

Resolution No. 102

A RESOLUTION ADOPTING SEWERS AND DRAINS SPECIFICATIONS

WHEREAS, the Council of the Town of Gig Harbor recently amended Town Ordinances to require sewers and drains to be constructed in conformance with adopted standards and specifications; and

WHEREAS, there are no sewer and drain standards and specifications presently adopted by the Town of Gig Harbor; and

WHEREAS, the Council of the Town of Gig Harbor has reviewed the attached document entitled "TOWN OF GIG HARBOR TECHNICAL SPECIFICATIONS FOR SEWERS AND DRAINS" and found that it would be in the best interests of the health, safety, general welfare and morals of the residents of the Town of Gig Harbor to adopt said document;

NOW, THEREFORE, BE IT RESOLVED that the attached technical specifications are adopted as the standards and specifications for the construction of sewers and drains within the Town of Gig Harbor.

Ruth Bogue
RUTH BOGUE, Mayor

ATTEST:

Donald J. Avery
DONALD J. AVERY, Town Clerk

TOWN OF GIG HARBOR TECHNICAL SPECIFICATIONS
FOR
SEWERS AND DRAINS

1.00 SCOPE

The specifications of this section are devoted to the construction of sanitary sewers, storm drains and appurtenances. In case of a conflict between this section and Special Provisions, Special Technical Specifications and Plans, prepared for each particular project, the later three shall govern.

2.00 GENERAL

2.01 Rights-of-way

The developer shall provide all easements or rights-of-way that are necessary, in the opinion of the town engineer, for construction of the project. It shall be the responsibility of the Contractor to determine for himself to what degree the limits of the rights-of-way will influence his work.

The Contractor shall also inform himself with the following items related to the provided rights-of-way: Local specifications, permits, construction procedures, special inspections, bounds, insurance, flagmen, etc.

2.02 Clearing and Grubbing

Contractor shall limit all clearing and grubbing operation to the provided rights-of-way. Off-site disposal of all debris and vegetation shall be considered a part of the clearing.

2.03 Existing Utilities, Interferences and Obstructions

It shall be the Contractor's or developer's responsibility to verify existence and location of the utilities, interferences and obstructions, by contacting appropriate agencies, boring, or by special devices.

The cost incurred by the locating, bracing, repairing, shoring and extra care and protection of utilities, interferences and obstructions shall be borne by the Contractor or Developer, as well as any costs of the interrupted service or damaged utilities.

2.04 Restoration of the Surface Improvements

Contractor shall cause minimum damage to the street surfacing, curbs, driveways and sidewalks. All damage done by the Contractor's equipment to the surface improvements shall be the responsibility of the Contractor.

2.05 Lawns, Trees and Shrubs

Any damage to the landscaped areas caused by the construction shall be repaired and the areas shall be restored to their original condition as close as possible. Such restoration shall include lawns, trees, shrubs, etc.

2.06 Survey Monuments, Bench Marks and Property Corners

Contractor shall preserve all survey monuments, bench marks and property corners. In case of a necessity to disturb a survey monument, bench mark or a property corner, the

Contractor shall request the town engineer in advance to reference it. Failure to do so, or disturbing of any of the above named objects by negligence shall be Contractor's responsibility. Cost of said location will be charged to the developer.

2.07 Interruption of Traffic

The permissible length of open trench shall be determined by the Sewer Superintendent. The trench shall not be excavated until all material is on hand and a rapid completion of work is insured. Free access for a fire engine must be provided at all times of construction. Where it is necessary for the emergency or business vehicles, adequate temporary bridges must be kept over the trench.

No building or property shall be left without a vehicular or pedestrian access for an unreasonable time. Should the Contractor fail to provide necessary backfill or bridging when requested by the Sewer Superintendent, the latter may stop all other work until his request is satisfied.

2.08 MATERIALS

2.09 Quality, Abbreviations and References

All material shall be new, of the highest quality and made by reputable manufacturers. It shall be installed in good working order and any defects either in manufacture or caused by handling or storage shall be the responsibility of the Contractor.

Following are the abbreviations used in these specifications:

AASHO-American Association of Highway Officials

ACI-American Concrete Institute

ANSI-American National Standards Institute.

APWA-American Public Works Association (Washington State Chapter)

ASTM-American Society for Testing Materials

AWWA-American Water Works Association

References to any specifications of the above agencies shall mean the latest revision of such specifications.

3.00 Pipe

3.00.1 Pipe shall be of the type and class shown on plans or specified in the special Technical Specifications.

3.00.2 Concrete Pipe Unreinforced - All unreinforced concrete sewer, culvert, and storm drain pipe shall conform to ASTM designation C-14 Extra Strength.

3.00.3 Concrete Pipe Reinforced - All reinforced concrete sewer, culvert, and storm drain pipe shall conform to ASTM designation C-76. The class shall be noted on the plans or in the Special Technical Specifications. Bells and spigots shall be reinforced in all sizes thirty inches (30") and over. When used with flexible gasket joint for sanitary sewer pipe in addition to C-76 requirements, it shall also conform to the permeability and hydrostatic test requirements of C-14.

3.00.4 Asbestos-Cement Gravity Sewer Pipe - All asbestos-cement gravity sewer pipe and couplings shall conform to ASTM designation C428 Type II. The class shall be as specified on the plans or in the Special Technical Specifications.

Testing shall conform to ASTM C500. Joints shall conform to ASTM D1869 in addition to the specifications herein.

3.00.5 Vitrified Clay Sewer Pipe - All vitrified clay sewer pipe shall conform to ASTM designation C200 and Clay Pipe Institute. West Coast Standard extra strength pipe.

The joint for clay pipe shall be factory-made, mechanical compression joint, conforming to ASTM designation C425. All plugs or caps for wyes, tees, house laterals, or clean-outs shall be manufactured for use with the same joint.

3.00.6 Cast Iron Pressure Pipe - All cast iron pipe shall conform to AWWA standards C-106 or C-108. Cast iron pipe shall be cement mortar lined inside in accordance with AWWA C-104 and coal-tar coated outside unless otherwise specified.

3.00.7 Ductile Iron Pressure Pipe - All ductile-iron pipe shall conform to AWWA standard C-151. Ductile iron pipe shall be cement mortar lined inside in accordance with AWWA C-104 and coal tar coated outside, unless otherwise specified.

3.00.8 Asbestos-Cement Pressure Pipe - All asbestos-cement pressure pipe shall conform to AWWA standard C-400. Pressure class, length, specials, and couplings shall be as specified in C-603 and in the Special Technical Specifications.

3.01 Jointing Materials

3.01.1 Except where mechanical joints are needed and unless otherwise specified on Plans or in the Special Technical Specifications, all pipes, sewer or storm drains shall have flexible, gasketed joints.

3.01.2 Flexible Gasketed Joints - Flexible joints shall be rubber gasketed when used with concrete pipe and conform to ASTM C443. Asbestos-Cement joints shall conform to ASTM D1869. Clay pipe shall conform to ASTM C425.

Gasketed material shall be stored in a cool, clean place, protected from sunlight and contaminants until ready for installation on the pipe. Pipes with gaskets affixed shall be installed in the sewer line within 28 days, unless adequately protected against sunlight and contaminants.

All surfaces of the joint upon or against which the gasket may bear shall be smooth, free from spalls, cracks or fractures and imperfections which would adversely affect the performance of the joint.

The joints of the pipe shall be of such design that they will withstand the forces caused by the compression of the gasket, when joined, without cracking or fracturing.

The rubber type gasket shall be the sole element depended upon to make the joint flexible and watertight.

The gasket shall be a continuous ring which fits snugly into the annular space between the overlapping surfaces of the joints of the pipe to form a flexible watertight seal. The gasket shall not be stretched more than 20% of its original circumference when seated in the spigot or tongue end of the pipe.

The annular space, including the manufacturer's tolerances, between the gasket bearing surfaces of the respective cones when the joint has been closed shall not be more than 5% of the uncompressed thickness of the applied gasket.

3.01.3 Mortar Joints - Pipe ends designed for rigid mortar joints shall conform to ASTM designation C14 or C76 as may be applicable. Mortar shall be cement mortar mixed in the proportion of one (1) part Portland Cement to one and one-half (1-1/2) parts plaster sand mixed with the least amount of clean water necessary to provide a workable mortar.

3.01.4 Couplings for Cast Iron and Ductile-Iron Pipe - Mechanical joint type couplings shall conform to the AWWA Specification C-111. Other types of joints shall conform with Federal Specifications WW-P-42 lb., Type I, for caulk joints, or Type II, for push on joints. Flanged couplings shall be drilled and faced in accordance with American Standard B-16.1, or B-16.2.

3.01.5 Couplings for Asbestos-Cement Pressure Pipe - Every coupling shall include an asbestos-cement sleeve of the same composition as the pipe, and two rubber rings. The couplings shall be mechanical so as to insure a tight joint with the pipe. The rubber rings used to seal the joints of the asbestos-cement pipe shall conform to the latest requirements of ASTM designation D1869.

3.02 Fittings

3.02.1 Tees and Wyes, Pipe Sewer - A tee or wye fitting shall be provided in the main line sewer for all side sewer, catch basin, and inlet connections. Fitting branch shall be sized as shown on the Plans, and be of sufficient strength to withstand all handling and load stresses normally encountered. The fitting shall be of the same material as the pipe except that cast iron fittings shall be used with asbestos-cement pipe, and shall show no signs of cracking or breaking under such normally imposed loads. The fitting branch socket shall be made for a rubber gasketed connection unless otherwise specified and shall be fitted with a rubber gasketed plug, properly secured, so an ex-filtration test can be performed.

3.02.2 Fittings for Cast Iron and Ductile-Iron Pipe - Ordinary cast iron fittings shall conform to the AWWA Standard C-110. Cast iron fittings for use with Federal Specifications Type II and Type III cast iron water pipe shall conform to the same specifications except that joint shall be mechanical type and include cast iron glands, plain rubber gaskets, and T-head cast iron bolts and nuts per ASA A-21.11 or an approved compression type with rubber gasket.

3.02.3 Fittings for Asbestos-Cement Pressure Pipe - Ordinary fittings for asbestos-cement pressure pipe shall be cast iron and shall be designed for installation with rubber rings. Fittings shall be similar and equal to Tifco pipe fittings as manufactured by the Independent Fitting Company, Portland, Oregon.

3.03 Manholes

Standard manholes may be constructed of precast units set on either a precast base or a poured in place concrete base, all in accordance to standard plans and these specifications.

3.03.1 Base Sections - Base sections for manhole construction shall be either poured in place concrete and be not less than 6 inches in thickness or precast sections conforming to the requirements for precast manhole sections, unless otherwise provided in

the plans and special provisions. Base sections shall be constructed to form a watertight structure.

Openings to receive pipe shall be circular, tapered in toward the inside of the section and shall be held to the minimum size possible to accommodate the pipe to be inserted and to effectively seal the joints. Openings for pipe up to 24" diameter may be provided in 48" base sections. Openings for pipe up to 42" diameter may be provided in 72" base sections. Where pipe of larger diameters are to be accommodated, a monolithic base structure shall be provided.

3.03.2 Precast Manhole Sections - Standard precast manhole sections shall conform to ASTM C478 and consist of circular sections in standard nominal diameters. No more than two lift holes shall be cast into each section. Holes shall be so located as to not damage reinforcing, or expose it to corrosion. At the Manufacturer's option, steel loops may be provided for handling, in lieu of lift holes.

Unless otherwise provided in the special provisions, steps shall be installed in each section so that sections placed together in any combination will provide a continuous vertical ladder with rungs equally spaced. Steps shall project uniformly from the inside wall of the manhole as per the standard drawings, and shall be cast or firmly grouted in place so as to insure complete watertightness. Where it is intended that manholes be installed without fixed steps, the special provisions shall so specify.

3.03.3 Precast Cones - Standard precast cones shall be eccentric and shall conform to ASTM C478.

3.03.4 Flat Slab Covers - Flat slab covers shall conform to ASTM C478.

3.03.5 Steps - Manhole steps shall be galvanized deformed bar steps conforming to ASTM A 15 and the galvanizing shall conform to ASTM A 123. Step dimensions and patterns shall conform to the Standard Details Sheet of Plans. The diameter of the bar steps shall not be less than 3/4". The spacing shall conform to local state safety code. Wrought iron steps may be used as an alternate.

3.03.6 Frames and Covers - Manhole frames and covers shall be of the size and shape detailed in the standard plans.

Castings shall be tough, close-grained, gray iron free from blow holes, shrinkage and cold sheets. They shall conform to ASTM A 48 and shall be sound, smooth, clean and free from blisters and defects. Castings shall be planed and ground when necessary to insure perfectly flat and true surfaces. Covers shall be true and shall seat within the ring at all points.

Castings shall be as shown on the Plans.

3.04 Concrete

3.04.1 Structural concrete for manhole bases and other minor structures shall have a minimum compressive strength of 3000 pounds per square inch at 28 days. Minimum cement content shall be 6 sacks (546 pounds) per cubic yard and cement shall be Type II conforming to ASTM designation C150.

3.04.2 Cradle concrete for use in Class A bedding shall have a minimum 28 day compressive strength of 2000 pounds per square inch and shall have a minimum cement content of 4 sacks (376 pounds) per cubic yard and cement may be Type I, II, or III conforming to ASTM designation C150.

3.05 Bedding Material, Granular

The granular material used for bedding shall be approved by the Engineer before delivering to the job. It shall be a non-cohesive material which will flow readily and can be consolidated when sliced with a shovel and which will not bulk with moisture.

Type 1 - Crushed Rock - Gradation shall be as follows: not less than ninety-five percent (95%) to be retained on a #4 sieve.

Type 2 - Pea Gravel - Gradation shall be as follows: not less than ninety-five percent (95%) passing 1/2" and not less than ninety-five percent (95%) to be retained on a #4 sieve.

Type 3 - Sand - Sand shall be as follows: well graded from coarse to fine with not more than ten percent (10%) by weight passing the No. 200 sieve.

3.06 Backfill Material, Granular

The purpose of the granular material is to eliminate backfill settlement. The surfacing may then be replaced without continued maintenance. The granular backfill material shall be hard, clean, and well-graded.

All granular material for backfill shall be approved by the Engineer before delivering to the job. Sands and river-run gravel vary considerably from the same source. Therefore, approval of samples and/or a portion of the material shall not be a blanket approval of the entire source.

Type of granular backfill will be shown on the drawings or specified elsewhere. The types are:

Type 1 - Crushed Rock - Gradation shall be as follows:

<u>Sieve Designation</u>	<u>Percentage Passing</u>
2-1/2 inch	not less than 95
1 inch	65
No. 4	35
No. 200	12

Type 2 - River Run Gravel - Gradation may vary. However, the maximum size shall be such that ninety-five (95%) percent will pass two and one-half inch (2-1/2") and all be retained at a #60 sieve.

Type 3 Sand - Sand shall be well graded from coarse to fine with not more than ten percent (10%) by weight, clay or loam.

3.07 Excavation and Backfill

3.08 Materials and Conditions

Classification of the trench excavation shall be determined exclusively by:

- a. The size of pipe for which the trench is excavated.
- b. By the depth of the flow line of pipe beneath the top of ground.

No extra payment whatsoever will be allowed for the dewatering of trench or for the presence of water, rock sand, peat, hardpan, sandstone, boulders, old-wearing surfaces, debris, or any other type of earth or foreign objects found in or near the trench excavation. The Contractor shall conduct such investigations as he deems necessary to

properly acquaint himself with existing ground conditions and materials.

3.09 Excavation

The trench shall be excavated so as to ensure construction of pipe to the line and grade shown on the Plans. The sides shall be vertical from the bottom of the trench to a distance of twelve inches (12") over the top of the pipe and shall be limited in width as follows: 21-inch pipe and under, the width shall not exceed the inside diameter plus eighteen inches (18"); 24-inch and over pipe, the width shall not exceed the inside diameter plus twenty-four inches (24"). The width of the upper portion of the trench shall be determined by the nature of the soil, depth of trench, proximity to obstructions and interferences, and safe working conditions. The minimum width shall be determined by type of pipe and joint and backfill requirements. Sufficient space must exist between side of trench and pipe to inspect joint and compact backfill. Trenches wider than the maximum specified may result in a greater load of overburden than the pipe is designed for and, consequently, if the maximum trench width is exceeded by the Contractor without the written consent of the Sewer Superintendent, the Contractor will be required to provide pipe of higher strength classification, or to provide a higher class of bedding, as may be deemed necessary by the Sewer Superintendent.

4.00 Structure Excavation

Excavation for manholes and other structures shall be sufficient to provide a minimum of twelve (12) inches between their surfaces and the sides of the excavation.

4.01 Excavated Material

The location of spoil piles shall be determined by traffic conditions. The material shall be confined to the smallest area possible. Sufficient distance shall exist between the spoil pile and trench edge to prevent material from rolling and falling into the trench. It shall be piled in such manner as will cause a minimum of inconvenience to public travel, and provision shall be made for merging traffic where such is necessary. Free access shall be provided to all fire hydrants, water valves and meters, and clearance shall be left to enable free flow of storm water in all gutters, other conduits, and natural water courses.

4.02 Shoring, Sheetin and Bracing of Trenches

Whenever necessary to prevent caving or lateral movement which might damage adjacent property or utilities, excavation in sand, gravel, sandy soil, or other unstable material shall be adequately sheeted and braced. All sheeting and shoring must be removed unless removal would disturb the pipe.

In lieu of bracing and shoring, where permitted, the trench may be widened at the top and the sides sloped.

4.03 Tunneling

If the Contractor wishes to tunnel under existing utilities, interferences, and surfacing, the method must have the prior approval of the Sewer Superintendent. Payment for tunneling will be the same as if the open cut method were used.

4.04 Dewatering

Pipe trenches shall be kept free from water during pipe laying and jointing by such

method as the Contractor may elect, provided the method is acceptable to the Sewer Superintendent. The Contractor shall be responsible for damages of any nature resulting from the dewatering operations, notwithstanding tacit approval of the method by the Sewer Superintendent.

4.05 Extra Bedding in Unstable Grounds

Where in the opinion of the Engineer native bottom of trench is unstable, construction of extra bedding will be required as follows:

The trench shall be overexcavated to the satisfaction of the Engineer and granular material of the type selected by the Engineer shall be placed in layers not to exceed 6" and compacted to 95% of maximum density. The top of such extra bedding shall be at the elevation of the bottom of the normal bedding specified for the particular area.

Extra bedding shall be bid as a separate item, which shall include overexcavation, disposal of the overexcavated material and furnishing, placement and compaction of the granular material. The quantity of the extra bedding shall be expressed in terms of cubic yards of the overexcavated area. Measurement of the width of the overexcavated area shall not exceed the width of trench at the level of pipe, specified on Standard Details Sheet of Plans.

4.06 Pipe Bedding

4.06.1 Before placement of the pipe the bottom of the trench shall be carefully leveled. One of the four classes of bedding shall be constructed as follows:

4.06.2 Class A Bedding. Place the pipe on a cradle of 2000 psi concrete. The minimum thickness of the concrete under the pipe shall be equal to 1/4 the inside diameter or four inches (4"), whichever is greater. The maximum thickness shall be twelve inches (12"). The concrete shall extend up along the pipe to 1/4 the outside diameter for the full width of the trench.

4.06.3 Class B Bedding. The pipe shall be laid on a thoroughly compacted bedding of granular material, per paragraph 3.05. The depth of the bedding below the bottom shall be as follows:

<u>Inside Pipe Diam., In.</u>	<u>Minimum Bedding Depth Below Pipe Barrel</u>
4, 6, or 8	4 inches
10 and larger	6 inches

The Contractor shall form a depression for the bell before placement of the pipe.

After the pipe has been laid to grade and line additional granular bedding material shall be placed around the pipe up to the springline of pipe for the full width of the trench. This additional material shall be compacted by spading, rodding, tamping, or other means which will compact the material.

4.06.3 Class C Bedding. Class C Bedding shall be the same as Class B except that the additional granular material around pipe shall be placed up to 1/4 of the outside diameter of pipe.

4.06.4 Class D Bedding. Bottom of the trench shall be shaped to form a cradle with depressions for the bell. The cradle shall have a depth in the middle equal to 1/4 of the outside diameter of pipe and shall provide a uniform contact with the pipe. After the pipe has been laid select earth shall be placed to the springline of pipe

full width of trench and compacted under and around pipe.

4.07 Pre-Cover

After completion of bedding all pipes must be pre-covered to one foot above the top of pipe by hand. Pre-cover material shall be the same type as specified for the backfill but must be selected and free of any hard objects, like rocks, hard clay lumps, frozen dirt, debris, etc.

Method of placement and degree of compaction shall be identical to those specified for backfill in this particular area, except that pre-cover of all PVC pipes shall be compacted to 95% of maximum density.

4.08 Backfill

After precover has been completed and approved by the Sewer Superintendent, the trench shall be backfilled using one of the following methods:

- 4.08.1 Type A Backfill. Backfill the trench with the material excavated. Place the material in lifts not to exceed two (2) feet and compact to 90% density. Machine may be used to backfill. Mound the excess material over the trench.
- 4.08.2 Type B Backfill. Backfill the trench with the material excavated. Place the material in six inch (6) to eight inch (8) layers and compact with mechanical tampers to a relative density of ninety five percent (95%).
- 4.08.3 Type C Backfill. Backfill the trench below four foot (4') depth with native material in lifts not to exceed two feet (2') and compact to 90% density. Backfill of the upper four feet (4') shall be imported granular material in six-inch (6") to eight-inch (8") layers and compacted with mechanical tampers to 95% density.
- 4.08.4 Type D Backfill. Backfill the entire trench with imported granular material and compact to ninety-five percent (95%) relative density.
- 4.08.5 In the area of type C & D the excess excavated material shall be removed from the job site no later than three (3) days after completion of backfilling.

At all points where pipe crosses beneath any other underground utility line, Type D backfill and granular material for precover shall be used within five feet of crossed line.

4.09 Dewatering

Dewatering, sufficient to maintain the ground water level at or below the surface of trench bottom or base of the bedding course, shall be accomplished prior to pipe laying and jointing, if not prior to excavation and placing of the bedding as called for in other sections of the specifications or special provisions. The dewatering operation, however accomplished, shall be carried out so that it does not destroy or weaken the strength of the soil under or alongside the trench. The normal water table shall be restored to its natural level in such manner as to not disturb the pipe and its foundation.

5.00 Bedding

The pipe bedding shall be placed so that the entire length of the pipe will have full

bearing. No blocking of any kind shall be used to adjust the pipe to grade except when used with embedment concrete. Bell holes shall be dug as required to assure uniform support along the pipe barrel.

5.01 Pipe Laying

Laying of pipe shall be to line and grade in the trench only after it has been dewatered and the foundation and/or bedding has been prepared. Mud, silt, gravel and other foreign material shall be kept out of the pipe and off the jointing surfaces.

All pipe laid shall be retained in position by mechanical means or otherwise, as approved by the Sewer Superintendent, so as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. All pipe shall be laid to conform to the prescribed line and grade shown on the plans.

The sewer pipe, unless otherwise approved by the Engineer, shall be laid up grade from point of connection on the existing line or from a designated starting point. The pipe shall be installed with the bell end forward or upgrade unless approved otherwise. When pipe laying is not in progress the forward end of the pipe shall be kept tightly closed with an approved temporary plug.

Where pipe lines are to be laid on specified curves of sufficiently short radius to deflect the pipe joints in an amount greater than recommended by the manufacturer, the pipe ends shall be canted at the factory in an amount necessary to meet the manufacturer's recommendations. The pipe lines laid on curved alignment will be measured for payment along the center line of the pipe, and no additional compensation will be allowed for canting.

All pipe, fittings, and accessories shall be inspected before lowering into the trench. After inspection they shall be placed in the trench in such a manner as to prevent damage. Dropping of the pipe onto the trench bottom will not be allowed. Any pipe or appurtenance which inadvertently or otherwise has been laid or jointed in non-accordance with the specifications and special provisions shall, upon direction of the Sewer Superintendent at any time before final acceptance of the contract or before expiration of the guaranty period, be repaired or be removed and replaced at the expense of the Contractor, and to the satisfaction of the Sewer Superintendent.

5.02 Building Connections and Wye Branches

The type and size of building connections and wye or tee branches shall be as indicated on the Plans or in the Special Technical Specifications.

The tee or wye branch shall be placed in the location indicated and turned up at a slope of 1/4" per foot. The end of the tee or wye branch shall be plugged or capped against ground water.

Where the building connection is to be installed under this contract, a tee is to be installed in the line then laid on a straight line and uniform grade to its end. The end shall be (permanently) plugged or capped if the actual connection is not immediately made. If a representative of the Sewer Superintendent is not present when wye branches and building connections are installed, the Contractor shall note the station and depth of the wye or end of the building connection line. Failure to do so will result in the Contractor reexcavating the pipe and exposing the branch for verification of location, to the satisfaction of the Sewer Superintendent.

The ends of all building connection lines and wyes or tees shall be marked with a 2" x 4" extending from the end of the wye to a point minimum 18" above the ground.

The upper 12" of the 2" x 4" shall be painted white, using exterior type paint. The depth of the building connection shall be clearly indicated in two inch (2") high figures using black paint.

5.03 Plugs and Connections

Plugs for pipe branches, stubs or other open ends which are not to be immediately connected shall be made of an approved material and shall be secured in place with a joint comparable to the main line joint.

5.04 Thrust Blocks

All changes in direction in force mains shall be anchored with concrete thrust blocks or other means approved by the Sewer Superintendent.

5.05 Manhole Construction

5.06 Dewatering

Dewatering of the site shall conform to the requirements for sewer trench dewatering in Section 4.04.

5.07 Sub-Base Preparation

Adequate foundation for all manhole structures shall be obtained by removal and replacement of unsuitable material with well graded granular material; or by tightening with coarse ballast rock, or by such other means as provided for foundation preparation of the connected sewers, or as required in the special provisions. Where water is encountered at the site, all cast-in-place bases or monolithic structures shall be placed on a one-piece waterproof membrane, so placed as to prevent any movement of water into the fresh concrete.

5.08 Bedding

Precast base sections shall be placed on a well graded granular bedding course conforming to the requirements for sewer bedding but not less than 4 inches in thickness and extending either to the limits of the excavation or to a minimum of 12 inches outside the outside limits of the base section. In the latter case, the balance of the excavated area shall be filled with select material compacted to the level of the top of the bedding to positively prevent any lateral movement of the bedding when the weight of the manhole is placed upon it. The bedding course shall be firmly tamped and made smooth and level to assure uniform contact and support of the precast elements.

5.09 Concrete Base

The concrete base for pre-cast manholes shall be constructed to permit the first section of the pre-case manhole to have uniform bearing throughout the full circumference of the manhole wall. Sufficient mortar shall be deposited on the concrete base to provide a watertight seal between the base and the manhole wall. The concrete base shall not be placed in water and if the trench foundation is not stable the contractor shall over-excavate to a depth below invert as per Engineer's direction. The over-excavation shall be brought to grade with gravel.

6.00 Manhole Invert

The invert of the manhole shall conform to details shown on the Plans. Care shall be taken to construct the invert of the manhole to provide smooth flow-through characteristics. No sharp edges or rough sections which will obstruct the flow of sewage will

be permitted. In general, the invert shall be constructed to a section identical with that of the sewer pipe. Where size of sewer pipe changes at the manhole, the invert shall be constructed in the form of a smooth transition without abrupt breaks or unevenness of invert surfaces. Where a full section of concrete sewer pipe is laid through the manhole, the top shall be broken out to the spring line of the pipe, and the exposed edge of the pipe completely covered with mortar. During the construction of the invert section, and for a period of not less than 24 hours following placing of concrete or mortar in the invert sections, the Contractor shall temporarily divert existing flows of ground water or sewage from new concrete or mortar surfaces to prevent damage to the fresh concrete or mortar within the manhole until initial set has been achieved.

6.01 Manhole Walls

Manhole walls shall be constructed plumb and true in accordance with the details shown on the Plans. Where walls are constructed using precast concrete sections, joints shall be mortared tight, to provide a water-tight joint which will prevent infiltration of ground water into the manholes.

6.02 Pipe Connections

All unreinforced pipes entering or leaving the manhole shall be provided with flexible joints within 12 inches of the exterior wall of the manhole structure and shall be placed on firmly compacted bedding, particularly within the area of the manhole excavation which normally is deeper than that of the sewer trench. Special care shall be taken to see that the openings through which pipes enter the structure are completely and firmly rammed full of mortar to ensure water-tightness.

6.03 Grade Adjustment

Final elevation for each manhole will be determined by the Sewer Superintendent, and tilt shall conform to the existing street surface unless otherwise specified or directed by the Sewer Superintendent.

6.04 Streets at Grade

Where work is in paved streets or areas which have been brought to grade, the top of cone or slab shall be minimum 8" and maximum 24" below the underside of the manhole casting ring. Concrete riser rings shall be used between the top of cone and the underside of manhole.

6.05 Backfill

Backfill around the manhole shall be as specified for pipe backfill.

6.06 Drop Manholes

Drop manholes, where shown on the plans, shall conform in all respects to the requirements for standard manholes.

6.07 Manhole Steps

Manhole steps shall be placed at a maximum of spacing of 12 inches. The bottom step shall not be more than 12 inches above the floor of the manhole. The top step shall not be more than 18 inches below the top of the manhole cover.

6.08 Street Surfacing, Driveways, Curbs, and Sidewalks

The Contractor shall replace all street surfacing damaged during construction. The restoration shall be at least equal in workmanship and materials to the original surface. The restoration shall comply with the requirements of the governing authorities having jurisdiction over the particular street or road.

6.09 Trench Maintenance

Before the replacement of permanent surfacing the Contractor shall maintain the trenches in an acceptable condition. Trenches shall be maintained seven (7) days in a week. Where asphalt concrete or Portland cement concrete surfacing is to be replaced, a temporary cold asphalt patch shall be applied 24 hours after backfilling.

The Contractor shall be responsible for the replaced pavement for a period of one (1) year should it fail due to inadequate compaction of backfill or use of inferior surfacing materials. If the Contractor should fail to restore such trenches after proper notification, the Owner may restore the trench and properly charge the work to the Contractor or deduct the charge from any monies due the Contractor.

7.00 Road Section

Where granular backfill is specified, either entire depth of trench or within upper 4 feet of it, such backfill, if approved by the Street Superintendent, shall extend to a point 2" below the bottom of asphalt, followed by 2" of 3/4"-0" crushed rock, leveled and compacted until no settlement occurs.

7.01 Surfacing Depth

The depth of the compacted and completed surfacing, unless specified otherwise on the Plans or in the Special Technical Specifications, shall be as follows:

<u>Type of Surfacing</u>	<u>Depth</u>
Asphaltic Concrete	2"
Asphaltic Concrete (State Highway Dept.)	4"
Gravel	3"
Concrete	
Streets	8"
Driveways	6"
Walks	4"
Oil Mat	As directed by the Street Supt.

7.02 Asphaltic Concrete

The method of placement shall be as follows:

1. Remove the sub-base material to the depth of pavement specified.
2. Level and compact the exposed material.
3. Clean the exposed edges of mud and loose material and if the surfacing has cracked beyond the trench edge, recut the surfacing to that point and replace with one continuous patch.
4. Prime the exposed edges with a tack coat, consisting of either an RS-1 or RS-2 emulsion or RC-2 or RC-3 liquid asphalt.
5. Use plant mix asphaltic concrete with a gradation equal to Washington State Highway Class "B" mix at a minimum temperature of 250°.

6. Compact asphalt concrete to a relative density equal to ninety-five percent.(95%)
7. No asphalt concrete shall be placed when the temperature is below 45° F, or in water.
8. The patch shall be left 1/16" higher than the existing surface.

7.03 Gravel Surfacing

Where gravel surfacing (streets, shoulders, driveways, etc.) has been cut it shall be replaced with the same type thickness of material leveled to a minimum depth of three inches (3").

7.04 Concrete Surfacing

- 7.04.1 Strength - The concrete shall have a strength of 3000 psi for streets, driveways, walks and curbs.
- 7.04.2 Subgrade Preparations - The subgrade shall be brought to approximately grade and compacted. The day before placement the subgrade shall be thoroughly wet.
- 7.04.3 Placement and Finishing - The concrete shall be deposited on subgrade evenly to avoid rehandling, spaded to insure uniform compaction, leveled to match the existing grade, and finished identically as the adjacent existing concrete surface improvements.
- 7.04.4 Curing - The surface of all concrete shall be cured by keeping continuously wet or by the application of an approved membrane, or curing compound.

7.05 Oil Mat

The surface replacement of oiled and light bituminous streets and roads shall be with plant mix asphalt for small trenches and patches. However, where the trench is larger or the entire surface width has been damaged, the Contractor shall scarify, blade, use new gravel, shape and apply two (2) applications of oil mat. The replacement of the surface shall be approved by the Town Engineer.

7.06 Testing

After backfilling is completed and the lines cleaned, flushed and lamped, gravity sewer lines and force mains shall be tested. Testing of gravity lines may be done by a low pressure air testing method, by water exfiltration testing method, or, if requested by the Sewer Superintendent, by water infiltration testing method.

Force mains shall be pressure tested using water. The Contractor shall furnish all labor, materials, tools and equipment necessary to make the test, clean the lines and to perform all work incidental thereto. Precautions shall be taken to prevent joints from drawing during tests, and any damage resulting from tests shall be repaired by the Contractor at his own expense. The manner and time of testing shall be subject to approval of the Sewer Superintendent, provided that the superintendent may limit pipe footage to be laid without testing.

The first section of pipe not less than three hundred (300) feet in length installed by each crew shall be tested, if required by the Sewer Superintendent, in order to qualify the crew and/or the material; and successful installation of this section shall

be prerequisite to further pipe installation by the crew.

7.07 Water Testing of Gravity Sewer Lines

The Sewer Superintendent may require a hydrostatic test on any or all portions of the completed line. The test may be either interior or exterior and shall have a head that will cover all joints by four feet (4'). Should the line fail to pass the test as defined below it shall either be repaired or replaced so that it will pass the test.

The fact that an entire system may pass the test requirements will not relieve the Contractor of repairing, or replacing faulty joints or sections known to be contributing a considerable portion of the leakage water.

7.07.1 Leakage Requirements - Pipe and joints shall sustain a maximum leakage limit of four-tenths (0.4) gallons per hour per inch diameter per one hundred (100) feet of pipe when field tested by actual infiltration conditions. For exfiltration testing the requirement is the same, except that an allowance of additional ten percent (10%) of gallonage shall be permitted for each additional two (2) foot head over a basic four (4) foot minimum internal head. Head shall be measured from the crown of the lower end of the pipe section being tested.

7.07.2 Allowance for Absorption - At the Contractors option, pipe may be filled up to twenty-four (24) hours prior to the time of exfiltration testing to permit normal absorption into the pipe walls to take place. Where water for infiltration is supplied by flooding the trench, such flooding shall be commenced at the Sewer Superintendent's option, up to twenty-four (24) hours prior to the time of testing or until such lesser time as measured infiltration becomes reasonably constant.

7.07.3 Inclusion of Laterals and Manholes - All lateral branches included in the test section shall be taken into account in computing allowable leakage. An allowance of 0.2 GPH per foot of head above invert shall be made for each manhole included in a test section. If a test produces more than the allowable leakage the Contractor should test manholes and line separately.

7.07.4 Plugging of Wyes, Tees or Stubs - All wyes, tees, or stubouts shall be plugged with flexible-jointed caps, or acceptable alternates, securely fastened to withstand the internal test pressure. Such plugs or caps shall be readily removable and their removal shall provide a socket suitable for making a flexible-jointed lateral connection or extension.

7.07.5 Testing Equipment and Procedure - The Contractor shall furnish all necessary testing equipment, and shall perform the test in a manner satisfactory to the Sewer Superintendent. Any arrangement of testing equipment which will provide readily observable and reasonable accurate measurements of leakage under the specified conditions will be permitted.

In the event the Contractor elects to test large diameter pipe one (1) joint at a time, leakage allowances shall be converted from GPH per one hundred (100)feet to GPH per joint, by dividing by the number of joints occurring in one hundred (100) feet.

7.08 Pneumatic Testing of Gravity Sewer Lines

7.08.1 The Contractor shall furnish all facilities and personnel for conducting the test under the observation of the Sewer Superintendent. The equipment and personnel shall be subject to the approval of the Sewer Superintendent.

7.08.2 When the section of pipe to be tested is securely plugged, air shall be slowly supplied to the test section until the internal air pressure reaches 4.0 pounds

per square inch greater than the average back pressure of any ground water that may submerge the pipe. At least two minutes shall be allowed for temperature stabilization before proceeding further. The rate of air loss shall then be determined by measuring the time interval required for the internal pressure to decrease from 3.5 to 2.5 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe.

The pipeline shall be considered acceptable when tested at an average pressure of 3.0 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe, if the section under test does not lose air at a rate greater than 0.0030 cubic feet per minute per square foot of internal pipe surface.

If the pipe installation fails to meet these requirements, the Contractor shall determine at his own expense the source or sources of leakage, and he shall repair or replace all defective materials or workmanship. The completed pipe installation shall then be retested and shall meet the requirements of this test.

The average back pressure of any ground water shall be computed by adding 0.433 psig for each foot of ground water submerging the pipe to be tested. The ground water elevation shall be determined by the Contractor in a manner satisfactory to the Sewer Superintendent.

7.08.3 Equipment for conducting air tests shall conform to the requirements specified in the publication titled: "Low Pressure Air Test for Sanitary Sewers" by Roy E. Ramseier and George C. Riek, as published in the Journal of the Sanitary Engineering Division Proceedings of the American Society of Civil Engineers, Volume 90. SA 2, April, 1964. Gauges included in such equipment shall be calibrated with a standardized test gauge calibration set at the commencement of each day of testing, or when called for by the Sewer Superintendent. Such calibration will be witnessed by the Sewer Superintendent. The Contractor shall furnish all facilities, equipment and personnel for conducting such calibrations and maintaining records thereof.

The Contractor shall furnish a stop watch for conducting all air tests with each set of test equipment.

The minimum allowable time for the pressure drop to occur shall be computed by using the method, equations, and nomograph as published in the articles "Low Pressure Air Tests for Sanitary Sewers" previously quoted.

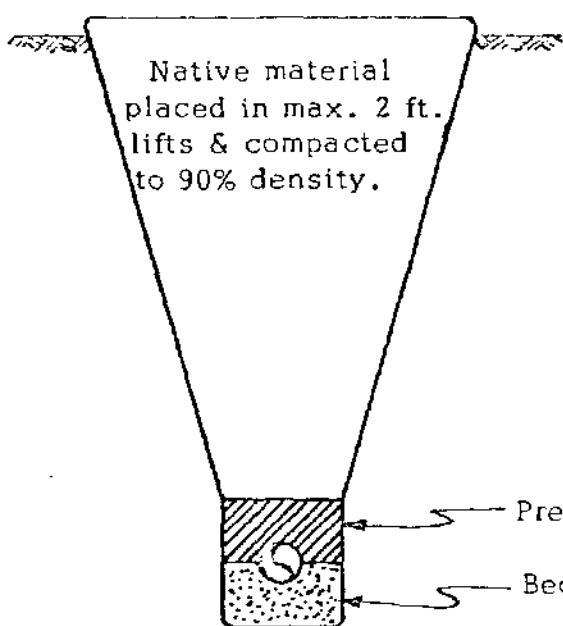
7.09 Pressure Testing

All force mains shall be subjected to a pressure test in the presence of the Sewer Superintendent.

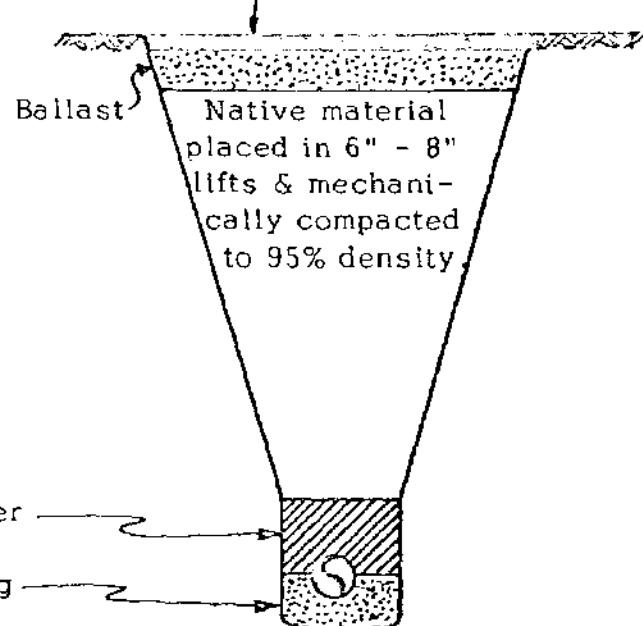
A separate test shall be made on each section of the project whenever any section of the work is installed in such a manner as to permit its segregation as a unit.

When the section of the work is ready for testing, a corporation stop shall be installed on the pipe then a pressure gauge shall be installed. A curb stop shall then be installed before connecting to the pressure pump.

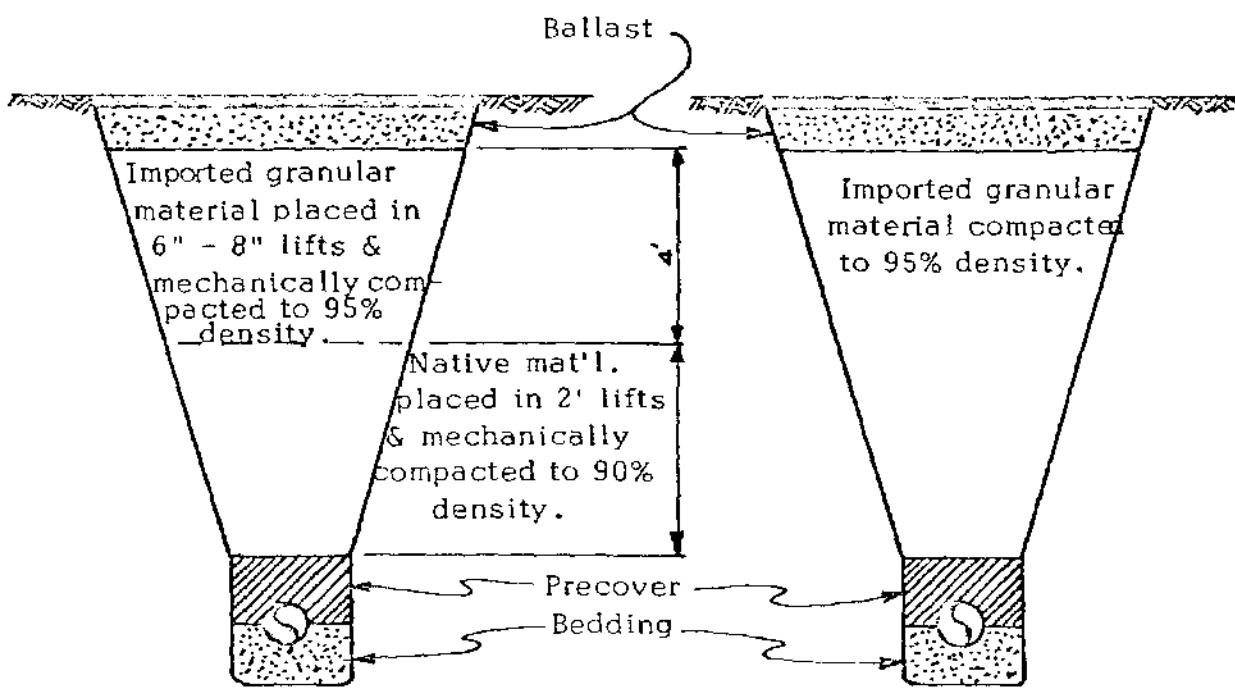
The section of pipe to be tested shall be completely filled with water and care shall be taken to insure that no air pockets exist. The test pressure shall then be raised to twice the design working pressure but in no event to less than 50 pounds per square inch. The test pressure shall then be held for one (1) hour with pressure maintained within ten (10) pounds of that specified.



TYPE "A" BACKFILL



TYPE "B" BACKFILL



TYPE "C" BACKFILL

TYPE "D" BACKFILL

BACKFILL DETAILS