min.
ASTM D 4751	Equivalent Opening Size (EOS)	U.S. sieve No. 20

ASTM D 4491	Permittivity	>.01 sec. -1
ASTM D 4355	U.V. Resistance (500 hrs. exposure)	70%

The Mullen burst strength shall be greater than 150 psi. The edges shall be treated to prevent unraveling.

2. Support - Fence posts shall be spaced a maximum of six feet apart. Woven wire will be used to support the material. Fence posts are to be 4"x4" wood posts or fabricated steel posts.

B 24.5 GABION STRUCTURE ASSEMBLY

1. Materials:

- (a) General: Gabions shall consist of rectangular, compartmented wire baskets filled with stone used for slope or bank protection and erosion control on open channels.
- (b) Gabions: Gabion baskets shall consist of uniform hexagonal wire mesh woven in a double twist pattern with openings fabricated in such a manner as to be non-raveling and designed to provide the required flexibility and strength.

The perimeter edges of the twisted wire mesh shall be woven around a reinforcing wire in a manner designed to prevent slippage. The edges of the mesh shall be securely selvedged. All corners shall be reinforced by heavier wire.

Gabions shall be so fabricated that the sides, ends, lid, base and diaphragms can be readily assembled at the construction site into rectangular baskets with a minimum thickness of one foot. Where the length of the gabion exceeds 1½ times its horizontal width, the gabion shall be divided, by diaphragms of the same mesh and gauge as the body of the gabion, into cells whose length does not exceed the horizontal width. Diaphragms shall be secured in the proper position on the base section.

All dimensions are subject to a tolerance of five (5) percent.

Wire shall conform to the following requirements in accordance with current Federal Specifications QQW-461 Class 3 - Finish 5 - Soft.

Wire for Fabric (diam.)	3.00 mm plus or minus 2.5 percent
Wire for Selvedges and Corners (diam.)	3.90 mm plus or minus 2.5 percent
Wire for Binding and Connecting (diam.)	2.20 mm plus or minus 2.5 percent
Tensile Strength (psi)	60,000 - 70,000

Weight of zinc coating 0.80 oz./sq. ft.
for all wire

(c) Stone: The stone shall be graded from three (3") to eight (8") inches. The stone shall have a specific gravity of at least 2.40 and shall have a percent of wear not more than 40 when tested in accordance with Texas Department of Transportation Test Method TEX-410-A.

(d) Geotextile Fabric: Geotextile fabric for use as filter media shall be placed with a minimum overlap of eighteen (18") inches. Fabric shall be secured as necessary with pins or other suitable means before placing gabion baskets.

(e) Protective Aggregate Filter Layer: As an alternate to Geotextile fabric, a protective aggregate filter layer may be utilized. The filter shall be designed by a Registered Professional Engineer specializing in Geotechnical Engineering.

(f) Rejection: Gabions may be rejected for failure to meet any of the requirements of this specification.

**PART C CONSTRUCTION AND
INSTALLATION SPECIFICATIONS**

C 1 GENERAL

C 1.1 SCOPE

This section of the specifications contains detailed specifications and descriptions covering the major items of construction and the workmanship necessary for building and completing the various components of a water and/or sewer project. These specifications are written with the intention that materials and workmanship of such a quality are provided as to result in an economical quality balance, which will produce first class unit installations that integrate as functional additions into total systems, all to the initial and long term advantage of the City. The material and work shall meet each and every requirement of these specifications even if it necessitates the upgrading of some work components. The fact that these specifications may fail to be so complete as to cover all details will not relieve the Contractor of full responsibility for providing a complete project of high quality, first class finish and appearance that is satisfactory for operation.

C 1.2 USE OF VALVES IN EXISTING SYSTEM

The contractor shall not operate any valve in the existing water system. The valves will be operated only by a Water Utilities Department Service Specialist. If one is not available then only with the presence of a Capital Improvements Inspector and/or a representative of the Water Utilities Department Field Operations Division will the Contractor be allowed to operate a valve. The City will inspect all valves prior to initial acceptance of the project. All repairs or replacements required to restore satisfactory operation of the valve shall be at the expense of the Contractor.

C 1.3 PROJECT MAINTENANCE AND GUARANTEE

The Contractor shall guarantee all work for a period of two (2) years, unless otherwise specified, from the date of initial acceptance by the City. Damage or leaks due to acts of God or from sabotage and/or vandalism are specifically excepted from this guarantee. The Contractor shall furnish a maintenance bond to be effective for two (2) years or other period as set forth in the contract documents after initial acceptance as a part of this guarantee.

When defective material and/or workmanship are discovered, the required repairs are to be made under this guarantee, and all repair work shall be performed at the Contractor's expense immediately after notice has been given him by the Owner. No materials (clamps, etc.) shall be used to make repairs that are unacceptable for use in the initial construction. Should the Contractor refuse or fail to make the necessary repairs within five (5) day's thereafter, the City may make the necessary repairs and charge the Contractor with the actual cost of the labor and material required.

C 1.4 PROJECT SIGNS

The Contractor shall furnish and erect one or more signs identifying the project at locations selected by the City. The sign shall be substantially in accordance with the appurtenant

drawings and shall be constructed of 3/4 inch exterior plywood. Signs shall be placed in a prominent location and maintained in good condition until the completion of the project. Project signs will not be paid for directly but will be considered subsidiary to the various other unit prices. Projects signs will be removed by the Contractor upon the completion and acceptance of the project.

C 1.5 SALVAGING OF MATERIAL

All salvaged material shall remain the property of the City and salvable material which is destroyed or damaged due to negligence of the Contractor shall be replaced with new material by the Contractor at no expense to the City. Salvaged material, unless designated for reuse, shall be returned to the Water Department warehouses or storage yards by the Contractor. Returned salvaged materials shall be inspected by a Water Utilities representative prior to acceptance of the material and issuance of a receipt for the material. Concrete blocking and extraneous material shall be removed prior to delivery.

C 1.6 STORAGE

Materials delivered to the site of the work in advance of their use shall be stored so as to cause the least inconvenience to the public and in a manner satisfactory to the City.

Materials shall be stored in accordance with the material manufacturer's recommendation.

C 1.7 EQUIPMENT

All machinery and equipment shall be maintained in good condition to insure the completion of the work without excessive delays for repairs and replacements. Equipment used for disposal of surplus materials beyond the limits of the work shall avoid spilling or wasting of materials along the line of haul. The Contractor shall immediately clean up all materials spilled or wasted along the haul route.

C 1.8 CONSTRUCTION WATER

Contractor is responsible to provide all water necessary for the construction of this project. All construction water will be metered by City owned meters. A fee and a deposit must be paid before the meter is released to the contractor. Payment and meter pick up locations are the South Service Center, 1100 S.W. Green Oaks, or City Hall Customer Care, 101 W. Abram. The meter readings will be submitted online by the contractor and billed each month in accordance with the current Customer Care and Business Services Policy. Any damage that occurs to the meter during this time will be repaired by the City of Arlington at the expense of the Contractor. The cost of the repairs will be deducted from the deposit and the remaining deposit will be returned to the Contractor. This procedure will be followed wherever construction water is needed. If the meter is set on a fire hydrant, the meter assembly shall be provided with an approved backflow prevention device, provided by the contractor in accordance with the standard detail and the Fire Hydrant Meter Agreement requirements located under <http://www.arlington-tx.gov/water/builder-services/construction-meters-backflow-prevention/>.

C 1.9 DUST NUISANCE

It shall be the responsibility of the Contractor to take preventive measures to eliminate, reduce, or alleviate any dust nuisance in his work area by the use of hoses, water trucks, etc. This control of dust nuisance is most important in populated areas. The method used will be approved by the City. Should the Contractor fail to control dust as outlined above, the City may suspend the work, as outlined in Part A. "General Provisions " until corrective measures are taken.

C 1.10 INGRESS AND EGRESS

The Contractor shall endeavor at all times to leave private drives and roadways open so that property owners may have ingress and egress to their property. It is realized that during certain work operations, ready access is impossible. However, the Contractor will attempt to keep drives open as long as it does not interfere with the progress of the work. The Contractor shall at the end of each day leave streets and drives open to the public. In the event of rain, the Contractor shall check and repair trenches and assist in ingress and egress to properties.

C 1.11 MARKERS

The Contractor shall identify and reference all right-of-way and property line markers along the route of construction. The Contractor shall replace all markers damaged or destroyed during construction, under the supervision of a Registered Professional Land Surveyor, at no cost to the City.

C 1.12 CONSTRUCTION STAKING

The full responsibility for holding to alignment and grade shall rest upon the Contractor.

Where construction operations require the removal of construction stakes, the Contractor shall reference such points in an approved manner. If the points cannot be referenced, the Contractor must obtain authorization for their removal. In the case of their unauthorized destruction or removal, they will be replaced at the Contractor's expense.

The Contractor shall safeguard all points, stakes, grade marks, etc., re-establishing same if disturbed, and shall assume the entire expense of rectifying work improperly constructed due to failure to maintain and protect such established points, stakes, and marks.

C 1.13 CLEAN-UP

The Contractor shall maintain the construction site in a neat and orderly manner at all times and remove daily the trash, paper, rubbish, and debris resulting from the Contractor's operations or that of employees. Upon completion of the project, all equipment, remaining construction materials, trash, broken concrete, lumber, etc. shall be removed from the construction site. The entire construction site shall be graded and cleaned to present a neat appearance prior to acceptance of the project.

C 2 REMOVAL AND/OR ADJUSTMENT OF EXISTING STRUCTURES

C 2.1 SCOPE

This section of the specifications covers the removal and/or adjustment of existing facilities and structures. The removal and satisfactory disposal, adjustment, and replacement of existing structures shall be in accordance with the plans and these specifications.

C 2.2 METHODS OF REMOVAL AND DISPOSAL

All structures which are to be salvaged shall be removed in such a manner as to prevent being unduly damaged.

Materials or parts of structures which are to be broken up, dismantled or removed, and which are to be salvaged shall be removed, loaded, cleaned up, hauled, and unloaded at the site designated on the plans or as directed by the City. Materials which are not designated to be salvaged shall become the property of the Contractor and shall be properly disposed of by the Contractor at the Contractor's cost and expense. Asbestos-cement pipe shall be left in the ground where practical. Asbestos-cement pipe removed shall be disposed of in accordance with E.P.A. requirements for the disposal of asbestos materials.

Existing concrete pavements, driveways, curbs, gutters, sidewalks, etc., to be removed shall be broken up and disposed of at approved sites. The limits for removal will be as specified and any excess removal and the replacement thereof shall be at the entire cost and expense of the Contractor. Where permanent paving (concrete or asphaltic concrete) is to be cut, the pavement shall be cut full depth before opening the ditch to insure a neat straight edge. An approved power driven concrete saw, manufactured especially for the purpose of sawing concrete, shall be suitable for the work to be performed, and the cut shall be vertical to the top and face. The exposed face of the cut shall be vertical for the full depth of the pavement. Saw blades shall be designed to make a clean, smooth cut and guides shall be used to provide true alignment of the cut.

The area where the pavement is to be removed by the use of a concrete saw shall be designated on the plans or as designated by the City's representative.

After the removal of structures, all excavations not to be occupied by new work, and all holes created, shall be backfilled with approved materials thoroughly compacted in place.

All damage done to adjacent property or structures shall be repaired by the Contractor at the Contractor's cost and expense to the satisfaction of the City. Any unsightly places created shall be cleaned up and the site left in a neat, clean and orderly condition.

C 2.3 REMOVAL AND REPLACEMENT OF FENCE

The Contractor shall do the necessary removing of fencing on the right-of-way and shall rebuild same after the pipe line work is completed. The fences shall be rebuilt of the same quality of materials or better than that which was removed. All posts, wires and other

material shall be sound, straight, equal to or better than the materials removed. Gates shall be replaced in a manner acceptable to the Inspector, and all corner, gate and end posts shall be well braced.

Where fences are removed, the Contractor shall be responsible for the protection of livestock, etc. with temporary fencing.

C 2.4 POLES, SIGNS, GUY WIRES, ETC.

The Contractor shall be responsible for all damage to street sign posts and signs within the limits of operations that remain in place or are removed and replaced. In the event street sign posts and signs are damaged or destroyed by the Contractor's operations, they shall be replaced at the Contractor's expense.

If requested by the Contractor, regulatory and street name signs which interfere with construction or repair work shall either be relocated or made portable by City traffic forces as needed to avoid undue interference with construction activities, provided that all such regulatory and street name signs remain visible to vehicular and pedestrian traffic. This work shall be at no cost to the Contractor.

C 2.5 OTHER UTILITIES

All water mains, water services, sanitary sewers, sanitary sewer house laterals, storm sewers, power conduits, gas mains, gas service laterals telephone lines, cable television lines, and other appurtenances encountered during construction shall be supported or replaced as necessary to insure uninterrupted service.

Where the exact depth of a utility is not shown on a plan, or the utility is not shown, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary, and extra compensation will not be paid for such delays.

When it is necessary to remove or adjust another utility, a representative of that utility will be notified to decide method and work to be done. The Contractor shall make satisfactory arrangements with other utilities for the cutting or adjustments required. No extra compensation will be paid due to delays caused by removal of public utility structures or for hand excavation required in or around such structures.

The Contractor will be held liable for any negligent or willful damage to any other utility and shall be expected to pay for the cost of all necessary repairs and any damages resulting to public or private property therefrom.

C 2.6 METHOD FOR MEASUREMENT

When the items specified are classified separately in the proposal and contract as separate pay items, measurement for payment will be made as described in the proposal. When the items specified are not classified separately in the proposal contract as separate pay items,

such items will be considered as incidental work and the cost thereof shall be included in such contract pay items as are provided in the proposal and contract.

C 2.7 BASIS OF PAYMENT

When the items specified are classified separately in the proposal and contract as separate pay items, payment will be made at the unit prices set forth. When the items specified are not classified separately in the proposal and contract as separate pay items, such items will be considered as incidental work and the cost thereof shall be included in such contract pay items as are provided in the proposal and contract.

C 3 EXCAVATION, EMBEDMENT, AND BACKFILL

C 3.1 SCOPE

This section of the specifications contains detailed specifications and descriptions concerning the following items of work:

- a. The furnishing of all labor, materials, tools, equipment and machinery necessary for cleaning and removing from the site of the work, wherever located, all obstructions, trees, stumps, brush, vegetation, wood and debris, and all earth, rock, and other materials to be excavated.
- b. The removal of existing structures except where specifically paid for as set forth in Section C 2, "Removal And/Or Adjustment of Existing Structures".
- c. The furnishing, placing, and maintaining of all sheeting, shoring, and bracing necessary to protect the work and adjacent properties and to support all adjacent structures above and below the ground.
- d. Providing for all pumping, bailing, and draining necessary to keep the excavation free from seepage water and water from other sources.
- e. Providing for the uninterrupted flow of sewers and surface waters during progress of construction including bypass pumping or temporary lines.
- f. Removing, after the completion of the work, of all sheeting, shoring, and bracing not necessary to support the sides of the excavation.
- g. The furnishing and placing of all embedment called for on the plans and contained in the specifications.
- h. The satisfactory disposal of excess and unsuitable materials not required or which cannot be used for backfilling.
- i. Backfilling, tamping, compacting, and refilling, after settlement, of all excavation areas.
- j. The backfilling of all streets, alleys, rights-of-way, easements and other lands, private or public, damaged or occupied by the Contractor in the performance of the contract.
- k. The replacement of topsoil, where called for on the plans or set forth in the specifications, after backfilling operations have been completed.
- l. Sodding, sprigging, seeding, or hydromulching where required.

C 3.2 CLASSIFICATION

There will be no classification of excavation. Excavation will include all materials encountered, including rock, regardless of their nature or the manner in which removed.

C 3.3 BORINGS AND SUBSURFACE INFORMATION

Any subsurface information shown on plans shall not in any manner be construed as a warranty on the part of the City of the exact nature of the subsurface conditions that will be encountered during construction of the work. It is intended only as a guide to the Contractor in making investigations preliminary to submitting a bid for the work.

Bidders must satisfy themselves as to the actual existing subsurface conditions, including, but not limited to depth, location, and sizes of pipes or conduits of various kinds in place.

C 3.4 EXCAVATION-GENERAL

The construction site shall be prepared for construction operations by the removal and disposal of all obstructions and objectionable materials. It is the intent of this specification to provide for the removal and disposal of all objectionable materials not specifically provided for elsewhere by the plans and specifications to a depth of not less than 1 foot below the foundation or subgrade. The removal of such items shall be accomplished prior to excavation operations. The removal and disposal of such items will not be measured or paid for as a separate contract pay item. Such items will be considered as incidental work and the cost thereof shall be included in such contract pay items as are provided in the proposal and contract.

In general, all excavations shall be made by open cut from the surface of the ground and shall be no greater in width or depth than is necessary to permit the proper construction of the work in accordance with the plans and these specifications. The amount of excavation approximately to grade shall not exceed 100 feet from the end of the completed pipe, and no excavation shall be over 300 feet in advance of the completed pipe, unless otherwise authorized.

The sides of the excavation shall be cut and maintained as nearly vertical as practicable to one foot (1') above the top of the pipe and in accordance with current O.S.H.A. Standards. The entire foundation area in the bottom of all excavation shall be firm and stable and, unless necessary, materials shall not be disturbed below grade. "Grade" in this instance is the base of the embedment as will be called for on the plans and/or as detailed. However, any soft, spongy, disintegrated, or other unsuitable materials shall be removed to the depth below grade as directed by the City. Such materials removed shall be replaced with foundation materials as specified in Section B 19, "Embedment Materials ", or with other material satisfactory to the City and thoroughly compacted in place to the finish grade elevation.

Where the character of the foundation material is such that a proper foundation cannot be prepared at the elevation shown on the plans, then when directed in writing by the City, the Contractor shall deepen the excavation so that a proper foundation can be prepared. If, in the opinion of the City, the condition is the result of the Contractor's negligence to make proper provisions for adequate drainage of the excavation, the cost of the foundation material will not be reimbursed. If the Contractor elects to undercut the trench and use gravel and drain pipe as an underdrain in lieu of, or in conjunction with, pumping, bailing, draining or well point, the additional work will be considered as incidental work and additional compensation will not be allowed.

Embedment for the pipe, or the pipe itself, will not be laid in water. If the Contractor overcuts the trench it will be brought back to grade by the use of compacted select material from the ditch excavation. The final cleaning and preparing of the foundation area shall be done immediately prior to the placing of the embedment materials or structures.

C 3.5 MAXIMUM WIDTH OF TRENCH

The width of trench at a point one (1') foot above the top of the pipe being laid shall conform to the following table:

Size of Pipe
(I.D. in Inches)

Pipe with Bells	Min. Width of Trench	Max. Width of Trench
6" thru 30"	O.D. + 12"	O.D. + 16"
36" and larger	O.D. + 16"	O.D. + 24"

Pipe with Sleeves, Sockets, or Couplings

4" thru 12"	O.D. + 12"	O.D. + 16"
15" & larger	O.D. + 16"	O.D. + 21"

The above widths are for trenches without sheeting, shoring, or bracing.

If the maximum allowable trench width is not maintained to a point one foot (1') above the top of pipe, the Contractor shall provide at his expense the next higher class of embedment as directed by the City which will provide adequate support for the pipe material being installed.

C 3.6 DEPTH OF CUT SHOWN ON PLANS

Profile elevations shown on plan-profile sheets for sanitary sewer lines are flow line elevations. Grade stakes placed in the field normally are measured from elevations of reference point hub to flow line of pipe to be installed. Payment for depth of cut will be measured from the actual ground elevation at the center line of the pipe to the flow line of the pipe to be installed.

Profile elevations shown on plan-profile or profile sheets for water lines are top of pipe elevations.

C 3.7 BOTTOM OF DITCH IN ROCK

Where rock is encountered in the ditch at the elevation where the bottom of the pipe rests, the ditch shall be undercut a minimum of six inches (6") or to the depth indicated on the plans or appurtenant drawings for any special type of bedding.

C 3.8 PIPE FOUNDATION IN WET TRENCH

When ground water is encountered, six inches (6") of crushed stone shall be used in lieu of any other type embedment material. Where the only purpose of the crushed stone is to provide a dry, stable working surface for the convenience of the Contractor, no additional payment will be made for the use of crushed stone in lieu of lesser embedment material.

Rock foundation, as defined in Section B 19.2 of these specifications, is to be used only in the event that the trench bottom is so unstable that normal construction will not be permitted. Rock foundation will be placed only at the direction and in the location indicated by the City.

C 3.9 BLASTING

The use of explosives is discouraged. If the use of explosives is necessary and approval by the City is granted, the Contractor may elect to use explosives in the prosecution of the work. Utmost care shall be exercised so as not to endanger life or property. The Contractor shall use only such methods as are currently utilized by persons, firms, or corporation engaged in a similar construction business. The Contractor shall be solely responsible for the determination as to whether explosives shall be used. The Contractor shall indemnify the City of Arlington whole and harmless against any claim of damage or injury to persons or property, real or personal, resulting from the use of explosives by the Contractor or any subcontractor. The Contractor shall furnish the City of Arlington evidence of insurance sufficient to cover any such possibility. Insurance shall include the City of Arlington as an additional insured.

All explosives shall be stored in a safe and secure manner, under the care of a competent guard at all times, and all such storage places shall be marked clearly "DANGEROUS-EXPLOSIVES." Blasting caps and explosives shall be stored separately, and not more than 50 pounds of explosives shall be stored on the site. The method of storing and handling explosives and highly inflammable materials shall conform with Federal and State laws, City of Arlington ordinances, and Arlington Fire Department regulations. The Contractor shall notify each utility company having structures in proximity to the site of the work of the intention to use explosives, and such notice shall be given sufficiently in advance to enable the companies to take such steps as they may deem necessary to protect their property for injury. Such notice shall not relieve the Contractor of responsibility for any damage resulting from blasting operations.

No blasting will be permitted within state highway right-of-way without written permission from the Texas Department of Transportation.

The blasting area will be covered with heavy timbers chained together, a rope mat, or some equally effective method of blast protection, reviewed by the City. In addition to the "DANGEROUS-EXPLOSIVES" sign displayed, two signs marked "EXPLOSIVES, TURN ALL RADIOS OFF" shall be placed in conspicuous locations readily visible to vehicular traffic and not less than three hundred fifty feet (350') from the blasting cap storage area. During each blast, exposed pipe shall be covered with planking.

C 3.10 TRENCH SAFETY, SHEETING, SHORING, AND BRACING

The sides of all excavation shall be supported in accordance with O.S.H.A. regulations. In wet, saturated or flowing materials, where it is necessary to install tight sheeting of cofferdams, wood or steel sheet piling shall be used. All sheeting, shoring and bracing shall have sufficient strength and rigidity to withstand the pressure exerted and maintain the sides of the excavation properly in place and protect all persons or property from injury or damage. When excavations are made adjacent to existing building or other structures or in paved streets, particular care shall be taken to adequately sheet, shore and brace the sides of the excavation to prevent undermining of or settlement beneath the structures or pavement. Underpinning of adjacent structures or pavement shall be done by the Contractor at his own cost and expense. When required, the pavement shall be removed, the void satisfactorily refilled, compacted, and the pavement replaced. The entire expense of such removal and subsequent replacement thereof shall be borne by the Contractor.

The removal of all trench safety equipment, sheeting, shoring and bracing shall be done in such manner as not to endanger or damage either new or existing structures, private or public properties, and so as to avoid cave-ins or sliding of the banks. All holes or voids left by the removal of the sheeting, shoring or bracing shall be immediately and completely filled and compacted with suitable materials.

C 3.11 PUMPING, BAILING AND DRAINING

The Contractor shall immediately remove all surface or seepage water from sewers, drains, ditches, and other sources which may accumulate during the excavation and construction work, by providing the necessary underdrains or otherwise, and by doing the necessary pumping, bailing or draining. The Contractor shall have available at all times sufficient equipment in proper working order for doing the work herein required. All water removed from excavations shall be disposed of in an approved manner, so as not to create unsanitary conditions, cause environmental damage, nor to cause injury to persons or property, or damage to the work in progress, nor to interfere unduly with the use of streets, private driveways or entrances. No water shall be allowed to flow through or over unset concrete or through the completed line. Adequate plugs or night caps shall be properly installed on pipe ends when the work is unattended. No water removed from the site shall be discharged to the City's sanitary sewer system without prior approval of the City.

C 3.12 DISPOSAL OF EXCAVATED MATERIALS

Suitable excavated materials shall be piled adjacent to the work, in accordance with O.S.H.A. regulations, to be used for backfilling. Excavated materials unsuitable for backfilling, or in excess of that required for backfilling, shall be disposed of by the Contractor. The location of suitable disposal sites is solely the responsibility of the Contractor and must be suitable to the Texas Natural Resource Conservation Commission; the City shall in no way be responsible for the actions of the Contractor. No disposal shall be allowed in flood plains or below the 100 year flood elevation of drainage ways.

Desirable topsoil, sod, etc., shall be carefully removed and piled separately adjacent to the work when required. Excavated materials shall be handled at all times in such manner as to cause a

minimum of inconvenience to public travel and to permit safe and convenient access to private and public property adjacent to or along the line of the work. The excavated material not suitable for bedding or backfill will be disposed of by the Contractor and suitable selected material will be provided at no cost to the City.

C 3.13 PROTECTION OF TREES, PLANTS, SHRUBBERY, ETC.

No trees shall be removed unless so noted on the plans or upon the specific approval of the City. Where trees, plants, shrubbery, etc., are adjacent to the line of the work and are not to be removed or removed and replaced, the Contractor shall protect such trees, plants, shrubbery, etc., by substantial guards; and if, in the opinion of the City, such trees, plants, shrubbery, etc., would be damaged by machinery, etc., hand excavation may be required. The Contractor shall be responsible for all damages to adjacent trees, plants, shrubbery, etc. All damaged limbs over one inch (1") in diameter shall be sawed clean adjacent to the damaged area or at the trunk and dressed with a suitable tree wound paint. The cost of such protection will not be paid for as a separate contract pay item, and the costs thereof shall be included in such pay items as are provided in the proposal and contract.

C 3.14 EMBEDMENT

Embedment describes the material in the area below, around, and above the pipe as described below. Embedment shall be one of the following types and conform to the requirements of Sect. B 19 "Embedment Materials":

- a. Class "A" Embedment. The trench shall be undercut to a point four inches (4") below the outside of the pipe. The pipe shall be laid to grade on concrete blocks or bricks and properly jointed. The pipe will then be restrained to prevent flotation. Class "B" Concrete will then be poured on either side of the pipe to form the bedding under the pipe and up the sides of the pipe to a depth of one-fourth (1/4) the outside diameter (O.D.) of the pipe. Prior to the placement of granular embedment, grades will be checked to insure that no flotation or settlement has occurred. Granular embedment material as defined in Section B 19.4 shall then be placed to a point six inches (6") above the top of the pipe barrel in 3" to 6" lifts and compacted to ninety-five percent (95%) \pm 2% of maximum dry density as defined in ASTM D 698, latest revision.
- b. Class "B" Embedment. The ditch shall be excavated to a minimum of six inches (6") below the finished grade of the outside pipe. A minimum six inches (6") of crushed stone shall then be placed in the trench. The crushed stone shall then be compacted, graded and bell holes dug. The pipe shall then be placed on the firm trench bottom and jointed. Crushed stone embedment shall then be placed to six inches (6") above the top of the pipe and compacted.
- c. Class "C" Embedment. The trench shall be undercut to a point six inches (6") below the barrel of the pipe. Six inches (6") of granular embedment material as defined in Sect. B 19.3 shall then be placed in the ditch and compacted. Bell holes shall then be excavated in the embedment material and the pipe laid and jointed. Granular embedment material shall then be carefully placed around the pipe haunch area to a point six inches (6") above the top of the pipe. The embedment shall then be thoroughly consolidated by mechanical tamping to ninety

five percent (95%) \pm 2% of maximum dry density as defined in A.S.T.M. D698, latest revision.

- d. Class "D" Embedment. The trench shall be undercut to a point six inches (6") below the barrel of the pipe. Six inches (6") of granular embedment material shall be placed in the ditch and compacted. Additional granular material shall then be placed alongside the pipe to a depth of one-fourth (1/4) the outside diameter of the pipe above the bottom of the pipe and compacted. Select material shall then be placed in the trench to a point six inches (6") above the top of the pipe and consolidated by mechanical tamping to ninety-five percent (95%) \pm 2% of maximum density as defined in A.S.T.M. D698, latest revision.
- e. Class "E" Embedment. The ditch shall be excavated to a minimum of four inches (4") below the finished grade. A minimum four inches (4") or 1/8 of the outside diameter of the pipe of crushed stone shall then be placed in the trench. The crushed stone shall then be compacted, graded and bell holes dug. The pipe shall then be placed on the firm trench bottom, and granular embedment material placed along the sides of the pipe to six inches (6") above the top of the pipe barrel. The granular embedment material shall be placed in 3" to 6" lifts and compacted to ninety-five percent (95%) \pm 2% of maximum dry density as defined by ASTM D 698, latest revision.
- f. Class "F" Embedment. The ditch shall be excavated to a minimum of four inches (4") below the finished grade. A minimum four inches (4") or 1/8 of the outside diameter of the pipe of crushed stone shall then be placed in the trench. The crushed stone shall then be compacted, graded and bell holes dug. The pipe shall then be placed on the firm trench bottom and jointed. Select material shall be placed under the haunch area of the pipe and along the sides to six inches (6") above the top of the pipe. The select material shall be place in 3" to 6" lifts and compacted to ninety-five percent (95%) \pm 2% of maximum dry density as defined by ASTM D 698, latest revision.

C 3.15 BACKFILL

The placing of backfill shall not begin until the pipe has been laid, jointed and embedded. The excavation shall be backfilled only with materials approved by the City. Normally, material excavated from the ditch will be used for backfill, except when granular material is used, provided that all hard rock, stones, or boulders having any dimensions greater than two inches (2"), debris and roots larger than two inches (2"), and any soil balls or clods greater than the maximum allowed lift are removed.

- a. Tamped Native Material. After free moisture is gone from the embedment material, the ditch shall be backfilled with native material and compacted by mechanical methods. If hand pneumatic tampers are used, the backfill shall be placed in layers not exceeding six inches (6") in loose thickness and thoroughly compacted to ninety-five percent (95%) Standard Proctor density at optimum moisture content, + two percent (2%) as determined by ASTM D698, latest revision. Backfill shall be placed in uniform layers completely across the trench, and compaction shall proceed in an orderly, uniform manner. If compaction is performed by the use of heavy tamping (sheep's foot) rollers, backfill shall be placed in layers not exceeding nine inches (9") in loose thickness and compacted to ninety-five percent (95%)

Standard Proctor density at optimum moisture content, + two percent (2%) as determined by ASTM D698, latest revision.

- b. Sand Backfill. At the option of the Contractor, in areas where the PI of the native material is less than 15, and the PI of the native material has been verified by testing, granular embedment material (field sand) may be used as backfill material. If this option is selected, the granular embedment material shall be placed above the previously installed and compacted pipe embedment material shall be backfilled as described above.
- c. Backfill in areas with new street construction. The backfill as described above shall continue to within two feet (2') of the subgrade. At this point the trench shall be widened a minimum of one foot (1') on each side. The remaining two feet (2') shall be native material, mechanically compacted in six inch (6") loose lifts at optimum moisture content, + two percent (2%), to a density of ninety-five percent (95%) of maximum dry density, as determined at ASTM D698, latest revision.
- d. Testing. The City of Arlington shall be responsible for testing during backfill operations. If a test does not meet the requirements as outlined above, the Contractor shall be responsible for the cost of additional testing until the compaction requirements are met.

C 3.16 BACKFILL OF SERVICE LINE TRENCHES

Backfill requirements for water or sewer house service lines shall be the same as that required for the line to which they connect unless otherwise specified.

C 3.17 BACKFILL UNDER EXISTING UTILITIES

When existing utility lines have soil or other backfill material removed from beneath them, they will be backfilled in accordance with Section C 3.15 of these specifications before the remaining backfill is placed.

C 3.18 MAINTENANCE OF STREETS DURING CONSTRUCTION

The Contractor shall at all times maintain the surfaces of streets on which he/she is working or has worked. The maintenance required will include the filling of holes, blading or otherwise smoothing of the street surfaces (particularly the trench area), cleaning and removal of surplus excavation material, rubbish, etc., sprinkling of streets with water to abate dust nuisance, and the elimination of interference resulting from blocking the street to residents thereon. Any or all of such operations shall be performed by the Contractor upon demand by the City, but the Contractor shall not wait for instruction from the City before performing maintenance work obviously in need of being done to meet the requirements of these specifications. All costs of work covered by this paragraph shall be included in the prices bid for the various items of work, and no separate payment will be made. In the event the Contractor fails or refuses to properly maintain the barricades and/or surfaces of streets on which work is being performed, the City after due notice to the Contractor's Superintendent, will perform the necessary maintenance, and all costs to the City incurred in the performance of such work will be deducted from any monies due or to become due to the Contractor for work performed, or the Contractor will be billed for

such costs directly as the City shall elect. Notice to the Contractor to be given by the City shall be in writing, and it shall be delivered to the Contractor's Superintendent or authorized agent. Except in emergency cases, where immediate action is required, the Contractor shall have twenty-four (24) hours in which to comply with the instructions of the City. Should the Contractor fail to do so, the City will proceed with the work as set forth above. The Contractor shall provide traffic protection as specified in the City of Arlington's Work Area Traffic Control Manual.

Where traffic must cross open trenches, such as street intersections and driveways, the Contractor shall provide suitable backfill bridges, protective barricades and such other safety equipment as required. The use of machinery must be so regulated as to preclude any unnecessary interference with traffic, utilities, etc. The Contractor shall abide by all applicable Federal, State or Local laws governing excavation work including OSHA and E.P.A. regulations.

C 3.19 DEPTH OF COVER

- a. Sewer lines. Sewer lines shall be laid to the grades shown on the plans.
- b. Water Lines. Unless otherwise shown on the plans or plan-profile sheets, water lines in the locations described shall have the following minimum depths of cover:
 - (1) City Streets. Within the right-of-way of city streets, all water lines will be laid with the top of the pipe a minimum of forty-two inches (42") below the top of the existing or proposed curb, whichever is lower.
 - (2) County Type Roads. Where water lines are installed within the right-of-way of county type roads (no curb and gutter), the top of the water line shall be at least forty-eight inches (48") below the elevation of the lowest roadside (borrow) ditch existing on either side of the road.
 - (3) Open Country. Across open country, cover over water lines shall be a minimum of forty-eight inches (48").

C 3.20 CONDITIONS OF PAYMENT

- a. Water Lines. Trenching, embedment, and backfilling for the installation of water lines will be paid at the unit prices set forth in the plans and in the contract documents.
- b. Sewer Lines. Trenching, embedment, and backfilling for the installation of sewer lines will be paid at the unit prices set forth in the plans and contract documents for the various increments of depth of cut.
- c. Trench Foundation Materials. Trench foundation materials will not be paid for as a separate pay item unless its use is directed by the City.
- d. Subsidiary Items. The following items and/or others not covered by specific bid items will be included in the price bid per foot for the various sizes of water lines and sewer lines over

twelve inches (12") in diameter or for "Trenching and Backfill" for sewer lines twelve inches (12") and smaller in diameter:

- (1) Excavation.
- (2) Furnishing, placing, and compacting embedment material.
- (3) Pumping, bailing, and draining as may be required.
- (3) Maintaining satisfactory condition of streets in work area.
- (4) Disposal of excess material from ditch (spoil).
- (5) Placing backfill above embedment.
- (6) Compaction of embankment above embedment layer by tamping, or other methods as required to obtain the densities specified.
- (7) Clean-up.
- (9) Finishing trench surfaces (not including pavement replacement) to a condition satisfactory to the Owner.

C 3.21 MEASUREMENT

Where trenching and backfill is listed as a pay item in the contract documents (for sewer lines 12" and smaller in diameter), it shall be measured by the linear foot in the various depth of cut brackets.

Rock cushion will be measured by the cubic yard. Pay quantities will be based upon a six (6") inch depth and the maximum permissible trench width as set forth in Section C 3.5 unless a greater depth is ordered by the City.

C 3.22 PAYMENT

Where trenching and backfill is listed as a pay item in the contract documents (for sewer lines 12" and smaller in diameter), it shall be paid for at the unit price bid per linear foot of the various depth of cut brackets.

Rock cushion will be paid for at the unit price bid per cubic yard.

(9) Finishing trench surfaces (not including pavement replacement) to a condition satisfactory to the Owner.

C 3.21 MEASUREMENT

Where trenching and backfill is listed as a pay item in the contract documents (for sewer lines 12" and smaller in diameter), it shall be measured by the linear foot in the various depth of cut brackets.

Rock cushion will be measured by the cubic yard. Pay quantities will be based upon a six (6") inch depth and the maximum permissible trench width as set forth in Section C 3.5 unless a greater depth is ordered by the City.

C 3.22 PAYMENT

Where trenching and backfill is listed as a pay item in the contract documents (for sewer lines 12" and smaller in diameter), it shall be paid for at the unit price bid per linear foot of the various depth of cut brackets.

Rock cushion will be paid for at the unit price bid per cubic yard.

C 4 INSTALLATION OF CONCRETE PRESSURE PIPE AND FITTINGS

C 4.1 SCOPE

This section of the specifications covers the installation of any of the various types of concrete pressure pipe and fittings used primarily in the domestic water system.

C 4.2 GRADES AND COVER

Where plan-profile or profile sheets are included in the plans, concrete water lines shall be laid to the grades shown.

Where grades are not shown, minimum cover as set forth in Section C 3.19 shall be maintained.

C 4.3 EMBEDMENT

- a. Prestressed Pipe. The minimum permissible bedding for Prestressed Concrete Cylinder Pipe manufactured in accordance with AWWA C301 shall be Class "D" as set forth in Section C 3.14d.
- b. Bar-Wrapped Pipe. The minimum permissible bedding for Bar-Wrapped Concrete Cylinder Pipe manufactured in accordance with AWWA C303 shall be Class "C" as set forth in Section C 3.14c.
- c. Pipe Cover in Excess of 10 Feet. Where the depth of backfill over the top of the pipe exceeds ten (10") feet, the embedment shall be of the class shown on the plans or set forth in the contract documents.

C 4.4 PIPE HANDLING

Pipe, fittings, valves and other accessories shall be hauled to and distributed at the site of the project by the Contractor; they shall at all times be handled with care to avoid damage. In loading and unloading they shall be lifted by hoists, cranes or rolled on skidways in a manner which avoids sudden shock. Under no circumstances shall pipe be dropped. Pipe handled on skidways must not be skidded or rolled against pipe already on the ground. Pipe shall be placed on the site of the work parallel with the trench alignment and with bell ends facing the direction in which the work will proceed.

Proper implements, tools, equipment and facilities shall be provided and used by the Contractor for the safe and correct prosecution of the work. All pipe, fittings, specials, valves, etc., shall be lowered into the trench by means of a suitable machine and shall not be rolled or dumped into the trench. The equipment shall have sufficient capacity to handle the pipe. The method of construction shall be subject to the City's approval. Before being

lowered into the trench, each joint of pipe shall be inspected and any unsound or damaged pipe shall be repaired or rejected.

The pipe shall be kept free of all debris during the laying operation. The pipe shall be swept or swabbed prior to installation. The swab should be of a design acceptable to the City. At the close of each operating day the open end of the pipe shall be effectively sealed against the entrance of all objects, especially water. No pipe shall be laid in water or when the trench conditions or the weather are unsuitable for such work, except in an emergency and then only upon permission of the City.

All pipe shall be laid accurately to established lines and grades with valves and fittings at the required location and with joints centered and spigots pushed home.

Where it becomes necessary to make deflections in line of the pipe, sections of pipe with beveled ends or fabricated fittings shall be used. Minor deflection of the line of the pipe may be obtained in standard pipe joints; however, the maximum joint opening caused by such deflection shall not exceed the recommendations of the pipe manufacturer. Random length pipe and/or grade adapters may be used to make unforeseen changes in the field.

C 4.5 PIPE JOINTING

Sections of pipe shall be tightly fitted together, and care shall be exercised to obtain true alignment and grade.

Before laying each joint of pipe, the bell and spigot rings shall be thoroughly cleaned by wire brushing and wiping until clean and dry. The gasket and the inside surface of the bell shall be lightly lubricated with a suitable solution (flax soap) which will facilitate the telescoping of the joint. When pipe is being laid, the gasket shall be placed on the spigot ring, and the spigot end of the pipe shall then be entered into the bell of the last, previously laid pipe and telescoped into position. No "blocking up" of pipe or joints will be permitted.

- a. Inside Cement Mortar Joints: The inside joint recess of pipe shall be filled with mortar and finished smooth with a hand trowel after the joint is engaged. If approved by the City prior to the commencement of pipe laying operations, mortar for the inside joint of pipe 24" and smaller in diameter may be deleted provided that exposed steel in the inside joint recess is coated with a paint recommended by the pipe manufacturer and approved by the City.
- b. Outside Cement Mortar Joint. After the spigot has been telescoped into the bell and the joint checked and found satisfactory, a wrapper shall be placed around the pipe, covering the joint. The wrapper shall be of the quality manufactured by the Mar-Mac Manufacturing Company or approved equal, and shall be hemmed at each edge to allow threading with a steel strap to securely fasten the wrapper around the pipe by means of a stretcher and sealer. The wrapper shall have a minimum width of 7" for 33" pipe and smaller and 9" for pipe larger than 33" diameter and sufficient length to encircle the pipe, leaving enough space between the ends at the top to allow the cement mortar to be poured. The entire joint shall be poured with cement mortar and consolidated and rodded

or agitated to eliminate voids. Prior to pouring the cement mortar, the joint shall be thoroughly cleaned. Any joint showing shrinkage or excessive cracking shall be cleaned and remade.

- c. Cement Mortar. The mortar used at the joint shall consist of one part portland cement to 2-1/2 parts fine, sharp clean sand mixed with water to the consistency of thick cream. The mortar required at the interior joint shall not be placed in freezing weather unless adequately protected from freezing.

Careful inspection shall be made of each joint to insure a smooth continuous interior surface. The interior of the pipe shall be thoroughly cleaned and cleared of any obstructions that may reduce its carrying capacity.

Where designated on the plans, joints will be electrically bonded and by-pass connectors installed past valves to maintain a continuous electrical circuit through the entire length of pipe.

C 4.6 WELDED PIPE JOINTS

Where indicated on the plans or specified in the Special Contract Documents, the concrete pressure pipe shall have welded joints.

Pipe furnished for this type installation shall have joints trimmed or prepared for joint welding, as recommended by the manufacturer and approved by the Engineer.

Before laying, the bell and spigot rings shall be thoroughly cleaned for welding by wire brushing and wiping.

In placing the pipe, the sections shall be fitted together with care being taken to secure true alignment and grades as shown on the plans.

For lined cylinder prestressed pipe, welds will be skip welds as recommended by the manufacturer. For embedded cylinder prestressed pipe, welds will be made on the interior of the pipe and will be continuous.

Slag shall be removed from each welded joint and visually inspected for blow holes prior to application of grout.

C 4.7 PROTECTIVE COATING APPLIED IN FIELD

The Contractor shall provide a 1" minimum thickness concrete or cement mortar coating in the field for the protection of all exposed steel such as flanges, caulked joints, threaded outlets, closures, etc. The cement mortar used shall consist of one part portland cement to two and one-half parts of fine, sharp (plaster) sand. Where shown, coating is to be reinforced with wire mesh.

Any surface receiving a cement mortar coating shall be thoroughly clean and wetted with water just prior to placing the cement mortar coating. After placement, care shall be taken to prevent the cement mortar coating from drying out too rapidly by covering with damp earth or burlap. Cement mortar coating shall not be applied during freezing weather.

C 4.8 TUNNEL INSTALLATION

Concrete pressure pipe shall have uniform alignment and bearing when installed as a carrier pipe in a tunnel or encasement pipe. To provide straight alignment and grade, concrete paving within the encasement may be necessary. Concrete pressure pipe to be installed in an encasement pipe will be manufactured with 1" thick x 24" wide bands of mechanically impacted mortar in addition to the normal coating as set forth in Section B 2.10 of these specifications. To prevent carrier pipe from floating, a minimum of one hold down jack per joint shall be placed on the pipe. Alternate means and methods for securing pipe in place may be submitted for consideration.

- a. 21" Pipe and Smaller. The first pipe shall be placed in the tunnel leaving the bell end extending outside the tunnel approximately one foot. Interior joint protection shall be applied in a manner consistent with the requirements for all other portions of the pipeline. "Flex-Protex" joint filler as manufactured by the Mar-Mac Manufacturing Co., Inc., or approved equal, shall be placed over the spigot of the second pipe, the rubber gasket positioned in the spigot groove, joint lubricant applied to the joint surfaces, the joint engaged, and the gasket position checked. Both pipe shall then be moved into the tunnel, again leaving the bell end of the second pipe extending approximately one foot outside the tunnel. The above steps shall be repeated until all pipe are placed in the tunnel.
- b. 24" Pipe and Larger. "Flex-Protex" joint filler, or approved equal, shall be used for Bar-Wrapped Concrete Cylinder Pipe, and AWWA C301 Prestressed Concrete Lined Cylinder Pipe. Exterior joint protector placed according to its manufacturer's instructions shall be used for AWWA C304 Prestressed Concrete Embedded Cylinder Pipe. The joint filler shall be placed over the spigot, the rubber gasket positioned in the spigot groove, and joint lubricant applied to the joint surfaces prior to moving each pipe into the tunnel separately. The joint engagement shall be accomplished and the gasket position checked as each pipe is placed in its final position in the tunnel.

Casing pipe used with concrete pressure pipe shall generally be sized to provide a minimum of 15" clear space above the carrier pipe, with allowance made for bottom skid requirements. After the installation of the carrier pipe in the casing, each end of the casing pipe shall be sealed with brick and mortar or other approved means.

C 4.9 PIPE TECHNICIAN

The pipe manufacturer shall furnish a factory trained, job experienced field representative who shall visit the project at least weekly during the course of installation and at the unloading of the pipe at delivery to insure proper handling. The technician will also be

subject to call by the Contractor or City to advise and assist with the solution of field problems.

C 4.10 HYDROSTATIC TEST

All taps and corporation stops necessary for the proper testing or chlorination of the main shall be furnished and installed by the Contractor.

Pressure testing of concrete pressure water mains shall be in accordance with Section C 29 of these specifications.

C 4.11 THRUST BLOCKING

Reaction or thrust blocking shall be provided at each hydrant, valve, bend, tapping sleeve, tee and at reducers or fittings where changes in pipe diameter occur. Thrust blocks shall be centered on the longitudinal axis of the pipe and extended to solid undisturbed ground. The size and shape of the thrust blocking shall be as shown on the drawings or as specified in the contract documents.

C 4.12 MEASUREMENT

Concrete pressure pipe will be measured for payment as the length of installed pipe of the various sizes, types, and classes measured horizontally from the center of fitting or end of pipe without any deduction for the length of intermediate fittings or valves.

Fittings and specials will be considered subsidiary to the length of installed pipe except where they are set forth as separate items in the proposal included in the contract documents.

C 4.13 PAYMENT

Payment for concrete pressure pipe shall be made at the price bid per foot of pipe installed, which bid price shall be full payment for all labor and materials necessary to make the complete installation.

Where fittings and specials are set forth separately in the proposal, payment will be made at the unit price bid. Otherwise, payment will not be made separately for fittings and specials but will be considered subsidiary to the unit price or prices bid for pipe.

C 5 INSTALLATION OF ASBESTOS-CEMENT PRESSURE PIPE

C 5.1 SCOPE

Asbestos-cement pressure pipe shall not be used for new water line construction, but is included for guidance for repair, maintenance, and connection to existing water lines.

C 5.2 GRADES AND COVER

Where plan-profile or profile sheets are included in the plans, asbestos-cement lines shall be laid to the grades shown.

Where grades are not shown, minimum cover as set forth in Section C 3.19 shall be maintained.

C 5.3 EMBEDMENT

The minimum permissible embedment for asbestos-cement pressure pipe with ten feet (10') or less cover shall be Class "C" as set forth in Section C 3.14c of these specifications. Basically, this embedment requires a six inch (6") envelope of granular embedment material completely around pipe.

When the depth of backfill over the top of the pipe exceeds ten feet (10'), the embedment shall be of the class shown on the plans or set forth in the contract documents.

C 5.4 STORAGE

Safe storage shall be provided for material until it has been incorporated into the completed project. The interior of all pipe, couplings, rings, fittings, and other accessories shall be kept free from dirt and other foreign matter at all times.

C 5.5 PIPE HANDLING

At all times material shall be handled with care to avoid damage. Whether moved by hand, skidways, or hoists, material shall not be dropped, bumped, or allowed to impact on itself. In distributing the material at the work site, it shall be unloaded adjacent to or near the location where it is to be installed.

C 5.6 LAYING AND JOINTING OF PIPE

- a. Lowering of Pipe and Accessories into Trench. Pipe shall not be lowered into the trench until the pipe bed has been brought to grade. All pipe and accessories shall be inspected for defects. Dirt and other foreign matter shall be removed from the interior and the machined ends before lowering into the trench. Pipe and accessories shall be lowered carefully into the trench in a manner that will prevent damage to pipe and fittings or

injury to the installers. The sealing surfaces of all materials shall be kept clean during installation.

- b. Pipe Joints. The machined ends of pipe to be jointed, coupling grooves, and rubber rings shall be cleaned immediately before assembly, and assembly shall be made as recommended by the manufacturer. Care should be taken not to reverse the gasket when placed in the bell. Each pipe joint shall be sealed with a coupling consisting of an asbestos-cement sleeve and two rubber rings or an equivalent coupling or joint of equivalent strength and performance. The pipe joint shall not be deflected either vertically or horizontally beyond the limits recommended by the manufacturer.
 - (1) When pipe laying is not in progress, the open ends of installed pipe shall be closed to prevent entrance of trench water into the line.
 - (2) Whenever water is excluded from the interior of the pipe, enough backfill shall be placed on the pipe to prevent flotation. Any pipe that has floated shall be removed from the trench and the bedding corrected. No pipe shall be laid when the weather is unsuitable for the proper installation as determined by the City.
- c. Pipe Cutting. Pipe-cutting methods that produce a smooth square cut end without damage to the pipe and that minimize or eliminate airborne particles shall be employed. Safety procedures as recommended by the manufacturers of asbestos-cement pipe shall be strictly adhered to.
- d. End Preparation. Whenever it is necessary to cut a length of pipe in the field, the end shall be prepared as follows:
 - (1) The pipe end of random lengths shall be machined by commercially available field lathes designed for this purpose to ensure that the diameter, profile, and roundness meet the pipe manufacturer's specifications. The machined surface which the compression ring seals shall be smooth and cylindrical to ensure joint integrity.
 - (2) The pipe end of machined overall lengths shall be beveled in accordance with the pipe manufacturer's specifications.
- e. Length of Pipe at Fittings and Rigid Structures. When rigid joints are formed by caulked materials or by bolts with rubber ring seals, such as at fittings, the length of 8 in. diameter and smaller pipe fitted into the bell of the fittings shall not exceed 3 ft. 3 in. and the length of 10 in. diameter and larger pipe shall not exceed 6 ft. 6 in. At least one flexible joint shall be used between two adjacent rigid joints. A coupling shall be cast in the wall of rigid structures at the point of entry of pipelines to provide flexibility at the wall. To provide additional flexibility, the pipe at the point of entry shall have a laying length of not more than 6 ft. 6 in.

C 5.7 THRUST BLOCKING

Reaction or thrust blocking will be provided at each hydrant, valve, bend, and tee and at reducers of fittings where changes in pipe diameter occur. Thrust blocks shall be centered on the longitudinal axis of the pipe and extended to solid undisturbed ground. This size and shape of the thrust blocking shall be as shown on the drawings or as specified in the contract documents.

C 5.8 PLUGGING OF DEAD ENDS

Plugs shall be inserted into the bells of all dead-end fittings. Spigot ends of fittings and plain ends of pipe shall be capped. Thrust blocking shall be provided at all dead ends of pipe that are capped or plugged. Capped or plugged outlets to fittings shall be tied to the fittings and shall be restrained according to the fitting manufacturer's recommendations.

C 5.9 MEASUREMENT

The measurement of asbestos-cement pressure pipe for payment purposes will be the horizontally measured length of the line along its main axis from the center of fitting to center of fitting or end of pipe without deduction for the length of intermediate fittings or valves.

C 5.10 PAYMENT

Payment will be made at the unit price bid per linear foot of pipe installed for the various classes and sizes of pipe. Such payment shall be full compensation for all labor and materials – including trenching, embedment, and backfilling - necessary to make the complete installation.

Tapped coupling for water services will not be paid for directly but will be considered subsidiary to the unit prices bid for the various sizes of water services unless specifically set forth as a separate item in the contract documents.

C 6 INSTALLATION OF POLYVINYL CHLORIDE (PVC) WATER PIPE

C 6.1 SCOPE

This section of the specifications covers the installation of polyvinyl chloride (PVC) pressure pipe manufactured under AWWA C900 or AWWA C905 for use in the water distribution system.

C 6.2 GRADES AND COVER

Where plan-profile or profile sheets are included in the plans, PVC lines shall be laid to the grades shown. Where grades are not shown, minimum cover as set forth in Section C 3.19 shall be maintained.

C 6.3 EMBEDMENT

The minimum permissible embedment for PVC pressure pipe with 10 ft. or less cover shall be Class "C" as set forth in Section C 3.14.c of these specifications. Basically, this embedment requires a 6 inch envelope of granular embedment material completely around the pipe.

Where the depth of backfill over the top of the pipe exceeds 10 ft., the embedment shall be of the class shown on the plans or set forth in the contract documents.

C 6.4 STORAGE

Safe storage shall be provided for material until it has been incorporated into the complete project. The interior of all pipe, couplings, rings, fittings, and other accessories shall be kept free from dirt and other foreign matter at all times. The pipe shall be adequately protected, as recommended by the manufacturer, from damage from sunlight during storage.

C 6.5 PIPE HANDLING

At all times material shall be handled with care to avoid damage. Whether moved by hand, skidways, or hoists, material shall not be dropped, bumped, or allowed to impact on itself. Any damaged pipe will be rejected.

In distributing the material at the work site, it shall be unloaded adjacent to or near the location where it is to be installed.

C 6.6 PIPE CURVATURE

If necessary, the trench may be curved to change direction or avoid obstruction within the limits of the curvature of the pipe as shown in the following table:

<u>Pipe Size Minimum</u>	<u>Allowable Radius (Feet)</u>
4	100
6	150
8	200
10	250
12	300

The approximate force and offset per 20 feet length to accomplish these curvatures for Class 150 pipe are as follows:

<u>Pipe Size (Inches)</u>	<u>Offset per 20' Length (Inches)</u>	<u>Force per 20' Length (Pounds)</u>
4	23	20
6	16	60
8	12	135
10	9	250
12	8	425

C 6.7 PIPE LAYING AND JOINTING

The pipe shall be laid and jointed in the following manner:

- a. Clean Ring and Spigot. The gasket, groove, and pipe spigot shall be wiped clean of all foreign materials.
- b. Install Gasket. Insert the ring in the groove taking care to see that the gasket is evenly seated and free from twists. Some pipe gaskets are installed at the factory.
- c. Apply Lubricant. Lubricate the spigot end of the pipe from the pipe end to the full insertion mark. The coating should be the equivalent of a brush coat of enamel paint. Use only the lubricant approved by the manufacturer. After the spigot end has been lubricated it must be kept clean and free of dirt, sand, or embedment material. If foreign matter adheres to the lubricated end, the spigot must be wiped clean and relubricated.
- d. Assembly. After the pipe sections are aligned, the spigot end should be pushed into the bell or coupling until it hits the stop and/or the reference or insertion mark is in the proper location. The recommended assembly method is using a bar and a block. Pullers such as a "come along" may also be used if the pipe is protected from the chain or cable.
- e. Use of Swab. A swab shall be pulled through each joint after the joint is embedded in the trench.

C 6.8 PIPE CUTTING AND BEVELING

All field cuts must be square (perpendicular to the pipe centerline), and pipe shall be marked completely around its entire circumference prior to cutting to assure a square cut.

Using a factory finished end as a guide, all field cut pipe shall be beveled using a bevel tool, a coarse file, or a rasp.

C 6.9 PVC PIPE IN CASINGS

When PVC pressure pipe is installed in casings, skids shall be used along the pipe barrel to insure that the pipe does not rest on its bells or couplings as recommended by the manufacturer. Skids may extend for the full length of a pipe - including bell and spigot portions - or may be spaced at intervals. Skids shall be fastened securely to the pipe with strapping, cables, or clamps.

C 6.10 THRUST BLOCKING

Reaction or thrust blocking shall be provided at each hydrant, valve, bend, tapping sleeve, tee and at reducers or fittings where changes in pipe diameter occur. Thrust blocks shall be centered on the longitudinal axis of the pipe and extended to solid undisturbed ground. The size and shape of the thrust blocking shall be as shown on the drawings or as specified in the contract documents. Joint restraining devices manufactured and installed in conformance with the requirements of UNI B-13 "Recommended Standard Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride (PVC) Pipe" may be used for AWWA Standard C900 pipe.

C 6.11 MEASUREMENTS

The measurement of polyvinyl chloride (PVC) pressure pipe for payment purposes will be the horizontally measured length of the line along its main axis from center of fitting to center of fitting or end of pipe without deduction for the length of intermediate fittings or valves.

C 6.12 PAYMENT

Payment will be made at the unit price bid per linear foot of pipe installed for the various classes and sizes of pipe. Such payment shall be full compensation for all labor and materials – including trenching, embedment, and backfilling necessary to make the complete installation.

C 7 INSTALLATION OF DUCTILE IRON PIPE

C 7.1 SCOPE

This section of the specifications covers the installation of ductile iron pressure pipe. Except as modified below installation of ductile iron pipelines shall be in accordance with ANSI/AWWA C600.

C 7.2 GRADES AND COVER

Where plan-profile or profile sheets are included in the plans, ductile iron lines shall be laid to the grade shown.

Where grades are not shown, minimum cover as set forth in Section C 3.19 shall be maintained.

C 7.3 EMBEDMENT

The minimum permissible embedment for ductile iron pressure pipe shall be Class "C" as set forth in Section C 3.14c. of these specifications. Basically, this embedment requires a 6 inch envelope of granular embedment material completely around the pipe.

C 7.4 POLYETHYLENE WRAPPING

All ductile iron pressure pipe used in the water distribution system shall be fully wrapped – including appurtenances - with polyethylene wrapping as set forth in Section C 16 of these specifications.

Ductile iron pressure pipe used in the sanitary sewer system shall also require a polyethylene wrapping unless specifically shown otherwise on the plans or called for in the project contract documents.

C 7.5 PIPE HANDLING

Ductile iron pipe and appurtenances shall be lowered into the trench in such a manner as to preclude damage to the pipe, appurtenance, their linings and the polyethylene wrap. Damage to the lining shall be repaired in accordance with provisions set forth in ANSI/AWWA C104/A21.4. Damage to the polyethylene wrap shall be repaired in accordance with provisions set forth in ANSI/AWWA C105/A21.5. The pipe is to be kept clean during laying operations and sealed against the entrance of all objects at the close of each operating day.

Where it becomes necessary to deflect the pipe to avoid obstructions, the deflection of each joint shall be made in accordance with the manufacturer's recommendations.

C 7.6 JOINT MAKING

The type of joints will be mechanical joint or push-on joints as set forth in Section B 5 of these specifications. The methods of making each type of joint will be in accordance with the requirements of ANSI/AWWA C600.

C 7.7 DUCTILE IRON PIPE SEWER LINES

Ductile iron used in sewer lines construction shall be of the class and joint type as shown on the plans and set forth in the documents. Embedment shall also be of the class shown on the plans and set forth in the contract documents.

At connections of ductile iron pipe to PVC, clay, concrete or other types of sewer pipe, prefabricated watertight connectors shall be used. If such connectors are not available and pipe to pipe connection are required, any excess space in pipe bells shall be properly caulked and sealed. The entire joint connection shall then be encased with a minimum of six (6") inches of Class "A" concrete reinforced as shown in the "Concrete Encasement" detail of the Standard Details. It shall extend along the pipe a minimum distance of one pipe diameter on each side of the joint.

C 7.8 DUCTILE IRON PIPE IN TUNNEL

Ductile iron pipe installed through casing pipe shall be of mechanical or push-on joint. Timber skids, or other types acceptable to the City, shall be furnished and installed as necessary. Each joint shall be made up complete, tightened, and gasket position gauged prior to the pipe being placed into final position in the casing pipe.

C 7.9 THRUST BLOCKING:

Reaction or thrust blocking shall be provided at each hydrant, valve, bend, tee, tapping sleeve, and at reducers or fittings where changes in pipe diameter occur. Thrust block shall be centered on the longitudinal axis of the pipe and extended to solid undisturbed ground. The size and shape of the thrust blocking shall be as shown on the drawings or as specified in the contract documents.

C 7.10 MEASUREMENT

The measurement of ductile iron pressure pipe for payment purposes will be the horizontally measured length of the line along its main axis from center of fitting to center of fitting or end of pipe without deduction for the length of intermediate fittings or valves.

Ductile Iron fittings will be measured separately.

C 7.11 PAYMENT

Payment will be made at the unit price bid per linear foot of pipe installed for the various classes and sizes of pipe. Such payment shall be full compensation for all labor and materials including trenching, embedment, and backfilling necessary to make the complete installation.

C 8 INSTALLATION OF VITRIFIED CLAY SEWER PIPE

C 8.1 SCOPE

This section of the specifications covers the installation of vitrified clay sewer pipe and is provided as guidance for repair and/or maintenance of existing vitrified clay sewer pipe only.

C 8.2 EMBEDMENT

The minimum permissible embedment for vitrified clay sewer pipe with 10 ft. or less cover shall be Class "F" as set forth in Section 3.14f. of these specifications.

Where the height of backfill over the top of the pipe exceeds 10 ft., Class "B" Embedment as defined in Section 3.14b. shall be the minimum permissible embedment.

C 8.3 PIPE HANDLING

At all times material shall be handled with care to avoid damage. Whether moved by hand, skidways, or hoists, material shall not be dropped, bumped, or allowed to impact on itself.

Pipe and fittings shall be handled and stored so that no weight, including the weight of the pipe itself, will bear on or be supported by the pre-molded joint material. The spigot ring shall not be dragged on the ground or allowed to be damaged by contact with gravel, crushed stone, or other hard objects.

C 8.4 LAYING AND JOINTING

a. Laying. The pipe and specials shall be so laid in the trench that after the project is completed to the grade interior surface shall conform accurately to the grade and alignment indicated on the plans. Pipe shall be laid with the bell (or groove) up grade unless otherwise approved by the engineer.

b. Cleaning. Before laying, the interior of the bell shall be carefully wiped smooth and clean and the annular space shall be kept free from dirt, stones or water. All water must be kept out of bell hole during laying.

c. Jointing. Pipe shall be installed and joints made up in complete conformance with the instructions and recommendations regarding proper installation and assembly furnished by the manufacturer.

C 8.5 CONNECTIONS TO MANHOLES AND OTHER STRUCTURES

Where pipe connects with outside faces of manhole walls or the outside faces of the walls of other structures, a short pipe stub 12 to 18 inches in length shall be extended from the manhole or other wall face to provide a flexible joint near the wall face. Where connecting to an existing manhole, a temporary watertight plug shall be installed in the line at the downstream end (outlet pipe) of the manhole unless service is disrupted. This may be the

case where more than one line ties into the manhole. If a disruption of existing service occurs, the new system (line) should be plugged a minimum of three feet (3') from the connection or removal of the plug shall not be done prior to the acceptance of the new system. The Contractor will be required to remove all water and other materials from the new sanitary sewer system prior to its connection. The ground water, construction water, and/or other materials shall not be discharged into the City's existing sanitary sewer system. The Contractor's failure to abide by this specification may result in their being barred from doing future construction.

C 8.6 MEASUREMENT

The measurement of vitrified clay sewer pipe for payment purposes will be horizontally measured length of the line from center of the fitting or manhole to center of fitting or manhole without deduction for intermediate fittings or manholes.

Trench depth shall be measured from the surface of the ground to the flow line of the pipe.

C 8.7 PAYMENT

Payment will be made at the unit price bid per linear foot of pipe for the pipe sizes and trench depths as set forth in the contract documents. Such payment shall be full compensation for all labor and materials –including trenching, and backfilling necessary to make the complete installation.

C 9 INSTALLATION OF POLYVINYL CHLORIDE (PVC) SEWER PIPE

C 9.1 SCOPE:

This section of specifications covers the installation of polyvinyl chloride (PVC) sewer pipe for gravity flow sewers.

C 9.2 EMBEDMENT

The minimum embedment for PVC sewer pipe shall be Class "B" as defined in Section 3.14 of these specifications.

C 9.3 STORAGE OF PIPE AND FITTINGS

The interior, as well as all sealing surfaces of all pipe, fittings, and other accessories shall be kept free from dirt, and foreign matter. Pipe bundles shall be stored on flat surfaces with uniform support. Pipe and gaskets stored outside shall be protected from sunlight as recommended by the manufacturer. Clear plastic sheets shall not be used, and air circulation shall be provided under covering. Gaskets shall be kept away from oil, grease, electric motors (which produce ozone), excessive heat and direct rays of the sun.

C 9.4 PIPE HANDLING

Materials shall at all times be handled properly to prevent damage in accordance with manufacturer's recommendations. Pipe and fittings shall not be thrown, dropped, or dragged.

C 9.5 CURVED ALIGNMENT

Where curved alignment is required, the recommended allowable minimum curve radii PVC sewer pipe shall be based on the formula:

$R = 300 D$; where

R = minimum allowable radius of curvature from bending,

D = outside pipe diameter, (where R and D are in the same dimensional units.)

C 9.6 JOINTING

- a. Cutting and Beveling Pipe: For shorter than standard pipe lengths, field cuts may be made with either hand or mechanical saws or plastic pipe cutters. Ends shall be cut square and perpendicular to the pipe axis. Spigots shall have burrs removed and ends smoothly beveled by a mechanical beveler or by hand with a rasp or file. Field spigots shall be stop-marked with felt tip marker or wax crayon for the proper length of assembly insertion. The angle and depth of field bevels and lengths to stop-marks shall be comparable to factory pipe spigots.

- b. Bell Holes for Elastomeric Seal Joints. The bell hole shall be no larger than necessary to accomplish proper joint assembly. When joint has been made, the void under the bell shall be filled with bedding or haunching material to provide adequate support to the pipe throughout its entire length.
- c. Assembly of Joints. All joints shall be assembled in accordance with the recommendations of the manufacturer. Proper jointing may be verified by rotation of the spigot by hand or with a strap wrench. If unusual jointing resistance is encountered or if the insertion mark does not reach the flush position, disassemble the joint, inspect for damage, reclean the joint components and repeat the assembly steps.

C 9.7 BRANCH CONNECTIONS

Fittings for service branches in new construction shall be molded or fabricated with all gasketed connections. Taps into existing lines shall use a gasketed fitting in conjunction with a repair sleeve coupling or a gasketed saddle wye or tee with all stainless steel clamps. Saddles may be mounted on pipe with solvent cement or gasket but shall be secured by metal banding. Saddles shall be installed in accordance with manufacturer's recommendations. Holes for saddle connections shall be made by mechanical hole cutters or by keyhole saw or sabre saw. Holes for wye saddles shall be laid out with a template and shall be deburred and carefully beveled where required to provide a smooth hole shaped to conform to the fitting.

The Contractor will be permitted to use fittings which are prefabricated using pipe sections, molded saddles and PVC solvent cement, provided the solvent cement used in fabrication has cured at least 24 hours prior to installation. Cemented mitered connections without socket reinforcement shall not be permitted. Only PVC primer and solvent cement shall be used in cementing in accordance with the cement manufacturer's recommendations and ASTM D2855. "Making Solvent-Cemented Joints with PVC Pipe and Fittings."

C 9.8 MANHOLE CONNECTIONS

All manhole connections shall be made using proper water stops. If Portland Cement grout is incorporated in the manhole connection, the grout shall be of a type that expands, rather than shrinks, upon curing. Where connecting to an existing manhole, a temporary watertight plug shall be installed in the line at the downstream end (outlet pipe) of the manhole unless service is disrupted. This may be the case where more than one line ties into the manhole. If disruption of existing service occurs, the new system (line) should be plugged a minimum of three feet (3') from the connection to the existing system (line or manhole). The final connection or removal of the plug shall not be done prior to the acceptance of the new system. The Contractor will be required to remove all water and other materials from the new sanitary sewer system prior to its connection. The ground water, construction water, and/or other materials shall not be discharged into the City's existing system. The Contractor's failure to abide by this specification may result in their being barred from doing future construction.

C 9.9 PVC PIPE IN CASINGS

Runners or cradles shall be used to support all pipe in casings. One end of the casing spacer or skid shall be secured at the insertion mark on the spigot end of the pipe to avoid over assembly during the installation of the pipe in the casing. Wooden skids shall not be made of creosote treated wood. The maximum span between the supports for pipe lengths of 20 feet shall not exceed that shown in the following table:

MAXIMUM RECOMMENDED SUPPORT SPACING FOR 20-FOOT LENGTHS OF PVC SEWER PIPE AT MAXIMUM TEMPERATURE OF 73.4 DEGREES F (23 DEGREES C)

<u>Nominal Pipe Size (Inches)</u>	<u>Unsupported Span (Feet)</u>
4	6.25
6	6.75
8	7.50
10	7.75
12	8.00
15	8.25

C 9.10 MEASUREMENT

The measurement of polyvinyl chloride (PVC) pipe for payment purposes will be the horizontally measured length of the line from center of fitting or manhole to the center of fitting or manhole without deduction for intermediate fittings or manholes.

Trench depth shall be measured from the surface of the ground to the flow line of the pipe.

C 9.11 PAYMENT

Payment will be made at the unit price bid per linear foot of pipe for the pipe sizes and trench depths as set forth in the contract documents. Such payment shall be full compensation for all labor and materials - including trenching, embedment, and backfilling - necessary to make the complete installation.

C 10 INSTALLATION OF REINFORCED CONCRETE PIPE

C 10.1 SCOPE

This section of the specifications covers the installation of reinforced concrete pipe with rubber gaskets for use in the sanitary sewer system.

C 10.2 EMBEDMENT

Where the depth of cut - measured from the pipe flow line to the surface of the ground - does not exceed 10 ft., the minimum permissible embedment for Class III pipe, as defined in ASTM C 76, shall be Class "E" as set forth in Section 3.14e of these specifications.

For all other pipe classifications and trench depths, the embedment shall be as shown on the plans.

C 10.3 PIPE HANDLING

Care shall be taken to prevent any collision of one pipe section with another which will result in chipping or spalling, particularly to joint surfaces.

C 10.4 PIPE LAYING AND JOINTING

- a. **Inspection.** Allowable manufacturing irregularities of the pipe shall be fitted and adjusted so that the lower one-half of the inside surfaces of adjacent sections of pipe will provide the best possible flow conditions. Prior to jointing, an inspection shall be made to be certain that the pipe ends and gaskets are thoroughly clean with no foreign matter adhering to them.
- b. **Jointing.** The bell groove slopes of the preceding pipe shall be coated with a lubricated material, such as flax soap or other lubricant approved by the manufacturer for this purpose. Petroleum lubricants will not be permitted. The pipe shall then be assembled by pulling the tongue or spigot of the joint being laid into the groove or bell of the preceding pipe with sufficient force necessary to make a tight seal on the gasket. All joints shall be checked with a feeler gauge. If any irregularity in the position of the gasket is detected at any point on the entire circumference of the pipe, the pipe shall be removed and the gasket examined for cuts. If the gasket is undamaged, it may be used again, but both it and the joint must be relubricated. Before the pipe sling is removed, the rubber gasket of the joint shall be checked for proper position as outlined above. Jointing shall be done in a manner to prevent damage to the pipe and joints.
- c. **Laying.** The pipe and specials shall be so laid in the trench that after the project is completed the interior surface shall conform accurately to the grade and alignment indicated on the plans. Pipe shall be laid with the bell (or groove) end up grade unless otherwise approved by the engineer.

C 10.5 MEASUREMENT

The measurement of reinforced concrete sewer pipe for payment purposes will be the horizontally measured length of the line from center of fitting or manhole to center of fitting or manhole without deduction of intermediate fittings or manholes. Trench depth shall be measured from the surface of the ground to the flow line of the pipe.

C 10.6 PAYMENT

Payment will be made at the unit price bid per linear foot of pipe for the pipe sizes and trench depths as set forth in the contract documents. Such payment shall be full compensation for all labor and materials - including trenching, embedment, and backfilling -necessary to make the complete installation.

C 11 INSTALLATION OF DUCTILE IRON FITTINGS

C 11.1 SCOPE

This section of the specifications covers the installation of ductile iron fittings.

C 11.2 TYPES OF FITTINGS

Ductile iron fittings shall consist of crosses, tees, bends, offsets, plugs, caps, sleeves, connecting pieces, etc. for use with PVC and ductile iron piping systems.

C 11.3 JOINTING

- a. Mechanical Joint. Shall comply with procedure set forth in Section C 7.6 of these specifications
- b. Push-On Joint. Shall comply with procedure set forth in Section C 7.6 of these specifications.
- c. Flanged Joints. Flanged connections shall be made by means of erection bolts and drift pins without undue forcing and with no restraint on the ends of the pipe or fittings which would prevent pressure from being evenly and uniformly applied to the gasket. The gaskets shall be full face, manufactured true to shape from approved black neoprene rubber stock of a thickness not less than one-sixteenth (1/16) inch. The gasket shall be of virgin stock and shall conform to the physical and test requirements specified in ANSI/AWWA C111. Finished gaskets shall have holes punched by manufacturer and shall match the flange pattern in every respect. Frayed cut edges resulting from job site gasket fabrication shall not be acceptable except under emergency conditions, and then only when specifically approved. The pipe or fitting must be free to move in any direction while bolting. Flanged bolts shall be installed with all bolt heads faced in one direction except specified otherwise.

C. 11.4 POLYETHYLENE WRAPPING

All ductile iron fittings shall be fully wrapped (double wrapped) with polyethylene wrapping as set forth in Section C16 of these specifications.

C 11.5 MEASUREMENT

Ductile iron fittings will be measured for payment as part of the price bid for pipe.

C 11.6 PAYMENT

Ductile iron fittings, including polywrap, blocking, bolts, gaskets, or any other joint accessories, shall be subsidiary to the price bid for pipe and no separate payment will be made for fittings.

CII.6PAYMENT

Payments will be made at the unit price bid per unit weight of ductile iron fittings. Such payment shall be full compensation for all labor and materials necessary to make the complete installation.

C 12 FIRE HYDRANT INSTALLATION

C 12.1 SCOPE

This section of the specifications covers the installation of fire hydrants.

C 12.2 FIRE HYDRANT LEADS

All fire hydrant leads shall be at least six inches (6") in diameter. Where fire hydrant leads are stubbed from mains twelve inches (12") and larger in diameter, a gate valve shall be installed in the hydrant lead between the fire hydrant and the main. Where fire hydrants are located along the major thoroughfares or streets with large volumes of traffic, a gate valve will be installed in the hydrant lead regardless of the size of the supply main if so directed by the City. On fire hydrant leads requiring gate valves the gate valve shall be restrained to the main.

C 12.3 FIRE HYDRANT LOCATION

Where possible, fire hydrants shall be located so that the face of the fire hydrant is three (3) to five (5') feet behind the back of the curb with the steamer nozzle facing the street. Fire hydrants will be located outside of curb returns at intersections and outside of all sidewalks.

The City may vary this location somewhat if street paving procedures require it.

C 12.4 DEPTH OF BURY:

The normal depth of bury shall be four feet (4') unless otherwise shown. In no case shall the depth of bury exceed six feet (6'). Where main depths are greater than six feet (6'), offsets, bends, and fittings as required shall be used to reduce the depth of bury to no more than six feet (6'). Fire hydrants installed between four feet (4') and six feet (6') deep shall be installed with Gradeloc or ductile iron fittings.

C 12.5 INSTALLATION

The hydrant shall be set vertical and to a depth such that the center of the steamer nozzle is not less than sixteen inches (16") nor more than twenty inches (20") above curb grade.

Each fire hydrant shall be set on a concrete slab not less than sixteen inches (16") square and six inches (6") in minimum thickness.

Around the base of the hydrant there shall be placed not less than seven (7) cubic feet of crushed rock or washed gravel to provide reservoir capacity so that the hydrant will completely drain when closed.

The hydrant shall be carefully and firmly blocked against firm trench walls with Class "A" concrete. Provisions must be made to protect the hydrant drain from blockage.

C 12.6 MEASUREMENT

Fire hydrants will be measured for payment per each, complete in place. Offsets, bends, or fittings for the adjustment of depth of fire hydrant bury shall be considered subsidiary to the price bid for the fire hydrant.

C 12.7 PAYMENT

Payment for fire hydrants will be made at the unit price bid for each, which unit price will include all necessary extensions. Such payment shall be full compensation for all labor and materials necessary to make the complete installation.

C 13 GATE VALVE AND TAPPING SLEEVE & VALVE INSTALLATION

C 13.1 SCOPE

This section of the specifications covers the installation of gate valves and tapping sleeves and valves.

C 13.2 HANDLING GATE VALVES

Valves shall be carefully handled and lowered into position in such a manner as to prevent damage to any part of a valve. The valve shall be placed in the proper position and held securely until all connections have been made.

C 13.3 INSTALLING GATE VALVES

Where valves are to be placed in concrete vaults or structures, the floor or bottom shall be completed before installing the valve. The valve shall be securely blocked so that its weight is carried by the floor rather than being supported by the connected piping.

Valves not housed in concrete structures shall be supported on the bottom and sides by Class "A" concrete. An adjustable cast iron valve box and cover shall be provided for each buried valve. All valve boxes shall be two piece screw type with the stem or extension (if required to bring operating nut to within four feet (4') of natural ground or finished grade) in a truly vertical position with the box centered over the operating nut.

The use of pieces of asbestos-cement, PVC, or cast or ductile iron pipe as valve boxes shall not be permitted. However, ductile iron pipe shall be used on valves deeper than six feet (6'), but in all cases the top portion shall be an adjustable screw type valve box. Ductile iron pipe shall not be in pieces, but shall be one solid piece.

When the valve box is in position and the top of the box adjusted to the proper elevation, select backfill material shall be placed around the valve box and thoroughly tamped. After compaction the contractor shall verify that the valve has remained in a vertical position for ease of valve operation.

C 13.4 INSTALLING TAPPING SLEEVES AND VALVES

Mechanical joint and two (2) piece tapping sleeves shall be used. The use of caulked type tapping sleeves will not be permitted.

Prior to placement of the tapping sleeve, the surface of the pipe to be tapped shall be thoroughly cleaned.

Tapping sleeves shall be oriented so that the valve setting shall be truly vertical.

The procedure for installing tapping valves shall be identical to that described above for gate valves. Concrete blocking shall be placed in accordance with Fig. 4. The tapping sleeve shall have thrust blocking placed as for a tee or plug.

C 13.5 MEASUREMENT

If gate valves and tapping sleeves and valves are not included as subsidiary components of a structure or connection they shall be measured by the units of various size complete in place including concrete pads, required valve stem extensions, and valve boxes and covers.

C 13.6 PAYMENT

Payment for the various sizes of gate valves and tapping sleeves and valves will be made at the unit prices bid which shall be full compensation for all labor and materials necessary to make the complete installation.

C 14 COMBINATION AIR VALVES

C 14.1 SCOPE

This section of the specifications covers the installation of combination air valves in the water supply and water distribution system.

C 14.2 VALVE SIZES

Minimum size valves and fittings shall be in accordance with the following table or as indicated on the plans:

<u>Main Size</u>	<u>Valve Size</u>
16" through 36"	2"
39" and larger	3"

Equivalent sized taps shall be provided for the above sized valves.

C 14.3 ACCESS MANHOLE AND EXHAUST PIPING

All air and combination air valves shall be installed in manholes having a minimum inside diameter of 48 inches. Outside paved areas, Class III Reinforced Concrete Pipe (ASTM C 76) may be used for the access manhole with a 3/8 inch thick steel cover with a 2" rim sized to fit over the pipe.

Outside paved areas, the exhaust piping may penetrate the steel cover of the access manhole. Inside paved areas, the exhaust piping shall be sloped upward to a point outside the paved area.

C 14.4 MEASUREMENT

Air valves and combination air valves will be measured per each, by size, complete in place including required main taps or outlets, valves, fittings, piping, access manholes and covers, etc., complete in place.

C 14.5 PAYMENT

Payment for the various sizes of combination air valves shall be made at the unit prices bid which shall be full compensation for all labor and materials necessary to make the complete installation.

C 15 INSTALLATION OF MISCELLANEOUS VALVES

C 15.1 SCOPE

This section of the specifications covers the installation of miscellaneous valves, flap valves and check valves, in the water and sanitary sewer systems.

C 15.2 HANDLING

Valves shall be carefully handled and lowered into position in such a manner as to prevent damage to any part of the valve. The valve shall be placed in the proper position and held securely until all connections have been made. Valves shall be wrapped with polyethylene wrap as described in Section C.16.

C 15.3 INSTALLATION OF FLAP AND CHECK VALVES

Where check valves are to be placed in concrete vaults or structures, the floor or bottom shall be completed and inspected before installing the valve. The valve shall be securely blocked so that its weight is carried by the floor rather than being supported by the connected piping.

When installing flap valves on the end of a pipe run, the valve shall be installed in a truly vertical position.

C 15.4 MEASUREMENT

Where miscellaneous valves are not included as subsidiary components of a structure or connection, they shall be measured by the units of various size complete in place.

C 15.5 PAYMENT

Payment for the various sizes of miscellaneous valves will be made at the unit prices bid which shall be full compensation for all labor and materials necessary to make the complete installation.

C 16 INSTALLATION OF POLYETHYLENE WRAP

C 16.1 SCOPE

This section of the specifications covers the installation of polyethylene wrap on ductile iron pipe and all fittings and valves in accordance with ANSI A21.5/AWWA C105, latest revision.

C 16.2 USE

In order to form a dielectric barrier against electrolytic soil action polyethylene wrap shall be used on all ductile iron pipe fittings and appurtenances.

C 16.3 INSTALLATION ON PIPE

To install polyethylene wrap on ductile iron pipe, the following procedure shall be followed:

- a. Place Wrapping on Pipe: By the use of a sling or pipe tongs, the pipe shall be raised a suitable working distance off the ground. A polyethylene tube approximately two feet longer than the pipe joint shall be slipped over the spigot end of the pipe, centered, and the excess length gathered near the hoisting sling. The wrapping shall be taped so that smooth unwrinkled wrapping extends one foot past the spigot end. The polyethylene tape furnished shall be in conformance with Section B17.3
- b. Lower Pipe into Place. The pipe shall be lowered into the trench and the joint made with the preceding pipe section. A shallow bell hole must be made at joints to facilitate installation of the polyethylene tube.
- c. Complete the Wrapping Installation. After the pipe joint has been made, the bunched polyethylene from the preceding length of pipe shall be pulled over the new pipe length and taped or otherwise secured. The end of the polyethylene on the new pipe section shall be slipped over the first wrap until it overlaps the joint for one (1') foot the end of the preceding length of pipe. The overlap shall be secured in place.

The slack width shall be taken up to make a snug, but not tight, fit along the pipe barrel and secured at the quarter points.

- d. Repairs. Any rips, punctures, or other damage to the polyethylene shall be repaired with polyethylene tape or with a short length of polyethylene tube cut open, wrapped around the pipe, and secured in place.
- e. Successive Pipe Runs. Repeat steps a. through d.

C 16.4 INSTALLATION ON FITTINGS AND SPECIALS:

Fittings, such as bends and reducers, shall be wrapped in a manner similar to that described in paragraph C 16.3a. to C 16.3c. However, all bolts on mechanical joint and/or flanged fittings shall receive an extra (separate) wrapping of polyethylene in addition to that described herein. This wrapping shall be beneath the overall wrapping and shall be taped in place using the approved materials. Polyethylene wrapping shall have no bulges, large air gaps or pockets which can accommodate ground water left when the wrapping is completed.

Appurtenances such as valves, hydrants, crosses, etc., shall be wrapped by splitting, tucking and overlapping the polyethylene tube, then closing the field made splices with the required tape. All seams shall be folded twice prior to taping in accordance with AWWA C 105.

Material to cover valves may be acquired from the overlapping excess polyethylene tube on the adjacent pipe lengths. The tubing should be drawn over the bell of pipe on either side and insulated with field made seams as described above.

Hydrants shall be encased with the polyethylene tubing slipped over the hydrant and extended to a point 2 to 3 inches above the ground line. The wrap shall be perforated in the drain region to allow normal drain function of the hydrant.

All fittings and specials that require concrete blocking shall be completely wrapped prior to pouring the concrete blocking.

C 16.5 MEASUREMENT AND PAYMENT:

The furnishing and installing of polyethylene wrapping will not be measured and paid for directly but will be considered subsidiary to the unit prices bid for installing pipe, valves, or fittings, complete in place.

C 17 WATER SERVICE LINE INSTALLATION

C 17.1 SCOPE

This section of the specifications governs the construction of water services used to connect the customer's water meter to the City main.

C 17.2 GENERAL

"Service" shall be defined as a service line to an individual customer consisting of a corporation stop, Type "K" copper tubing, quarter bend coupling, curb stop, meter coupling, threaded galvanized pipe nipple, and a second meter coupling. A meter box furnished by the City shall be placed over the curb stop and connected threaded galvanized nipple spacer. Thread protector caps shall be placed on any exposed pipe threads.

"Bullhead" shall be defined as an individual service line with branches at the end to serve two customers consisting of a corporation stop, Type "K" copper tubing, quarter bend coupling, U-branch connection and curb stops. Each leg of the U-branch connection shall have a curb stop, meter coupling and threaded galvanized nipple spacer and be enclosed in a City furnished meter box. All exposed pipe threads shall be protected with a thread protector.

C 17.3 TAPS

All taps in ductile iron water mains shall be installed through a bronze double strap tapping saddle.

Taps in concrete cylinder water mains shall be made where possible at locations where factory fabricated threaded couplings exist. A bronze or brass bushing shall separate the corporation stop from the steel coupling. At locations other than where factory fabricated threaded couplings exist, taps shall be made through a double strap tapping saddle. Taps in PVC water lines shall be made using double strap tapping saddles.

Taps shall not be made at an angle of more than 45 above the spring line of the pipe. All taps on PVC water mains shall be in accordance with Unibell standards.

C 17.4 LOCATION AND DEPTH OF COVER

All water services shall be located so that the edge of the meter box nearest the street is located three feet (3') behind the back of the curb unless otherwise approved by the City. At the point where the water services cross beneath the curb, the minimum depth of cover from the bottom of pavement shall be three feet (3'). The end of the water service shall be located eight inches (8") to ten inches (10") below the top of the meter box when the meter box is placed flush with the finish grade of the parkway. Where meter banks are installed (3 or more meters), permanent metal tags with addresses shall be installed on the service line at the curb stop to correlate the service with the address to be served. Where existing services are to be connected to for tie-ins or relocations, a compression coupling shall be used to make the

connection. Only full length joints of pipe shall be used for connecting to an existing service or for a new service being installed within the pavement area of a street for services larger than one inch (1") in diameter. No couplings shall be installed within the pavement area of the street for services one inch (1") in diameter and smaller.

C 17.5 METER BOX INSTALLATION

After the curb and gutter and base courses of asphalt have been installed and the street contractor has restored to good condition the parkway area behind the curb, the contractor shall install a City furnished meter box over the end of each water service. The City will furnish the Contractor one meter box initially for each water service constructed. Any additional meter boxes required to replace boxes damaged after installation will be at the expense of the contractor.

C 17.6 TESTING

Each water service line and/or bullhead shall be checked for leaks and full flow at the time the water mains are pressure tested.

C 17.7 MEASUREMENT

Water services and/or bullheads will be measured for payment per each, classified according to size, location, and length--if different categories of length are set forth in the Proposal or other contract documents.

C 17.8 PAYMENT

Water services and/or bullheads will be paid for at the unit price for each complete in place, including all labor and materials necessary to make the complete installation, including tapping the main with or without tapping saddle as required.

C 18 VAULT AND MANHOLE CONSTRUCTION

C 18.1 SCOPE

This section of the specifications covers the construction of vaults for water valves, control devices, large meters, etc., and sanitary sewer manholes.

C 18.2 WATER LINE VAULTS

- a. General. Vaults may be of Class "A" reinforced concrete, precast reinforced concrete or as specifically shown on the project plans. If not shown on the project plans or appurtenant drawings, the following requirements shall govern:
 - (1) Cast-in-place vault walls shall be formed on both sides to the specified thickness. Unless shown otherwise on the project plans or in the contract documents, walls shall not be less than six inches (6") in thickness.
 - (2) The top slab, floor and inside walls of vaults shall be completely sealed with two coats of Thoroseal (off-white) as manufactured by Thoro System or as approved by the City. Any visible leakage, no matter how small, shall be sealed and stopped.

C 18.3 MANHOLES

Standard sanitary sewer manholes shall be constructed as monolithic concrete structures or as precast reinforced concrete structures. Fiberglass may be used only when specifically approved by the Engineer.

- a. Foundations. Foundations of manholes for sanitary sewer shall be of Class "A" concrete. The bottom of the foundation shall be at least eight (8") inches below the bottom of the pipe and shall extend at least six (6") inches past the outside of the manhole. The trough shall be smooth, accurately shaped, and in accordance with the plans. Where changing line sizes, the crowns (top insides) of the pipe shall be matched unless otherwise approved by the Water Utilities Department. The invert of the manholes shall be shaped and smooth so that no projections will exist and flow channels will be formed in the inverts so that the manhole will be self-cleaning and have smooth flow transitions. They shall be free of areas where solids may be deposited as sewage flows through the manhole from all inlet pipes to all outlet pipes. Where the pipe can be laid continuously through the manhole, the pipe can be placed in the base. Pipe boots such as Kor-n-Seal connection, or approved equal, shall be installed around the pipes where they pass through the manhole wall. After the construction of the manhole, the pipe can be trimmed by cutting out the top half of the pipe after the concrete base is constructed and has cured sufficiently. If it is not possible to lay the pipe continuously through the manhole base, the base may be poured and formed directly in the concrete of the manhole base. The invert bench shall have a minimum slope of 1/4 inch per foot to the pipe trough. The manhole invert shall extend from wall to wall. At changes of direction or changes of

grade the minimum drop across the manhole invert shall be 0.1 foot or as shown on the plans.

Pipe extending from the manhole shall be cradled in concrete to the first pipe joint in the same pour as the manhole foundation.

Rock cushion shall be used beneath manhole bottoms where water is encountered. In the event that ground water is present during the pouring of a cast-in-place manhole foundation, a pump shall be used to remove the ground water. Prior to pouring, the subgrade shall be stable, free from muck, etc. After the concrete foundation has been poured, the pump shall continue to run for at least one (1) hour to enable the concrete to obtain its initial set.

- b. Precast Reinforced Concrete Manholes. The standard sanitary sewer manholes of the precast reinforced concrete type shall be constructed of ASTM C 76 Class III reinforced concrete pipe and shall be of the bell and spigot design incorporating trapped ring gaskets.

In precast manhole construction, combinations of joint lengths shall be selected to minimize the number of individual segments required to provide the total depth specified. Long joints shall be used in the bottom with shorter segments utilized for the top adjustments. The inside diameter of the manhole shall be forty-eight inches (48") or sixty inches (60") minimum.

Pipe boots such as Kor-n-Seal flexible pipe to manhole connection or approved equal shall be installed at all connections to manhole bases of the diameter pipe being installed. The material is to be EPDM Rubber.

Where precast manhole bottoms are utilized, the excavation shall be undercut by a minimum of six inches (6") and shall be backfilled to grade with one inch (1") diameter washed rock.

- c. Cast-In-Place (Monolithic) Concrete Manholes. Cast-in-place concrete manholes shall have an inside diameter at the base of four feet (4') or six feet (6') and an inside diameter at the top of the barrel of not less than twenty-six inches (26"). The manhole shall have a minimum wall thickness of six inches (6") and shall be smooth having no form marks on the interior wall or exterior wall of the manhole exceeding one-quarter inch ($\frac{1}{4}$ ") in depth. Concrete used for the manhole barrel shall be Class "A" with a slump of five inches (5") to seven inches (7") during the pour. During the pour of the concrete in the manhole barrel forms, thorough rodding or vibrating shall be completed after approximately each two feet (2') of pour into the form. If cold joints are necessary due to a time lapse of more than one hour between pours or the adjustment of the manhole, a concrete bonding adhesive shall be applied to the existing concrete. A concrete collar at least four inches (4") thick shall extend a minimum of eight inches (8") above and below the new joint around the outside of the manhole. If honeycombing of the barrel of the manhole is found to be present after removal of the forms, such honeycombing shall be

repaired as directed by the Engineer. Any form marks shall be smoothed and grouted as directed. Covers may be used at the option of the Contractor to protect the concrete to prevent cracking during the curing process and to protect the manhole during freezing temperatures. The manhole shall not be backfilled for at least 12 hours after forms have been removed. Cast in place manholes shall be coated prior to backfill with two mop coats of Tnemec 450 Heavy Tnemecol or Koppers Bitumastic Super Service, Black or a coating approved by the Engineer.

Water stops, a flexible pipe to manhole connector, or approved equal, will be installed around the pipe at all pipe-manhole wall penetrations. The material shall conform to ASTM C923.

- d. Grout. The grout to be used in all types of manholes for both the precast and cast-in-place manholes for inverts, the grouting of the ring and lid, and cold joints shall consist of one part cement to two parts masonry sand.

C 18.4 TESTING OF MANHOLES

All manholes shall be vacuum tested. Manholes shall be tested in the presence of the City's Representative. The vacuum test shall consist of applying a vacuum to the manhole.

Each manhole shall be tested after the installation has been completed. All pipes entering the manhole shall be plugged, taking care to securely brace the plug from being drawn into the manhole. The test head shall be placed at the inside of the manhole cover frame, the seal inflated and the manhole shall be tested in accordance with the following. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches of mercury. The manhole shall pass if the time is greater than 60 seconds for 48" diameter, 75 seconds for 60" diameter and 90 seconds for 72" diameter manholes. For manholes deeper than 20 feet, the test times shall decrease by one second per foot of additional manhole depth.

C 18.5 MEASUREMENT

If vaults are not included as subsidiary components of a larger structure, they shall be measured by the units of various sizes and types complete in place.

Measurement for manhole structures shall be on a per each basis for a basic depth of six feet (6'). Extra depth in excess of the basic depth of six feet (6') shall be measured in one-tenth foot (0.1') increments.

C 18.6 PAYMENT

Payments for the various sizes and types of vaults will be made at the unit prices bid for each which shall be full compensation for all labor and materials necessary to make the complete installation.

Payment for manhole structures will be made at the unit prices bid per each. Extra depth for manholes in excess of the basic six foot (6') depth will also be made at the unit prices bid per linear foot. Payment for manholes and accompanying extra depth will be full compensation for all labor and materials necessary to make the complete installation.

C 19 INSTALLATION OF SANITARY SEWER CLEANOUTS

C 19.1 SCOPE

This section covers the installation of sanitary sewer cleanouts used on the end of some sanitary sewer mains.

C 19.2 CLEANOUTS ON SANITARY SEWER MAINS

Cleanouts shall be installed on sanitary sewer mains where shown on the project plans. Cleanout installations shall consist of a 22½° bend (1/16 bend) encased in Class "B" concrete, the appropriate length of six inch (6") diameter pipe for the cleanout stack, and the cleanout casting with cover installed on a 6" x 2' -0" x 2' -10" concrete slab and encased in Class "B" concrete. All cleanouts shall be a minimum of six inches (6") in diameter.

All castings with covers used for cleanouts on sanitary sewer mains shall be heavy duty cast iron.

C 19.3 MEASUREMENT

Cleanouts installed on sanitary sewer mains shall be measured per each, regardless of depth.

C 19.4 PAYMENT

Payment for cleanouts installed on sanitary sewer mains will be made at the unit price bid per each which shall be full compensation for all labor and materials to make the complete installation.

C 20 INSTALLATION OF SANITARY SEWER SERVICES

C 20.1 SCOPE

This section of the specifications covers the construction of sanitary sewer services used to connect the customer's sanitary sewer system at the property line or utility easement to the City's main.

C 20.2 GENERAL

A sanitary sewer service shall be defined as a service line connecting the customer's sewer system at the property line or utility easement to the City's main and shall consist of the service combination tee wye, the necessary Class "B" concrete cradle or crushed stone for the tee wye, the service pipe necessary to extend the line from the main to the customer's property line and a plug placed in the end of the service line.

Services for single family residences shall normally be four inches (4") in diameter.

C 20.3 EXTRA DEPTH SANITARY SEWER SERVICES

Where the sanitary sewer main is at a depth much greater than that necessary to serve the abutting property, an extra depth or deep sanitary sewer service connection shall be installed. The extra depth service is identical to a standard or "normal" sanitary sewer service except that pipe risers will be installed at a maximum forty-five (45) degree angle into the trench walls to connect the combination tee wye and forty-five (45) degree bend to the service pipe.

C 20.4 SLOPE AND DEPTH OF COVER

Where possible, a minimum slope of one-fourth inch (1/4") per one foot (1') - equivalent to two percent (2%) - slope down toward the main will be maintained on all sewer services.

Where the sanitary sewer main is located in the street and the abutting property slopes to the street, the sanitary sewer service shall normally have a minimum depth of four feet (4') below the top of the curb at the point where it passes beneath the curb.

Where abutting property slopes away from the sanitary sewer main, sewer services shall be placed at a depth adequate to serve the normally expected use of the abutting property.

Where water and sanitary sewer services cross they shall be treated in accordance with the Texas Natural Resource and Conservation Commission Regulations, latest revision.

C 20.5 MARKING

The end of each sewer service shall be marked with heavy gauge polyethylene tape, six (6") inches in width with a thickness of .004 inches. The film should be yellow in color on which has been printed, "Caution Buried Sewer Line Below", in a continuous print. The heavy

gauge polyethylene tape shall be that as manufactured by Allen System Marking Tape or approved equal. The tape shall have a minimum tensile strength of 1,700 psi lengthwise and 1,200 psi crosswise.

The tape shall be securely tied to the end of the sewer service and placed in such a manner that when the trench is backfilled, approximately six (6") to twelve inches (12") of tape will be visible above the ground. The tape above ground shall be firmly attached to a two inch (2") by four inch (4") stake four feet long (4').

C 20.6 MEASUREMENT

Sanitary sewer services or extra depth sanitary sewer services will be measured for payment per each, classed according to size and length if different categories of length are set forth in the Proposal or other contract documents.

C 20.7 PAYMENT

Sanitary sewer service or extra depth sanitary sewer service will be paid for at the unit price for each, complete in place, including all labor and materials necessary to make the complete installation.

C 21 ELEVATED CROSSINGS

C 21.1 SCOPE

This section of the specifications covers the installation of elevated crossings of water or sanitary sewer lines over creeks and waterways.

C 21.2 FOUNDATIONS

Foundations for elevated crossings will be drilled shafts of a diameter sufficient to carry the dead and superimposed loads. Where rock is present, drilled shafts shall penetrate into sound rock at least 2 feet. Where no rock is present, the minimum depth of drilled shafts shall be at least ten feet (10') below the bottom of the stream bed.

The use of spread footings as a foundation for elevated crossings is to be avoided.

All drilled shafts will be constructed of Class "A" concrete in accordance with the plans.

C 21.3 CARRIER PIPE

Where the pipe acts as a structural beam and is not supported by a truss, I beam, etc., the pipe shall be either ductile iron or concrete cylinder pipe specifically manufactured and fabricated for the individual project. There shall be at least one foundation support for each joint of pipe.

At each support, the carrier pipe shall be secured to the support with galvanized steel straps.

C 21.4 ANCHORAGES

Elevated crossings shall be anchored at each end where the pipe structure enters the ground. Anchorages shall be constructed of Class "B" concrete and of such a size and configuration as shown in the plans and specifications.

C 21.5 CROSSING APPURTENANCES

For sanitary sewer main crossings a manhole shall be placed at each end of the crossing behind the anchorages. For water line crossings, twelve (12") inches and smaller, a valve shall be placed at each end of the crossing behind the anchorages.

C 21.6 MEASUREMENT

Elevated crossings will be measured for payment as specified in the respective items in the proposal at the unit price bid.

C 21.7 PAYMENT

The contract price shall be full compensation for all labor and materials necessary to make the complete installation.

C 22 CONSTRUCTION OF BORED, JACKED, OR TUNNELED CROSSINGS

C 22.1 SCOPE

This section of the specifications governs the installation of encasement or carrier pipe for water and sanitary sewer mains by the methods of jacking, boring or tunneling.

C 22.2 GENERAL

Where encasement or carrier pipe is required to be installed under railroad embankments or highways, streets, or other facilities by jacking, boring or tunneling methods, construction shall be made in a manner that will not interfere with the operation of the railroad, highway, or other facility, and will not weaken or damage any embankment or structure. During construction operations, barricades and lights to safeguard traffic and pedestrians shall be furnished and maintained, as approved by the City and shown in the City of Arlington Work Area Traffic Control Manual, until such time as the backfill has been completed and then shall be removed from the site. The Contractor shall notify the railroad company or Texas Department of Transportation at least 48 hours prior to construction. The Contractor shall provide insurance with limits as required by the governing authority.

The drilling of pilot holes for the alignment of pipe prior to its installation by jacking, boring or tunneling will not be a requirement but may be necessary to maintain grade. The drilling of pilot holes will be considered as incidental work and the cost thereof shall be included in such contract pay items as are provided in the proposal and contract.

The Contractor shall take the proper precautions to avoid excavating beyond the limits of excavation needed to install the pipe. All damages shall be repaired or replaced at the Contractor's expense. The removal of any obstruction that conflicts with the placing of the pipe will not be measured for payment or paid for as a separate contract pay item.

The removal of any such obstruction will be included in such contract pay items as are provided in the proposal and contract.

The Contractor shall dispose of all surplus materials at the Contractor's expense.

Jacking, boring, or tunneling may be used in lieu of open cut at the Contractor's discretion. No additional compensation will be provided.

All excavations shall be safely secured at all times to prevent unauthorized access to the excavation site.

C 22.3 CONSTRUCTION BY JACKING

If the grade of the pipe at the jacking end is below ground surface, suitable pits or trenches shall be excavated for the purpose of conducting the jacking operations and for placing end joints of the pipe. This excavation shall not be carried to a greater depth than is required for placing of the guide and jacking timbers and no nearer the roadbed than the minimum distance shown on the plans.

At the other end of the pipe, an approach trench shall be excavated accurately to grade. All open trenches and pits shall be braced and shored in such a manner to adequately prevent caving or sliding of the walls into the trench or pit and be in accordance with OSHA standards for trench safety.

Heavy duty jacks suitable for forcing the pipe through the embankment shall be provided. In operating jacks, even pressure shall be applied to all jacks used. A suitable jacking head not less than 6 inches larger than the outside diameter of the pipe, usually of timber, and suitable bracing between jacks and jacking head shall be provided so that pressure uniformly will be applied to the pipe uniformly around the ring of the pipe. The jacking head shall be of such weight and dimensions that it will not bend or deflect when full pressure is applied at the jack. The jacking head shall be provided with an opening for the removal of excavated materials as the jacking proceeds. A suitable jacking frame or backstop shall be provided. The pipe to be jacked shall be set on guides which are straight and securely braced together in such a manner to support the section of the pipe and to direct it in the proper line and grade. All timber and other materials used in the construction of the jacking assembly will be of such quality and dimensions that they will withstand all stresses to which they are subjected in such a manner as to insure even pressures on the pipe during jacking operations. The whole jacking assembly shall be placed so as to line up with the direction and grade of the pipe.

As the jacking proceeds, the embankment materials shall be excavated slightly in advance of the pipe in such a manner to avoid making the excavation larger than the outside diameter of the pipe, with the excavated material being removed through the pipe. The excavation for the underside of the pipe, for at least one-third of the circumference of the pipe, shall conform to the grade of the pipe. The excavation for the top half of the pipe shall conform closely to the outside diameter of the pipe and a clearance greater than 2 inches will not be permitted. All voids between the pipe and the earth will be filled with grout proportioned one part Portland cement to 5 parts washed sand and an air entrainment agent to facilitate grout flow if necessary. Grout holes may be provided in the pipe or grouting may be made through drill holes from the ground surface if practical. The grouting shall follow immediately upon completion of the jacking operation.

All carrier pipe installed by jacking shall be supported by quarter point cradle of 2000 psi concrete across the jacking pit and to the first joint in the ditch section on each end.

The distance that the excavation shall extend beyond the end of the pipe depends on the character of the material, but it shall not exceed 2 feet in any case. Preferably, the pipe shall

be jacked from the low or downstream end. Lateral or vertical variation in the final position of the pipe from the line and grade established by the plans will be permitted only to the extent of 1 inch per 10 feet, provided that such variation shall be regular and only in one direction and that the final grade the flow line shall be in the direction indicated on the plans.

When jacking of pipe is once begun, the operation shall be carried on without interruption, insofar as practicable to prevent the pipe from becoming firmly set in the embankment.

Any pipe damaged in jacking operations shall be repaired or removed and replaced at the Contractor's expense.

The pits or trenches excavated to facilitate jacking operations shall be filled immediately after the jacking of the pipe has been completed unless an encasement pipe only has been installed; in which case, the trenches and pits shall be left open until the carrier pipe has been laid through and manholes have been built if required. The pipe or trenches will then be backfilled.

C 22.4 CONSTRUCTION BY BORING

The hole shall be bored mechanically with a suitable boring assembly designed to produce a smooth, straight shaft and so operated that the completed shaft will be at the established line and grade. The size of the bored hole shall be of such diameter to provide ample clearance for bells or other joints. All carrier pipe installed by boring shall be supported by quarter point cradle of Class "D" concrete across the boring pit and to the first joint in the ditch section on each end. All bore pits and other excavations shall be completed in accordance with OSHA standards.

All voids will be grouted with a 1:5 minimum mix of portland cement and clean washed sand with sufficient air entertainment to facilitate flow. Grout will be considered a part of the unit price of the boring operation.

C 22.5 CONSTRUCTION BY TUNNELING

The tunnel shall be excavated in such a manner and to such dimensions which will permit placing of the proper supports necessary to protect the excavation in accordance with OSHA standards. The Contractor shall take proper precautions to avoid excavating earth or rock or shattering rock beyond the limits of excavation shown on the plans. All damages by excavating and blasting, either to surface or subsurface structures, shall be repaired or replaced at the Contractor's cost and expense.

Adequate provisions shall be made for safety and health of the workers in accordance with OSHA standards. All equipment operated in the tunnel shall be powered by either air or electricity. No equipment will be permitted in the tunnel that uses a petroleum product for fuel. Electric lights shall be used for illumination of the tunnel construction.

The Contractor shall monitor the quality of air in the tunnel in accordance with OSHA standards.

A sufficient supply of fresh air shall be provided and maintained at all times in all underground places and provisions shall be made for the quick and complete removal of gases and dust resulting from blasting or other tunnel operations. Except when unnecessary due to natural ventilation, artificial ventilation shall be maintained in the tunnel by ventilating plants of ample capacity operated when needed to meet the preceding requirements.

If required by the plans or if required for safety, suitable steel or timber sheeting, shoring and bracing shall be used to support the sides and roof of the excavation. Supports may be left in place provided that they clear the encasement or carrier pipe. No separate payment will be made for supports left in place. Nothing contained herein shall prevent the Contractor from placing such temporary or permanent supports as shall be deemed necessary, nor shall it be construed as relieving the Contractor from full responsibility for the safety of the work, and for all damages to persons and property.

If specified, the entire void between the outside of the pipe and the tunnel walls shall be backfilled with Class "D" concrete or grouted with 1:5 minimum mix grout of portland cement and clean washed sand with sufficient entrained air to facilitate flow. The minimum thickness of concrete required for backfill in excess of the minimum dimensions shown on plan will be at the entire expense of the Contractor. The carrier pipe shall be inspected by televising or other means to insure that the pipe is constructed to proper line and grade prior to placement of grout.

All pipe damaged during operations shall be repaired or removed and replaced at the Contractor's expense.

C 22.6 JOINTS

When reinforced concrete pipe twenty-four (24") inches and larger in diameter with tongue and groove joints is used for the encasement pipe, the interior joints for the full circumference shall be sealed and packed with mortar and finished smooth and even with the adjacent section of pipe.

C 22.7 MEASUREMENT

Openings provided by jacking, boring or tunneling will be measured for payment in linear feet along the center line of the opening measured from face to face of the trench ends or pit walls between which the jacking, boring or tunneling traverses, and will not be classified for payment according to depth. The carrier pipe when required will be measured for pay as provided elsewhere in these specifications. The encasement pipe will be considered to be included in the unit price bid for jacking, boring or tunneling.

The Contractor will only be paid for the limits of the openings as shown on the plans and contract specifications. Any overrun, except as approved by the City, will be at the Contractor's expense.

C 22.8 PAYMENT

Openings provided by jacking, boring or tunneling will be paid for at the contract unit price per linear foot, complete in place, as provided in the proposal and contract. The contract unit price shall be the total compensation for furnishing and placing all materials; and for all labor, tools, equipment, encasement pipe and incidentals necessary to complete the work. The carrier pipe, when required, will be paid for as provided elsewhere in these specifications.

C 23 REMOVAL AND REPLACEMENT OF PAVED SURFACES

C 23.1 SCOPE

This section of the specifications covers the removal of paved surfaces for the installation of water and sanitary sewer facilities and the replacement of these paved surfaces after the utilities have been installed.

C 23.2 DETOURS AND BARRICADES

The Contractor shall deliver a construction traffic control plan to the City Transportation Department for approval. After approval, the Contractor shall, before closing any street or causing any obstruction to traffic on any street, furnish and erect suitable barricades and warning signs to protect the traveling public, as set forth in the City of Arlington Work Area Traffic Control Manual or current requirements. The barricades and warning signs will be constructed, placed, and adequately maintained as directed by the City.

C 23.3 CUTS OF SIDEWALK, DRIVEWAY, OR CURB AND GUTTER

When a sidewalk, driveway, or curb and gutter are cut, such cuts shall be made with a pavement saw. At the discretion of the Owner, the Contractor may break out sidewalks, driveways, curb and gutter, etc., to the nearest expansion joint, but no additional payment will be made for the removal and replacement of the additional pavement unless previously approved by the City.

C 23.4 PAVEMENT CUTS

Prior to removal, all existing pavement shall be cut with a pavement saw the full depth of the pavement to be removed. If the depth of cut is not sufficient and a ragged edge results, the pavement shall again be sawed and a neat straight edge established. The additional saw cut and pavement replacement shall be at the Contractor's expense.

In reinforced concrete streets, the reinforcement shall be cut at the centerline of the ditch and bent back.

C 23.5 PAVEMENT REPLACEMENT

- a. Type 1. Asphalt Street HMAC - Hot Mix Asphaltic Concrete.
 - (1) The existing pavement shall be sawed to a neat straight line and removed. This line shall be as shown in the standard details for existing street backfill and repair.
 - (2) The pipe and embedment shall be installed as shown in the standard embedment details, and granular embedment material or crushed stone shall extend to a point at least one foot (1') above the top of the pipe.

- (3) Tamped native material shall then be placed in the ditch from the top of embedment to the bottom of the 2:27 concrete as shown on the standard detail for existing street backfill and repair.
 - (4) This material shall be thoroughly compacted after placement.
- (5) A six inch (6") layer of Class "A" (3,000 psi) concrete, extending twelve inches (12") outside the ditch line on each side shall be placed to a point two inches (2") below existing surface. On major arterials and thoroughfares, this six inch (6") layer of concrete shall be reinforced with #4 reinforcing steel spaced at twelve inch (12") centers both ways.
- (6) A tack coat of MS-Z or SS-1 shall be applied to the surface of backfill material and the edge of the existing hot mix. The tack coat shall be applied to each layer at a rate not to exceed 0.05 gallons per square yard of surface.
- (7) Two inches (2") of Hot Mix Asphaltic Concrete (Fine Graded Surface Course/Type D) shall be placed and compacted.

b. Type 2. All Concrete Streets

- (1) The existing pavement shall be sawed full depth to a neat straight line and removed. This line shall be at least twelve inches (12") back of the firm banks of the ditch when the ditch width conforms to maximum and minimum widths as set forth in Section C 3.5. The existing reinforcing steel shall be cut at the ditch centerline and bent back during ditching operations.
- (2) The pipe and embedment material shall be installed, as shown in the embedment details, and granular embedment material or crushed stone shall extend to a point at least one (1') foot above the top of the pipe. This material shall be thoroughly tamped after placement.
- (3) Tamped select native material shall then be placed in the ditch from top of embedment to within one foot (1') below the bottom of the existing concrete surface.
- (4) Six inches (6") of 2:27 concrete backfill material shall be placed in the ditch to the bottom of the original pavement surface.
- (5) Any material remaining between the sawed removal lines shall be removed to the bottom of the original pavement surface.
- (6) The transverse reinforcing steel shall be restored to its original horizontal position and spliced with one (1) No. 4 rebar dowel at least thirty inches (30") in length on twelve inch (12") centers. Longitudinal steel shall be No. 4 bars on twelve inch (12") centers.
- (7) All concrete paving shall be replaced at a minimum thickness of 6" or to match existing pavement thickness and shall be poured and finished by broom or burlap

drag to match existing surface. Type 2 (white pigmented) curing compound shall be applied to the surface of the slab.

C 23.6 MEASUREMENT

There shall be no separate pay item for sawing or removal of plain or reinforced concrete pavement, slabs, drives, aprons, sidewalks, curbs and gutters, etc. The cost of sawing and removal shall be considered in the replacement costs.

The various types of pavement replacement shall be measured by the square yard based on maximum trench width as set forth in Section C 3.5 and this section or by the linear foot of pavement to be repaired measured along the ditch centerline. Additional ditch width above that set forth in Section C 3.5 and this section will not be measured for payment unless specifically approved by the City.

C 23.7 PAYMENT

Payment for the various types of pavement replacement shall be made at the unit prices bid which shall be full compensation for all labor and materials necessary to make the complete installation.

C 24 CONSTRUCTION WITHIN TEXAS DEPARTMENT OF TRANSPORTATION RIGHT-OF-WAY

C 24.1 SCOPE

This section of the specifications covers the construction of water and sanitary sewer lines within highway right-of-way under the jurisdiction of the Texas Department of Transportation (TXDOT).

C 24.2 GENERAL

Where proposed lines are in a state highway right-of-way, the work shall not be started until the Contractor has an approved permit from the Texas Department of Transportation, received through the City. In addition, the Contractor shall notify the TXDOT maintenance foreman at least 48 hours prior to commencing any work covered by the approved permit.

The Contractor shall provide and employ adequate warning signs, barricade, lights, watchman, etc., to fully protect workers and the traveling public in accordance with TXDOT requirements.

When the crossing of a highway is permitted by open cut, the Contractor shall prosecute the work in such a manner that one-half the traveled roadway is open to traffic at all times.

Highway crossings shall be tunneled and cased in accordance with Section C 22. However, in certain cases only where specifically shown on the plans, the Contractor shall make the crossing by open cut.

No changes shall be made in location as shown on the plans within the limits of a state highway right-of-way without prior authorization of the Texas Department of Transportation and the City.

C 24.3 BACKFILL REQUIREMENTS

All backfill requirements in this section shall conform to current TXDOT requirements.

After the installation of the pipe and the embedment, the ditch shall be backfilled with Type 1 Backfill in all cases except the following:

Type 2 Backfill, when allowed by the permit, agreement, or by the TXDOT representatives, may be used only in trenches parallel and adjacent to right-of-way lines and in areas where there will be no earthwork construction or construction traffic except that this method may be used for placing backfill which will later be removed by highway construction.

Types 3 or 4 Backfill may be required for special conditions where the possibility of settlement or erosion of backfill must be eliminated or when, after backfill is started, it becomes apparent that Type 1 Backfill is unsuitable.

C 24.4 TYPES OF BACKFILL

- a. Type 1 Backfill (Compacted Backfill). Type 1 Backfill shall consist of compacted material obtained from suitable soil excavated from the trench, or from sources outside the highway right-of-way. Material shall be free of rock, lumps, or clods that will not break down under compaction.

Backfill material shall be placed in the trench in layers not to exceed six (6") inches in depth and compacted. Water shall be added as required to facilitate compaction.

Compaction shall be done with rollers or mechanical tamps. Use of rollers will be permitted only when such use is not believed detrimental to any highway facility and the type roller used is acceptable to the TXDOT representative. When rollers are employed, mechanical tamps shall be used along sides of trench to compact any backfill that cannot be reached with rollers. Compacting shall be continued until a backfill density equal to that of the adjacent undisturbed material has been obtained.

Where trenches lie within the limits of drainage ditches and channels which are in rock, the Type 1 Backfill used in trench shall be sealed with one (1') foot of concrete backfill struck off flush with the top of rock.

- b. Type 2 Backfill (Water Jetted Backfill). Type 2 Backfill shall consist of suitable material excavated from the trench or other acceptable material obtained from sources outside the highway right-of-way.

Backfill shall be placed in the trench in layers not to exceed two (2') feet in depth by blading, dozing, or other approved means and then jetted with water delivered under pressure through a metal jet. After the trench is filled and jetted, additional material shall be mounded thereon and rolled with construction equipment.

- c. Type 3 Backfill (Stabilized Sandy Soil or Washed Sand). Stabilized backfill shall consist of either sandy soil free of lumps and clods or washed concrete sand, stabilized with two sacks of portland cement per cubic yard.

If aggregates are not sufficiently moist to produce a mixture suitable for compaction, water shall be added as required. Either transit mix or stationary type mixers may be used.

After mixing, the stabilized material shall immediately be placed in the trench in uniform layers not to exceed six (6") inches in depth and compacted as specified for Type 1 Backfill. Compaction shall be completed within two hours after mixing.

- d. Type 4 Backfill (Lean Concrete). Concrete backfill shall contain either one or two sacks of portland cement per cubic yard of concrete as may be specified by the agreement or permit or by the TXDOT representative.

Concrete aggregates shall be washed.

Concrete may be mixed on the project in an approved mixer or in an approved central mixing plant. Slump shall be between three and six inches as directed by the TXDOT representative.

Concrete shall be deposited in lifts not to exceed 18 inches in depth. Sufficient vibration shall be done to eliminate voids but care shall be exercised that contamination by adjacent soil does not occur during vibration. All concrete shall be placed within one hour after mixing.

C 24.5 MEASUREMENT

Open ditch excavation and backfill within highway right-of-way will not be measured separately from other trenching and backfill but will be measured as set forth in Section C 3.20 as a part of the overall job total.

Boring and tunneling within highway right-of-way will be measured as set forth in Section C 22.7.

C 24.6 PAYMENT

Boring and tunneling within highway right-of-way will be paid for at the unit price bid as set forth in Section C 22.8.

C 25 CONNECTION TO EXISTING WATER MAINS

C 25.1 SCOPE

This section of the specifications governs the connection of repaired, renovated, or new water mains and/or facilities to existing water mains.

C 25.2 GENERAL

Connection to an existing water main shall include not only branch connections but in-line connections for the purpose of making required pipe adjustments as well. Any connections or series of connections required to be performed on an existing water main shall meet with the City's specific approval as to the seasonal period when the work can be performed, the length of time required for the work to be completed, the work procedures proposed, or any other facet that could affect curtailment of quality or quantity of water supply to the affected area. The work shall be performed with stringent built-in safeguards (such as adequate back-up equipment, labor and materials available) to insure that the time schedules are met without failure and subsequent setback. Every effort shall be made to accomplish as much of the work as possible before the actual tie-in is made into the existing main. This is especially applicable where vertical and horizontal concrete thrust blocks are a necessity to impose proper restraint of the pipe when the main is returned to full service. A detailed schedule of operations for making such connections shall be approved by the City before any work commences.

It shall be generally understood that water mains sixteen (16") inches in diameter and larger shall not be removed from service during the months of May through October unless specified otherwise in the project contract documents, and then only (since this work is so closely dependent on seasonal conditions) with the final approval of the City. The City is the final authority on all scheduled "shut-offs" or interruptions to service.

C 25.3 DESCRIPTION

Where indicated on the plans and/or herein specified, the Contractor shall connect the new main with existing mains. The Contractor shall furnish all labor, materials, equipment, and services required for the locating and uncovering of the existing line, the making of cuts in the line, the removal, relocation, and/or lowering of existing lines as required, de-watering of the trench, connecting of the existing line into the new main and all appurtenant work required for a complete connection. Relocated mains or lines shall be laid so that all valve stems shall be set vertically.

Only such connections to existing mains as are necessary to load, test, and sterilize mains under construction with water from City mains will be permitted prior to the chlorination of new mains. All other connections to existing mains shall be made only after the new main has been satisfactorily disinfected and the City has authorized the connections. The Contractor will be required to plug and block lines, crosses, tees, or other fittings installed in

the new main to permit testing and chlorination prior to the making of connections. Such plugs and blocking shall be adequate to withstand a test pressure of 150 p.s.i.g.

Where cut-ins are made immediately adjacent to valves which are under pressure, the Contractor shall take all necessary precautions to brace such valves with temporary blocking and bracing which shall be of ample size and properly placed to prevent movement or blowing off of any pipe, valves, or fittings due to water pressure on the main.

C 25.4 NOTICE TO BUSINESSES AND INDUSTRIES, PUBLIC SCHOOLS, AND OTHER WATER CUSTOMERS BEFORE STOPPING WATER SERVICE FOR SCHEDULED WORK:

The Contractor will notify all business and industries in the affected area a minimum of twenty-four (24) hours prior to disrupting water service due to scheduled water shut-offs. All water shut-offs will be scheduled through the City's representative. If the water shut-off will be a hardship on any business or industry, the Contractor will make tie-ins and other water shut-offs after hours (5:30 PM thru 7:00 AM and/or weekends) at a time convenient to the water customers. No additional payment shall be made when after hours work is necessary to accommodate water customers.

Failure to notify water customers may result in damage to equipment and could result in claims against the Contractor. In case of emergency shut-offs or repairs, the affected customers shall be notified immediately after repairs are made and/or service restored so that all facilities can be checked.

The Contractor will notify the Administrative Offices of the Arlington Independent School District and the office of the school building affected at least twenty-four (24) hours prior to any scheduled water shut-off or disruption of service. The office of the Administrative Assistant of School Plant Services shall be notified by phone during their normal working hours, 7:30 a.m. to 4:00 p.m., Monday thru Friday. After hours numbers for school district personnel to be contacted are available from the City of Arlington Water Utilities Dispatcher.

The Contractor shall notify all other water customers by giving a minimum of twenty-four (24) hours notice prior to disruption of service. Residents shall be notified either in person or by placing a notice on the door of the dwelling. The notice shall contain the reason for the disruption or service, the time the water is to be turned off, and the approximate length of time the water is to remain off. Notices are available from the Water Utilities Department. The Contractor is responsible for proper completion of the form prior to distribution.

C 25.5 MEASUREMENT

Connections to existing water mains will not be measured for payment unless specifically set forth in the Proposal and other contract documents.

C 25.6 PAYMENTS

If specifically set forth in the contract documents, payment for connections to existing water mains will be paid for at the unit price bid. Otherwise, payment for connections to existing water mains will be considered subsidiary to the various other unit prices.

C 26 CLEANING AND STERILIZATION OF WATER MAINS

C 26.1 SCOPE

This section of the specifications covers the cleaning and sterilization of water mains prior to placing them into service in the City's water system.

C 26.2 GENERAL

Before any newly constructed water main is placed into service, it shall be cleaned, sterilized, and tested until the bacteria count in the water within the main meets the standards of purity established by the Texas Natural Resource Conservation Commission and the City of Arlington. No service from the main will be provided any customer until these standards are met.

C 26.3 PRECAUTIONS DURING CONSTRUCTION

During the construction operations, workers shall use care to assure that all installed surfaces of the system which will come in contact with the City water supply are maintained in a sanitary condition.

Every effort must be made to keep the inside of the pipe, fittings, and valves free of all loose foreign matter. Any time that the pipe fittings or valves become contaminated with loose foreign matter, the Contractor shall, at no additional expense to the City, restore the pipe, fittings or valves to a sanitary condition. Sanitary condition will be defined as being free of any foreign substance. The final determination as to the sanitary condition of the pipe will be made by the City.

As each joint of pipe is being laid, it shall be swabbed with a clean and effective cleaning tool as approved by the City.

Exposed open ends of pipe shall be temporarily blocked or capped with a water tight cap during construction. Particular care shall be taken to protect pipe ends at any time actual laying is not in progress.

C 26.4 CLEANING

Cleaning shall be accomplished by passing an appropriate sized "Poly-Pig(s)" through the pipe. "Poly-Pigs" will be furnished by the City and may be picked up at the Water Utilities Field Operation Warehouses for sizes sixteen inches (16") and larger. For fifteen inch (15") and smaller sizes, the "Poly-Pigs" shall be furnished by the Contractor. The "Poly-Pigs" shall be minimum five (5) pounds per cubic foot density and shall be the double spiral wrapped type. The "Poly-pigs" shall be operated in accordance with the manufacturer's recommendations. Soft or uncoated "Poly-Pigs" will not be acceptable. The procedure for "Poly-Pigging" shall be as follows:

- a. The Contractor shall prepare the main for the installation and removal of "Poly Pigs" as required.
 - (1) In general, this will consist of furnishing all equipment, material, and labor to satisfactorily expose cleaning wyes, remove cleaning wye covers, etc., as directed by the City and to insert the "pigs" into the mains at points indicated on plans. On mains twelve inches (12") or smaller, the Contractor will insert the "Poly-Pig" into the pipeline at points indicated on plans while installing the water main.
 - (2) At point of expulsion of the "Poly-Pig", the Contractor shall prevent back flow of purged water into the main after passage of the pig. On small pipe, through twelve inches (12"), back water can be prevented re-entry into the pipe by the temporary installation of mechanical joint bends and pipe joints to provide a riser out of the trench. Excavation of the trench may serve the same purpose. Where a trench is used, the excavation shall be lined with polyethylene and secured, and a ditch be cut to allow the water to drain from the excavation.
 - (3) After passage of the "Poly-Pig" and flushing of all back water from the pipe, the Contractor shall continue to flush the main until the water runs clear and no noticeable sand or debris can be seen in a white sample cup or until notified by the City. The Contractor shall complete work at openings by plugging and blocking, installing cleaning wye blind flanges, etc., then backfill and complete all appurtenant work necessary to secure the system.
- b. Water Department personnel will shuttle "Poly-Pigs" through the main from point of insertion to exit. Where the pipe in the main forms a loop distribution system, every effort will be made to sweep the complete system.
- c. Short dead end pipe sections not swabbed by the pig shall be flushed.
- e. The procedure set forth below in section C 26.5 STERILIZATION shall be followed prior to any flushing or sampling taking place.
- e. Appropriate erosion control methods will be placed to prevent transportation of silt or other debris away from the work site during flushing. This may include restricting flow to avoid damage to adjacent landscape and exposed earthen surfaces.

C 26.5 STERILIZATION

The following procedure shall be used for sterilization:

- a. Chlorine will be injected into the section of line being sterilized so that its entire capacity will be filled with water containing chlorine in the amount of 50 parts per million (p.p.m.) or in such other quantity as determined by the City. The contractor shall provide a service tap near the water source end of the line, minimum size 3/4", for the injection of the chlorine solution. The sterilizing agent shall be introduced at one end of the section and

the water released from the opposite end until the sterilizing agent is present at the discharge end in such quantity as to indicate a residual chlorine of 50 p.p.m. or as otherwise determined by the City. All valves shall then be closed and the sterilizing solution permitted remain in the pipe line section for not less than twenty-four (24) hours. Chlorination shall be executed in accordance with "Procedures for chlorination and sampling of new water lines" published by the Pierce-Burch Water Treatment Plant and described in C26.8.

- b. At the end of the sterilizing period, the sterilizing solution shall be discharged from the pipe and replaced with City water direct from a City main. The solution may be discharged to the City sanitary sewer system under the direction of the City Engineer.
- c. A sample of water from the sterilized main shall be taken (not through a fire hydrant) from a suitable tap under the supervision of the City and submitted to the Pierce-Burch Water Purification Plant Laboratory. The Contractor shall provide a service tap near the discharge end of the line, minimum size 3/4", for obtaining a water sample for analysis. If the test shows a satisfactory quality of water, the line so sterilized may then be placed in service. If the sample shows unsatisfactory quality of water, the process of sterilization shall be repeated until a satisfactory water sample is obtained.

C 26.6 AUTHORIZATION

Sterilization of the line or any section thereof shall not begin until the City's approval of the method, apparatus, sterilizing agent, and disposal of chlorinated water, for the section of the line has been obtained.

C 26.7 MEASUREMENT AND PAYMENT

No separate payment will be made for the cleaning and testing specified herein, and the cost thereof shall be included and considered subsidiary to the various other items.

C 26.8 PROCEDURES FOR CHLORINATION AND SAMPLING OF NEW WATER LINES:

To assist the contractor, the procedures for chlorination and sampling of new lines in Arlington, are provided in this section.

Contractor Responsibilities:

Install a riser with a hose bib at the end of the new line for sampling purposes. It should be 2-3 feet above the ground. Fire hydrants are not the best place to obtain a sample.

1. Using the following table, determine the amount of HTH needed to disinfect the amount of water mains you have laid and cleaned. Remember that the table is made for 100 linear feet of pipe. To use it for any other lengths of pipe you must use the formula given below. The following procedure should be used to disinfect new water lines:

Pipe Size (in) HTH per 100 LF (lbs) Time required to pull HTH Solution through 100 LF of pipe using a flow of 700 gpm from fire hydrant

6	0.10	15 seconds
8	0.16	22 seconds
10	0.25	35 seconds
12	0.37	50 seconds
16	0.65	1 minute, 30 seconds
18	0.82	2 minutes
20	1.02	2 minutes, 20 seconds
24	1.46	3 minutes, 20 seconds
27	1.85	4 minutes, 15 seconds
30	2.29	5 minutes, 15 seconds
33	2.77	6 minutes, 20 seconds
36	3.29	7 minutes, 30 seconds
42	4.48	10 minutes, 15 seconds

For quantities of pipe other than 100 LF:

$$= (\text{chart quantity}) \times \frac{(\text{actual LF})}{(100 \text{ LF})}$$

Example: The following calculates the amount of HTH needed for 867 LF of 12" line and 1,289 LF of 20" line, and also indicates the time required to pull the chlorine solutions through the pipe.

$$\text{HTH} = (0.37) \times \frac{(867 \text{ LF})}{(100 \text{ LF})} = 3.21 \text{ lbs of HTH}$$

$$\text{HTH} = (1.02) \times \frac{(1,289 \text{ LF})}{(100 \text{ LF})} = 13.15 \text{ lbs of HTH}$$

Total lbs of HTH needed = 3.21 + 13.15 = 16.36 lbs
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$$\text{Time} = (50 \text{ sec}) \times \frac{(867 \text{ LF})}{(100 \text{ LF})} = 7 \text{ min } 14 \text{ sec}$$

$$\text{Time} = (2 \text{ min } 20 \text{ sec}) \times \frac{(1,289 \text{ LF})}{(100 \text{ LF})} = 30 \text{ min}$$

Total time needed = 7 min 14 sec + 30 min = 37 min 14 sec

2. Dissolve the HTH in a clean 55 gallon drum (used only for this purpose) or some other suitable container. Use caution when doing this since HTH can release strong chlorine fumes when the containers are first popped open, especially in warm weather. Mix the HTH with tap water and stir well. Complete mixing is important to the disinfection

process. The vapor from the mixture should not be inhaled, especially in an enclosed environment!

- 2a. Determine the number of 55 gallon drums that you will need to mix up by using the following:

$$\text{Drums} = \frac{\text{total time}}{10 \text{ min}}$$

Example:

$\text{Drums} = \frac{37 \text{ min}}{10 \text{ min}} = 4 \text{ drums of chlorine solution} *$

* From the example in No. 1

- 2b. Determine the pumping rate of the chlorine solution:

$$\frac{\# \text{ of } 55 \text{ gal drums needed} \times 55 \text{ gal}}{\text{total minutes needed}}$$

Example:

$4 \text{ drums} \times 55 \text{ gal. drum} = 5.9 \text{ gal per min}$ 37 minutes
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- 2c. To determine how many pounds of HTH you will need to add to each 55 gallon drum:

$$\text{lbs of HTH needed per drum} = \frac{\text{tot. lbs HTH needed}}{\# \text{ of } 55 \text{ gal drums needed}}$$

Example:

$\text{lbs of HTH/drum} = \frac{16.36 \text{ lbs}}{4 \text{ drums}} = 4.1 \text{ lbs/HTH per drum}$

3. Feed this SOLUTION until the chlorine solution from the drums is nearly gone. Then begin checking the residual at the opposite end of the line (as explained below). If the residual is not up to 50 ppm, continue feeding the chlorine solution. You may have to mix up an additional drum of chlorine and feed some more. Be sure to open the sample riser hose bib to allow it to be disinfected also.
4. Check the chlorine residual. A chlorine test kit which may be purchased at any pool supply store and at many grocery stores is adequate. However, these kits are only designed to measure a chlorine concentration up to 3.0 to 3.5 ppm. You need to be able to measure a concentration of 50 ppm. To do this you must dilute the sample of water coming from the new line. To measure the concentration of chlorine in the new line:
- Purchase an eye dropper (at any grocery store or pharmacy).
 - Put 6 drops of sample into the test kit vial.

- c. Fill to the mark with distilled water or normal Arlington City tap water.
- d. Proceed with the kit instructions.
- e. Take the reading from the kit and multiply by 20.

Example: $2.8 \times 20 = 56$ ppm chlorine in the new line

5. When a residual of 50 ppm of chlorine has been achieved valve off the line and allow it to sit for at least 24 hours.
6. Arrange a time with your inspector to flush the water from the line and have the inspector obtain a bacteriological sample.

Inspector's Responsibility:

1. Help the contractor during the chlorination process to insure that:
the correct amount of HTH is put into solution, it is fed through the new line properly, there is a chlorine level of 50 ppm in the entire line, it sits for at least 24 hours, it is completely flushed prior to sampling, and there is an appropriate sample collection site.
2. Obtain a bacteriological sample bottle from the Arlington Water Utilities Laboratory. Check the chlorine residual at the sample collection point. Check the chlorine residual at a representative site in the area. make sure that the two are similar. (If the residual in the new line is 3.5 ppm and the normal residual in the system in that area is 1.4 ppm, the new line has not been flushed entirely.) Be sure that the contractor remembers to flush the sample collection riser and hose bib.
3. Disinfect the hose bib with chlorine bleach. Allow the bleach to remain in contact with the hose bib for 5 minutes. Turn on the hose bib and allow it to run at a high rate for 5 minutes. Adjust the flow to a steady slow stream. Remove the cap from the sample bottle and hold it in one hand with the inside of the cap facing down. Fill the sample bottle to the 100 mL mark. Return it to the laboratory as soon as possible before 3:00 p.m. (Monday-Friday, 8:00 a.m. - 3:00 p.m.) at the latest on the day that the sample is taken. Fill out the lab paperwork identifying the site, the date the sample was taken and the chlorine residual that was obtained prior to sampling.

No samples will be submitted to the laboratory for the two days prior to a City holiday or weekend associated with the holiday unless prior arrangements are make.

4. The inspector will be provided with the results of the sample within 48 hours of having submitted it to the lab or by 9 a.m. on Monday for samples that are submitted on a Thursday or Friday. A sample will be found to pass or fail. If the sample fails, the lab will

also give recommendations to whether the new line needs to be rechlorinated or just flushed again.

5. If the sample fails, the inspector will make sure that the contractor follows the recommendations of the lab. When the new line is ready for a bacteriological resample, the inspector will arrange a date and time with the lab. A laboratory technician will take the resample.

Laboratory Services Responsibilities:

Because the Water Utilities Department wants to provide the customer with the best water possible, the laboratory has consistently upheld the need for standards that were more strict than those established by the State.

On January 1, 1992, the laboratory changed the method for bacteriological analyses to coincide with new technology approved by the Environmental Protection Agency. This technology allows us to analyze for 2 different indicator organisms in one test. However, the test does not tell us the number of bacteria present, only if they are present or not.

Since only a very small number of bacteria can seriously impair water quality in the distribution system, the laboratory wanted a way to know how many bacteria were present in a sample if that sample was positive. Therefore, we began to run a Heterotrophic Plate Count (HPC) analysis on each sample at the same time that we run the Coliform analysis. The HPC sample takes 48 hours. That is why it now takes 48 hours for the results to be reported to the inspectors.

1. If a new line sample fails the Coliform part of the test (24 hours), the laboratory will notify Engineering Services by 4:30 p.m. on the day after the sample was submitted (Monday through Thursday). Results of samples submitted on Friday or before holidays will be telephoned to the Department by 9 a.m. of the next working day.
2. If the sample passes the Coliform part of the test, no notification will be given to the Department until the 48 hour test is read. At this time the final results will be called in.
3. When the inspector is informed that a new line has failed, he/she will get back with the contractor to arrange for appropriate remedial action to be taken. Once this action is complete, the inspector will arrange with the laboratory for a repeat sample to be taken. A laboratory technician will take the repeat sample and the notification will proceed as above. **Please do not call the lab for results.** In the interest of avoiding miscommunications, the lab will no longer give out results except to the Engineering Services Representative. If, however, you wish to discuss a problem with a new line or the results from new line analyses, please feel free to call the lab at 817- 457-7550.

C 27 DEFLECTION TESTING OF PVC SANITARY SEWER MAINS

C 27.1 SCOPE

This section of the specifications covers the deflection testing by the Contractor of PVC sewer mains.

C 27.2 GENERAL

Deflection testing will be done after the sanitary sewer installation is complete and all backfill has been completed and in place for at least 30 days. The Contractor will pull a mandrel through the pipe to test for a maximum five percent (5%) deflection. The mandrel will be constructed and sized as listed on the mandrel deflection table.

C 27.3 MANDREL DEFLECTION TABLE

5 PERCENT DEFLECTION MANDREL					
Nominal Size, In.	Mandrel O.D., In.	Tolerance In.	Nearest 1/16"	Min. Runner Length, In.	Min. # Of Mandrel Runners
6	5.45	± 0.01	5-7/16	4	6
8	7.28	± 0.01	7-4/16	4	6
10	9.08	± 0.01	9-1/16	5	8
12	10.79	± 0.01	10-13/16	6	8
15	13.20	± 0.01	13-3/16	8	8
18	16.13	± 0.01	16-2/16	8	12
21	19.00	± 0.01	19	8	12
24	21.36	± 0.01	21-6/16	8	12
27	24.07	± 0.01	24-1/16	8	12
18	16.53	± 0.01	16-1/2	8	9
21	19.30	± 0.01	19-5/16	8	9
24	22.08	± 0.01	22-1/16	8	9
27	24.84	± 0.01	24-13/16	8	9
30	27.62	± 0.01	27-5/8	10	9
33	30.38	± 0.01	27-5/8	10	9
36	33.15	± 0.01	33-1/8	12	9
42	38.68	± 0.01	38-11/16	12	9

C 27.4 MEASUREMENT AND PAYMENT

No separate payment will be made for the deflection testing of PVC sewer mains. The cost of deflection testing shall be included in and subsidiary to the cost of installation of PVC sewer mains.

C 28 CCTV INSPECTION OF SANITARY SEWER MAINS

C 28.1 SCOPE

This section of the specifications covers the City inspection of sanitary sewer mains by closed circuit television (CCTV).

C 28.2 GENERAL

The final inspection on all projects shall include a CCTV inspection of the completed sanitary sewer main installation, exclusive of services. The CCTV inspection, including furnishing of necessary personnel, equipment and materials, shall be performed by the Contractor. All defects in the installed facility revealed by the CCTV inspection shall be remedied by the Contractor prior to the acceptance of the project. The City will conduct a CCTV inspection prior to the project's two year warranty expiration. All defects in the installed facility revealed by the CCTV inspection shall be remedied by the Contractor under the two year warranty.

C 28.3 CONTRACTOR'S RESPONSIBILITIES

Prior to sanitary sewer main acceptance, the Contractor shall inspect all newly constructed mains, excluding services, by CCTV in accordance to the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment & Certification Program (PACP) standards, latest edition. The Contractor shall provide the City a PACP inspection report summarizing the inspection with all PACP observation codes with their corresponding Structural Grade and O&M condition grades clearly marked. The inspection shall be performed by a NASSCO PACP Certified inspector, and the report shall clearly show the CCTV inspector's name and registration number. In addition to defects noted for NASSCO PACP sanitary sewer standards, the CCTV inspector shall note any defects that meet the NASSCO PACP definition of 'Joint Offset Small (JOS)', Joint Separated Small (JSS)', or 'Joint Angular Small (JAS)'. Such defects shall be clearly highlighted, embolden, circled or marked in a way to distinguish them from the other observation codes.

The sanitary sewer main shall be thoroughly cleaned and flushed with water, by the Contractor, prior to CCTV inspection. The pipe shall have flow depth less than ¼ pipe full unless approved by the City in writing. The CCTV inspection video does not need to be provided to the City but shall be made available upon request.

The Contractor will be held liable for all damages to the public and private property caused directly and/or indirectly by the CCTV inspection or by surcharging of sanitary sewer mains. The Contractor is responsible for any fines, penalties or other costs imposed upon the City by any agency or private party as a result of the CCTV inspection or improper discharges by the Contractor. The Contractor shall ensure no equipment or other obstructions remain in the line after inspection. All costs associated with retrieving any lodged equipment, shall be incidental to the inspection.

C 28.4 BASIS FOR CCTV REPORT ACCEPTANCE AND WARRANTY VERIFICATION

CCTV inspection report will be accepted by the City if the inspection noted under C 28.3 has a PACP Overall Pipe Structural and O&M Rating of 0, and contains no defects meeting the NASSCO PACP definition of JOS, JSS, or JAS. Any defects observed shall be corrected and re-inspected by the contractor prior to acceptance by the City.

Prior to the expiration of the two year warranty period, the City will conduct a second CCTV inspection to verify the sanitary sewer mains meet the conditions stated above. If defects are observed in this inspection, the contractor shall repair the mains per conditions stated in the warranty Section A 3.2 and elsewhere in this document.

C 28.5 MEASUREMENT AND PAYMENT

No separate payment will be made for the CCTV inspection of sanitary sewer mains, but the cost thereof shall be included and considered subsidiary to the various other items.

C 29 AIR TESTING OF SANITARY SEWER MAINS

C 29.1 SCOPE

This section of the specifications describes the procedures to be used in air testing sanitary sewer mains where such procedures are required prior to acceptance by the City.

C 29.2 GENERAL PROCEDURES

All pipe shall be backfilled prior to air testing.

Air tests shall be made by the pressure drop versus time method.

For pipes less than 36 inches in diameter, the air test shall be performed by testing complete sections of pipe between manholes. For pipes 36 inches in diameter and over, the air test may be performed by testing each joint connection individually. The Contractor shall have the option, however, of testing pipe over 36 inches in diameter by testing sections of pipe over various lengths if so desired.

The Contractor shall furnish all material, equipment and labor necessary to perform the air test. Air gauges shall be recently calibrated and shall be stamped showing the date of calibration.

Should the sanitary sewer system fail air testing, the Contractor shall repair the leaks and retest at no expense to the City.

C 29.3 TESTING PIPE LESS THAN 36 INCHES IN DIAMETER

Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking. All air used shall pass through a single control panel.

Three individual hoses shall be used for the following connections: From the control panel to pneumatic plugs for inflation; from the control panel to a sealed line for introducing the low-pressure air; and from a sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

The air compressor shall be of adequate capacity for charging the system.

The following procedure shall be used for air testing a sewer system: All pneumatic plugs shall be seal-tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against his pressure without bracing and without movement of the plugs out of the pipe.

After a manhole-to-manhole reach of pipe has been backfilled and the pneumatic plugs checked, the plugs shall be placed in the line and inflated to 25 psig. Low pressure air shall be injected into the line until the internal pressure reaches 4 psig. Two minutes shall then be allowed for the pressure to stabilize. If the pipe section to be tested is submerged in ground water, a pipe probe shall be inserted into the backfill adjacent to the centerline of the pipe. The pressure in the probe shall then be determined by reading the pressure when air first begins to slowly pass through it. This reading is back pressure due to ground water submergence, and all gauge pressures in the test should be increased by this amount. After the pipe pressure has stabilized at 3.5 psig or the adjusted pressure due to ground water submergence, a stop watch shall be started and the time required for the internal pressure to reach 2.5 psig determined. Minimum permissible holding time for runs of single pipe diameter are indicated in the table at the end of this section of the specifications.

C 29.4 TESTING PIPE 36 INCHES AND LARGER IN DIAMETER

Pipe 36 inches and larger in diameter may be air tested at each joint by utilizing a joint tester similar to the Cherne Joint Tester. No joint shall be air tested until the pipe has been backfilled. At no time shall pipe installation exceed 100 feet from the latest joint tested unless sections of pipe are being tested. The method of testing shall be described in Section C 29.3. The time allowed for the pressure drop from 3.5 psig to 2.5 psig shall be 10 seconds. Failure to pass the air test shall be cause for rejection. Rejected pipe shall be removed. Reinstallation and/or repairs may be made at the option of the City.

C 29.5 BASIS FOR AIR TEST ACCEPTANCE

Sewer mains will receive air test acceptance only after meeting the test requirements. If the installation fails to meet this requirement, the Contractor shall, at his sole expense, determine the cause of test failure. The Contractor shall then repair or replace any defective material or work and retest the main.

C 29.6 MEASUREMENT AND PAYMENT

No separate payment will be made for the tests specified herein, but the cost thereof shall be included and considered subsidiary to the various other items.

AIR TEST TABLES

MINIMUM HOLDING TIME IN MINUTES AND SECONDS REQUIRED FOR

PRESSURE TO DROP FROM 3.5 TO 2.5 PSIG

1 Pipe Diameter (in.)	2 Min. Time min:sec	3 Length for Min Time (ft)	4 Time for Longer Length (sec.)	Specifications Time for Length (L) Shown in (min:sec)											
				NOTE: TO BE USED WHEN TESTING ONE DIAMETER											
				100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.	500 ft.	600 ft.	650 ft.	
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:48	4:07
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24	7:07	8:33	9:15	
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24	12:11	15:11	16:27	
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:4	17:48	19:47	23:44	25:43	
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	9	25:38	28:29	34:11	32:02	
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	22:47	40:04	44:31	53:25	57:52	
18	17:00	133	7.692 L	17:00	19:1	25:38	32:03	38:27	44:52	35:36	57:41	64:05	76:55	83:20	
21	19:50	114	10.470 L	19:50	3	34:54	43:37	52:21	61:00	51:16	78:31	87:15	104:42	113:20	
24	22:40	99	13.674 L	22:47	26:10	45:34	56:58	68:22	79:46	69:48	102:33	113:58	136:45	148:09	
27	25:30	88	17.306 L	28:51	34:11	57:41	72:07	86:32	100:57	91:10	129:48	144:14	173:05	187:30	
30	28:20	80	21.366 L	35:37	43:16	71:13	89:02	106:50	124:38	115:22	160:15	178:04	213:41	231:30	
33	31:10	72	25.852 L	43:05	53:25	86:10	107:43	129:16	150:43	142:26	193:53	215:28	258:34	286:06	
36	34:00	66	30.768 L	51:17	64:38	102:34	128:12	153:50	179:29	172:21	230:46	256:25	307:42	333:21	
39	36:50	61	36.114 L	60:11	76:55	120:22	150:28	180:34	210:39	205:07	270:51	300:56	361:08	391:14	

C 30 PRESSURE TESTING OF WATER LINES

C 30.1 SCOPE

This section of the specifications covers the pressure testing of water lines prior to their sterilization and placement into service in the domestic water system.

C 30.2 GENERAL

After the pipe has been laid and backfilled, it shall be subjected to a hydrostatic pressure test by raising the pressure in the pipe to 150 psi at the low point of the test section.

C 30.3 DURATION OF TEST

The duration of each test shall be three (3) hours.

C 30.4 TEST PROCEDURE

Tests shall be made against valves when available, or by placing temporary plugs and bulkheads in the pipe, and filling the line slowly with water. Care shall be used to see that all air vents are open during the filling.

If the Contractor proposes to test against an existing valve, the Contractor shall be satisfied that the valve is not leaking prior to making the connection. If the connection is made but a satisfactory pressure test cannot be accomplished because of valve leakage, the Contractor shall remove the connection and plug and block the new line in order to perform the pressure test necessary for City acceptance. No direct compensation will be made for this work, and it will be considered subsidiary to the various bid items.

After the line, or section thereof, has been completely filled, it shall be allowed to stand under a slight pressure for at least 48 hours to allow the escape of air from any air pockets. During this period, the bulkheads, valves, and connections shall be examined for leaks. The water necessary to maintain the test pressure shall be measured through a meter or by other means satisfactory to the City.

Before applying the specified test pressure, all air shall be expelled from the pipe. In the event it is necessary to expel air from high points other than where air valves are provided, the Contractor may tap the line for this purpose and afterwards tightly plug the tap.

C 30.5 VISUAL EXAMINATION

During the last two hours of the test, the entire route of the pipeline shall be inspected to locate any leaks or breaks. Any defective joints, cracked or defective pipe, fittings, or valves discovered in consequence of this pressure test shall be removed and replaced with sound material and the test shall be repeated until satisfactory results are obtained.

Any and all noticeable leaks shall be repaired regardless of whether the actual leakage is within the allowable.

C 30.6 PERMISSIBLE LEAKAGE AND MAKEUP WATER

No pipe installation will be accepted until or unless the makeup water is less than 12 gallons per mile per 24 hours per inch of nominal diameter of pipe.

Makeup water is defined as the quantity of water to be pumped into the newly laid pipe, or any valved section of it, necessary to maintain the specified test pressure after the pipe has been filled with water and the air expelled.

PERMISSIBLE LEAKAGE IN THREE-HOUR PERIOD

3-Hr. Leakage in Gallons

<u>Size Main</u>	<u>per 100 Linear Feet of Main</u>
6"	0.22
8"	0.29
10"	0.37
12"	0.44
14"	0.51
16"	0.59
18"	0.66
20"	0.74
24"	0.88
30"	1.10
36"	1.32
42"	1.54
48"	1.77
54"	1.99

C 30.7 MEASUREMENT AND PAYMENT

No separate payment will be made for the tests specified herein, and the cost thereof shall be included and considered subsidiary to the various other items.

C 31 CONCRETE STRUCTURES AND CONCRETE BLOCKING AND CRADLE

C 31.1 SCOPE

This section of the specification shall govern the construction of concrete structures or concrete structural units as well as the construction of concrete cradles and blocking for pipelines.

C 31.2 MATERIALS

Materials used in the performance of work described in this section of the specifications shall comply with Section B 20, "Concrete," and B 21, "Reinforcing Steel," of these specification.

C 31.3 STRUCTURAL EXCAVATION AND BACKFILL

This item shall govern the excavation for the placing of such structures as indicated or specified; for the disposal of all material from such excavation; and for the backfilling around completed structures to the level of the original ground. Unless otherwise provided, the work included hereunder shall provide for the removal of old structures or portions thereof, trees, and all other obstructions when such removal is necessary for the proper completion of the proposed construction. Excavation will be unclassified.

Excavation shall be done in accordance with the lines and depths indicated on the plans or as established by the Engineer. Unless written permission is given by the City, no excavation shall be more than three (3') feet from the footing in any direction.

The final elevation to which a foundation is to be constructed shall be as shown on the plans or as raised or lowered when such alterations are judged proper to satisfactorily comply with the design requirements for the structure. Should it be found necessary, in the judgment of the City, to increase or decrease the depth of footings from that shown on the plans, the necessary alterations in the details of the structure shall be accomplished in a manner as directed by the City.

When a structure is to rest on an excavated surface other than rock, special care shall be taken not to disturb the bottom of the excavation and the final removal of the foundation material to grade shall be performed just before the footing is to be placed.

The excavation shall be maintained in a dry condition. All pumping or bailing from the interior of any excavation shall be done in such a manner as to prohibit the movement of water through or alongside any concrete being placed.

As soon as practicable, the excavated areas around the structure shall be backfilled with approved material.

Backfill which will not support any portion of the completed structure shall be placed in layers not more than eight (8") inches in loose measurement or as otherwise recommended

and shall be compacted to a density equal to the adjacent undisturbed material. Material for backfill shall be composed of earth only and shall contain no wood, roots, other concrete, stones, trash, or debris of any kind.

Backfill which will support any portion of the structure shall consist, to maximum extent available, of the excess earth obtained from structure and trench excavations. Additional material may be obtained from borrow pits as necessary.

All materials placed in fills and embankments shall be free from rocks or stones larger than three (3") in their greatest dimension, brush, stumps, logs, roots, debris, and organic or other deleterious materials. No rocks or stones shall be placed in the upper eighteen (18") inches of any fill or embankment. Rocks or stones within the allowable size limit may be incorporated in the remainder of fills and embankments provided they are distributed so that they do not interfere with proper compaction.

After preparation of the fill or embankment site, the subgrade shall be leveled and rolled so that the surface materials of the subgrade will be as compact and well bonded with the first layer of the fill or embankment as specified for subsequent layers.

All fill and embankment materials shall be placed in approximately horizontal layers not to exceed eight (8") inches in uncompacted thickness. Material which is deposited in piles or windrows by excavating and hauling equipment shall be spread and leveled before compaction.

Each layer of material being compacted shall have a uniform moisture content to insure satisfactory compaction. The Contractor will be required to add water and harrow, disc, blade, or otherwise work the material in each layer to insure uniform moisture content and adequate compaction. Each layer shall be thoroughly compacted by rolling or other method approved by the Engineer to 95 percent of the maximum density at optimum moisture content as determined by ASTM D 698. If the material fails to meet with the density specified, the compaction methods shall be altered as necessary to obtain the specified density. All compaction shall be accomplished at a moisture content from 0 to 2 percent above optimum.

No backfill shall be placed against any abutment or retaining wall until such structure has been in place at least 7 days. Backfill placed around abutment and piers shall be deposited on both sides to approximately the same elevation as at the same time.

C 31.4 GENERAL REQUIREMENTS

Prior to starting work the Contractor shall inform the City as to the methods of construction and the amount and character of equipment he proposes to use, the adequacy of which shall be subject to the approval of the City.

Plans for forms and false work to be used in the construction of the various units of a structure shall be submitted if requested by the City. Such plans shall be sufficiently complete to show all essential details of the proposed forms, false work, and bracing.

Forms for walls or columns shall not be erected on concrete footings until the concrete in the footing has cured at least two (2) curing days. Concrete may be placed in walls or columns as soon as the forms and reinforcing steel placement have been approved by the City. Approval by the City of any construction methods, equipment, or form and false work plans will not relieve the Contractor of responsibility for the safety or correctness of methods used, adequacy of equipment, or from carrying out the work in full accordance with the contract.

C 31.5 CURING DAY

A curing day will be any calendar day on which the atmospheric temperature, taken in the shade and away from artificial heat, is above 50 degrees F. for at least eighteen (18) hours. Colder days may be counted if proper provisions are made, and the air temperature adjacent to the concrete is maintained above 50 degrees F. throughout the entire day.

C 31.6 CONSTRUCTION JOINTS

Construction joints shall be placed as shown on the plans unless otherwise specifically authorized. All construction joints shall be made on horizontal and vertical planes and formed with mortises or keys made in the concrete unless shown otherwise on the plans. Sufficient section shall be provided in horizontal and vertical keys to resist shear. Where construction joints are placed, forms shall be tightly framed around the reinforcing steel to prevent the escape of mortar, and the joint shall be so made that its trace in the exposed face of the finished structure will be an exactly vertical or horizontal line. Where, to accomplish this purpose, finishing strips are needed, they shall be nailed to the forms and the concrete carefully finished to them. The surface of finished concrete and forms shall be thoroughly cleaned and wetted immediately before resuming concreting. Care shall be exercised to obtain maximum density and insure against honeycomb, etc.

Special care shall be taken to remove all laitance and to roughen any smooth set surface with picks or by other approved methods before the plastic concrete is placed against the old concrete.

C 31.7 FORMS

Except where otherwise specified, forms may be constructed of either timber or metal as elected by the Contractor.

Forms shall be designed for the pressure of a liquid weighing 150 pounds per cubic foot. The rate of placing the concrete shall be taken into consideration in determining the depth of the equivalent liquid. An additional live load of 50 pounds per square foot shall be allowed on horizontal surfaces.

If at any stage of the work, the forms show signs of bulging or sagging, that portion of the concrete causing such conditions shall be removed immediately, if necessary, and the forms shall be reset and braced securely against further movement.

Nominal one inch lumber surfaced to a uniform width and thickness will be permitted for general use on the various portions of structures if backed by a sufficient number of studs and wales. All forms shall be face lined with an approved type of form lining material. If desired by the Contractor, facing for such surfaces may be constructed of three-quarter (3/4") inch plywood backed by adequate studs and wales, in which case form lining will not be required.

Forms shall be built mortar tight and of material of sufficient strength to prevent bulging between supports and shall be set and maintained to the lines designated until the concrete is sufficiently hardened to permit form removal. Forms shall be maintained in such a manner as to prevent warping and shrinking. All details of form construction shall be subject to the approval of the City, and permission to place concrete will not be given until the form work is complete to its satisfaction.

Where corners occur, suitable chamfer strips shall be placed at the angle of the forms to round off or bevel them.

All forms shall be constructed so as to permit removal without injuring the concrete.

At the time of placing concrete, the forms shall be clean and entirely free of all chips, dirt, sawdust, and other extraneous matter.

For thin wall sections and other locations where access to the bottom of the forms by other methods would be cumbersome and inadequate, clean-out openings shall be provided.

Only approved form spreaders shall be used.

Metal form ties of an approved type shall be used to hold forms in place, and they shall have provision to permit ease of removal of the metal as hereinafter specified.

Metal ties shall be held in place by devices attached to walls. Each device shall be capable of developing the strength of the tie.

All metal appliances used inside of forms to hold them in correct alignment shall be removed to a depth of at least one-half (1/2") inch from the surface of the concrete and shall be so constructed that the metal may be removed without undue injury to the surface by chipping or spalling. Such devices, when removed, shall leave a smooth opening in the concrete. Burning off of rods, bolts, or ties will not be permitted. Where wire ties are used, all wires, upon removal of the forms, shall be cut back at least one-half (1/2") inch from face of the concrete with a sharp chisel or nippers.

All cavities produced by the removal of metal ties shall be carefully cleaned and completely filled with re-tempered sand cement mortar mixed in proportion of one to three, and the concrete shall be left smooth and even.

C 31.8 REINFORCING STEEL

When placed in the work, reinforcement shall be free from dirt, paint, grease, oil or other foreign materials. Before being placed in the work, reinforcement shall be cleaned of all loose mill scale and rust. Tightly adhered scale or rust which resists removal by vigorous wire brushing need not be removed except that excessive loss of section to the reinforcement due to rust shall be cause for rejection. Excessive loss of section shall be defined as loss of section to the extent that the reinforcement will no longer meet the physical requirements for the size and grade of steel specified. Reinforcement shall be placed in the position shown on the plans. In the plane of the steel parallel to the nearest surface of concrete, bars shall not vary from plane placement by more than one-twelfth of the spacing between bars. In the plane of the steel perpendicular to the nearest surface of concrete, bars shall not vary from plan placement by more than one-quarter (1/4") inch.

The reinforcing steel shall be spaced its required distance from the face of the forms by means of approved galvanized metal spacers or approved precast mortar or concrete blocks. All reinforcing steel shall be wired together at all intersections. Before any concrete is placed, all mortar shall be cleaned from the reinforcement.

Reinforcement shall be supported and tied in such manner that a practically rigid cage of steel is provided. If the cage is not adequately supported to resist settlement or floating upward of the steel, overturning of truss bars, or movement in any direction during concrete placement operations, permission to continue concrete placement will be withheld until corrective measures are taken. Sufficient measurements shall be made during concrete placement to insure compliance with spacing and clearance requirements herein specified. All reinforcing bars in all members shall be supported rigidly in their correct locations, in slabs, beams, walls, columns, drilled shafts, or footings.

No concrete shall be deposited until the City has inspected the final placement of the reinforcing metal and given permission to place concrete.

C 31.9 PLACING CONCRETE - GENERAL

The Contractor shall give at least 24 hours advance notice prior to pouring concrete in any unit of the structure to permit the inspection of forms, the placement of reinforcing steel, and the preparations for the mixing and placing of the concrete. The mixing of concrete and placing of same in the form shall not be commenced until the City has given its approval of the forms, the placing of reinforcing and miscellaneous steel, and the Contractor's arrangements for mixing and placing concrete. No concrete shall be placed in any unit prior to completion of the form work and the placement of the reinforcing and other steel. No concrete shall be placed before the completion of any other operation which might prove detrimental to the concrete.

Whenever it is necessary to continue the mixing, placing and finishing of concrete after the daylight hours, the site of the work shall be brilliantly lighted so that all operations are

plainly visible. In general, however, concrete placing shall be so regulated as to permit finishing operations to be completed in the daylight hours.

The City reserves the right to order postponement of concrete placing operations when, in its opinion, impending weather conditions may result in rainfall or low temperatures which will impair the quality of the finished work. In case rainfall should occur after placing operations are started, the Contractor shall provide ample covering to protect the work. In case of drop in temperature, the provisions set forth herein shall be applied.

The sequence and manner of placing concrete shall be as provided on the plans. The operation of depositing and compacting the concrete shall be conducted so as to form a compact, dense, impervious mass of uniform textures which shall show smooth faces on all surfaces.

The method and manner of placing shall be such as to avoid the possibility of segregation of the aggregate or the displacement of the reinforcement. Concrete shall not have a free fall sufficient to cause segregation of materials. Tremies shall be used in order that the free fall of mix shall be held to a maximum of three (3') feet, unless otherwise approved by the Engineer.

Each part of the forms shall be filled by depositing concrete directly as near its final position as possible. The coarse aggregate shall be worked back from the face of the forms and the concrete shall be forced under and around the reinforcement bars without displacing them. Depositing large quantities at one point in the forms and running or working it along the forms will not be allowed.

After the concrete has taken initial set, the forms or the reinforcing steel shall not be jarred or any strain placed on projecting reinforcement.

Chutes, troughs, or pipes used as aids in placing concrete shall be arranged and used so that the ingredients of the concrete will not be separated. Open troughs and chutes shall extend, if necessary, down inside the forms or through holes left in the forms, or the ends of such chutes shall terminate in vertical downspouts. All chutes, troughs, and pipes shall be kept clean and free from coating by hardened concrete by a thorough flushing with water before and after each placement. Water used for flushing shall be discharged clear of the concrete in place.

Where the Contractor's operations involve the placing from above, that is, directly into an excavated area in or through the completed forms, particularly in the case of abutments, piers, columns, retaining walls, walls, floors, footings, and deep girders, all concrete so placed shall be deposited through a vertical sheet metal or other approved pipe not less than six (6") inches nor more than ten (10") inches in diameter. The pipe shall be made in sections so that the outlet may be adjusted to proper heights during placing operations.

Concrete shall be placed in continuous horizontal layers approximately twelve (12") inches in thickness. The rate of delivery shall be so arranged that a cold joint is not allowed to form

between loads. The Contractor shall avoid unauthorized construction joints by placing required portions of abutments, piers, walls, floors, slabs, columns or superstructures in one continuous operation. As a safety precaution, openings in the forms shall be provided for the removal of laitance and other foreign material.

All concrete shall be well compacted and the mortar flushed to the surface of the forms by continuous working with concrete spading implements and mechanical vibrators of an approved type. Vibrators of the type which operate by attachment to forms or reinforcement will not be permitted. The vibrators shall be applied to the concrete immediately after deposit and shall be moved throughout the mass, thoroughly working the concrete around the reinforcement, embedded fixtures, and into the corners and angles of the forms until it has been reduced to a plastic mass. The mechanical vibrator shall not be operated so that it will penetrate or disturb layers placed previously which have become partially set or hardened. The vibration shall be of sufficient duration to accomplish thorough compaction and complete embedment of reinforcement and fixtures but shall not be done to an extent that will cause segregation. Vibration shall be supplemented by hand spading to insure the flushing of mortar to the surface of all forms.

C 31.10 PLACING CONCRETE IN COLD WEATHER

No concrete shall be placed when the atmospheric temperature is at or below 40 degrees F., taken in the shade away from artificial heat unless permission is given by the City. In cases where the temperature drops below 40 degrees F. after the concreting operations have been started, the Contractor shall furnish sufficient canvas and frame work or other type of housing to enclose and protect the structure in such a way that heated air around the forms and fresh concrete can be kept at a temperature not less than 40 degrees F. for a period of five days after the concrete is placed.

It is understood that the Contractor is responsible for the protection of concrete placed under any and all weather conditions. Permission given by the City to place concrete during low temperature or freezing weather will in no way relieve the Contractor of the responsibility for satisfactory results. Should concrete placed under such conditions prove unsatisfactory, it shall be removed and replaced by the Contractor at his expense.

The concrete shall be placed in horizontal layers of not more than twelve (12") inches in thickness extending from end to end or side to side of the section between walls or approved joints. A time interval of not longer than thirty (30) minutes shall elapse between the placing of successive layers. The concrete shall be compacted, evenly distributed and placed around the reinforcement, openings and structure so that honeycomb and/or defective areas are eliminated.

Wall forms shall at all times during the placing of the concrete and until its initial set has occurred, be maintained in true alignment and grade. During the placing of the concrete, frequent inspection shall be made and the necessary corrective measures taken if forms or supports show any tendency to become displaced.

Forms shall be removed in accordance with a time schedule to be approved by the City, and all defective areas, tie pits, etc., shall be immediately treated in accordance with the requirement of other items of these specifications.

C 31.11 TYPES OF FINISHING FOR CONCRETE

In general, except as elsewhere permitted in these specifications, special documents, specific plans, or by direction of the City, finishes shall be an integral part of a monolithic process. The following schedule of finishes shall apply according to their applicability unless otherwise specified, amended, or extended.

- a. Screeding. Screeding is an operation normally associated with horizontal concrete surfaces such as slabs. Screeding shall be done as soon as concrete has been approximately leveled. The screed shall be designed adaptable to the use intended, shall have provision for vertical adjustment, and shall be sufficiently rigid to remain true to shape during use.

The screed shall be vertically adjusted so as to leave the concrete surface at an elevation slightly above grade after the initial strike off to allow for consolidation and finishing. Continue screeding and tamping alternately or in unison until the concrete is properly consolidated and surface voids are eliminated. The surface shall then be brought to a smooth, true alignment by means of longitudinal screeding, then finished as specifically required.

- b. Surface Rubbing. Carborundum fluted surface stones provide an abrasive which, when applied in surface rubbing at the proper time in the concrete aging process, will remove form marks, surface imperfections, and otherwise smooth, shape, or finish the surface.

- (1) "First Surface Rubbing." As soon as the forms are removed all necessary pointing shall be done. When the pointing has set sufficiently to permit rubbing, all surfaces requiring surface finish shall be wet and given a first surface rubbing with a No. 16 Carborundum Stone or an abrasive of equal quality. The rubbing shall be continued sufficiently to bring the surface to a paste, to remove all form marks and projections, and to produce a smooth dense surface without pits or irregularities. The material that has been ground to a paste shall be carefully spread or brushed uniformly over the surface and allowed to take a reset. The use of cement to form a surface will not be permitted.

In general, chamfered corners shall not be rubbed in the first surface rubbing.

- (2) "Final Finish." The surface of the entire structure requiring finish shall be cleaned of all drip marks, dirt, and discolorations and shall be given a final finish rubbing with a No. 30 Carborundum Stone or an abrasive of equal quality. On completion of this rubbing, the finished surfaces shall be neatly stripped with a brush, and the mortar on the surface shall be allowed to take a reset. After the mortar has taken a reset, the

surface shall be washed down with clean water. The entire structure shall be left with a clean, neat, and uniform appearing finish, and shall be uniform in color.

- c. Wood Float Finish. Surfaces shall be finished using a wood float to a true even plane with no coarse aggregate visible. Sufficient pressure shall be used on the wood float to bring all excess moisture to the surface so that it can be removed. The surface shall have a uniform appearance and shall meet straightness requirements.
- d. Steel Trowel Finish. After all surface moisture has disappeared following the wood float finish, surfaces shall be steel trowelled to a smooth, even, impervious finish, free from blemishes including trowel marks. Where indicated on the plans, a floor hardener shall be applied to slabs receiving a steel trowel finish.
- e. Brush Finish. Following the steel trowel finish, surface of the concrete shall be brushed lightly with a soft-bristled brush. The brush shall be kept clean and shall be dipped in water frequently so that it will be clean and wet at all times. Brushing shall be limited to that necessary to remove the glaze and produce a nonslip surface.
- f. Power-Machine Finish (option). In lieu of hand finishing, surfaces of slabs may be finished by using an approved power finishing machine in accordance with the directions of the machine manufacturer. The preparation of concrete surfaces for finishing by machine shall in general be the same as required for hand finishing, and the finish shall be of the quality required for the specific surface.

C 31.12 FINISHING SLABS (ROOF, TOPS, ETC.)

As soon as concrete placing operations have been completed for a slab section of sufficient width to permit finishing operations, the concrete shall be approximately leveled and then struck off, tamped, and screeded using a longitudinal screed. The surface shall then be brought to a smooth, true alignment by means of longitudinal screeding, floating, belting, and/or other methods. When templates are used, they shall be of such design as to permit early removal in order to avoid construction joints and to permit satisfactory finishing at and adjacent to the site of the template.

While the concrete is still plastic, the surface shall be straightedged by the use of a standard ten (10') footmetal straightedge. Deviations in excess of permissible variations shall be corrected. The final surface finish of the slab shall be done after the initial straightedging, and corrective adjusting, if required, is completed.

C 31.13 FINISHING EXPOSED SURFACES

All tie wires shall be cut back below the surface and then pointed over. All imperfections such as fins shall be removed and local surface depressions pointed over. Exposed interior surfaces, excluding vaults unless otherwise specified, and exterior surfaces to an elevation of one (1') foot below planned grade, which will be exposed to view after backfilling, shall be surface rubbed with Carborundum fluted surface stones.

C 31.14 CURING CONCRETE

All upper surfaces not formed shall be cured by one of the following methods:

- a. Wet Covering. The surface shall be covered by wet burlap, cotton mats or canvas covering immediately following the finishing operations and shall be kept thoroughly wet for a period of four (4) curing-days after the concrete is placed. Covering shall be held in direct contact with the concrete. Water used for curing shall be free from injurious amount of oil, acid, alkali, salt, or other deleterious substances.

Immediately following the finishing operations, concrete slabs, including roof slabs, shall be covered with wet cotton mats or with a temporary covering of canvas or burlap. The temporary covering will be required when the size of slab, size of mats, or other factors are such that the mats cannot be placed immediately following the finishing operations without marring the finish of the slab.

Canvas or burlap covering material shall weigh not less than twelve (12) ounces per square yard, and the sections shall be placed with a lap at the edges of at least eight (8") inches. Cover material shall be saturated with water before placing and shall be kept saturated as long as it remains in place. Care shall be exercised in the placing of the cover material in order to prevent marring the concrete surface.

When temporary coverings are used, they shall remain in place only until the slab has hardened sufficiently that a cotton mat covering can be substituted without marring or disturbing the slab finish. Cotton mats shall be thoroughly saturated before placing and shall be kept on the slab in a saturated condition for a period of at least four (4) curing-days after the concrete is placed.

- b. Impervious Coating. Immediately after finishing, the surface of the concrete shall be covered with a continuous, uniform, water impermeable coating of curing compound. Immediately after removal of the side and end forms, the sides and ends of all concrete shall receive a like coating. The solution shall be applied under pressure with a spray nozzle in such a manner as to cover the entire exposed surface thoroughly and completely with a uniform film.

The rate of application shall be such as to insure complete coverage, but the area covered shall not exceed two hundred (200) square feet per gallon of curing compound.

Under normal conditions, the curing compound, after application, shall dry to touch within one (1) hour and shall dry thoroughly and completely within four (4) hours. When thoroughly dry, it shall provide a continuous flexible membrane free from cracks or pinholes and will not disintegrate, check, peel, or crack during the required curing period. If for any reason the seal is broken during the curing period, it shall be immediately repaired with additional sealing solution.

C 31.15 MEASUREMENT OF CONCRETE

The quantities of concrete not included in the bid price for a structure, vault, manhole, etc., of the various classifications which constitute the complete and accepted structure will be measured by the cubic yard in place. Only accepted work will be included, and the dimensions used will be those shown on the plans or ordered in writing by the Engineer. Reinforcing steel, not included in the bid price for a structure, vault, manhole, etc., will be measured by the pound, complete in place.

C 31.16 PAYMENT FOR CONCRETE

The concrete quantities, measured as provided above and not included in the bid price for the various structures, will be paid for at the unit bid price per cubic yard for the various classifications of concrete shown. Price will be full compensation for furnishing, hauling, and mixing all concrete materials; placing, curing and finishing all concrete; all grouting and pointing; and for all forms and false work, labor, tools, equipment, and incidentals necessary to complete the work.

Payment for all reinforcing in place and not included in the bid price for various structures, will be paid for at the unit price bid per pound.

Payment for all concrete and reinforcing steel in place in the completed structures shall be included in the bid price for the structures complete in place.

C 31.17 BLOCKING AND CRADLE

Concrete blocking including vertical tie-down and horizontal blocking and cradle shall be Class "B" concrete unless specified otherwise or shown on the Standard Details. Concrete cradles shall be placed under the pipe as directed by the City in areas of unsatisfactory foundation conditions or when there is an excessive cover over the pipe.

Blocking at bends shall be computed based upon pipe thrust at bends, or tees, with internal pressure of 150 psi. Where upward thrusts are to be blocked, the concrete blocking shall be of sufficient weight to resist the thrust and the concrete shall be reinforced as directed by the Engineer. Other blocking sizes shall be computed based upon a maximum safe allowable soil bearing pressure of 2,500 pounds per square foot of undisturbed earth.

The concrete blocking shall be placed against undisturbed trench walls, with a minimum of 18 inches between trench wall and pipe. Blocking shall extend a minimum of 0.75 X pipe diameter below and above the centerline of pipe and shall not extend beyond any joints. If requested by the Engineer, the ends of the thrust blocks shall be contained in wood or metal forms. Where upward thrusts are to be blocked, the concrete shall be formed from the centerline of pipe upward.

Concrete blocking shall be considered subsidiary to the various items. No additional payment will be made for concrete blocking.

C 32 TEMPORARY EROSION, SEDIMENTATION, AND WATER POLLUTION PREVENTION AND CONTROL

C 32.1 SCOPE

This item shall govern the control measures necessary to prevent and control soil erosion, sedimentation, and water pollution which may degrade receiving waters including rivers, streams, lakes, reservoirs, ground water, and wetlands. The control measures contained herein shall be installed and maintained throughout the construction contract and coordinated with any permanent or temporary pollution control features specified elsewhere on the plans and in the specifications to assure effective and continuous water pollution control throughout the construction and post construction periods. These control measures shall not be used as a substitute for the permanent pollution control measures unless otherwise directed by the City in writing. The controls may include silt fences, straw bale dikes, rock berms, diversion dikes, interceptor swales, sediment traps, and basins, pipe slope drains, inlet protection, stabilized construction entrances, seeding, sodding, mulching, soil retention blankets or other structural or non-structural storm water pollution control.

C 32.2 ITEMS OF WORK AND MATERIALS

It will be the Contractor's responsibility to determine the type and quantity of temporary erosion control measures required on the project. The materials used will be as specified in Section B of these specifications.

C 32.3 PRECONSTRUCTION SUBMITTALS

Prior to the start of construction, the contractor shall submit to the City, for acceptance, schedules for storm water pollution control measures in accordance with the erosion and sediment control plan or the Storm Water Pollution Prevention Plan (SWPPP). Work on the project shall not begin until the schedules have been reviewed and accepted, in writing, by the City. The Contractor shall provide the City, for information purposes, proposed methods of storm water pollution control for Contractor operations in areas which are outside the rights of way or easements (such as construction and haul roads, field offices, equipment and supply storage areas, portable process plants and source material storage) as well as a plan for disposal of waste materials.

C 32.4 CONSTRUCTION REQUIREMENTS

- a. The Contractor shall provide control measures to prevent or minimize the impact to receiving waters as required by the plans and/or as directed by the City in writing in accordance with an approved erosion and sediment plan or SWPPP.

In any disturbed area where construction activities have ceased, permanently or temporarily, the Contractor shall initiate stabilization of the area by the use of seeding, mulching, soil retention blankets or other appropriate measures within 14 calendar days.

The Contractor shall effectively prevent and control erosion and sedimentation on the site at the earliest practicable time as outlined in the approved schedule. Control measures, where applicable, will be implemented prior to the commencement of each construction operation or immediately after the area has been disturbed.

The Contractor shall limit the amount of disturbed earth to the area(s) shown on the plans or as directed by the City. The City has the authority to limit the disturbed surface area exposed by construction operations. If, in the opinion of the City, the Contractor is not able to effectively control soil erosion and sedimentation resulting from the construction operations, the City will limit the amount of disturbed area to that which the Contractor is able to control.

Should the control measures fail to function effectively, the Contractor shall act immediately to bring the erosion and sedimentation under control by maintaining existing controls, adding controls as needed or as directed by the City's Representative. When in the opinion of the City's Representative the site is adequately stabilized, the control measures, except mulches and soil retention blankets, will be removed and properly disposed of by the Contractor. Soil retention blankets shall be removed only when, in the opinion of the City's Representative, final permanent perennial seeding would be adversely affected by the presence of an existing soil retention blanket.

All erosion, sediment and water pollution controls will be maintained in good working order. Inspections should be made at least once every seven (7) days. A rain gauge provided by the Contractor shall be located at the project site. Within twenty-four (24) hours of a rainfall event of five-tenths (0.5) inch or more as measured by the project rain gauge, the Contractor and City's Representative will inspect the entire project to determine the condition of the control measures. Sediment shall be removed and devices repaired as soon as practicable but no later than seven (7) calendar days after the surrounding exposed ground has dried sufficiently to prevent further damage from equipment operations needed for repairs.

In the event of continuous rainfall over a twenty-four (24) hour period, or other circumstances that preclude equipment operation in the area, the Contractor shall install backup control measures, as determined by the City's Representative as soon as practical. Any corrective action needed for the control measures shall be accomplished in the sequence directed by the City's Representative.

- b. The Contractor shall also conform to the following practices and controls. All labor, tools, equipment, and incidentals to complete the following work will not be paid for directly, but shall be considered as subsidiary work to the various items included in the contract.
 - (1) Disposal areas, stockpiles, and haul roads shall be constructed in manner that shall minimize the amount of sediment that may enter receiving water. Disposal areas shall not be located in any flood plain or receiving water. Construction roads may not be located in or cross any receiving water without prior approval of the City's

Representative and shall be done in compliance with applicable rules and regulations.

- (2) Construction operations in receiving water shall be restricted to those areas where it is necessary to perform the work shown on the plans. Whenever streams are crossed, temporary bridges, timber mats or other structures shall be used.
 - (3) Protected storage for paints, chemicals, solvents, fertilizers, and other potentially toxic materials shall be provided by the Contractor at a location approved by the City's Representative.
 - (4) Construction staging areas and vehicle maintenance areas shall be constructed by the Contractor in a manner to minimize the area disturbed (use barriers to confine the area) and to prevent the runoff of pollutants at a location approved by the City's Representative. When work areas or material sources are located adjacent to a receiving water, control measures such as diversion dikes or rock berms, shall be used to keep sediment and other contaminants from entering the adjacent receiving water. Care shall be taken during the construction and removal of such barriers to minimize down-gradient sedimentation.
 - (5) All receiving water shall be cleared as soon as practicable of temporary embankment, temporary bridges, matting, false work, piling, debris, or other obstructions placed during construction operations that are not a part of the finished work.
 - (6) Disturbance of vegetation shall be minimized and limited to only what is shown on the construction plans or as directed by the City's Representative in writing.
 - (7) The Contractor shall clean paved surfaces as necessary by the end of each day to remove sediment which has accumulated on the roadway.
- c. The project shall not be accepted until the Contractor has cleaned up all areas listed in Item 32.4(b) to the satisfaction of the City's Representative. The project shall also not be accepted until the Contractor provides a uniform perennial vegetative cover with a density of seventy (70) percent of adjacent undisturbed areas, or, if in the opinion of the City's Representative, permanent measures such as rip rap, gabions, or geotextiles, supplemented by temporary measures such as mulching with seed, straw bale dikes, silt fences, earth dams, etc. have been employed that shall control erosion, sedimentation, and water pollution until sufficient vegetative cover can be established.

C 32.5 MEASUREMENT AND PAYMENT

If the Contractor is required to install temporary erosion, sediment and water pollution control measures due to negligence, carelessness, lack of maintenance, or failure to install permanent controls as a part of the work scheduled, and measures are ordered by the City's Representative, such work shall not be measured for payment but shall be performed at the

Contractor's expense. All labor, tools, equipment and incidentals to complete the work under Item 32.4(b) shall not be paid for under applicable contract items, but considered subsidiary to the various bid items.

When the need for control measures can not be attributed to the Contractor's negligence, carelessness, lack of maintenance, or failure to install permanent water pollution control measures and these measures are shown on the plans and/or directed by the City's Representative, these measures shall be measured and paid for in accordance with applicable contract bid items. For work performed under the requirements of this item which is not comparable to work performed under contract bid items, such work shall be performed by agreed unit prices or lump sum basis. Removal of control measures not incorporated as permanent control measures shall be measured and paid for in accordance with applicable contract bid items.

In case of failure on the part of the Contractor to prevent and control soil erosion, sedimentation, and water pollution which may degrade receiving water, the City's Representative reserves the right to employ outside assistance or to use City forces to provide the necessary corrective measures. All costs including engineering costs will be deducted from any moneys due or becoming due to the Contractor.

C 33 GABION STRUCTURES

C 33.1 SCOPE

a. Gabion Basket Assembly:

- (1) Gabion baskets shall be assembled by unfolding on a hard surface and stamping out all kinks. Fold up the front, back and back panels and fasten together with projecting heavy gauge wire by twisting it around the selvedge wire two complete turns. Fold the diaphragms up and secure them in the same manner. All edges and diaphragms to sides are now laced together in the following manner: Cut a length of lacing wire approximately five feet long, secure the wire at one end by looping and twisting together, then proceed lacing with a double loop (made at the same point) approximately every four to five inches apart, pulling the basket pieces tightly together. Secure the end of the wire by again looping and twisting.
- (2) Gabion baskets shall then be placed in position empty and shall be tied together each to its neighbor along all contacting edges in order to form a continuous connecting structural unit. Tying shall be in the same manner as that used to assemble baskets and shall produce a joint that is as strong as the body of the mesh.

b. Gabion Basket Placement: Gabions three feet high that are to be placed in a straight row are to be stretched in the following manner before being tied to the adjacent gabions. Tie together approximately 100 feet of gabion baskets end to end. Secure one end of the row by tying gabions already filled or fill the end gabion with stone and then stretch baskets sufficiently to removed any kinks. While maintaining tension, tie the row of baskets to its neighbor and then fill with stone.

c. Gabion Stone Placement: When the assembled empty gabion baskets have been installed, the gabion stone shall then be placed in the following manner: The gabion baskets may be filled by machine with sufficient additional hand work to accomplish a maximum density and a minimum amount of voids. Vertical outside surfaces shall be placed by hand with large select stone in order to achieve the best appearance. Baskets are to be filled in 12 inch layers in order to install a looped inner tie wire in each cell connecting to front and back faces every 12 inches of vertical height in any unsupported face. Individual cells may not be filled more than one foot above any adjacent cell unless looped inner tie wires run in both direction.

d. Gabion Basket Closure: When each gabion basket has been filled to its maximum, which is approximately 1½ inches higher than the sides and the surface leveled with a minimum amount of voids, the lids shall be pried down and over with a bar until the edge of the lid and edge of the basket are together. The heavy projecting wire on the lid shall be twisted around the heavy wire on the sides, two complete turns. The lid shall then be tied to the edges and tops of the diaphragms in the same manner as the baskets are assembled so that the finished joint is as strong as the body of the mesh. The lids of the gabion baskets shall also be tied together, each to its neighbor along the connecting edges to insure the

formation of a continuous connecting structural unit. Special attention shall be given that all projecting sharp ends of wire are turned in.

C 33.2 MEASUREMENT AND PAYMENT

Gabions shall be measured for payment in cubic yards, based on the dimensions shown on the plans or on revised dimensions, where changes are ordered or approved. Gabions shall be paid for at the contract unit price, complete in place, as provided in the proposal and the contract. The contract unit price shall be the total compensation for preparing the subgrade, including excavation, for furnishing, placing, shaping, and tamping backfill; and for all labor, tools, equipment and incidentals necessary to complete the work, all in accordance with the plans and specifications.

PART D
STANDARD DETAILS

SEE CITY OF ARLINGTON WEBSITE

<http://www.arlington-tx.gov/water/water-sewer-specs-details/>