



STANDARDS OF CONSTRUCTION

Revised: May 2005



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**STANDARDS OF CONSTRUCTION
COLLEGE UTILITIES CORPORATION AND GOLDEN HEART UTILITIES, INC
Revised: May 2005**

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Section 1000 - Wastewater Collection System Design Guidelines

SECTION 1000 - WASTEWATER COLLECTION SYSTEM DESIGN GUIDELINES

PART I - GENERAL

The design of a wastewater collection system within the College Utilities Corporation and Golden Heart Utilities, Inc., hereinafter referred to as CUC/GHU or the Utility, service areas that connects to the Utility system, shall be submitted to and approved in writing by the ADEC and the Utility prior to construction. The design shall be in accordance with State Regulations (specifically 18 AAC 72), Utility standard details, the current Uniform Plumbing Code, other Utility planning schemes, and the guidelines herein and shall be consistent with the Construction Guidelines for the Utility wastewater collection system. Final design shall be certified by a professional engineer registered in the State of Alaska. It is suggested that a preliminary concept of the wastewater collection system be submitted for review by the Utility prior to the preparation of the required final design report, construction plans, specifications and submission to the ADEC. The purpose of the preliminary submittal is to present the concept, factual data, including soil boring, controlling assumptions and considerations used for the functional planning of the proposed system.

The proposed final plat or metes and bounds description of the improvement area or other similar data must be submitted with each wastewater collection design. Permanent easements (with twelve (12) feet minimum on either side of the wastewater collection pipe and appurtenances) are required for wastewater systems constructed on private property for maintenance access. A copy of all recorded easements within the improvement area must be submitted with the plans if not shown on an approved plat. All pertinent non-objections and/or permits from affected utilities and/or government agencies shall be secured prior to final approval.

Any addition to the Utility wastewater collection system shall be consistent with the Utility's standards of design, quality of materials, and construction. Special emphasis shall be given to reduce future operation and maintenance costs due to conditions peculiar to Fairbanks.

This document compliments the Design and Construction Guidelines for Water Distribution Systems and both should be used together as appropriate to eliminate conflicts.

This document is designed to aid in meeting the requirements of the Utility. It must be emphasized that no single document can possibly present guidelines for all situations that will be encountered. The Utility shall have the ultimate authority to interpret this document and may direct modifications for specific situations.

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PART II - DESIGN CRITERIA

1.21 GENERAL

For the purpose of reviewing plans for a wastewater collection system, the design criteria contained in the Alaska Administrative Code (18 AAC 72) shall be utilized and supplemented by manufacturer's recommendations and provisions contained herein. Fundamentally, sewage must be transported in a sanitary manner to and through the Utility wastewater collection system with an absolute minimum of infiltration of groundwater and in-flow of storm run off. No storm drain or roof drains shall be allowed to connect to the wastewater collection system (18 AAC 72.010 and CUC Tariff, Section 6.2, Sheet No. 42 or GHU Tariff, Section 6.4, Sheet No. 42 entitled Unacceptable Wastes).

1.22 PARAMETERS

Attention shall be given to design details which will minimize potential freeze up problems within the wastewater collection system. Special consideration should be given to cold temperatures, permafrost, and high water tables; conditions common in Fairbanks. The reports, plans, and specifications for the wastewater collection system shall be certified by an engineer currently registered in the State of Alaska. Allowances for future extensions will be made in the design of all additions. The Utility's standard castings, pumps, and pipe shall be used in the design and construction of these improvements.

Basic design capacity shall be based on expected peak hourly flow from residents and other structures plus infiltration and inflow. For typical domestic situations, an average per capita production of wastewater in Fairbanks is seventy (70) gallons per day. Peak hourly flow factors are inversely proportional to total average daily flow within a pipe. The following are values currently accepted by the Utility for residential areas:

PEAKING FACTOR FOR PEAK HOUR FLOW

<u>TOTAL AVERAGE FLOW IN PIPE</u>	<u>PEAKING FACTOR</u>
10 gpm	5.6
100 gpm	3.4
1,000 gpm	2.5

Factors for total average flows other than these can be extrapolated. Industrial and commercial area flows should be determined on an individual basis.

Infiltration and inflow are variable factors but, for high water table areas, a minimum of one thousand five hundred (1,500) gallons per acre per day (GPAD), and for low water table areas, a minimum of seven hundred twenty-five (725) GPAD shall be assumed in design calculations. A peaking factor of 1.5 should be used with these flows to get

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GPM. In any case, wastewater mains shall be no less than eight (8) inches diameter.

Slopes of wastewater mains are critical to convey the materials suspended in the wastewater. Slopes shall be uniform between manholes and shall, unless specifically authorized, be such to maintain a minimum velocity of two (2) feet per second when flowing full. Wastewater mains shall be located in, or adjacent to, streets (rather than on rear or side lot lines) to facilitate maintenance.

1.23 INSULATION

To help prevent freezing all wastewater pipe, fittings, and manholes shall be completely insulated with at least two (2) inches of urethane foam except lines with pipe diameters twelve (12) inches or larger, where initial flow is anticipated to be greater than one third (1/3) the design flow, or where it can be demonstrated to the satisfaction of the Utility that the main will not freeze. Waterproof coating shall be used over the foam insulation where pipes are within close proximity to the natural groundwater table. All wastewater mains shall be installed with a minimum of five (5) feet of cover.

Wastewater services shall be protected with a minimum of three (3) inches of urethane foam. Any wastewater mains or services within seven (7) feet of storm drain lines will require extra insulation. Storm drains shall also be insulated where crossing wastewater lines.

1.24 MANHOLES

All intersections of gravity flow pipe shall be in manholes which shall be designed to minimize deposition, aid maintenance and inspection, and where possible, maintain hydraulic grade lines. When pipes of different sizes join, this can best be accomplished by matching their 0.8 depth points. The matching of crowns is also an acceptable technique. Where matching is not possible, inflow pipes shall have transitional grading in flow channels to minimize the effects of drops. For vertical differences of over twenty-four (24) inches, a drop manhole shall be required. Normally, the grade of a manhole channel shall be the same as the pipes entering and exiting, and a section of pipe with appropriate cut-out will pass completely through the manhole. Where there is a change of horizontal angle less than forty-five (45) degrees, there will be an incremental increase of slope up to 0.05 feet drop across the manhole. For a change of direction from forty-five (45) degrees to ninety (90) degrees, the drop shall be 0.10 feet. For changes in direction greater than ninety (90) degrees, the drop shall incrementally increase to 0.2 feet across the manhole. Typically, no service connections shall be allowed to manholes or interceptors but shall be accomplished with saddles placed on collection mains.

Manhole placement shall typically be within the street intersections. Distances between manholes shall not exceed three hundred (300) feet. The manhole inside diameter shall be forty-eight (48) inches. A manhole shall be placed adjacent to lift stations where necessary to offset the lift station from underneath the roadway driving surface

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and to facilitate bypassing operations. All dead end mains shall have an access at the end in the form of a manhole or a four (4) inch diameter cleanout and flush well. One full section of pipe is required between dual flush wells to reduce possible settlement. See standard detail drawing for further information.

1.25 WASTEWATER SERVICE STUBS

Each individual lot on a street to be paved or chipped fronting the wastewater collection system may be provided with a service connection stub which extends into the lot, three (3) feet past the property line and/or buried utilities. In no case will more than one (1) building be connected to the same service. Services shall typically be located no closer than ten (10) feet from interior property lines. If the wastewater stub is placed in the same trench with the water service, the bottom of the water pipes at all points shall be at least one (1) foot above the top of the wastewater stub. Services shall maintain a one (1) foot horizontal separation and wastewater shall be one (1) foot below water. Generally the wastewater service shall be four (4) inches in diameter unless the proposed use requires a larger service.

Service connection stubs belong to the property owner of the lot served. The property owner shall be responsible for the maintenance and all other costs associated with the service connection.

The utility will record at the district recording office "NOTICE OF NON-COMPLIANCE OF UTILITY SERVICE LINE HOOKUP". This will notify all interested parties that the service stub exists and is the property owner's responsibility.

1.26 LIFT STATIONS

The combination of flat topography, deep frost penetration, high water table, and high construction costs for excavation often makes wastewater lift stations necessary in the Utility wastewater collection system. Since lift stations are expensive to construct and to operate, they shall be utilized only as absolutely necessary, and be consistent with Utility planning.

Wastewater lift stations shall be designed with a reinforced concrete receiving well and furnished with at least two (2) heavy duty, submersible, non-clog wastewater pumps. The system will be completely automatic and electrical controls and accessories shall be completely compatible with the pumps. Each lift station shall be vented. The lift station site shall be readily accessible but outside of street driving surfaces. Safety shall be a primary concern in designing access within the lift station, and all electrical equipment within the lift station shall be explosion proof or intrinsically safe as specified in Section 2000, Wastewater Collection System Construction Guidelines.

Capacity of the lift station shall be based on the peak hourly flow (which is the expected average daily flows multiplied by the wastewater peak flow factor) and shall be the

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combined discharge of all the pumps except the one with the largest rated capacity. A minimum of two pumps shall be provided, each one capable of handling flows. The controls shall be designed to alternate between pumps, to maximize time between start-ups of each pump, and to equalize wear.

The minimum size of a lift station receiving well shall be six (6) feet in diameter. The depth of the receiving well, which is defined as the distance from the inlet invert to the bottom of the pump, shall be a minimum of five (5) feet and shall be designed to both minimize detention time within the lift station and minimize the running time and start-ups of the pumps.

Included in this document is the Lift Station Details (LS1). This and Section 2000, 2.28 Standard Detail for Lift Stations, shall be consulted for more design details.

The design report shall include pump curves, anticipated power consumption, operations and maintenance information, recommended spare parts, and other appropriate information.

1.27 MISCELLANEOUS

Pretreatment may be required for industrial wastes as specified in the Utility's tariff, approved by the Regulatory Commission of Alaska. A monitoring station may be required to assure compliance with these regulations.

Flow measurement stations may be required for private systems. Equipment shall be of the same type as already used in the Utility system to facilitate maintenance. Meter accuracy is expected to be the actual flow, plus or minus one (1) percent.

Wastewater collection mains beneath State of Alaska highways, other selected streets, or the Alaska Railroad, shall be placed in sleeves as necessary according to their specific utility permit requirements. Pipe for river or slough crossings, or other adverse conditions, require a ball joint connection system with minimum deflection of fifteen (15) degrees with full restraints.

1.28 REPORTS, PLANS, AND SPECIFICATIONS

A design report shall be submitted to the Utility and shall include assumptions used in the design, including expected occupancy of lots, expected population density and constants used for flow calculations. This report shall prove that existing downstream facilities have sufficient capacity and ability to accept the additional loads from the proposed development. The design report, plans, and specifications will be reviewed and approved by the Alaska Department of Environmental Conservation and the Utility. Final plans shall include both plan and profile details showing the relationship between the proposed wastewater improvement and all other existing or proposed utilities and improvements. The plans shall show exact location of proposed improvements from

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designated survey control points and shall specify required elevations including pipe and manhole depth. "As-built" plans shall be submitted on reproducible mylar and AutoCAD. All manholes, flush wells and service connections shall be located in their "as-built" positions.

Elevation datum shall be NAVD '29 and noted on the plans. A note must also be included on the plans specifying that construction will be in accordance with these Standards of Construction. Tolerances for survey control and location of improvements are provided in the Construction Guidelines.

1.29 SEPARATION DISTANCE

Horizontal and Vertical Separation – Water and sewer mains (including manholes) shall be separated by a minimum of ten (10) feet horizontally measured edge to edge. Where it is not practical to maintain a ten (10) foot separation, the ADEC may allow deviation on a case by case basis, if a waiver request is submitted to ADEC and is properly supported by data from the design engineer. Waiver requests must identify the reason for lesser separation and show:

- A. The lines are located in separate trenches and the top of the sewer main is a minimum of eighteen (18) inches below the bottom of the water main.
- B. The sewer line is designed and constructed in a manner equivalent to the requirements for a potable water pipe and is pressure tested to ensure water tightness or:
- C. The sewer line is enclosed in a water-tight carrier pipe of similar strength.

At locations where water and sewer mains must **cross**, a waiver is **not** required if:

- Water line is above the sewer line, **or**;
- Sewer line is bedded per Type 4 or 5 (AWWA Standard C600-9) **and**;
- Water line joints are at least nine (9) feet from the sewer line **and**;
- Water line is at least eighteen (18) inches vertically from the sewer line.

If the above conditions can not be met for sewer and water crossings; a waiver request (similar to horizontal separation) must be submitted to ADEC.

Any design that fails to meet the ten (10) foot horizontal or eighteen (18) inch vertical separation distance shall require a waiver from ADEC.

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SECTION 2000 - WASTEWATER COLLECTION SYSTEM CONSTRUCTION GUIDELINES

PART I - GENERAL

2.11 GUIDELINES

The design of a wastewater collection system which ultimately connects to the Utility collection system shall be submitted to and approved in writing by the Utility prior to construction. The design shall be in accordance with state regulations, the Utility Master Plan or other Utility planning schemes, and all aspects of this document. Final design will be submitted to and approved by the Alaska Department of Environmental Conservation and must be certified by a professional engineer registered in the State of Alaska (18 AAC 80) prior to beginning construction. In addition to basic design, the engineer shall look at such things as flow velocities, quantities in the proposed wastewater system, and any changes in the existing Utility system caused by the proposed addition.

This document is designed to aid in meeting the requirements of the Utility. It must be emphasized that no single document can possibly present guidelines for all situations that will be encountered. The Utility shall have ultimate authority to interpret this document and shall direct modifications for specific situations.

2.12 WORK INCLUDED

This section covers the installation of all wastewater pipe and appurtenances for the wastewater collection system.

Materials, operations or methods herein or indicated on the drawings as being required for the project shall be provided by the Developer/Contractor. The Developer/Contractor shall provide all the necessary labor, equipment, material and the incidentals necessary to complete the system as shown on the plans.

2.13 CODES AND REGULATIONS

In addition to complying with all pertinent codes and regulations, the Developer/Contractor must comply with all requirements of the most recent Uniform Plumbing Code, as adopted by the Utility, and this standard.

Where provisions of pertinent codes and standards conflict with this document, the more stringent provisions shall apply.

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2.14 CONSULTING ENGINEER

The consulting engineer shall be a registered engineer retained by the Developer/Contractor to design and coordinate the installation of the wastewater system.

- A. The consulting engineer shall furnish drawings and specifications which, as far as practical, completely represent the requirements of the work to be performed under the contract.
- B. The consulting engineer shall be responsible for the design of any construction changes required during the course of construction.
- C. The consulting engineer shall be responsible for submission of stamped as-built drawings to the Utility upon completion of the project. As-built drawings shall show all changes made during construction as well as a minimum of three (3) swing ties to all manholes.
- D. The consulting engineer will provide the Utility with advance notice of the work schedule and report to the Utility as to the progress of the work and manner in which it is being performed.
- E. The consulting engineer is not authorized to revoke, alter, enlarge, relax, or release any requirements of the plans and specifications, nor to approve or accept any portion of the work nor to issue instructions contrary to this document.

2.15 INSPECTION OF WORK BY THE UTILITY

The Utility shall perform inspections of the work and material to ensure compliance with the plans, specifications, and these Standards of Construction. Such inspections may extend to any part of the work including the preparation, fabrication, or manufacture of the materials used.

- A. The Utility's authorized representative will decide: all questions which may arise as to the quality and acceptability of materials furnished and work performed; all questions as to the degree of completion of the work; all questions which may arise as to interpretation of the plans and specifications, and all questions as to the acceptable fulfillment of the contract on the part of the Developer/Contractor.
- B. The Utility's authorized representative shall have the authority to reject any work or materials that do not meet Utility standards.

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- C. The presence or absence of the Utility's authorized representative does not relieve the Developer/Contractor from his obligation to fully perform all requirements of this document, nor does it give rise to any right of action or suit by the Developer/Contractor, or third persons against the Utility.

PART II - MATERIALS

2.21 GENERAL

All materials shall be new, of current manufacture, and conform to the specifications contained herein. The Developer/Contractor shall submit manufacturer's literature and affidavit of compliance with specified standards of the Utility for review and approval prior to procuring materials.

2.22 PIPING

- A. Gravity wastewater mains shall be ductile iron pipe.
- B. Force mains shall be ductile iron pipe.
- C. High density polyethylene may be used for trenchless rehabilitation of wastewater mains.
- D. Wastewater service piping shall be either ductile iron, high density polyethylene (HDPE) or woodstave pipe.
- E. Ductile iron pipe shall conform to AWWA C-151. Ductile iron pipe shall be cement mortar lined in accordance with applicable provision of AWWA C-104 and shall be minimum thickness class 50.
- F. Woodstave pipe shall be creosoted or pressure treated with pentachlorophenol, uncoated and manufactured to withstand forty (40) feet of head.
- G. High density polyethylene pipe (HDPE) shall be SDR 17.
- H. Insulated wastewater pipe installed in sleeves shall be coated using PDL Rimshield II.

2.23 PIPE JOINTS

- A. Joints for ductile iron pipe shall be rubber gasketed push-on joint (U.S. Pipe Tyton or equal) or mechanical joint conforming to AWWA C-111.
- B. Where indicated on the plans, approved restrained joint pipe or system of restraint shall be installed. Restrained joint pipe and fittings shall be designed for a maximum working pressure of 250 psi.

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2.24 PIPE FITTINGS

Fittings for ductile iron pipe shall conform to AWWA C-110. The fittings shall have a minimum rating of 150 psi working pressure but be capable of withstanding three times the rated water working pressure as per AWWA C-110. Fittings shall be ductile iron. Interior of fittings shall be cement mortar lined per AWWA C-104. Fittings with joint restraint shall be ductile iron and shall conform to ANSI A 21.10.

2.25 INSULATION

Urethane spray foam insulation shall be rigid closed cell, two component urethane foam with the following properties:

K Factor:	0.14 (Btu - in/FT ² - Hr - °F)
Compressive Strength:	25 psi
Density:	2.0 pcf

Insulation material shall be Resin Technology 2045. Applicator shall demonstrate prior experience of at least two (2) years, and the Utility shall be the sole judge of the qualifications of system, application method, and applicator.

2.26 PROTECTIVE COATINGS

Protective Coatings shall be a two component, one hundred (100) percent solids, sprayable polyurethane coating with the following properties:

Tensile Strength	1800 PSI
Elongation (percent)	120
Water Vapor Transmission	0.413 Perms

Coating material shall be Permex 700 by Resin Technology. Applicator shall demonstrate prior experience of at least two (2) years, and the Utility shall be the sole judge of the qualifications of system, application method, and applicator.

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2.27 MANHOLES and CLEANOUTS

- A. The manholes shall be completely watertight. Materials used in construction shall conform to the requirements of ASTM Specification Designation C-478 and approved details.
- B. Manhole bases and cones shall be formed of 2500 psi concrete. They shall have wire mesh and rebar as shown on the standard details.
- C. Each precast concrete manhole section shall be set and sealed by use of a gasket type seal such as Ram-Nek or equal.
- D. Manhole covers and rings shall be fabricated from cast iron per ASTM A-48, Class 24 (H-20 loading). The traffic cover shall have a diameter of twenty four and three quarter (24¾) inches with a clear inside diameter of twenty three (23) inches. Overall depth shall be ten (10) inches with a seven (7) inch height from the flange. The word "SEWER" shall be cast into the manhole cover. Manhole cover shall be solid except for a maximum of two lifting holes and a maximum of one side pick slot. Cover shall be ductile iron. Manhole rings and covers shall be machine ground on seating surfaces so as to assure a non-rocking fit in any position and interchangeability. Manhole rings and covers shall be Inland Foundry Company #741 or Olympic Foundry Inc. MH26. The Utility reserves the right to determine the suitability of the manhole covers and rings based upon its proposed location and projected traffic patterns.
- E. Force main and gravity cleanouts shall be as shown on the standard detail drawings.

2.28 LIFT STATIONS

- A. Pumps shall be submersible non-clog pumps and meet the Utility's specifications and requirements for each specific job.
- B. Control panels must be manufactured by USEMCO Incorporated and meet the Utility's specifications and requirements for each specific job.
- C. Electrical wiring and components must be in compliance with all applicable codes.
- D. Lift station pumps and controls shall be three phase if possible. Minimum size shall be 7 ½ horsepower. If three phase power is not available the station may be single phase. The minimum size shall be 3 horsepower for single phase pumps.

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PART III - EXECUTION

2.31 HANDLING

- A. Use all means necessary to protect materials before, during, and after installation.
- B. In the event of damage, immediately make all repairs and replacements necessary to keep materials in a "like new" condition. These repairs or replacements must be approved by the Utility and made at no cost to the Utility.
- C. All material shall be handled and installed in accordance with manufacturer's recommended handling and installation instructions.
- D. If, in the judgment of the Utility, materials and/or installed work are not being protected or handled as noted in these specifications, or in accordance with manufacturer's handling/installation recommendations, they shall be rejected and removed from the job site and shall not be used on any other work, either present or future for the Utility.

2.32 LAYING PIPE

- A. The pipe and fittings shall be inspected for defects before installation.
- B. All pipe shall be laid and maintained to the required lines and grades with fittings, manholes, cleanouts and appurtenances at the required locations as shown on the plans.
- C. Wastewater mains shall be laid so as to have a minimum of five (5) feet of backfill over the top of the pipe.
- D. Pipe interiors shall be thoroughly cleaned of all foreign matter before being lowered into the trench. At all times when work is not in progress, all open ends of pipe and fittings shall be securely closed so that no water, earth, rodents, or other substances may enter. Each length of pipe shall be examined during assembly in the trench for debris. Any debris found will be removed immediately.
- E. Trenches shall be kept sufficiently dry so that no pipe will be laid in water. Water shall be kept out of the portions of the trench in which uninsulated joints are located while the joints are insulated and otherwise readied for backfill.
- F. Cutting of pipe for closure or other reasons shall be done by methods which will not damage the pipe and which will ensure tight joints.

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- G. Pipe shall be inspected for defects before lowering into the trench. All defective, damaged or unsound pipe shall be replaced and removed from the site. Any section of pipe that is already laid out and found to be damaged or defective shall be replaced with new pipe at no cost to the Utility.
- H. Pipe bedding shall be as noted in Section 7000 Trenching, Backfilling, and Compaction. Bedding shall be placed so as to ensure that the pipe is given a uniform bearing for its full length.
- I. Deflections from a straight line or grade shall not exceed the limits recommended by the manufacturer. If the specified or desired alignment requires deflections in excess of such limits, the Developer/Contractor shall either provide special bends or a sufficient number of shorter lengths of pipe to provide angular deflection within such limits.
- J. Standard lengths of pipe shall be used except where short lengths are required for fittings, or wherever pipe passes through a rigid structure.
- K. Pipe ends for future connections shall be plugged or capped as shown on the plans.
- L. Final accuracy of all gravity main installations shall be within 0.01 feet vertically and 0.50 feet horizontally of the exact location taken from the project plans. In addition, no single section of pipe shall vary by more than ten (10) percent from the grade shown on the project plans. In no case will a reverse or flat grade be allowed. Pipe which exceeds the above limits of variation shall be adjusted immediately and no further pipe shall be laid until so authorized by the Utility. All costs incurred for adjusting grades of lines shall be the responsibility of the Developer/Contractor.
- M. Lubrication for push-on joints of ductile iron pipe shall be water soluble as recommended by the manufacturer.
- N. Any pipe or structure having its alignment or grade changed by floating in a flooded trench shall be relaid.

2.33 MANHOLES AND CLEANOUTS

- A. Generally, the manhole rings and covers shall be brought to the grades shown on the plans. However, the Developer/Contractor shall coordinate final grade with the engineer to ensure final grade "fits" as found conditions.
- B. All portions of precast manholes must be approved by the Utility prior to installation. This approval does not relieve the Developer/Contractor of the responsibility for protection of manholes against damage during handling and installation.

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- C. Manholes and cleanouts shall be installed at the locations shown on the plans such that primary leads enter radially at the invert elevations specified. The base section shall be set plumb on the prepared surface.
- D. Where indicated on plans, a stub shall be provided for future connections to the manhole. The end of the stub shall be stopped with a wooden plug, concrete biscuit, or other device designed to prevent substances and water from entering the pipe.

2.34 INSULATION

- A. The Developer/Contractor shall furnish labor, materials, equipment, and services necessary for, and incidental to, field application of sprayed urethane foam insulation.
- B. Wastewater mains and manholes shall have a minimum thickness of two (2) inches on all outside surfaces unless it can be demonstrated to the satisfaction of the Utility that the main will not freeze.
- C. Foam shall be applied to wastewater main pipe above ground in a local yard. Pipe may not be sprayed in the ditch except under special circumstances, which must be approved by the Utility.
- D. Wastewater services shall have a minimum of three (3) inches of urethane foam insulation on the top, sides, and bottom.
- E. Pre-insulated pipe that has damaged insulation due to transportation shall be reinsulated to the satisfaction of the Utility. Backfill shall not take place until all insulation has been inspected.
- F. Backfill shall be placed so that pipe insulation will not be damaged.

2.35 CONNECTIONS TO EXISTING SYSTEM

- A. Connections to existing Utility wastewater mains shall be made by Utility personnel only.
- B. Materials for these connections shall be furnished by the Developer/Contractor.
- C. The Developer/Contractor shall give the Utility at least forty-eight (48) hours advance notice when requesting a connection.
- D. The Utility reserves the right to schedule shutdowns to minimize possible conflicts.

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2.36 PRESSURE AND LEAKAGE TESTING

- A. The Developer/Contractor shall test the pipe for leaks in the following manner:
- 1) Both ends of the section to be tested will be plugged with airtight plugs and braced adequately to prevent slippage and blowout. One plug shall have an inlet tap or other provision for connecting the air hose. The air hose shall have a throttling valve, an air bleed valve, and a high pressure shut-off valve for control.
 - 2) The low pressure side of the throttling valve shall have a tee for the pressure gauge cock. This cock is kept closed except when pressure loss is being timed.
 - 3) Air shall be applied slowly to the pipeline until the pressure reaches four (4) psi. The air supply shall then be throttled so that the internal pressure is maintained between four point zero (4.0) and three point five (3.5) psi for at least two (2) minutes. During this time, the plugs shall be checked with soap solution to detect any plug leakage. The air supply shall then be disconnected.
 - 4) When the pressure reaches exactly three point five (3.5) psi, a stopwatch shall be started and the time recorded for the pressure to drop from three point five (3.5) to two point five (2.5) psi. The results shall be compared with the minimum permissible pressure holding times indicated in the table on the following page.

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NCPI AIR TEST TABLES

Minimum Holding Time in Seconds Required for Pressure to Drop from 3.5 to 2.5 PSIG

Length of Pipe	4"	6"	8"	10"	12"	15"	18"	21"	24"	27"	30"	33"	36"	39"
25	4	10	18	28	40	62	89	121	158	200	248	299	356	41
50	9	20	35	55	79	142	178	243	317	401	495	599	713	81
75	13	30	53	83	119	186	267	364	475	601	743	898	102	11
100	18	40	70	110	158	248	356	485	634	765	851	935		
125	22	50	88	138	198	309	446	595	680					
150	26	59	106	165	238	371	510							
175	31	69	123	193	277	425								
200	35	79	141	220	317									
225	40	89	158	248	340									
250	44	99	176	275										
275	48	109	194	283										
300	53	119	211											
350	62	139	227											
400	70	158												
450	170													
500	88													
550	97													
600	106													
650	113	170	227	283	340	425	510	595	680	765	851	935	1020	110

NOTE: To be used when testing one diameter only.

- 5) Should the time of pressure drop be less than the allowable specified time, the Developer/Contractor shall make the necessary leakage repairs and repeat the test.
- B. Force mains shall be hydrostatically tested at one hundred (100) psi for a period of two (2) hours. The maximum allowable leakage is no more than .59 gallons per hour per one thousand (1,000) feet of pipe for four (4) inch pipe and .89 gallons per hour for a six (6) inch pipe. Any pipe that has leakage greater than the allowed rates shall be repaired by the Developer/Contractor.

2.37 TEST FOR DAMAGED OR DEFECTIVE PIPE

After the pipe has been installed and tested, the pipe shall be inspected with a video camera system of a type and size approved by the Utility. The developer must cause and pay for a video inspection by a contractor approved by the Utility. One approved contractor is College Utilities Corporation. All video work shall be done in the presence of the consulting engineer and shall constitute tests for alignment, grade, damage, defective pipe, or other type of faulty installation. If this inspection indicates any faulty installation of pipe, the Developer/Contractor shall repair or replace the pipe as directed by the Utility.

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Section 3000 - Water Distribution System Design Guidelines

SECTION 3000 - WATER DISTRIBUTION SYSTEM DESIGN GUIDELINES

PART I - GENERAL

The design of a water distribution system addition within the CUC/GHU service areas that connects to the Utility system shall be submitted to and approved in writing by the ADEC and the Utility prior to construction. The design shall be in accordance with State regulations, the Water Master Plan or other Utility planning schemes, and shall be consistent with the construction guidelines of the Utility water distribution system. Final design will be submitted to and approved by the Alaska Department of Environmental Conservation and thus must be certified by a professional engineer registered in the State of Alaska (18 AAC 80). It is suggested that a preliminary concept, layout of the water mains, soils investigation report, etc., be submitted for review by the Utility prior to the preparation of the required final design report, plans and specifications. The purpose of the preliminary submittal is to present the concept, factual data and controlling assumptions and considerations used for the functional planning of the proposed site. A final design report, plans, and specifications shall be submitted to, and approved by the ADEC and the Utility. The design report shall primarily focus on flow velocities and fire flows in the proposed water system and any changes in the existing water system caused by the addition.

The proposed final plat or metes and bounds description of the improvement area or other similar data must be submitted with each water system design. Permanent easements with ten (10) feet minimum on either side of the pipe are required for water distribution systems constructed on private property for maintenance access. A copy of all recorded easements within the improvement area must be submitted with the plans, if not shown on an approved plat. All pertinent non-objections and/or permits from affected utilities and/or government agencies shall be secured prior to final approval.

Any addition to the Utility water distribution system shall be consistent with Utility standards of design, quality of materials and construction. Special emphasis shall be given to reduce future operation and maintenance costs due to conditions peculiar to Fairbanks.

This document compliments the Design and Construction Guidelines for Wastewater Collection Systems and both should be used together to diminish conflicts.

This document is designed to aid in meeting the requirements of the Utility. It must be emphasized that no single document can possibly present guidelines for all situations that will be encountered. The Utility shall have the ultimate authority to interpret this document and may direct modifications for specific situations.

Standards of Construction for CUC/GHU

Section 3000 - Water Distribution System Design Guidelines

PART II - DESIGN CRITERIA

3.21 GENERAL

For the purpose of reviewing plans for a water distribution system, the design criteria contained in the Alaska Administrative Code (18 AAC 80), the latest adopted edition of the Uniform Fire Code and the Standards of ANSI, AWWA, ASTM, and ASME shall be utilized and supplemented by manufacturer's recommendations and provisions included herein.

It is important that the quality of water within the system be maintained. In addition, the design must consider cold temperatures, permafrost, and other factors which contribute to freeze up problems. In addition, other maintenance and operations concerns and anticipated conflicts with other utilities must be satisfied and resolved.

3.22 PARAMETERS

Design shall facilitate required testing and must include cleanliness, quality, disinfection, and pressure.

Service connection design and construction requirements shall follow the Utility's Hookup Standards book available at USA Customer Service.

The Utility water distribution system is designed to minimize the risk of freezing. Water lines are insulated with urethane foam and are circulated by pump stations to prevent freezing. The distribution network is laid out in hydraulically balanced loops, and there are no dead ends in the system. Research has shown that a velocity of approximately 2 feet per second is required in the mains to circulate the customer's service line and keep them from freezing. New additions to the system must be designed for this minimum flow velocity and must not interfere with the balance of the existing distribution system. Additionally, new additions must supply sufficient flow to provide for both consumption and fire protection.

Basic design capacity shall provide for peak demand or fire protection requirement, whichever is larger. Design water consumption for the Utility shall be eighty-eight (88) gallons per day per capita. Peak hourly demand for residential areas shall generally be at least four and one-half (4½) times the yearly average daily water demand. Capacity for commercial and industrial use will usually be based on the fire protection requirement. Actual fire protection requirements are based on ISO requirements and will be determined in conjunction with ISO to optimize the insurance rating for the entire service territory.

Normal operating pressure of the CUC system is 145 psi and the nominal maximum system design pressure is 200 psi. Normal operating pressure of the GHU system is 95 psi and the nominal maximum system design pressure is 150 psi.

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Section 3000 - Water Distribution System Design Guidelines

The connection of a fire booster pump to the utility water system is prohibited without advance written approval from the Utility.

These guidelines shall also apply to water transmission lines except that system velocities may be reduced and service connections may be restricted.

See 1.29

3.23 REPORTS, PLANS, AND SPECIFICATIONS

The design report will include assumptions used in the design including expected occupancy of lots, expected population density, expected water consumption per capita, expected fire protection requirements, constants used for flow calculations, pump sizing calculations and initial set points for pump station controls. The design report, plans and specifications must be reviewed and approved by the Alaska Department of Environmental Conservation, the Utility and the appropriate Fire Department. "As-built" plans shall be submitted on reproducible Mylar and AutoCAD.

Flow analysis using the KYPIPE computer modeling program or approved equivalent, will be included with each design report. This analysis will include size of pipe, flow direction, calculated velocities, pressure losses, fire flow availability, peak demand requirements and temperature drop in the new water distribution system as well as detailing exactly how the existing system will be affected by the addition/changes.

Final plans will include both plan and profile details showing the relationship between the proposed water improvement and all other existing or proposed utilities and improvements. The plans shall show exact location of proposed improvements from designated survey control points and shall specify required elevations including pipe depth and fire hydrant top flange height. "As-built" plans must be certified by a Professional Engineer registered in the State of Alaska. All valves, hydrants, and service connections shall be located in their "as-built" positions. A minimum of three (3) swing ties shall be recorded to each valve and service connection. "As-built" plans must be submitted on reproducible Mylar and AutoCAD.

Elevation datum shall be NAVD '29 and noted on the plans. A note shall be included on the plans specifying that construction will be in accordance with these construction guidelines. Tolerances for survey control and location of improvements are provided in section 5.23, construction surveying.

Operation and maintenance (O&M) information shall detail the specific operational parameters and new components added to the existing water system. O&M manuals will include computer flow analysis, schematized flow pattern and a detailed narrative of the new system's operation, changes in the old system, and the method of operations set-up. Performance curves, equipment, "as-built" data sheets, test data, flow diagrams, "as-built" shop drawings and narrative description on O&M procedures shall be included. Spare parts information shall include parts lists accompanied with

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drawings, which identify parts by number.

3.24 MATERIALS and OTHER SPECIFICS

All pipe and material shall meet the requirements of the National Sanitation Foundation (NSF) 61. Water mains shall be constructed of ductile iron pipe (DIP) of minimum Class 50 thickness. Mains shall not be less than six (6) inches in diameter, except for service connections. Flexible joints shall be the design standard and flanges are only acceptable where adjacent flexible joints will adequately relieve potential stresses. All water mains, including fittings, shall be completely insulated with two (2) inches of urethane foam. Water services require three (3) inches of insulation and all water piping requires extra insulation where they are within seven (7) feet of storm drains, telephone duct banks, etc. Water mains installed in sleeves shall be coated with Resin Technology Permex 700.

Main line valving shall be provided at a maximum distance of every one thousand (1000) feet and shall be adjacent to fire hydrants, where possible, to facilitate access to the valve. Resilient seat gate valves shall be used.

Post indicator valves and/or flow control bypasses at interconnects shall be utilized as necessary. Throttling shall be accomplished with orifice plates or small diameter piping designed for each particular case. Valves shall not be used for flow control.

Water mains beneath State of Alaska highways, other selected streets or the Alaska Railroad, shall be placed in sleeves as necessary according to their specific utility permit requirement. Pipe for river or slough crossing or other adverse conditions require a ball joint connection system with minimum deflection of fifteen (15) degrees with full restraints.

Fire hydrants are typically required at every intersection and in typical residential areas at spacings of less than three hundred-twenty (320) feet. With corners having fifteen (15) foot radii, the hydrant will be set back twenty (20) feet from the nearest intersection corner. The intersection corner is defined as the intersection point of the right-of-way lines for each street. ISO requirements for hydrants per area with district definition and the hose laying method shall be utilized to obtain zero deficiencies for ISO Class 1 for hydrant layout and spacing. The water main typically will be designed with offset by the width of a six (6) inch valve and connecting tee only, while keeping the general alignment of the main seven (7) feet into the dedicated street right-of-way. Valve boxes shall not be located in ditches or low spots in streets thus minimizing drainage into them and avoiding disruption or maintenance problems.

Soil borings shall be required as necessary to specify the bedding material and determine the water table. Pipe bedding shall be detailed on the plans. Backfill shall be a minimum of four (4) feet over the pipes. Dewatering shall be required as necessary to allow installation without necessary interference from groundwater.

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Pump stations, if required, shall be duplex electric motor driven pump assemblies. Pump stations shall be equipped with temperature and pressure measuring devices and electro-magnetic flow meters. Flow control, bypass, pressure control, make-up heat and pump control devices will be provided as necessary. Upon completion, Developer/Contractor shall provide: operator training, operation and maintenance manuals, and complete documentation of all products installed and spare parts provided.

3.25 WATER SERVICE STUBS

Each individual lot on a street to be paved or chipped fronting the water distribution system may be provided with a property loop which extends into the lot three (3) feet past the property line and/or buried utilities. In no case will more than one (1) building be connected to the same service. Services shall typically be located no closer than ten (10) feet from interior property lines. If the property loop is placed in the same trench with the wastewater service, the bottom of the water pipes at all points shall be at least one (1) foot above the top of the wastewater stub. The water and wastewater services shall maintain a one (1) foot horizontal separation and wastewater shall be one (1) foot below water.

Service connection stubs belong to the property owner of the lot served. The property owner shall be responsible for the maintenance and all other costs associated with the service connection.

The utility will record at the district recording office "NOTICE OF NON-COMPLIANCE OF UTILITY SERVICE LINE HOOKUP". This will notify all interested parties that the service stub exists and is the property owner's responsibility.

3.26 SEPARATION DISTANCE

Horizontal and Vertical Separation – Water and sewer mains (including manholes) shall be separated by a minimum for ten (10) feet horizontally measured edge to edge. Where it is not practical to maintain a ten (10) foot separation, the ADEC may allow deviation on a case by case basis, if a waiver request is submitted to ADEC and is properly supported by data from the design engineer. Waiver requests must identify the reason for lesser separation and show:

- A. The lines are located in separate trenches and the top of the sewer main is a minimum of eighteen (18) inches below the bottom of the water main.
- B. The sewer line is designed and constructed in a manner equivalent to the requirements for a potable water pipe and is pressure tested to ensure water tightness or:
- C. The sewer line is enclosed in a water-tight carrier pipe of similar strength.

At locations where water and sewer mains must **cross**, a waiver is **not** required if:

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- Water line is above the sewer line, or;
- Sewer line is bedded per Type 4 or 5 (AWWA Standard C600-9) and;
- Water line joints are at least nine (9) feet from the sewer line and;
- Water line is at least eighteen (18) inches vertically from the sewer line.

If the above conditions can not be met for sewer and water crossings; a waiver request (similar to horizontal separation) must be submitted to ADEC.

Any design that fails to meet the ten (10) foot horizontal or eighteen (18) inch vertical separation distance shall require a waiver from ADEC.

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SECTION 4000 -WATER DISTRIBUTION SYSTEM CONSTRUCTION GUIDELINES

PART I - GENERAL

4.12 WORK INCLUDED

This section covers the installation of all water pipe, fittings, and appurtenances for the water distribution system.

Materials, operations or methods herein or indicated on the drawings as being required for the project, shall be provided by the Developer/Contractor. The Developer/Contractor shall provide all the necessary labor, equipment, material, and the incidentals necessary to complete the system as shown on the plans.

4.13 CODES and REGULATIONS

- A. In addition to complying with all pertinent codes and regulations, the Developer/Contractor must comply with all pertinent requirements contained in the most recent Uniform Plumbing Code as adopted by the Utility, the most recent standards of the AWWA as specified, ADEC Regulations, and the most recent standards of the Utility.
- B. Where provisions of pertinent codes and standards conflict with this document, the more stringent provision shall apply.

4.14 CONSULTING ENGINEER

The consulting engineer shall be a registered engineer retained by the Developer/Contractor to design and coordinate the installation of the water distribution system.

- A. The consulting engineer shall furnish drawings and specifications which, as far as practical, completely represent the requirements of the work to be performed under the contract.
- B. The consulting engineer shall be responsible for the design of any construction changes required during the course of construction.
- C. The consulting engineer shall be responsible for submission of stamped as-built drawings to the Utility upon completion of the project. As-built drawings shall show all changes made during construction as well as a minimum of three (3) swing ties to all valves.
- D. The consulting engineer will provide the Utility with advance notice of the work schedule and report to the Utility as to the progress of the work and manner in which it is being performed.

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- E. The consulting engineer is not authorized to revoke, alter, enlarge, relax, or release any requirements of the plans and specifications, nor to approve or accept any portion of the work nor to issue instructions contrary to this document.

4.15 INSPECTION OF WORK BY THE UTILITY

The Utility shall perform inspections of the work and material to ensure compliance with the plans, specifications, and these Standards of Construction. Such inspections may extend to any part of the work including the preparation, fabrication, or manufacture of the materials used.

- A. The Utility's authorized representative will decide: all questions which may arise as to the quality and acceptability of materials furnished and work performed; all questions as to the degree of completion of the work; all questions which may arise as to interpretation of the plans and specifications, and all questions as to the acceptable fulfillment of the contract on the part of the Developer/Contractor.
- B. The Utility's authorized representative shall have the authority to reject any work or materials that do not meet Utility standards.
- C. The presence or absence of the Utility's authorized representative does not relieve the Developer/Contractor from his obligation to fully perform all requirements of this document, nor does it give rise to any right of action or suit by the Developer/Contractor, or third persons against the Utility.

PART II - MATERIALS

4.21 GENERAL

All materials shall be new, of current manufacture and conform to the specifications contained herein. Submit manufacturer's literature and affidavit of compliance with specified standards of the Utility for review and approval prior to procuring materials. All material shall meet the requirements of the National Sanitation Foundation (NSF) 61.

4.22 PIPING

- A. Water mains shall be ductile iron pipe, pressure class 350, push on joint, cement lined. Pipe shall conform to AWWA C151. Cement lining shall conform to AWWA C104.
- B. Water service piping shall be either ductile iron, steel, or seamless copper water tube type K.

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- C. Steel pipe, when authorized, shall be schedule 40 with welded joints or Dresser style coupled joints.
- D. Copper tubing shall conform to the requirements of ASTM B-88 for seamless copper water tube, Type K. Copper tubing shall be true, smooth and clean on both the inside and outside and free from cracks, seams, or other defects. It shall be truly cylindrical of the full specified outside and inside diameters and of uniform thickness of metal.

4.23 PIPE JOINTS

- A. Joints for ductile iron pipe and fittings shall be furnished with rubber gasketed push-on joint (US Pipe Tyton or equal) or mechanical joint, both conforming to AWWA C111.
- B. Restrained joints shall consist of industry approved restrained joint pipe or systems of restraint. Restrained joint pipe and fittings pressure rating shall 350 psi.
- C. Steel pipe shall have plain ends suitable for Dresser type, (or equal) couplings, or welding. No threaded joints shall be used below ground.
- D. Joints for copper tubing shall be flare type only below ground.

4.24 PIPE FITTINGS

- A. Fittings for ductile iron pipe shall conform to AWWA C110 or C153. The fittings shall have a minimum pressure rating of 350 psi. Only ductile iron fittings are acceptable. Interior of fittings shall be cement mortar lined per AWWA C104. Flanged fittings shall use US Pipe flange-tyte gaskets.
- B. Fittings for steel pipe shall be welded joint.
- C. Fittings for copper tubing shall be flare type.

4.25 GATE VALVES

Gate valves shall conform to AWWA C-509 Resilient Seat Gate Valves. Valves shall be non-rising stem with o-ring seals. Valves shall have high strength cast iron bodies and be designed to withstand working pressures of 200 psi or more. Valves shall open by turning the operating stem in a counter-clockwise direction. Valves shall come equipped with name or symbol, the size of the valve, the year of manufacture and the working water pressure cast on the body of the valve. Valves shall be furnished with ends as specified on the plans. Gate valves shall be equipped with a two (2) inch square operating nut.

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4.26 FIRE HYDRANT ASSEMBLY

- A. Fire hydrants shall be Waterous Pacer 90. Each hydrant shall be equipped with two (2) two and a half (2-1/2) inch nozzles and one (1) four and a half (4-1/2) inch pumper nozzle. Nozzle threads shall be National Standard Fire Hose thread. The breakaway section shall be sixteen (16) inches long.
- B. Fire hydrant assemblies shall include fire hydrant, six (6) inch flange by mechanical joint gate valve, US Pipe "swivel" hydrant tee, and valve box. For main sizes fourteen (14) inches and larger, a standard MJ tee will be used.
- C. Fire hydrants shall be painted with two (2) coats of enamel paint after installation. Color shall be federal safety yellow.
- D. Gate valves shall conform with paragraph 4.25 of this section.
- E. Tee fittings shall conform to paragraph 4.24 of this section and shall be US Pipe Trim-Tyte ductile iron mechanical joint valve and hydrant tee, or equal.
- F. Valve box shall conform to paragraph 4.27 of this section.
- G. Insulation shall conform to paragraph 4.28 of this section.
- H. Bollards shall be installed at designated hydrants vulnerable to traffic damage. Bollards shall be installed per Standard Drawing WD1.

4.27 VALVE BOXES

All buried gate valves shall be furnished with cast iron valve boxes. Valve boxes shall be two (2) piece extension type with a cast iron cover. Valve boxes shall have walls not less than three sixteenth (3/16) inch thick and an internal diameter of not less than five (5) inches. Valve box covers shall have the word "water" cast into them.

Valve boxes shall be slip type with lower flanged top section and a deep well bottom section. Cast iron valve boxes shall be Inland Foundry No. 2060 top and No. 2056 bottom. Valve box top sections shall be installed five (5) inches above the last extension piece to allow room for a plastic dust or grit cup installed by the Utility. Screw type valve boxes are specifically prohibited.

Valve boxes shall be installed in a manner that will minimize the amount of run off water that will enter the valve box, and provisions shall be made so that water will drain out of the valve box. Valve boxes outside of roadway or sidewalks shall stick up approximately two to three (2-3) inches above ground level for ease in locating.

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4.28 INSULATION

Urethane spray foam insulation shall be rigid closed cell, two component urethane foam with the following properties:

K Factor:	0.14 (Btu - in/FT ² - Hr - °F)
Compressive Strength:	25 psi
Density:	2.0 pcf

Insulation material shall be Resin Technology 2045. Applicator shall demonstrate prior experience of at least two (2) years, and the Utility shall be the sole judge of the qualifications of application method and applicator.

4.29 PROTECTIVE COATINGS

Protective coatings shall be a two component, one hundred (100) percent solids, sprayable polyurethane coating with the following properties:

Tensile Strength:	1800 PSI
Elongation (percent):	120
Water Vapor Transmission:	0.413 Perms

Coating material shall be Resin Technology Permex 700. Applicator shall demonstrate prior experience of at least two (2) years, and the Utility shall be the sole judge of the qualifications of system, application method, and applicator.

4.30 CIRCULATION PUMPS

In the event that a customer owned circulation pump is to be the sole source of circulation for a Utility water main; the specifications, pump curves, etc., for this pump must be approved by the Utility prior to purchase of said pump. A typical installation of this type would be a commercial facility that is supplied with an eight (8) inch main and a four (4) inch return. At some point near the building, these mains become the hookup and property of the commercial facility which also owns the circulation pump. As the Utility mains are dead ended and can only be circulated by the customer's pump, it is necessary that the Utility approve the design and capacity of the pump.

The pump shall be sized to provide a minimum of one-tenth (1/10) foot per second in the largest Utility main circulated and change the water in the main a minimum of once every six (6) hours, (i.e. 4 times per day). In the example given above this would mean one-tenth (1/10) foot per second in the eight (8) inch main which could be up to one thousand five hundred sixty (1,560) feet long, to change each six (6) hours. The pump should pump fifteen (15) gallons per minute. The pump's operating point shall be determined by calculation of head loss of the service loop.

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4.31 POST INDICATOR VALVES

Post indicator valves shall be Mueller, non-rising stem and identical in construction to the gate valves specified. They shall be furnished with a standard two (2) inch operating nut and an indicator post flange. Valves shall open by turning in counter-clockwise direction.

Indicator posts shall be Mueller, and compatible with post indicator valves in all respects. Posts shall be of two (2) piece adjustable construction suitable for four (4) feet of cover on the main. They shall open counter-clockwise and be equipped with a lockable wrench. Indicator posts and guard posts shall be painted with at least two (2) coats of federal safety yellow after installation.

PART III - EXECUTION

4.33 HANDLING

- A. Use all means necessary to protect materials before, during, and after installation.
- B. In the event of damage, immediately make all repairs and replacements necessary to keep materials in a "like new" condition. These repairs or replacements must be approved by the Utility and made at no cost to the Utility.
- C. All material shall be handled and installed in accordance with manufacturer's recommended handling and installation instructions.
- D. If, in the judgment of the Utility, materials and/or installed work are not being protected or handled as noted in these specifications, or in accordance with the manufacturer's handling/installation recommendations, they shall be rejected and removed from the job site and shall not be used on any other work, either present or future for the Utility.

4.34 LAYING PIPE

- A. The pipe and fittings shall be inspected for defects before installation.
- B. All pipe shall be laid and maintained to the required lines and grades with fittings and appurtenances at the required locations as shown on the plans.
- C. Water mains shall be laid with a minimum of four (4) feet of backfill over the top of pipe.
- D. Pipe interiors shall be thoroughly cleaned of all foreign matter before being lowered into the trench. At all times when work is not in progress, all open ends

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of pipe and fittings shall be securely closed so that no water, earth, rodents or other substances may enter. Each length of pipe shall be examined during assembly in the trench for debris. Any debris found will be removed immediately.

- E. Trenches shall be kept sufficiently dry so that no pipe will be laid in water. Water shall be kept out of the portions of the trench in which un-insulated joints are located while the joints are insulated and otherwise readied for backfill.
- F. Cutting of pipe for closure or other reasons shall be done by methods which will not damage the pipe and which will insure tight joints.
- G. Pipe shall be inspected for defects before lowering into the trench. All defective, damaged or unsound pipe shall be replaced and removed from the site. Any section of pipe already laid but found to be damaged or defective shall be replaced with new pipe, at no cost to the Utility.
- H. Pipe bedding shall be as noted in Section 7000 Trenching, Backfill, and Compaction. Bedding shall be placed to ensure that the pipe is given a uniform bearing for its full length.
- I. Deflections from a straight line or grade shall not exceed the limits recommended by the manufacturer. If the specified or desired alignment requires deflections in excess of such limits, the Developer/Contractor shall either provide special bends or a sufficient number of shorter lengths of pipe to provide angular deflection within such limits.
- J. Standard lengths of pipe shall be used except where short lengths are required for fittings, or wherever pipe passes through a rigid structure.
- K. Pipe ends for future connections shall be valved, plugged or capped and shall be provided with thrust blocks or restraints.
- L. Lubrication for push-on of ductile iron pipe shall be water soluble as recommended by the manufacturer.
- M. Any pipe or structure having its alignment or grade changed by floating in a flooded trench shall be relaid.
- N. To counteract the unbalanced thrust at horizontal and vertical angle points, bends and other special fittings, the Developer/Contractor shall furnish and place concrete thrust blocks. Thrust blocks shall be as detailed on the drawings. All concrete thrust blocks shall be poured against undisturbed earth with smooth vertical bearing surfaces. The thrust block shall be placed and formed to provide access to the joints and fittings. See standard detail for thrust block sizing.

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- O. In lieu of concrete thrust blocks, other methods of joint restraint such as, Field Lok® Gaskets, Megalug® or rod and shackle joint restraint systems, as approved by the Utility Engineer, may also be used. If such joint restraint systems are used, all joints within the specified distance from the angle point shall also be restrained. Note the following table for restrained length requirements.

		HORIZONTAL ANGLE				
		11.25°	22.5°	45°	90°	Dead End
PIPE DIAMETER	4"	-	3'	6'	18'	32'
	6"	-	4'	9'	22'	46'
	8"	3'	6'	12'	28'	59'
	10"	3'	7'	18'	36'	72'
	12"	4'	8'	19'	40'	84'
	14"	4'	9'	20'	46'	96'
	16"	5'	10'	21'	54'	108'
	18"	5'	11'	23'	60'	120'

Example: For a 10"- 90° elbow; all joints within 36' of the elbow (either side) must be restrained; (in addition to the elbow itself) when using Megalug® glands and Field Lok® gaskets.

This table applies only to horizontal bends with a minimum of 4' backfilled cover. Restrained lengths for tee's, reducers, vertical bends or any other situation shall be as directed by the Utility Engineer.

4.35 FITTING AND VALVE INSTALLATION

- A. Fittings and valves shall be installed at the locations shown on the plans.
- B. Valve installation shall be in accordance with standard detail drawings.

4.36 FIRE HYDRANT INSTALLATION

- A. Fire hydrants shall be installed at the locations shown on the plans.
- B. Fire hydrant installation shall be in accordance with the standard detail drawings. Fire hydrants shall be inspected, installed, and tested according to the most recent publication of AWWA M-17.

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Section 4000 - Water Distribution System Construction Guidelines

4.37 INSULATION

- A. The Developer/Contractor shall furnish labor, materials, equipment and services necessary for, and incidental to, field application of spray urethane foam.
- B. Water mains and fittings shall have a minimum thickness of urethane foam insulation of two (2) inches on all outside surfaces.
- C. Insulation shall be applied to water mains above ground in a local yard. Pipe may not be insulated in the ditch except under special circumstances, which must be approved by the Utility.
- D. Water services shall have a minimum of three (3) inches of urethane foam applied to the top, sides, and bottom.
- E. Hydrants shall be insulated as shown on the standard detail drawings. The drain holes must not be covered.
- F. Buried valves shall be insulated with two (2) inches of urethane foam up to the packing gland.
- G. Pre-insulated pipe that has damaged insulation due to transportation shall be reinsulated to the satisfaction of the Utility. Backfill shall not take place until all insulation has been inspected.
- H. Backfill shall be placed so that pipe insulation will not be damaged.

4.38 CONNECTIONS TO EXISTING SYSTEM

- A. Connections to existing water mains shall be made by Utility personnel only, at the expense of the Developer/Contractor.
- B. Materials for these connections shall be furnished by the Developer/Contractor.
- C. The Developer/Contractor shall give the Utility at least forty-eight (48) hours advance notice when requesting a connection.
- D. The Utility reserves the right to schedule shutdowns to minimize possible conflicts and inconvenience to its existing customers.

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Section 4000 - Water Distribution System Construction Guidelines

4.39 PRESSURE TESTING

The Developer/Contractor shall perform a pressure test on the installed pipeline; in accordance with the latest revision of AWWA 600. All mechanical joints shall be left exposed until completion of the pressure test. All portions of the pipeline shall be adequately restrained or backfilled to counter-act thrust forces introduced by the pressure test. All pitorifice assemblies, service tees and hydrants shall be installed prior to the pressure test. All air shall be properly vented from the pipe during charging. Water for pressure testing and flushing will be provided by the Utility. Once the line has been filled and all air removed, the utility main connection shall be isolated from the new section of piping under test. The Contractor shall provide make-up water and test pump to pressurize the line to **150 psig**. The make-up water and pump shall be disconnected during the test period. Only approved pressure gauges with 5 psi increments shall be used, provided by the Contractor. While under this pressure, all joints shall be visually examined. Any evidence of leakage shall be repaired and the line retested until meeting these requirements.

After there is no evidence of leakage, the pipe section shall be held under pressure for **4 hours**, with an initial pressure of 150 psig. At the end of the 4 hours, the make-up water and pump shall be reconnected and the line re-pressurized to 150 psig. The make-up water shall then be bled off into a graduated container until the pressure equals the pressure indicated at the end of the 4 hour test. The allowable leakage shall be determined by the following formula:

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

L = allowable leakage (make-up water), in gallons per hour

S = length of pipeline tested (feet)

D = nominal diameter of the pipe (inch)

P = average test pressure during the test (psi)

No pipe section will be accepted if the leakage is greater than allowable. Service reconnections and final connections to the existing main shall be visually inspected at main line pressure.

Standards of Construction for CUC/GHU
Section 4000 - Water Distribution System Construction Guidelines

4.40 DISINFECTION AND FLUSHING

- A. Mains shall be disinfected in accordance with the latest revisions of AWWA C651. The Developer/Contractor shall furnish all material, labor, equipment, and services required for disinfection of the pipeline. Mains shall be chlorinated using calcium hypochlorite granules or tablets.

The main shall be filled slowly so as not to wash the chlorine to the end of the test section.

The chlorinated water will have a minimum contact time of 24 hours. A minimum chlorine residual of 25 mg/L is required at the end of the 24 hour period. Mains shall be thoroughly flushed following disinfection.

- B. All new lines shall be full bore flushed. Flushing through fire hydrants shall not be permitted.
- C. Disposal of the flushing water shall be the responsibility of the Developer/Contractor. Removal of this water shall not cause damage to property or inhibit the flow of vehicular traffic in or around the work area.
- D. The disinfection shall be supervised by a State certified laboratory. This laboratory shall certify that the initial, residual, and flushed chlorine concentrations meet the standards. A biological purity test shall be taken and the laboratory shall provide a drinking water analysis report for total coliform bacteria for each sample taken. Absolutely no service connections will be made until these test results have met Utility standards and have been approved by the Utility.

Standards of Construction for CUC/GHU
Section 5000 - Construction Surveying

SECTION 5000 - CONSTRUCTION SURVEYING

PART I - GENERAL

5.11 SCOPE OF WORK

The Developer/Contractor shall perform all surveying and staking essential for the completion of the project in conformance with the plans and specifications and shall perform all necessary calculations required to accomplish this work. Monumentation shall be in accordance with State of Alaska Standard Drawings.

5.12 QUALITY ASSURANCE

- A. In addition to complying with all pertinent codes and regulations, all staking, surveying computations and calculations shall be accomplished in accordance with standard surveying practices and instructions issued by the Utility.
- B. Where provisions of pertinent codes and standards conflict with this specification, the more stringent provisions shall control.
- C. The Developer/Contractor shall use competent personnel and suitable equipment for the layout work required and shall furnish all stakes, templates, straight edges and other devices necessary for checking and maintaining point, lines and grades.
- D. Upon the Utility's request, the Developer/Contractor shall provide evidence acceptable to the Utility that the individual who is proposed to perform the construction staking has a minimum of three (3) years experience in similar construction staking work in the State of Alaska, is knowledgeable in the operation of required staking instruments and is capable of reading, understanding and accomplishing the construction survey work described herein.
- E. All surveying work requiring the setting/resetting of monuments, property corners and all permanent survey monuments shall be accomplished under the direct supervision of a Registered Land Surveyor, licensed in the State of Alaska.
- F. The contractor shall maintain a red line "mark-up" set of plans which shall be revised by the contractor as the work progresses to reflect current conditions. The revisions are to be indicated in a neat, well organized manner and are to include all changes to the original plan as well as the elevation and plan location of any utilities, structures etc. encountered or installed. Field notes shall be kept in standard bound notebooks in a clear, orderly, and neat manner consistent with standard engineering practices. Field books shall be available for inspection by Utility personnel at any time. Copies of all field notes shall become the property of the Utility prior to final acceptance of the project. A minimum of three (3)

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Section 5000 - Construction Surveying

swing ties shall be recorded to all valve boxes, manholes, flushwells, and service connections.

5.13 DISCREPANCIES

In the event that a discrepancy or error is discovered in the plans, immediately notify the Utility in writing. Do not proceed with installation in the areas of discrepancy until all such discrepancies have been fully resolved.

PART II - CONSTRUCTION REQUIREMENTS

5.21 GENERAL

- A. The Developer/Contractor shall be responsible for the supervision of the construction surveying personnel. Any errors resulting from the preparations of said personnel shall be corrected at the expense of the Developer/Contractor, at no cost to the Utility.
- B. All lot corners adjacent to, or within the area of the construction project that are destroyed or disturbed by the Developer/Contractor, shall be replaced at the expense of the Developer/Contractor.
- C. If field measurements or construction work is necessary to determine quantities or verify proper installation, that work shall be performed by the Developer/Contractor's survey crew under the supervision of the Utility.
- D. The Developer/Contractor shall be responsible for recording the locations of all installed pipes and appurtenances to the accuracy stated in subsections 5.12(A), 5.23(A) and 5.23(B).

5.22 SURVEY CONTROL

All control, alignment, or grades necessary for construction shall be the responsibility of the Developer/Contractor. All alignment and grades shall be set in such a manner that they can be checked by the Utility.

5.23 FINAL ACCURACY

- A. A water system shall be installed within six (6) inches horizontally and six (6) inches vertically to the exact location taken from the project plans. However, the minimum of four (4) feet of cover shall always apply.
- B. Sanitary wastewater collection systems shall be installed within six (6) inches horizontally and one-hundredths (1/100) of a foot vertically of the exact location taken from the project plans. In addition, any action of pipe shall not vary by more than ten (10) percent of the gradient shown on the project plans.

Standards of Construction for CUC/GHU

Section 6000 - Traffic Control

SECTION 6000 - TRAFFIC CONTROL

PART I - GENERAL

The Developer/Contractor shall perform actions necessary to protect and maintain traffic during the life of the contract, including the furnishing of such personnel, equipment and devices as may be required to insure the safety of the traveling public. The street excavation permit will include signing requirements, which shall be followed by the Developer/Contractor.

6.11 PUBLIC NOTIFICATION

In the event that the planned construction will effect the public, the Developer/Contractor shall post a notice to the public in a local daily newspaper advising the public of the project boundaries including a scale map showing the project area and suggested detour routes, the project time limits, the general contractor's name, and the need to be alert for construction signs and traffic control. The notice, dimensioned 3"x 5" minimum, shall appear once fourteen (14) days prior to the start of work and continuously for seven (7) days beginning five (5) days before the start of work.

6.12 TRAFFIC CONTROL SIGNAGE

All traffic control devices used by the Developer/Contractor shall be placed and maintained in accordance with the requirements as specified in the Manual on Uniform Traffic Control Devices with Alaska Supplement. No construction operation will be allowed to commence until the Developer/Contractor has obtained the proper signs and placed them as required by UTCM. Hastily made hand painted signs and barricades will not be permitted.

6.13 ACCESS

The Developer/Contractor will be required to: maintain pedestrian access to all residences and businesses in the construction zone; maintain vehicle access for emergency vehicles, fire trucks, ambulances and police vehicles; provide barricades and flagging personnel as necessary while working all areas and in particular busy intersections on the project. Ditch openings which isolate businesses and other areas as specified by the engineer shall be provided with an approved bridge system capable of withstanding traffic loads to those areas. No road or business driveway may be closed without the approval of the engineer unless the Developer/Contractor has received written authorization from the owner affected.

Standards of Construction for CUC/GHU

Section 6000 - Traffic Control

6.14 OPEN WORK

At no time will the Developer/Contractor have more than one thousand (1,000) feet of trench open, nor more than two (2) existing intersections closed to vehicular traffic. Pedestrian access crossings suitably equipped with handrails shall be provided. The cost of such crossings, if required, shall be the responsibility of the Developer/Contractor.

6.15 BARRICADE WARNING LIGHTS

Barricade warning lights shall be provided and maintained at all barricades and at all other points where directed by the engineer and shall be kept continuously functioning from one (1) hour before sunset until one (1) hour after sunrise.

6.16 AGENCY NOTIFICATION

The Developer/Contractor is required to notify the following agencies at least twenty-four (24) hours prior to starting any work which might inconvenience or endanger vehicular traffic. Information on project area, duration and detour routes should be provided.

City of Fairbanks Fire Department	459-6500
City of Fairbanks Police Department	459-6500
City of Fairbanks Public Works	459-6896
University Fire Department	474-7721
Alaska State Troopers	451-5100
FNSB - Transit	459-1002
FNSB - School Bus (If during school year)	452-2000 x351 or 352

6.17 PERMITS

The Owner/Developer or his Developer/Contractor shall be responsible for obtaining all necessary federal, state, borough or city permits. The permit(s) shall describe all work to take place on Federal, State, Borough, or City owned lands, right-of-way(s), or accesses to include tie-in(s) to existing utilities.

Standards of Construction for CUC/GHU

Section 7000 - Trenching, Backfilling and Compaction

SECTION 7000 - TRENCHING, BACKFILLING and COMPACTION

PART I - GENERAL

7.11 WORK INCLUDED

The work covered by this section includes providing all labor, equipment, supplies, and materials required for excavation, backfill, and compaction for pipelines and related utility structures.

7.12 DEFINITIONS

Backfill	Material placed in an excavated area.
Bedding	Material in which utility pipelines or utility related structures are placed.
Classified Backfill	Material other than native material to be used for backfilling trenches or bedding.
Compaction	Tamping soils by hand or machine to achieve a specific in-place density.
Disposal Site	Specific site where construction wastes are deposited.
Engineer	Utility engineer or authorized representative responsible for engineering supervision of the construction and contract.
Excavation	The removal of material from an area to provide a suitable base for improvement and/or to reach a specified grade or depth of bury. The improvement may be the replacement of unsuitable material with other material, the removal of existing utility pipelines and related structures, the installation of new utility pipelines or related structures, or other work shown on the plans.
Unsuitable Material	Material which in the opinion of the Engineer is inadequate for use in the proposed project.
Embankment	Material placed above the original ground line.
Spoil	Material that has been removed from an excavation.
Over Excavation	Excavation beyond the depth required for setting a utility pipeline or related utility structure in the natural soil.

Standards of Construction for CUC/GHU
Section 7000 - Trenching, Backfilling and Compaction

Trench	Any excavation for a pipeline, pipeline appurtenance, or related utility structure.
Spring Line	Horizontal line coincidental with the centerline of a buried pipeline.
Pipe Zone	Interval of backfill around a buried pipe extending from the bottom of the pipe to a level of one (1) foot over the top of the pipe.

7.13 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

Before any excavation is started, the Developer/Contractor shall contact all other utility companies to determine the exact locations of underground utilities in the field.

The Developer/Contractor shall be responsible for any and all costs incurred in protecting existing utilities during construction.

PART II - MATERIALS

7.21 CLASSIFIED BACKFILL (SELECT GRAVEL)

Classified backfill material shall be well-graded, select, alluvial gravel and shall consist of hard, durable particles or fragments of granular aggregates naturally blended with fine sand, clay, silt or other similar binding or filler material from approved sources. The material shall be free of organic matter, lumps or excessive amounts of clay or silt and objectionable or foreign substances. It shall have a plasticity index not greater than six (6) as determined as AASHTO T-90. Select gravel shall meet the following gradation requirements as determined by Alaska T-7. The maximum size of material shall be three (3) inch.

GRADING REQUIREMENTS FOR SELECT GRAVEL
 Percent Passing by Weight

<u>Sieve Designation</u>	<u>Grading (% Passing)</u>
4 in.	100
2 in.	85-100
No. 4	30-70
No. 60	35 Max.
No. 200	6 Max.

7.22 BACKFILL MATERIAL

Backfill material shall be thawed material obtained during excavation, which is free from organic or frozen material, stumps, roots, trash, high water content, and any other material that in the opinion of the Engineer is unsuitable. Material deemed unsuitable for backfilling shall be removed from the site and replaced with suitable material.

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Section 7000 - Trenching, Backfilling and Compaction

7.23 PIPE BEDDING

Pipe bedding material shall be select gravel.

7.24 FILTER CLOTH

Filter cloth shall consist of woven or unwoven polypropylene or polyethylene monofilament yarn having a maximum weight of four (4) ounces per square yard and a minimum tensile strength of one hundred (100) pounds as determined by ASTM D-1682.

PART III - EXCAVATION

7.31 GENERAL

Trench and structure excavation shall be by open cut unless otherwise noted on the plans.

The Developer/Contractor shall perform all excavation of the depth and alignment shown on the plans unless otherwise directed by the consulting engineer in writing. Materials to be used for backfilling shall be piled a sufficient distance from the excavation to avoid overloading that could cause slides or cave-ins.

The Developer/Contractor shall be responsible for preventing standing water in any excavation prior to placement of compacted backfill. Any grading necessary to prevent surface water from draining into excavation shall be done. Any water standing in open excavation shall be promptly removed. Any pipe or structure having its alignment or grade changed by floating in a flooded trench shall be relaid.

Equipment with tracks that is used on pavement shall be equipped with suitable pads to prevent damage to pavement. The Developer/Contractor shall be responsible for any damage to pavement.

Disposal of surplus or unsuitable material: Excavated material not required for fill or backfill and/or unsuitable excavated material shall be removed to a disposal site by the Developer/Contractor.

Standards of Construction for CUC/GHU
Section 7000 - Trenching, Backfilling and Compaction

7.32 TRENCH EXCAVATION

- A. Trench depth: The depth of the trench excavation shall be such that the pipe can be laid on the native soil on the bottom of the trench at the invert grade or pipe bury shown on the plans. The excavation shall be finish graded by hand to provide a uniform bearing for the pipe on undisturbed earth between joints.

Care shall be taken not to over excavate except as required by frozen ground conditions or as directed by the Engineer.

- B. Frozen material: Where frozen material is encountered during trench excavation, the Developer/Contractor shall excavate the trench to approximately six (6) inches below required trench grade and replace the excavated frozen material with thawed material from the trench excavation, or from other sources, as bedding for the pipe.
- C. Over-excavation: When, in the opinion of the Engineer, material is encountered at the bottom of the trench, which is unsuitable for pipe bearing, the Developer/Contractor shall over-excavate at least one and one-half (1½) feet and replace the unsuitable material with bedding material. If any ice lenses are present, they must be completely excavated and removed to the satisfaction of the Engineer.
- D. Excavation for joints: After the trench bottom has been graded, excavations for joints shall be made to the length, depth, and width to properly make the joint.
- E. Trench configuration: Trench width shall be adequate for proper laying and joining of the pipe and for compaction of backfill around the pipe, but not so wide that excess loads on the pipe will result.

Trench walls shall be vertical, except in trenches more than four (4) feet in depth, and where required to prevent sloughing of trench walls, the trench walls shall be sloped so as to meet Alaska Department of Labor Safety Codes and other applicable codes.

- F. Bracing and sheeting: Where required to protect adjacent structures and safeguard employees, the trench shall be properly sheeted and braced as prescribed in the construction safety code of the Alaska Department of Labor and other applicable codes. The Developer/Contractor shall be responsible for all costs incurred for any shoring or bracing needed to protect employees and/or adjacent structures and utilities.
- G. Open trenches: The Developer/Contractor shall have on hand all material and equipment for the completion of work prior to commencing any excavation. Unless specified in writing by the Engineer, the Developer/Contractor shall not expose more than one thousand (1,000) linear feet of open trench at any one

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time. In trenches adjacent to and in traveled streets, the Developer/Contractor shall not expose any more trench than can be properly backfilled by 6:00 PM of the day that the trench is excavated, unless a written variance is obtained from the consulting engineer. In no case shall trenches for driveway or street crossings be left open past 5:00 PM on the day they were excavated.

- H. Mailboxes and street signs: During trenching operations, temporary relocation of mailboxes and street signs is required. They shall be set firmly at locations approved by the Engineer. After completion of the trenching operation, the mailboxes and street signs shall be reset in their original location and condition.
- I. Damage or disruption to property: At his expense, the Developer/Contractor shall replace all fences, mailboxes, animal pens and other private or public improvements which are damaged or disturbed as a result of his activity. Where gardens, lawns, or landscaping are encountered along the route of the excavation, the existing topsoil shall be removed and stockpiled for replacement in original condition after the trench is backfilled.

7.33 BACKFILLING and COMPACTION

- A. Bedding: Utility pipelines and related structures shall be bedded in native material or as otherwise indicated on the plans. Pipe bedding shall be shaped to fit the lower third of the pipe. Whenever the trench bottom does not afford a sufficiently solid and stable base to support the pipe or appurtenances, the Developer/Contractor shall over-excavate to a depth of at least one and one-half (1½) feet and backfill with bedding material to the specified grade. The Engineer may require a layer of filter cloth to be placed between the subgrade and the bedding material. The bedding shall support the full length of the pipe. Compaction of the subgrade may be required.
- B. Backfill around pipe: Backfill to the spring line shall be placed by hand in maximum layers of three (3) inches and thoroughly compacted by tamping. Special care shall be taken to assure complete compaction under that portion of the pipe between the spring line and the bottom of the pipe. Backfill material shall be placed in the trench for its full width on each side uniformly.

Material shall have sufficient moisture to permit thorough compaction under and on both sides of the pipe to provide full support free from voids.

From the spring line of the pipe to a depth of one (1) foot above the top of the pipe, the backfill shall be placed in eight (8) inch maximum layers and compacted by tamping.

Compaction of backfill from the bottom of the trench to one (1) foot over the pipe shall be not less than ninety (90) percent of the maximum density as determined by AASHTO Method T-180, Method D.

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All backfilling shall be done progressively. As soon as sections of pipe are laid to proper grade and line, backfilling may proceed.

- C. Backfill above pipe: Backfill in this zone may be placed by any method approved by the consulting engineer, providing such method shall not impose excessive concentrated or unbalanced loads which will transmit shock or impact to the buried pipe. All trenches shall be backfilled in uniform layers not exceeding six (6) inches loose depth and compacted to obtain eighty-five (85) percent of maximum density. Under traveled ways, and within street right-of-ways, material shall be compacted to ninety-five (95) percent of AASHTO T-180 Method D., density. Water settling will not be allowed.

No rocks or stones exceeding six (6) inches in the largest dimension shall be placed within one (1) foot of the top of the trench.

After backfilling and prior to performing surface restoration, the Developer/Contractor shall grade all trenches and maintain them during the period of construction to provide safe travel by the public, free of settlement, mud holes, ruts and high centers.

- D. Backfill or trenches across or along borough, city, or state roadways: Backfill of a trench in borough, city or state right-of-way must comply fully with the conditions of the permit(s) issued by the appropriate agency.
- E. Compaction testing: Field density tests of compacted backfill may be run at all stages of backfill. These tests will be performed by the Engineer at the expense of the Developer/Contractor to insure that the specified density is being obtained.

Acceptance of the compactive effort shall be based on the average of four (4) tests made in a test area. The test area shall not exceed one thousand (1,000) feet of trench.

The test area shall be accepted when the average of four (4) density determinations is not less than the minimum specified density and when no determination is lower than the specified minimum density by three (3) percentage points.

Test areas that are not acceptable shall be brought in compliance by removing and reworking the backfill at the Developer/Contractor's expense.

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7.34 DEWATERING

- A. General: The Developer/Contractor may devise his own method of dewatering excavations. Whatever method is chosen must be approved by the Engineer in writing prior to implementation. The dewatering operation must be conducted so as to dispose of water in the excavation without damage to property, inconvenience to property owners, inconvenience to the public, or impairment of traffic.
- B. Disposal of water: The disposal of water removed from excavations shall be done in accordance with state regulations, including those of the Department of Environmental Conservation and the Department of Fish and Game. The Developer/Contractor shall be responsible for applying for and securing whatever permits are required for his proposed plan and for complying with the conditions of those permits.
- C. Liability for damage: The Developer/Contractor shall assume liability for flooding or related water damage to private or public property as a result of dewatering.
- D. Coordination with utilities: In the event the Developer/Contractor uses a system of well points, he shall, prior to work, coordinate with local utilities to field determine the location of all buried utilities which could be damaged by driving or otherwise setting well points. The Developer/Contractor shall assume liability for damage to any buried utility, which occurs as a result of his work.