



**Northshore Utility District
King County, Washington**

2021 ENGINEERING SPECIFICATIONS

MATERIALS OF CONSTRUCTION

April, 2021



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Section 9 – Engineering Specifications Materials of Construction

9.1 GENERAL

The type and class of materials to be used shall be as shown on the project plans. Where no specific reference is shown, the following specifications shall govern the materials used. All materials shall be new and undamaged of a known brand, with replacement parts readily available from the general Seattle area.

Prior to the installation of any of the facilities required on the project, all materials shall be approved by the District.

All reference specifications herein shall be of the latest revision.

9.2 SEWER PIPE AND FITTINGS

Sewer pipe material shall be of the following type unless otherwise specified or as indicated on the Plans:

Locations with less than four (4) feet or more than eighteen (18) feet of cover from finished grade	Class 52 Ductile Iron Pipe
Locations with between four (4) feet and eighteen (18) feet of cover from finished grade	PVC Pipe, ASTM 3034, SDR 35
As indicated on the Plans	High Density Polyethylene (HDPE) Pipe

(a) DUCTILE IRON SEWER PIPE AND FITTINGS

1. Ductile iron pipe shall be new, Class 52, cement-lined, conforming to AWWA C151.
2. Ductile iron pipe shall be push-on joint. Pipe shall be furnished with a single rubber ring gasket lubricated to effect the seal.
3. Restrained joint pipe shall be U.S. Pipe “TR Flex” or push-on joint pipe restrained with U.S. Pipe “Field Lok” gaskets, or equal. Each length of pipe shall be clearly marked with the manufacturer’s identification, year, thickness, class of pipe and weight.
4. The Contractor shall furnish certification from the manufacturer of the pipe and gasket being supplied that the inspection and all of the



specified tests have been made and the results thereof comply with the requirements of this standard.

5. Ductile iron fittings shall be short body with a 350-psi pressure rating for mechanical joint fittings and 250-psi for flanged fittings. All fittings shall be cement lined and shall be in conformance with AWWA C153. All fittings shall be domestic and made in the United States of America.

(b) PVC SEWER PIPE AND FITTINGS (ASTM D3034)

All PVC pipe and fittings shall be integral wall bell and spigot, rubber gasket joint, unplasticized polyvinyl chloride (PVC) pipe in conformance with ASTM D3034 and shall have a maximum SDR of 35. PVC pipe shall have a minimum "pipe stiffness" of 46 psi at 5 percent deflection when tested in accordance with ASTM Designation D2412 and a minimum impact strength of 210 foot-pounds based upon ASTM D3034.

All pipes shall be clearly marked with the manufacturer's identification, year, and class of pipe.

All fittings and accessories shall be manufactured and furnished by the pipe supplier, or shall be District approved equal.

Pipe joints shall use flexible elastomeric gaskets conforming to ASTM D3212.

Connections for side sewer stubs shall be 6 inches inside diameter tee fittings. Wye branches shall be used where the sewer line size is less than 8-inch inside diameter.

(c) HIGH DENSITY POLYETHYLENE (HDPE) SEWER PIPE

High Density Polyethylene (HDPE) sewer pipe shall be PE 4710 high density conforming to ASTM D3350 cell classification PE445474C or higher, with a DR of 11 unless otherwise specified.

The workmanship shall be of the highest level compatible with current commercial practice. The PE pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, or other injurious defects. It shall be uniform in color, opacity, density, and other physical properties.

Butt fusion of pipes and fittings shall be performed in accordance with the pipe manufacturer's recommendations as to equipment and technique. The pipe shall be fused by a certified installer who has a demonstrated ability to fuse polyethylene pipe in the manner recommended by the pipe supplier and/or the fusion manufacturer.

The pipe shall be Phillips 66 Driscopipe 8700 or District approved equal.



(d) FLEXIBLE COUPLING ADAPTERS

Flexible coupling adapters shall meet the specifications set forth in the AWWA Standard C219 coupling specification and be rated for working pressures up to 250 psi. Flexible coupling adapters shall be Romac XR501, Hymax 2000, or District approved equal.

(e) POLYETHYLENE PIPE ENCASEMENT

Ductile iron pipe shall be encased with polyethylene encasement (8 mil thickness). Material and installation shall be in accordance with AWWA C105. Installation shall be in accordance with AWWA C105, Method A or Method C.

In Method A, polyethylene encasement tubes are used and in Method C, polyethylene sheets are used. In Method A, one length of polyethylene encasement tube is used for each length of pipe. In Method C, every section of pipe is completely wrapped with a flat sheet of polyethylene encasement. In both Methods, the polyethylene is overlapped at the joints and taped.

During the sewer main installation and/or side sewer installation, repair all rips, tears, or other damage to the polyethylene encasement with adhesive tape (i.e. Christy's Pipe Wrap Tape), per the manufacturer's recommendation.

9.3 MANHOLES

Manholes shall be of the offset type, shall be precast concrete sections with a precast base, and shall be made from 3,000 psi structural concrete. All manhole joints shall be watertight and shall be confined O-ring type. They shall be constructed in full compliance with the Standard Details and as further specified herein.

Manhole materials and manufacturing shall be in accordance with ASTM C478.

Minimum standard manhole depth is eight (8) feet and maximum depth is eighteen (18) feet. Depths other than within this range shall require special design and approval by the District.

The base sections and risers of the manholes shall be arranged so no pipes pass through the manhole joints.

(a) Manhole Sections

Manhole sections shall be placed and aligned so as to provide plumb vertical sides and vertical alignment of the ladder steps. The completed manhole shall be rigid, true to dimension and be watertight. The ladder shall be rigidly attached to the side of the manhole.



Manhole grade rings shall be reinforced 3,000 psi structural concrete, 24 inches in diameter and 4 inches high. Grade rings shall be set in a full-width bed of cement grout. Provide grout between rings and between upper ring and casting. Inside rings shall be troweled smooth with 1/2-inch (minimum) of grout in order to provide a watertight surface.

In addition to the O-ring rubber gaskets, all new manhole joints shall be sealed with a flexible butyl joint sealant conforming to ASTM C990-96 and Federal Specification SS-S-210. The flexible butyl joint sealant shall be "Kent Seal #2" as manufactured by Hamilton-Kent Company or "Ram-Nek" as manufactured by K.T. Snyder Company.

Steel lifting loops or hooks for precast manhole components shall be removed to a minimum depth of one (1) inch below the surface and the remaining hole packed with grout. Precast sections with damaged joint surfaces or with cracks or other damage that may permit infiltration will not be allowed.

Reinforcement for precast manholes shall be in accordance with ASTM C 478-97.

(b) BASE LINERS

All new manholes shall be installed with a prefabricated manhole base liner made of polypropylene (PP) and/or fiberglass reinforced plastic (FRP). The base liner shall be integrally cast and adequately anchored inside new precast concrete manhole base sections during the concrete casting process at the manhole suppliers manufacturing facility. The base liner shall be cast integral with the precast concrete manhole base section in accordance with the liner manufacturer's specifications. The liner must be fully supported during the casting process and lifting devices shall not penetrate the base liner.

The manhole base liner shall be prefabricated from a one piece homogeneous composite and/or thermoplastic with a minimum thickness of 0.12-inch (3 mm) and shall be in lengths and nominal inside diameters corresponding to the precast concrete base section and be a non load-bearing component, which is resistant to the chemical environment normally found in wastewater collection systems. The outer surface of the liner shall be coated with aggregate and/or PP pellets bonded to the outer surface and have perforated PP I-beam "bonding bridge" anchors bonded to the outer surface in order to insure adequate anchoring to concrete base sections to pass vacuum testing with 10-inch of negative pressure.

The inside liner surfaces shall be free of bulges, dents and other defects that result in a variation of inside diameter of more than 1/4-inch (7 mm) for base liner flow channel and pipe connections. The precast concrete pipe penetration joint surfaces shall be free of excess concrete at external and



internal surfaces to insure a proper seal between the pipe connection and the liner.

The manhole base liner shall include full flow channels with sidewalls to the crown of the pipe. The inner surface of the bench shall be provided with an anti-skid pattern. Watertight gasketed pipe bell connections to suit specific pipe types, grade, and alignment, shall be monolithically attached to the base liners and shall extend to the outside profile of the precast concrete structure.

If PP base liner is utilized, a minimum slope of 0.06 foot is acceptable across the invert channel. The FRP base liner shall require the District standard minimum slope of 0.1 foot across the invert channel.



Base liner properties shall be in accordance with the following:

MATERIALS

Polypropylene (PP): 100% Copolymer
Minimum thickness: 3mm
Hardness: 75 Shore D
Density: 56.8 lb/ft³ (0.91 g/cm³)
Color: Dull mustard/goldenrod

Fiberglass Reinforced Plastic (FRP): Polyurethane Hybrid Composite
Glass fiber: Type E, min fiber length of 0.625-inch (16mm), 10 - 12% content by weight
Inert filler: 10 - 13% content by weight
Minimum thickness: 3mm
Hardness: 85 Shore D
Density: 73.0 lb/ft³ (1.17 g/cm³)
Color: Dull mustard/goldenrod

Aggregate bonding medium: Processed sand containing crushed & uncrushed dry and cleaned semi-round particles in the 0.08 - 0.12-inch (2 - 3mm) size range

Gaskets: Polyisoprene, unless otherwise specified
Hardness: 50 - 55 Shore A

PHYSICAL PROPERTIES

Percolation Test: Water absorption of top surface - 0.032%
Thermal shock (CSA-B45-M93): 100 thermal cycles - no sign of surface defects



Chemical Resistance (ASTM D1308):

Selected Reagents

Reagent	Result
Nitric Acid 69%	No surface Degradation - Surface Staining
Hydrochloric Acid 60%	No surface Degradation
Ammonia 28%	No surface Degradation
Sodium Hydroxide 5.25%	No surface Degradation
Sulfuric Acid 50%	No surface Degradation
Sulfuric Acid 70%	No surface Degradation
Sulfuric Acid 80%	No surface Degradation
Acetone	No surface Degradation
Unleaded Gasoline	No surface Degradation
Turpentine	No surface Degradation
Acetone Immersion (ASTM D2152)	No Attack

Base liners shall be manufactured and supplied by Predl Systems North America of Burnaby, B.C.

(c) MANHOLE STEPS

Manhole steps shall be made of 1/2-inch Grade 60 Steel reinforcing bars coated with copolymer polypropylene, equal to Lane International Manhole Step #P-14850.

The steps shall be installed at the manhole manufacturer's yard in conformance with the step manufacturer requirements. At a minimum, the step ends shall be coated with non-shrink epoxy grout and driven into pre-drilled holes with dimensions of 1-inch diameter and 3-1/2-inch depth. The pre-drilled holes shall not penetrate the exterior manhole wall.

(d) GRADE ADJUSTMENT

The depth of the 24-inch diameter manhole neck from the top of the frame to the top of the cone shall be from between 14-inch and 26-inch.

(e) CHANNELS

All new manholes shall be provided with fiberglass reinforced plastic base liners per Subsection 9.3.b of these specifications, unless otherwise indicated on the plans or approved by the District. Manholes approved for cement concrete channels shall conform to this subsection of the specifications.



Channels shall be made to conform accurately to the sewer grade and shall be brought together smoothly with well-rounded junctions, subject to approval by the District.

Channels shall consist of commercial grade concrete, minimum Class 3000 in accordance with Section 6-02 of the latest published Standard Specifications for Road, Bridge and Municipal Construction of the Washington State Department of Transportation.

The channels shall be field poured after the inlet and outlet pipes have been laid and firmly grouted into place at the proper elevation. Allowances shall be made for a minimum of one-tenth foot (0.1 foot) drop in elevation across the manhole in the direction of flow. The maximum allowable drop in inlet elevation across the manhole in the direction of flow shall be 0.5 foot. Channel sides shall be carried up vertically from the invert to three-quarters of the diameter of the various pipes. The concrete bench shall be warped evenly and sloped two percent (2%) to drain. Rough, uneven surfaces will not be permitted. Channels shall be constructed to allow the installation and use of a mechanical plug of the appropriate size.

(f) PIPE CONNECTIONS

All pipe entering or leaving the manhole shall be placed on firmly compacted bedding. Special care shall be taken to see that the openings through which pipes enter the structure are completely and firmly filled with mortar from the outside to insure water tightness. All PVC pipe connections to manholes shall be made with GPK PVC Manhole Adapters (also known as "sand collars") with an external abrasive silica layer or Kor-N-Seal Connector manufactured by NPC. Inc.

All stubbed out sewer pipes placed through manhole walls for future connections shall be suitably plugged and blocked in a manner acceptable to the District.

(g) SHELF REPAIRS

Shelf repairs at connections to the existing manholes shall be class 3000 commercial grade cement in accordance with the Engineering Specifications.

(h) GROUT

Grout for all uses including, but not limited to, shelves, pick-holes, and adjusting rings, shall be cement based, nonshrink, noncorrosive, and nonmetallic grout conforming to ASTM C 1107. Grout shall be Dayton Superior 1107 Advantage Grout, Basalite Non-Shrink Grout - Fast Set, SpecChem SC Multipurpose Grout, or Quikrete Commercial Grade FastSet Non-Shrink Grout. The District may sample and test grout to determine conformance with the specifications.



(i) DROP MANHOLES

Drop manholes shall, in all respects, be constructed as a standard manhole with the exception of the drop connection as shown on the Standard Detail.

(j) LIFT HOLES

All lift holes shall be completely filled smooth with grout both inside and out in order to insure water-tightness.

(k) MANHOLE CERTIFICATION

The Contractor shall provide written certification from the manhole manufacturer that the manholes provided meet or exceed the specifications and that the materials used in the construction of the manhole are in accordance with the specifications. A Manufacturer's Certificate of Compliance shall be provided for each manhole delivered to the project and shall include the manufacturer's name and address, the District's manhole number, reference to the applicable project specifications being used, the design mix and 28-day strength of the cement concrete used, drawings indicating reinforcing steel details, such as size and location, results of materials testing conducted by the manufacturer and the signature of a responsible corporate official of the manufacturer.

The District may test manholes and materials used at any time, including after installation, and any manhole not conforming to the specifications shall be rejected by the District and replaced with a conforming manhole provided and installed by the Contractor.

9.4 MANHOLE AND CLEANOUT FRAME AND COVERS

Frames and covers shall be cast iron and conform to the Standard Details and these specifications. Castings shall conform to the requirements of ASTM A-48, Class 30 and shall be free of porosity, shrink cavities, cold shuts or cracks, or any surface defects that would impair serviceability. Repair of defects by welding, or by the use of smooth-on or similar material, will not be permitted. Frames and covers shall be machine-finished or ground on seating surfaces so as to assure non-rocking fit in any position and interchangeability of covers.

All manhole frames and covers will be locking type. Manhole frame and cover shall be East Jordan Ergo Assembly, Part No. 001040105L01.

Cleanout frame and cover shall be locking type equal to Armorcast Polymer Concrete Box Assembly with Pentahead locking bolt style and "CO" imprinted on cover, part number A6001423TA (see NUD Standard Sewer Detail #9).



9.5 WATER MAIN PIPE AND APPURTENANCES

(a) DUCTILE IRON WATER PIPE

Ductile iron pipe shall be new, restrained joint, Class 52, cement-lined, conforming to AWWA C151.

Ductile iron pipe shall be U.S. Pipe “TR Flex” or push-on joint pipe restrained with U.S. Pipe “Field Lok” gaskets, or equal. Each length of pipe shall be clearly marked with the manufacturer’s identification, year, thickness, class of pipe and weight.

The Contractor shall furnish certification from the manufacturer of the pipe and gasket being supplied that the inspection and all of the specified tests have been made and the results thereof comply with the requirements of this standard.

(b) GALVANIZED IRON WATER PIPE AND FITTINGS

Galvanized iron pipe where specified for use shall be Schedule 40 hot dipped, zinc-coated (galvanized) welded and seamless steel pipe for ordinary uses (ASTM A-120). Fittings shall be screwed malleable iron galvanized per USA Standard B16.3.

(c) CROSS-LINKED POLYETHYLENE (PEXa 3306) SERVICE PIPE

Service pipe shall be MUNICIPEX® from REHAU Construction, LLC. Pipe shall be crosslinked polyethylene (PEXa 3306), using the high-pressure peroxide extrusion method. The pipe shall meet or exceed the requirements of ASTM F876, CSA B137.5 and PPI TR-3, and is certified to NSF Standards 14 and 61, and AWWA C904. No substitutions will be allowed.

(d) POLYETHYLENE PIPE ENCASEMENT

Ductile iron pipe shall be encased with polyethylene encasement (8 mil thickness). Material and installation shall be in accordance with AWWA C105. Installation shall be in accordance with AWWA C105, Method A or Method C.

In Method A, polyethylene encasement tubes are used and in Method C, polyethylene sheets are used. In Method A, one length of polyethylene encasement tube is used for each length of pipe. In Method C, every section of pipe is completely wrapped with a flat sheet of polyethylene encasement. In both Methods, the polyethylene is overlapped at the joints and taped.

During the water main installation and/or water service installation, repair all rips, tears, or other damage to the polyethylene encasement with adhesive tape (i.e. Christy’s Pipe Wrap Tape), per the manufacturer’s recommendation.



(e) DUCTILE IRON FITTINGS

Ductile iron fittings shall be short body with a 350-psi pressure rating for mechanical joint fittings and 250-psi for flanged fittings. All fittings shall be cement lined and shall be in conformance with AWWA C153 for mechanical joint fittings and AWWA C110 for flanged fittings.

All mechanical joint fittings shall be restrained with EBAA Iron, Inc. "Mega-Lug" mechanical joint restraints, or equal.

Megalug fittings are prohibited for use on cast iron pipe. Restrained joint connections to existing cast iron water main shall be made with Romac Alpha Couplings and fittings only.

All deactivated water mains shall be capped with Romac EC501 End Cap Coupling or equal.

(f) FIRE HYDRANTS

Fire hydrants shall conform to AWWA Standard Specification C502 and be one of the following types:

- Mueller Super Centurion
- American Darling B-62-B
- Clow Medallion
- M & H 129
- East Jordan Iron Works WaterMaster 5CD250

They shall be a rising stem compression-type which opens counterclockwise and closes with the pressure. The minimum main valve opening diameter shall be 5-1/4-inch unless otherwise specified. The hydrant seat and hydrant seat retaining ring shall be bronze. All external bolts, nuts and studs shall be cadmium plated in accordance with ASTM A165 Type HS or rust proofed by some other process approved by the District. Gaskets shall be of rubber composition.

Fire hydrants shall be equipped with one 5-inch pumper connection (Seattle Standard Thread) with Storz Adapter (integral or non-integral) as required by those jurisdictions shown on the Standard Details. The hydrant shall include two 2-1/2-inch NST hose ports. Pentagon nuts or caps and operating stem shall measure 1-1/4-inch point to flat and shall open by turning to the left. Nozzle shall be fitted with renewable bronze nipples locked in place.

Fire hydrants shall be set plumb and ports shall be oriented as directed by the Fire Protection District having jurisdiction over said area.



Fire hydrant piping from the main line valve to the hydrant base shall be restrained joint pipe or shall be restrained with stainless steel shackle rods and nuts.

The hydrants shall be coated with enamel paint in accordance with the Standard Details.

See the Standard Detail for additional requirements.

(g) GATE VALVES

Gate valves shall be ductile iron body valves with resilient wedge conforming to the latest revision of AWWA Standard C515 and shall be NSF 61 approved. Valves shall have epoxy coating fusion bonded to all internal and external surfaces of the valve body and bonnet in compliance with AWWA C550. The wedge shall be fully encapsulated in rubber. The valves shall be non-rising stem, open to the left, equipped with standard 2-inch square operating nuts and O-ring seals at all joints. Resilient wedge gate valves shall be American Flow Control Series 2500, Clow model 2638, Mueller 2360 series, Kennedy 7000 series, East Jordan FlowMaster or M&H Style 7000.

(h) BUTTERFLY VALVES

Butterfly valves shall be ductile iron body of the tight closing rubber seat type with rubber seat either bonded to the body or mechanically retained in the body with no fasteners or retaining hardware in the flow stream. The valves shall be epoxy coated inside and outside. The valves shall meet the full requirements of AWWA C504, class 150 B, except the valves shall be able to withstand 200 psi differential pressure without leakage. The valves shall be equal to Pratt "Groundhog" or Mueller Linesal III.

Butterfly valves to be installed underground shall have sealed mechanical operators and 2-inch standard square operating nuts. Complete manufacturer's Specifications for the valves proposed for use shall be submitted to the District for approval.

(i) VALVE BOXES

Valve boxes shall be two-piece, cast iron, East Jordan Iron Works:

- Valve box cover, 06800209
- Valve box top, 85557016U
- Valve box bottom, 85556036U

(j) FIRE HYDRANT GUARD POSTS



Concrete fire hydrant guard posts, if required as directed by the District, shall be made of precast reinforced concrete, nine (9) inches in diameter, six (6) feet long, or 8-inch x 6-inch x 6 feet long. The guard posts shall be coated white with enamel paint in accordance with the Fire Hydrant Assembly Standard Detail.

(k) METER BOXES

The meter boxes shall be according to the Standard Details.

(l) SERVICE SADDLES

For ductile iron and cast iron water mains larger than 4-inch diameter, direct tapping of 1-inch standard corporation stop threaded tap will be required. Saddles will not be allowed on ductile iron and cast-iron pipe larger than 4-inch diameter for 1-inch water services.

Service taps for all other water main sizes and materials shall be as follows:

1. Service saddles for 1-inch, 1-1/2-inch, and 2-inch standard corporation stop threaded tap, shall be single strap and shall be equal to Mueller Company DR1S, Ford Meter Box Company FC101, or Romac Industries, Inc. 101NS.
2. Saddles for PVC pipe shall be stainless steel, double strap type and shall be equal to Mueller Company DR2S, Ford Meter Box Company FCD202, or Romac Industries, Inc. 202NS.

On existing water mains that are live and connected to the existing system; the Contractor shall furnish and install all parts of the water service and reconnection as required, except the tap. The District will provide all parts necessary to perform the tap (including but not limited to the corporation stop and saddle) and the Contractor shall repair the polyethylene encasement material per manufacturer's recommendations and per the District's Standard Detail.

On new water mains installed and not yet connected to the existing system; the Contractor shall provide all parts and equipment necessary to tap the new main and repair the polyethylene encasement material per manufacturer's recommendations and per the District's Standard Detail.

(m) SERVICE MATERIALS

Service materials including valves, pipe and fittings be as specified on the Standard Details. All brass appurtenances shall be "lead free" and conform to NSF/ANSI 372 and NSF/ANSI 61 standards. 2-inch ball valves shall be furnished with a slotted operator, and with an adapting 2-inch-square operating nut (Ford Cat. QT-67) secured with a stainless-steel cotter pin.



(n) RESIDENTIAL DOMESTIC AND FIRE SPRINKLER SERVICES

Combination service for residential domestic and fire sprinkler systems shall be according to the Standard Detail.

(o) BLOW-OFFS AND AIR & VACUUM RELIEF VALVES

2-inch Blow-offs and 2-inch Air & Vacuum Relief Valves shall be installed for 12-inch diameter pipe and smaller in accordance with the standard detail. Blow-offs for pipe larger than 12-inch in diameter shall be as directed by the District.

(p) STAINLESS STEEL TAPPING SLEEVE

Tapping sleeve shall be constructed of all stainless steel with removable, replaceable bolts and coated nuts to prevent galling. Gaskets shall provide a full circumferential seal. Tapping sleeve shall be Romac STS 420, JCM 432, or Ford FTSS stainless steel tapping sleeve.

9.6 STEEL CASING

Steel casing pipe shall meet ASTM A-53, having a minimum tensile strength of 60,000 psi and a minimum yield strength of 35,000 psi. Wall thickness shall be sufficient to withstand jacking forces without deformation, with minimum wall thickness of 0.375-inches for casing pipe diameters up to 22-inches. For casing pipe diameters larger than 22-inches, please see the table at the end of this subsection. All joints shall be welded. All field-welded joints shall comply with AWS Code for procedures of manual shielded metal arc welding.

The carrier pipe shall be installed with casing spacers. Spacers shall be placed in accordance with the Methods of Construction and shall be at least 12-inches wide. Spacers shall be designed to provide a maximum space of 1-inch between the upper runners and the inside of the steel casing. The spacers shall prevent the pipe bells from touching the inside of the casing. Metal components of casing spacers shall be Type 304 (18-8) 14-gauge (minimum) stainless steel. The liner shall be neoprene rubber or PVC, and the runners shall be polyethylene with a low friction factor. Casing spacers shall be designed for center restraint. Casing spacers shall be Model CCS by Cascade Waterworks manufacturing, or District approved equal.

Where casing spacers must be custom designed to account for a specific grade of the carrier pipe inside the casing, submittals must be provided which include drawings and dimensions for each of the casing spacers and the respective location of each of the spacers relative to the casing and carrier pipe.

Casing end seals shall be 1/8-inch thick synthetic rubber with two stainless steel bands and clamps. The end seal shall be Model S by Pipeline Seal and Insulator, or APS Model AC, or approved equal.



Steel Casing Pipe Wall Thickness Table	
Diameter of Casing Pipe	Minimum Thickness
22 or Less	0.3750"
Over 22" – 28"	0.4375"
Over 28" – 34"	0.5000"
Over 34" – 42"	0.5625"
Over 42" – 48"	0.6250"
Over 48"	Review Required

9.7 FOUNDATION, BEDDING AND BACKFILL MATERIALS FOR TRENCHES

Recycled concrete will not be allowed as foundation gravel, pipe bedding, or trench backfill material.

(a) FOUNDATION MATERIALS

Foundation gravel shall consist of clean, granular material free from objectionable materials such as organic matter or other deleterious substances with at least 90 percent coarse material ranging from 1-inch in diameter to 3-inch in diameter and 100 percent 3-inch in diameter or less, unless otherwise specified or approved by the District.

(b) BEDDING MATERIALS

Water Main Pipe:

Bedding material shall consist of imported gravel backfill, crushed rock, or controlled density fill as indicated on the plans or as directed by the District.

Water Service Pipe:

Bedding material shall consist of 100% clean sand. Native material will not be allowed by the District.

Sewer Main and Lateral Pipe:

Bedding material shall consist of clean, granular, manufactured pea gravel conforming to the following gradation:

U. S. Standard Sieve Size	% Passing by Weight
----------------------------------	----------------------------



1/2-inch	100
3/8-inch	85 – 95
No. 4	5 – 15
No. 8	0 – 2

(c) TRENCH BACKFILL

Native material may be used for trench backfill if the material meets the requirements of Section 9-03.14(2) of the latest published Standard Specifications for Road, Bridge and Municipal Construction of the Washington State Department of Transportation for Select Borrow. Native material shall be free from wood waste, organic waste, coal, charcoal, and other extraneous or objectionable materials and shall have no material larger than 2-inch in diameter. The material shall be non-plastic and shall not contain more than 3 percent organic material by weight.

Imported gravel backfill shall be a granular material conforming to Section 9-03.14(1) of the latest published Standard Specifications for Road, Bridge and Municipal Construction of the Washington State Department of Transportation.

Where designated on the Contract Drawings, as required by the roadway permitting agency or as directed by the District, the trench backfill shall be controlled density fill (CDF), as manufactured by Cadman Inc., product #110021, "Pro-Flow Trench Five Hour", or District approved equal.

9.8 REPLACING ROAD SURFACE

(a) CRUSHED SURFACING

Crushed surfacing material shall be 1-1/4-inch base course and 3/4-inch minus top course crushed gravel and shall be manufactured from ledge rock, talus or gravel in accordance with the provisions of Section 9-03.9(3) of the latest published Standard Specifications for Road, Bridge and Municipal Construction of the Washington State Department of Transportation.

(b) GRAVEL BASE

All gravel base shall conform to the requirements of Section 9-03.10 of the latest published Standard Specifications for Road, Bridge and Municipal Construction of the Washington State Department of Transportation.

(c) HOT MIX ASPHALT SURFACING



Hot mix asphalt surfacing or repair shall be as required by the roadway permitting agency, and shall conform to Section 5-04 of the latest published Standard Specifications for Road, Bridge and Municipal Construction of the Washington State Department of Transportation and the Standard Specification Drawing for Typical Trench Section.

(d) CEMENT CONCRETE PAVEMENT

Cement concrete pavement shall be in accordance with Section 5-05 of the latest published Standard Specifications for Road, Bridge and Municipal Construction of the Washington State Department of Transportation and shall be furnished only by manufacturers who are members of the Portland Cement Association. All reinforcing steel shall conform with and be placed in accordance with Section 5-05 of the latest published Standard Specifications for Road, Bridge and Municipal Construction of the Washington State Department of Transportation and shall conform to the requirements of ASTM Designation A-15 and A-305, latest revisions.

(e) RIGID-TYPE PAVEMENTS RESURFACED WITH HOT MIX ASPHALT

Hot mix asphalt surface mat to be placed over Portland cement concrete base shall be as required by the roadway permitting agency; both the base and the surface mat shall be carefully prepared, placed and cured in full compliance with Section 5-04.3 of the latest published Standard Specifications for Road, Bridge and Municipal Construction of the Washington State Department of Transportation.

9.9 GRASS SEEDING AND SOD

(a) TOPSOIL

Topsoil shall be Type B or C in accordance with Section 9-14.2(2) or 9-14.2(3) of the latest published Standard Specifications for Road, Bridge and Municipal Construction of the Washington State Department of Transportation. The Contractor shall provide a topsoil material submittal to the District for review and approval prior to construction.

(b) SEED

Seed material, storage and certification shall conform to Section 9-14.3 of the latest published Standard Specifications for Road, Bridge and Municipal Construction of the Washington State Department of Transportation. Seed shall be "Certified" grade seed or better. The Contractor shall provide a seed mix material submittal to the District for review and approval prior to construction.

(c) FERTILIZER



Fertilizer shall be commercial grade in conformance with Section 9-14.4 of the latest published Standard Specifications for Road, Bridge and Municipal Construction of the Washington State Department of Transportation. The Contractor shall provide a fertilizer material submittal to the District for review and approval prior to construction.

(d) MULCH AND AMENDMENTS

Mulch shall be approved by the District and shall be certified grass hay or straw or wood cellulose fiber for hydroseeding. Wood cellulose fiber shall be in accordance with Section 9-14.5(2) of the latest published Standard Specifications for Road, Bridge and Municipal Construction of the Washington State Department of Transportation.

(e) SOD

The Contractor shall provide grass mixtures to the District for review and approval prior to construction.

Sod shall be field grown one year or older, have a well-developed root structure and be free of all weeds, disease, and insect damage.

Prior to cutting, the sod shall be green, in an active and vigorous state of growth and mowed to a height not exceeding 1-inch.

The sod shall be cut with a minimum of 1-inch of soil adhering.