ALL SECTIONS OF THIS SPECIFICATION BELOW, SHALL HAVE METHODS AND MATERIALS APPROVED BY THE OWNER'S FIELD REPRESENTATIVE OR GEOTECHNICAL ENGINEER, HEREIN REFERRED TO AS THE 'AUTHORITY'. ALL WORK SHALL BE AS APPROVED, AND PERFORMED TO THE SATISFACTION OF THE OWNER, OWNER'S FIELD REPRESENTATIVE, GEOTECHNICAL ENGINEER, OR THE AUTHORITY HAVING JURISDICTION.

B. <u>GENERAL</u>

PIPE SHALL BE OF THE TYPE AND SIZES SPECIFIED AND SHALL BE LAID ACCURATELY TO LINE AND GRADE. STRUCTURES SHALL BE ACCURATELY LOCATED AND PROPERLY ORIENTED. THE SECTIONS OF THESE SPECIFICATIONS ENTITLED "PIPE AND UTILITY STRUCTURES" AND "TRENCH EXCAVATION AND BACKFILL" SHALL APPLY TO THE WORK OF THIS SECTION. THE REQUIREMENTS OF THE HEALTH DEPARTMENT AND ANY OTHER AUTHORITY HAVING JURISDICTION SHALL GOVERN THE INSTALLATION, AND THE HORIZONTAL AND VERTICAL SEPARATION OF SANITARY SEWERS FROM WATER LINES.

SERVICE LINE(S) SHALL BE INSTALLED FROM THE SANITARY SEWER SYSTEM TO POINT(S) LOCATED FIVE (5) FEET OUTSIDE THE BUILDING LINES. WORK SHALL ALSO INCLUDE CONNECTION(S) TO THE SANITARY SEWER SYSTEM AND CONNECTION(S) TO THE WORK OF THE BUILDING PLUMBING CONTRACTOR. THE CONTRACTOR SHALL COORDINATE HIS WORK WITH THE WORK OF THE BUILDING PLUMBING CONTRACTOR TO DETERMINE THE EXACT LOCATION(S) AND ELEVATION(S) OF THE POINT(S) OF ENTRY INTO THE BUILDING.

C. <u>TESTS</u>

AS APPLICABLE, THE CONTRACTOR SHALL TEST THE COMPLETED SANITARY SEWERS FOR LEAKAGE AND DEFLECTION AS SPECIFIED HEREIN. THE TESTS SHALL BE CONDUCTED BY THE CONTRACTOR AS DIRECTED, AND THE CONTRACTOR SHALL FURNISH ALL NECESSARY EQUIPMENT, MATERIALS AND LABOR FOR THE TESTS AS SPECIFIED. THE CONTRACTOR SHALL NOTIFY THE OWNER'S FIELD REPRESENTATIVE AND SITE ENGINEER AT LEAST 48 HOURS PRIOR TO THE START OF TESTING, AND TESTING SHALL BE DONE IN THEIR PRESENCE.

ADDITIONAL TEST REQUIREMENTS — RUNS OF PIPE AND/OR MANHOLES TESTED FOR LEAKAGE PRIOR TO COMPLETION OF THE PROJECT SHALL BE SUBJECT TO ADDITIONAL LEAKAGE TESTS, IF WARRANTED.

PROCEDURE AND METHOD OF TESTING - THE TEST LENGTH INTERVALS AND TYPE OF LEAKAGE TEST SHALL BE AS DIRECTED. IN THE CASE OF SEWERS LAID ON STEEP GRADES, THE LENGTH OF LINE TO BE TESTED BY EXFILTRATION AT ANY ONE TIME MAY BE LIMITED BY THE MAXIMUM ALLOWABLE INTERNAL PRESSURE ON THE PIPE AND JOINTS AT THE LOWER END OF THE LINE. DEPENDING ON FIELD CONDITIONS AND/OR DESIRE OF THE CONTRACTOR, THE FOLLOWING HYDROSTATIC OR VACUUM AND AIR TESTS FOR LEAKAGE MAY BE EMPLOYED:

HYDROSTATIC TESTING (INFILTRATION/EXFILTRATION) SHALL BE AS FOLLOWS: -

THE TEST PERIOD, WHEREIN THE MEASUREMENTS ARE TAKEN SHALL NOT BE LESS THAN FOUR (4) HOURS IN EITHER TYPE OF TEST. THE TOTAL LEAKAGE OF ANY SECTION TESTED SHALL NOT EXCEED THE RATE OF 100 GALLONS PER MILE OF PIPE PER 24 HOURS PER INCH OF NOMINAL PIPE DIAMETER. FOR PURPOSES OF DETERMINING THE MAXIMUM ALLOWABLE LEAKAGE, MANHOLES SHALL BE CONSIDERED AS SECTIONS OF PIPE AND SHALL BE TESTED AT A LEVEL ABOVE THE HIGHEST JOINT PRIOR TO THE CONCRETE/RIM CONNECTION

WHEN A STANDPIPE AND PLUG ARRANGEMENT IS USED IN THE UPPER MANHOLE OF A LINE UNDER TEST, THERE MUST BE SOME POSITIVE METHOD OF RELEASING ENTRAPPED AIR IN THE SEWER PRIOR TO TAKING MEASUREMENTS.

- (a) INFILTRATION TEST THIS TEST MAY BE USED ONLY WHEN GROUND WATER LEVELS ARE AT LEAST TWO (2) FEET ABOVE THE TOP OF THE PIPE FOR THE ENTIRE LENGTH OF THE SECTION TO BE TESTED DURING THE ENTIRE PERIOD OF THE TEST. GROUND WATER LEVELS MAY BE MEASURED IN AN OPEN TRENCH OR IN STANDPIPES PREVIOUSLY PLACED IN BACKFILLED TRENCHES DURING THE BACKFILLING OPERATIONS. WHEN STANDPIPES ARE INSTALLED IN THE BACKFILL FOR GROUND WATER MEASUREMENT, THE LOWER ENDS OF THESE SHALL BE SATISFACTORILY EMBEDDED IN A MASS OF CRUSHED STONE OR GRAVEL TO MAINTAIN FREE PERCOLATION AND DRAINAGE. INFILTRATION THROUGH JOINTS SHALL BE MEASURED BY USING A WATERTIGHT WEIR OR ANY OTHER APPROVED DEVICE FOR VOLUMETRIC MEASUREMENT INSTALLED AT THE LOWER END OF THE SECTION UNDER TEST.
- (b) EXFILTRATION TEST THIS TEST CONSISTS OF FILLING THE PIPE WITH WATER TO PROVIDE A HEAD OF AT LEAST TWO (2) FEET ABOVE THE TOP OF THE PIPE OR TWO (2) FEET ABOVE GROUND WATER, WHICHEVER IS HIGHER, AT THE HIGHEST POINT OF THE PIPELINE UNDER TEST, AND THEN MEASURING THE LOSS OF WATER FROM THE LINE BY THE AMOUNT WHICH MUST BE ADDED TO MAINTAIN THE ORIGINAL LEVEL. IN THIS TEST THE LINE MUST REMAIN FILLED WITH WATER FOR AT LEAST TWENTY-FOUR (24) HOURS PRIOR TO THE TAKING OF MEASUREMENTS. EXFILTRATION SHALL BE MEASURED BY THE DROP OF WATER LEVEL IN A CLOSED-END STANDPIPE OR IN ONE OF THE SEWER MANHOLES AVAILABLE FOR CONVENIENT MEASURING.

VACUUM AND AIR TESTING — SHALL BE AS FOLLOWS:

- (a) VACUUM TESTING OF MANHOLES SHALL CONFORM TO THE REQUIREMENTS OF ASTM C-1244 "STANDARD TEST METHOD FOR CONCRETE SEWER MANHOLES BY NEGATIVE AIR PRESSURE (VACUUM) TEST PRIOR TO BACKFILL".
- (b) LOW-PRESSURE AIR TEST OF PLASTIC PIPELINES SHALL CONFORM TO THE REQUIREMENTS OF ASTM F-1417 "STANDARD TEST METHOD FOR INSTALLATION ACCEPTANCE OF PLASTIC GRAVITY SEWER LINES USING LOW-PRESSURE AIR".

DEFLECTION TESTS - IN ADDITION TO THE TEST(S) FOR LEAKAGE, THE CONTRACTOR SHALL TEST ALL THERMOPLASTIC MAIN LINE PIPE BY USE OF A CALIBRATED MANDREL OR OTHER DEVICE APPROVED BY THE OWNER'S FIELD REPRESENTATIVE TO ENSURE THAT NO PIPE DEFLECTION HAS OCCURRED GREATER THAN 5 PERCENT OF THE INSIDE DIAMETER OF THE PIPE. THE CONTRACTOR SHALL TEST THE ENTIRE LENGTH OF THE SEWER INSTALLED. ANY PIPE SECTION EXHIBITING GREATER THAN 5 PERCENT DEFLECTION SHALL BE REPLACED AND RETESTED, AT NO ADDITIONAL COST TO THE OWNER. IF A SECOND DEFLECTION TEST IS REQUIRED, IT WILL BE AT THE CONTRACTOR'S EXPENSE.

CORRECTION OF DEFECTIVE WORK - IF THE TESTS EXCEED THE SPECIFIED AMOUNT, THE CONTRACTOR SHALL, AT HIS OWN EXPENSE, MAKE THE NECESSARY REPAIRS OR REPLACEMENTS REQUIRED TO PERMANENTLY REDUCE THE LEAKAGE AND/OR DEFLECTION TO WITHIN THE SPECIFIED LIMITS, AND THE TESTS SHALL BE REPEATED UNTIL THE TEST REQUIREMENTS ARE MET. ANY DEFECTS FOUND IN THE SANITARY SEWERS SHALL BE MADE GOOD BY AND AT THE EXPENSE OF THE CONTRACTOR SO AS TO CONFORM STRICTLY TO THE SPECIFICATIONS AND TO THE SATISFACTION OF THE OWNER'S FIELD REPRESENTATIVE. ALL REPAIRS SHOWN NECESSARY BY THE TESTS SHALL BE MADE, BROKEN OR CRACKED PIPE REPLACED, ALL DEPOSITS REMOVED, AND THE SANITARY SEWERS LEFT TRUE TO LINE AND GRADE AND ENTIRELY CLEAN, FREE FROM LUMPS OF CEMENT, PROTRUDING GASKETS, BULKHEADS, ETC., AND READY FOR USE BEFORE FINAL ACCEPTANCE SHALL BE MADE.

REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION - IN THE EVENT OF CONFLICT BETWEEN THE TEST REQUIREMENTS SPECIFIED HEREIN AND THE TEST REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION OVER ALL OR ANY PORTION OF THE SANITARY SEWERS INSTALLED UNDER THE CONTRACT, THE MORE RESTRICTIVE REQUIREMENTS SHALL GOVERN.

D. <u>MATERIALS</u>

THE MATERIALS TO BE USED IN THE CONSTRUCTION SHALL BE THOSE INDICATED ON THE DRAWINGS AND SPECIFIED HEREIN. THE CONTRACTOR SHALL SUPPLY TO THE OWNER'S FIELD REPRESENTATIVE. PRIOR TO INSTALLATION. CERTIFICATES OF COMPLIANCE FOR THE MATERIALS USED. THE CONTRACTOR SHALL ALSO SUBMIT SHOP DRAWINGS AND CATALOG CUTS OF ALL SANITARY SEWER ITEMS AND APPURTENANCES (PIPE, FITTINGS, JOINTS, CASTINGS, STEPS, PRECAST CONCRETE STRUCTURES. ETC.) TO THE SITE ENGINEER FOR REVIEW PRIOR TO ORDERING.

PIPE AND JOINTS SHALL BE AS INDICATED IN THE UTILITY NOTES.

STRUCTURES SHALL BE AS SPECIFIED IN THE SECTION OF THESE SPECIFICATIONS ENTITLED "PIPE AND UTILITY STRUCTURES". WHERE MATERIAL REQUIREMENTS SPECIFIED HEREIN CONFLICTS WITH THE REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION, THE REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION SHALL

VII.WATER LINES

A. <u>SCOPE</u>

THE CONTRACTOR SHALL PROVIDE ALL LABOR, PLANT, MATERIAL, AND EQUIPMENT NECESSARY AND REQUIRED TO INSTALL ALL OF THE WATER LINE FACILITIES IN ACCORDANCE WITH THE CONTRACT DOCUMENTS. WORK SHALL INCLUDE, BUT NOT BE LIMITED TO, INSTALLATION OF THE WATER LINES CONSISTING OF ALL PIPE, FITTINGS, VALVES, VALVE BOXES, HYDRANTS, ANCHOR AND/OR THRUST BLOCKS, AND ALL NECESSARY AND REQUIRED APPURTENANCES, ACCESSORY ITEMS AND OPERATIONS, INCLUDING CONNECTION(S) AND INSTALLATION OF BUILDING SERVICE LINES. WORK SHALL ALSO INCLUDE REMOVAL AND RELOCATING HYDRANTS AND WATER LINES (AS APPLICABLE), INSTALLATION OF POST INDICATOR VALVES, AND TESTING AND DISINFECTION.

ALL SECTIONS OF THIS SPECIFICATION BELOW, SHALL HAVE METHODS AND MATERIALS APPROVED BY THE OWNER'S FIELD REPRESENTATIVE OR GEOTECHNICAL ENGINEER, HEREIN REFERRED TO AS THE 'AUTHORITY'. ALL WORK SHALL BE AS APPROVED, AND PERFORMED TO THE SATISFACTION OF THE OWNER, OWNER'S FIELD REPRESENTATIVE, GEOTECHNICAL ENGINEER, OR THE AUTHORITY HAVING JURISDICTION.

THE CONTRACTOR SHALL INSTALL ALL WATER LINES, INCLUDING SERVICE LINES, IN THE LOCATIONS SHOWN ON THE DRAWINGS AND/OR AS DIRECTED BY THE OWNER'S FIELD REPRESENTATIVE. PIPE AND FITTINGS SHALL BE OF THE TYPE AND SIZES SPECIFIED AND SHALL BE LAID ACCURATELY TO LINE AND GRADE. HYDRANTS, VALVES, AND ALL OTHER WATER LINE APPURTENANCES SHALL BE ACCURATELY LOCATED AND PROPERLY ORIENTED. THE SECTIONS OF THESE SPECIFICATIONS ENTITLED "PIPE AND UTILITY STRUCTURES" AND "TRENCH EXCAVATION AND BACKFILL" SHALL APPLY TO THE WORK OF THIS SECTION. THE REQUIREMENTS OF THE HEALTH DEPARTMENT AND ANY OTHER AUTHORITY HAVING JURISDICTION SHALL GOVERN THE INSTALLATION, AND THE HORIZONTAL AND VERTICAL SEPARATION OF WATER LINES FROM SANITARY SEWERS AND STORM DRAINS, AND THE HYDROSTATIC TESTING AND DISINFECTION OF THE WATER LINE.

THE INSTALLATION OF ALL WATER LINES SHALL CONFORM TO THE REQUIREMENTS OF THE WATER AUTHORITY AND ALL OTHER AUTHORITIES HAVING JURISDICTION. THE WATER AUTHORITY AS REFERRED TO HEREIN SHALL BE UNDERSTOOD TO REFER TO SUEZ WATER, AND SHALL BE DESIGNATED AS THE WA.

C. <u>PIPE DEFLECTION AND COVER</u>

PIPE DEFLECTION — MAXIMUM ALLOWABLE DEFLECTION FOR PIPE LAID WITHOUT FITTINGS SHALL NOT EXCEED THE PIPE MANUFACTURER'S REQUIREMENTS AND THE REQUIREMENTS OF THE WA. DEFLECTION WHICH EXCEEDS THE MAXIMUM ALLOWABLE AS ESTABLISHED BY THE PIPE MANUFACTURER AND THE WA OR ANY OTHER AUTHORITY HAVING JURISDICTION SHALL BE GROUNDS FOR REJECTION OF THE LINE

COVER - THE WATER LINES SHALL BE LAID SO AS TO PROVIDE A MINIMUM COVER BELOW FINISHED GRADE AS REQUIRED BY THE WA.

D. <u>WATER LINE APPURTENANCES</u>

GATE VALVES AND VALVE BOXES - GATE VALVES SHALL BE INSTALLED ON ALL WATER LINES, HYDRANT LATERALS, AND SERVICE LINES. UNLESS OTHERWISE STATED, VALVES SHALL BE OF THE SAME SIZE AS THE LINE. VALVE BOXES SHALL BE PLACED OVER ALL BURIED VALVES AND SHALL BE PLACED SO AS NOT TO TRANSMIT VEHICLE LOADS OR SHOCK TO THE VALVES, CENTERED AND SET PLUMB OVER THE OPERATING NUT OF THE VALVE. THE COVER OF THE BOX SHALL BE SET EVEN WITH FINISHED GRADE. HYDRANTS SHALL BE INSTALLED/RELOCATED VERTICAL AND PLUMB. WITH THE REQUIRED COVER OVER THE HYDRANT LATERAL AND REQUIRED VEHICULAR CLEARANCE FROM CURB LINE AND/OR EDGE OF PAVEMENT. THE INSTALLATION SHALL PROVIDE PROPER ACCESS FOR FIRE DEPARTMENT CONNECTIONS. HYDRANTS AND THEIR INSTALLATION SHALL CONFORM TO THE REQUIREMENTS OF THE WA AND FIRE DEPARTMENT.

RESTRAINING DEVICES - AT HYDRANTS, BENDS, DEAD ENDS, ETC. THE INSTALLATION SHALL BE RODDED AS REQUIRED.

CONCRETE BLOCKING - WHERE PIPES CHANGE HORIZONTAL AND VERTICAL DIRECTION, AT HYDRANTS, TEES AND OTHER FITTINGS, AND WHENEVER ABNORMAL THRUST FORCES ARE DEVELOPED, THE CONTRACTOR SHALL CONSTRUCT THRUST AND/OR ANCHOR BLOCKS CONSISTING OF CLASS "A" CONCRETE, AND OF MINIMUM DIMENSIONS AS DETAILED ON THE DRAWINGS OR OF ADEQUATE SIZE TO SUIT ACTUAL CONDITIONS TO WITHSTAND THE PRESSURES ANTICIPATED, FOUNDED IN VIRGIN SOIL.

E. <u>SERVICE LINES</u>

UNDERGROUND WATER SERVICE LINES TWO (2) INCHES IN DIAMETER OR LESS SHALL BE TYPE K COPPER. JOINTS IN UNDERGROUND COPPER WATER SERVICE LINES SHALL BE MADE WITH FLARED FITTINGS OR WITH COMPRESSION FITTINGS (MUELLER COMPANY OR APPROVED EQUAL); SWEAT JOINTS SHALL NOT BE PERMITTED. UNDERGROUND WATER SERVICE LINES GREATER THAN TWO (2) INCHES IN DIAMETER SHALL BE DUCTILE IRON PIPE.

SERVICE LINE(S) SHALL BE INSTALLED FROM THE WATER DISTRIBUTION SYSTEM TO POINT(S) LOCATED FIVE (5) FEET OUTSIDE THE BUILDING LINE. WORK SHALL ALSO INCLUDE CONNECTION(S) TO THE WATER DISTRIBUTION SYSTEM AND CONNECTION(S) TO THE WORK OF THE BUILDING PLUMBING CONTRACTOR. THE CONTRACTOR SHALL COORDINATE HIS WORK WITH THE WORK OF THE BUILDING PLUMBING CONTRACTOR TO DETERMINE THE EXACT LOCATION(S) AND ELEVATION(S) OF THE POINT(S) OF ENTRY INTO THE BUILDING.

F. <u>TESTS</u>

THE CONTRACTOR SHALL PROVIDE ALL NECESSARY EQUIPMENT AND SHALL PERFORM ALL WORK REQUIRED IN CONNECTION WITH ALL TESTS AS SPECIFIED HEREIN. ALL PIPE SHALL BE TESTED BY HYDROSTATIC PRESSURE, FIFTY (50) PERCENT IN EXCESS OF THE NORMAL PSI WORKING PRESSURE, BUT NOT LESS THAN 150 PSI OR MORE THAN THE DESIGN RATING OF THE PIPE OR APPURTENANCES IN ACCORDANCE WITH AWWA C-600. THE TEST PRESSURE SHALL BE DETERMINED BY THE WA AND/OR OWNER'S FIELD REPRESENTATIVE.

EACH SECTION TESTED SHALL BE SLOWLY FILLED WITH WATER, CARE BEING TAKEN TO EXPEL ALL AIR FROM THE PIPES. IF NECESSARY, THE PIPES SHALL BE TAPPED AT HIGH POINTS TO VENT THE AIR. REQUIRED PRESSURE, AS MEASURED AT THE POINT OF LOWEST ELEVATION, SHALL BE APPLIED FOR NOT LESS THAN TWO (2) HOURS. AND ALL PIPE. FITTINGS. VALVES. HYDRANTS. AND JOINTS SHALL BE CAREFULLY EXAMINED FOR DEFECTS. LEAKY JOINTS SHALL BE MADE WATERTIGHT.

A LEAKAGE TEST SHALL ALSO BE CONDUCTED IN ACCORDANCE WITH AWWA C-600. PERMISSIBLE LEAKAGE SHALL BE IN ACCORDANCE WITH AWWA C-600. IN THE EVENT OF CONFLICT BETWEEN THE TESTS SPECIFIED HEREIN AND THE TEST REQUIREMENTS OF THE WA, HEALTH DEPARTMENT OR ANY OTHER AUTHORITY HAVING JURISDICTION OVER ALL OR ANY PORTION OF THE WATER LINES INSTALLED UNDER THIS CONTRACT, THE MORE RESTRICTIVE REQUIREMENTS SHALL GOVERN.

DISINFECTION OF COMPLETED LINE

AFTER THE WATER LINE HAS PASSED THE REQUIRED PRESSURE AND LEAKAGE TESTS AND BEFORE BEING PLACED IN SERVICE, THE ENTIRE LINE SHALL BE DISINFECTED. ALL DISINFECTING METHODS AND MATERIALS SHALL BE IN ACCORDANCE WITH AWWA C-651. ALL DISINFECTION OPERATIONS AND PROCEDURES SHALL MEET WITH THE APPROVAL OF THE WA AND HEALTH DEPARTMENT.

IF THE INITIAL BACTERIOLOGICAL TESTS ARE NOT SATISFACTORY, THE CONTRACTOR SHALL DO EVERYTHING NECESSARY TO OBTAIN SATISFACTORY BACTERIOLOGICAL TESTS INCLUDING MAKING PROVISIONS TO ISOLATE SHORTER SECTIONS OF THE LINE IF NECESSARY TO LOCATE THE SOURCE OF CONTAMINATION. ALL WORK NECESSARY AND REQUIRED TO OBTAIN SATISFACTORY BACTERIOLOGICAL TESTS SHALL BE AT THE CONTRACTOR'S EXPENSE AND AT NO ADDITIONAL COST TO THE OWNER.

THE MATERIALS TO BE USED IN THE CONSTRUCTION SHALL BE THOSE INDICATED ON THE DRAWINGS AND SPECIFIED HEREIN. THE CONTRACTOR SHALL SUPPLY TO THE OWNER'S FIELD REPRESENTATIVE, PRIOR TO INSTALLATION, CERTIFICATES OF COMPLIANCE FOR THE MATERIALS USED. THE CONTRACTOR SHALL ALSO SUBMIT SHOP DRAWINGS AND CATALOG CUTS OF ALL WATER LINE ITEMS AND APPURTENANCES (PIPE, FITTINGS, VALVES, VALVE BOXES, HYDRANTS, ETC.) TO THE SITE ENGINEER FOR REVIEW PRIOR TO ORDERING.

WATER SYSTEM PIPE AND APPURTENANCES

ALL MATERIALS FOR WATER LINES AND APPURTENANCES SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE WA. PIPE AND JOINTS SHALL BE AS INDICATED IN THE UTILITY NOTES.

HYDRANTS - NEW HYDRANTS SHALL BE WA STANDARD. HYDRANT MUST BE APPROVED BY THE WA AND FIRE DEPARTMENT.

RESILIENT SEATED GATE VALVES - SHALL BE MADE IN ACCORDANCE WITH AWWA C-509. GATE VALVES SHALL BE IRON BODY, BRONZE MOUNTED, NON-RISING STEM ASSEMBLY, WITH O-RING SEALS AND MECHANICAL JOINT ENDS WITH FITTINGS. THE BODY AND BONNET SHALL BE COATED WITH 8 MILS MINIMUM FUSION BONDED EPOXY COMPLYING WITH AWWA C-550. VALVES ARE TO BE RATED AT 250 PSI FOR AWWA SERVICE AND 200 PSI FOR ULFM SERVICE. ALL VALVES ARE TO BE HYDROSTATICALLY TESTED AT 400 PSI. GATE VALVES SHALL CONFORM TO THE REQUIREMENTS OF THE WA.

GATE VALVE BOXES - SHALL BE SLIDING "BUFFALO" TYPE AND SHALL BE MADE OF CAST IRON (HEAVY PATTERN), HAVING A MINIMUM INTERIOR DIAMETER OF 5 1/4 INCHES, LENGTH AS REQUIRED. IT SHALL HAVE A BASE OF THE PROPER SIZE TO FIT THE VALVE UPON WHICH IT IS INSTALLED AND SHALL HAVE A DROP COVER MARKED "WATER".

SERVICE LINES - ALL SERVICE LINES TWO (2) INCHES OR LESS IN DIAMETER SHALL BE TYPE K COPPER CONFORMING TO THE "SPECIFICATIONS FOR SEAMLESS COPPER WATER TUBE" ASTM B-88 AND AWWA C-800. ALL SERVICE LINES GREATER THAN TWO (2) INCHES IN DIAMETER SHALL BE CONFORM TO THE REQUIREMENTS SPECIFIED ELSEWHERE IN THIS SECTION FOR WATER PIPE.

CORPORATION STOPS - SHALL BE APPROVED EQUAL TO MUELLER ORISEAL H-15000 SERIES WITH MUELLER 110 CONDUCTIVE COMPRESSION CONNECTION AND SHALL CONFORM TO AWWA C-800.

CURB STOPS - SHALL BE APPROVED EQUAL TO MUELLER ORISEAL H-15000 SERIES WITH MUELLER 110 CONDUCTIVE COMPRESSION CONNECTION, COPPER TO COPPER, WITH TEE HEAD, AND SHALL CONFORM TO AWWA C-800.

CURB BOX FOR CURB STOP - SHALL BE CAST IRON, APPROVED EQUAL TO MUELLER H-10350 "BUFFALO" TYPE, ARCH PATTERN, ADJUSTABLE CURB BOX COMPLETE WITH NECESSARY EXTENSION SECTION, LID AND BRASS LOCKING SCREW.

POST INDICATOR VALVE - SHALL BE AS REQUIRED BY THE WA AND/OR THE FIRE DEPARTMENT.

VIII.GAS & ELECTRIC SERVICES

THE CONTRACTOR SHALL PROVIDE ALL LABOR, PLANT, MATERIAL, AND EQUIPMENT AS SPECIFIED AND REQUIRED TO INSTALL THE GAS, AND ELECTRIC SERVICES IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.

ALL SECTIONS OF THIS SPECIFICATION BELOW, SHALL HAVE METHODS AND MATERIALS APPROVED BY THE OWNER'S FIELD REPRESENTATIVE OR GEOTECHNICAL ENGINEER, HEREIN REFERRED TO AS THE 'AUTHORITY'.

ALL WORK SHALL BE AS APPROVED, AND PERFORMED TO THE SATISFACTION OF THE OWNER, OWNER'S FIELD REPRESENTATIVE, GEOTECHNICAL ENGINEER, OR THE AUTHORITY HAVING JURISDICTION.

GENERAL REQUIREMENTS

ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE REQUIREMENTS OF THE UTILITY COMPANIES AND ALL OTHER AUTHORITIES HAVING JURISDICTION. THE CONTRACTOR MUST COORDINATE WITH UTILITY COMPANIES AND AUTHORITIES HAVING JURISDICTION TO DEMARCATE WORK TO BE DONE BY THE UTILITY COMPANIES (OR OTHERS), AND WORK TO BE DONE BY THE CONTRACTOR. NO CLAIM OF IGNORANCE WILL BE ACCEPTED.

<u>DAMAGE</u>

THE CONTRACTOR WILL BE RESPONSIBLE FOR ALL DAMAGE OCCURRING AS A DIRECT OR INDIRECT RESULT OF HIS WORK. WHERE AN ITEM OF WORK IS TO BE INSTALLED' BY OTHERS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DAMAGE CAUSED BY HIS NEGLECT OR DUE TO HIS FAILURE TO PROPERLY PROTECT THE ITEM OF WORK.

D. TRENCH EXCAVATION AND BACKFILL

SHALL BE PERFORMED IN ACCORDANCE WITH THE SECTION OF THESE SPECIFICATIONS ENTITLED "TRENCH EXCAVATION AND BACKFILL."

IX.PIPE AND UTILITY STRUCTURES

A. <u>PIPE INSTALLATION</u>

LAYING PIPE - EACH LENGTH OF PIPE SHALL BE LAID WITH FIRM, FULL AND EVEN BEARING THROUGHOUT ITS ENTIRE LENGTH, IN A TRENCH PREPARED AND MAINTAINED IN ACCORDANCE WITH THE DETAILS AS SHOWN ON THE DRAWINGS AND THE SECTION OF THESE SPECIFICATIONS ENTITLED "TRENCH EXCAVATION AND BACKFILL". PIPE SHALL BE LAID UPGRADE UNLESS OTHERWISE PERMITTED. BELL AND SPIGOT PIPE SHALL BE LAID WITH THE BELL END UPGRADE; TONGUE AND GROOVE PIPE SHALL BE LAID WITH THE GROOVE END UPGRADE. TRIMMING OF THE PIPE WILL NOT BE ALLOWED. EVERY LENGTH OF PIPE SHALL BE INSPECTED AND CLEANED OF ALL DIRT AND DEBRIS BEFORE BEING LAID. PRIOR TO THE PLACING OF A LENGTH OF PIPE. THE END OF THE PREVIOUSLY LAID LENGTH SHALL BE CAREFULLY AND THOROUGHLY WIPED SMOOTH AND CLEANED TO OBTAIN AN EVEN AND CLOSE-FITTING JOINT. NO LENGTH OF PIPE SHALL BE LAID UNTIL THE PRECEDING LENGTHS OF PIPE HAVE BEEN THOROUGHLY EMBEDDED IN PLACE, SO AS TO PREVENT MOVEMENT OR DISTURBANCE OF THE PIPE. SECTIONS OF PIPE SHALL BE JOINED SO THAT THE INTERIOR SURFACES ARE FLUSH AND EVEN.

LINE AND GRADE - PIPE FOR GRAVITY LINES SHALL BE LAID ACCURATELY TO THE LINE AND GRADE. EACH SECTION OF PIPE SHALL BE CHECKED FOR LINE AND GRADE AFTER BEING LAID. A CALIBRATED SURVEY INSTRUMENT SHALL BE USED DURING PIPE LAYING OPERATIONS, AND ALL ADJUSTMENTS WHICH MUST BE MADE SHALL BE MADE BY REMOVING MATERIAL OR FILLING WITH SELECT BEDDING MATERIAL UNDER THE BARREL OF THE PIPE AS NECESSARY AND NOT BY WEDGING OR BLOCKING ANY PORTION OF THE PIPE. DEVIATIONS FROM LINE AND GRADE SHALL BE A BASIS FOR REJECTION OF THE LINE OF PIPE. ANY LINE WHICH HAS BEEN REJECTED SHALL BE REBUILT TO THE CORRECT LINE AND GRADE BY THE CONTRACTOR AT HIS OWN EXPENSE.

FULL LENGTHS OF PIPE - ONLY FULL LENGTHS OF PIPE ARE TO BE USED IN THE INSTALLATION EXCEPT THAT PARTIAL LENGTHS OF PIPE MAY BE USED AT THE ENTRANCE TO STRUCTURES FOR STORM DRAINS AND SANITARY SEWERS WHERE NECESSARY TO OBTAIN PROPER CONNECTIONS TO STRUCTURES AND FOR CLOSURE PIECES IN THE INSTALLATION OF WATER LINES.

PIPE ENTRANCES TO STRUCTURES - PIPE ENTERING STRUCTURES SHALL BE CUT FLUSH WITH THE INSIDE FACE OF THE STRUCTURE. AND THE CUT ENDS OF THE PIPE AND SURFACE OF THE STRUCTURE SHALL BE ROUNDED AND FINISHED SO THAT THERE WILL BE NO PROTRUSION, RAGGED EDGES, OR IMPERFECTIONS THAT WILL IMPEDE THE FLOW OF WATER OR AFFECT THE HYDRAULIC CHARACTERISTICS OF THE INSTALLATION. THE METHOD OF CUTTING AND FINISHING SHALL BE SUBJECT TO THE

BEDDING AND BACKFILLING - THE TYPE OF MATERIALS TO BE USED AND THE METHOD OF PLACEMENT SHALL CONFORM TO THE REQUIREMENTS OF THE SECTION OF THESE SPECIFICATIONS ENTITLED "TRENCH EXCAVATION AND BACKFILL" AND AS SHOWN ON THE DETAILS OF THE DRAWINGS.

PROTECTION DURING CONSTRUCTION - THE CONTRACTOR SHALL PROTECT THE INSTALLATIONS AT ALL TIMES DURING CONSTRUCTION. MOVEMENT OF CONSTRUCTION EQUIPMENT, VEHICLES AND LOADS OVER AND ADJACENT TO ANY PIPE SHALL BE DONE AT THE CONTRACTOR'S RISK.

B. <u>UTILITY STRUCTURES</u>

LOCATIONS OF STRUCTURES - THE CONTRACTOR SHALL ACCURATELY LOCATE EACH STRUCTURE AND SET ACCURATE TEMPLATES TO CONFORM TO THE REQUIRED LINE AND GRADE. WHERE INLETS OR CATCH BASINS ARE TO BE PLACED ON CURB LINES OR AT EDGE OF PAVEMENTS, SUFFICIENT LENGTH OF PROPOSED CURB OR EDGE OF PAVEMENT ADJACENT TO THE STRUCTURE SHALL BE ESTABLISHED PRIOR TO CONSTRUCTION OF THE INLET OR CATCH BASIN TO INSURE THAT THE STRUCTURE IS CORRECTLY LOCATED AND ORIENTED. ANY STRUCTURE WHICH IS MISLOCATED OR ORIENTED IMPROPERLY SHALL BE REMOVED AND REBUILT IN ITS PROPER LOCATION, ALIGNMENT, AND ORIENTATION AT THE CONTRACTOR'S EXPENSE

PRECAST CONCRETE STRUCTURES - PRECAST CONCRETE STRUCTURES SHALL BE INSTALLED ONLY AFTER SHOP DRAWINGS HAVE BEEN REVIEWED BY THE SITE ENGINEER. PRECAST CONCRETE STRUCTURES SHALL BE DESIGNED AND FABRICATED FOR AN H-20 LOADING. THE MINIMUM COMPRESSIVE STRENGTH OF THE CONCRETE USED SHALL BE 4,000 PSI. PIPE CONNECTIONS IN STRUCTURES SHALL BE MADE WATERTIGHT. PRIOR TO FABRICATION. THE CONTRACTOR SHALL SUBMIT FOUR (4) SETS OF PLANS OF THE PROPOSED STRUCTURES TO THE SITE ENGINEER FOR REVIEW ALONG WITH DESIGN CRITERIA AND CERTIFICATION FROM THE MANUFACTURER BY A LICENSED PROFESSIONAL ENGINEER REGISTERED IN THE STATE IN WHICH THE WORK IS PERFORMED THAT THE STRUCTURE WILL SUPPORT THE DESIGN LOAD.

PRECAST CONCRETE MANHOLE STRUCTURES SHALL CONFORM TO ASTM DESIGNATION C-478. PRECAST CONCRETE SQUARE OR RECTANGULAR BOX STRUCTURES SHALL CONFORM TO ASTM DESIGNATION C-913.

FOR PRECAST CONCRETE BOX STRUCTURES, THERE SHALL BE A MINIMUM OF SIX (6) INCHES OF PRECAST CONCRETE WALL BETWEEN THE OPENING FOR THE PIPE AND THE INSIDE WALL CORNER, AND A MINIMUM VERTICAL DISTANCE OF SIX (6) INCHES FROM THE OPENING FOR THE PIPE TO THE BOTTOM OF THE TOP SLAB, UNLESS OTHERWISE SHOWN, SPECIFIED OR ORDERED.

JOINTS IN THE STRUCTURES SHALL BE TONGUE AND GROOVE JOINTS, FORMED IN SUCH A MANNER SO THAT A WATERTIGHT RUBBER SEAL CAN BE APPLIED. JOINTS FOR PRECAST CONCRETE MANHOLE SECTIONS SHALL CONFORM TO ASTM C-443 OR ASTM C-990. JOINTS FOR PRECAST CONCRETE BOX SECTIONS SHALL CONFORM TO ASTM C-990. PROVISIONS SHALL BE MADE FOR INSTALLATION OF APPROVED WATERTIGHT CONNECTIONS AT PIPE ENTRANCES TO THE PRECAST CONCRETE STRUCTURES.

WHERE STEPS ARE REQUIRED IN STRUCTURES, STEPS SHALL BE INSTALLED DURING THE CASTING OF THE STRUCTURES. STEPS SHALL BE SPACED 12 INCHES VERTICALLY ON-CENTERS, AND SHALL BE ARRANGED SO THAT THE LOWEST RUNG IS NO MORE THAN 15 INCHES ABOVE THE BENCH IN STRUCTURES WITH AN INVERT, AND ABOVE THE BOTTOM OF THE STRUCTURES WITH NO INVERT. THE TOP RUNG IS TO BE INSTALLED NO MORE THAN 24 INCHES BELOW THE TOP OF THE CASTING. STEPS SHALL BE ARRANGED OUT OF THE ALIGNMENT OF THE PIPES AND/OR FLOOR CHANNEL AND SHALL BE CENTERED IN THE OPENING OF THE COVER.

NO PRECAST CONCRETE STRUCTURE SHALL BE FABRICATED OR DELIVERED TO THE JOB SITE UNTIL IT HAS RECEIVED FINAL REVIEW STATUS BY THE SITE ENGINEER. ALL STRUCTURES SHALL HAVE AN IDENTIFYING NUMBER AND MANUFACTURER'S NAME ON EACH SECTION.

WHEN PRECAST CONCRETE STRUCTURES ARE TO BE USED, THE CONTRACTOR SHALL BEAR ALL RESPONSIBILITY FOR THE PROPER LOCATIONS AND SIZES OF ALL OPENINGS TO RECEIVE THE PIPE. REVIEW OF SHOP DRAWINGS BY THE SITE ENGINEER SHALL NOT RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITY IN THIS MATTER.

KNOCK-OUTS NOT UTILIZED IN CONSTRUCTION SHALL BE MORTARED WITH COMMON BRICK AND HYDRAULIC CEMENT SO THAT THE KNOCK-OUT IS THE SAME THICKNESS AS THE STRUCTURE.

MASONRY STRUCTURES - THE FIRST COURSE OF MASONRY SHALL BE EMBEDDED IN THE CONCRETE FOUNDATION IMMEDIATELY AFTER THE FOUNDATION HAS BEEN POURED. BRICK MASONRY UNITS SHALL BE THOROUGHLY WETTED BEFORE LAYING.

BRICK SHALL CONFORM TO THE "SPECIFICATIONS FOR SEWER AND MANHOLE BRICK (MADE FROM CLAY OR SHALE)", AASHTO M-91, GRADE MS. CONCRETE BLOCK SHALL BE SOLID BLOCK AND SHALL CONFORM TO THE "SPECIFICATIONS FOR CONCRETE MASONRY UNITS FOR CONSTRUCTION OF CATCH BASINS AND MANHOLES," ASTM C-139.

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