2020 - SECTION 91
WATER DISTRIBUTION SYSTEM

91.1 GENERAL

The construction of all waterworks and appurtenances shall be in accordance with these specifications. Trenching and backfilling components are in a separate Section in this manual or refer to the appropriate Municipalities Standards.

Water mains shall refer to the supply, installation, testing, and cleaning of pipe and bedding in accordance with these specifications.

No persons, other than Aquatera employees, are to operate Aquatera water valves or other Aquatera appurtenances for any reason.

91.2 MATERIALS

All Bronze and Brass materials shall be lead free in compliance with NSF 61.

91.2.1 PIPE

Poly Vinyl Chloride (PVC) type CIOD (Cast Iron Outside Diameter) pipe meeting the specifications of AWWA C-900 (100 - 300 mm), AWWA C-905 (350 - 600 mm) and CSA-B137.3 latest version thereof.

The pipe must be CSA approved with a pressure rating of 1035 kPa (class 150).

Dimension Ratio (SDR) shall be a minimum 25.

Jointing shall be Gasketed bell-end, Gaskets shall conform to ASTM D1869, latest version thereof.

For trenchless methods TerraBrute PVC, fused PVC or HDPE DR-11 pipe, is approved for use.

In cases where pipe is shallower that 2.75 meters, pipes shall be insulated. Insulation used shall be a minimum of 50 mm thick and be composed of rigid polyurethane foam which is formed onto the pipe. The insulation shall have a thermal conductivity of 0.161 - 0.174 kcal/cm/h/m^2/°C and have a minimum service temperature of -45°C. As an alternative a frost box can be installed using 50 mm foam panels as per the Typical Detail Drawing (see 91-04).

91.2.2 FITTINGS

a) PVC

PVC Injection Moulded Gasketed Fittings meeting the specifications of CSA-B137.2 and AWWA C-907, latest version thereof. (Fittings of 300 mm or less).

Fittings shall be CSA approved with a pressure rating of 1035 kPa (class 150).

Dimension Ratio (DR) shall be a minimum 25. Colour coded blue.

Fabricated PVC reducers and fittings are not allowed.

b) Cast Iron

Will only be allowed if the fitting is not readily available in injection moulded PVC. (Fittings greater than 300 mm).

Conforming to AWWA C110Class 1725 kPa.

Jointed with push-on rubber rings.

Cathodic Protection shall be required.

c) Machined Fittings

Machined Fittings will be allowed subject to Aquatera approval for fittings between 250mm – 300mm.

91.2.3 TRANSITION COUPLINGS

Transition couplings to connect dissimilar pipe materials are to be Robar style or Aquatera approved equivalent. Robar 1696-2B stainless steel couplings are preferred where available.

The transition coupling shall have sleeves and end plates made of ductile iron conforming to ASTM A536. Bolts, nuts and washers shall be stainless steel type 304. Gaskets shall be made of vulcanized rubber conforming to the latest issue of ASTM D2000. The corrosion protective coating shall be applied to the sleeves and end plates and shall be factory coated with 3M scotchkote 206N or equal in accordance with AWWA C-213, coatings in contact with potable water. All coated elements shall carry a label identifying the name of the coating applicator. The couplings shall be packaged and delivered as a complete unit (c/w sleeve, gaskets, end plates, nuts, bolts and washers).

91.2.4 VALVES

Cast Iron body and bronze mounted with grade of bronze used to be completely resistant to de-zincafication by water having a pH of 9.0. All bronze and brass shall be lead free.

Resilient seat gate valve type conforming to AWWA C-509.

Operating pressure shall be 1,200 kPa.

Push-on rubber ring connectors.

Non-rising stems, type 304 stainless steel.

O-ring stem seals.

50 mm cast iron operating nut. All exterior nuts, bolts, and washers shall be type 304 stainless steel. All bolts and nuts shall have hexagonal heads.

Valves shall open in a counter clockwise direction.

Those portions of valves in contact with potable water shall be coated with 3M skotchkote 206N or approved equal in accordance with AWWA C213, coatings. All coated elements shall carry a label identifying the name of the coating and the coating applicator.

Internal and External portions of valves shall be coated with epoxy coating.

91.2.5 VALVE BOXES

Cast iron body, two section, bituminous coated.

Type A or equivalent adjustable (Valve boxes shall be sliding type) to 3.0 metre bury.

Comes with extension spindle and 50mm flange nut and cap and shall have a 2 inch top nut bolted to the rod with a stainless steel bolt. The rock catcher shall fit through the housing in any size casing.

Must be of sufficient length to provide adjustments of 300mm in up or down direction.

Extensions shall be cast iron suitable for use with valve boxes installed.

Lifter rings shall be Trojan Industries Type A or approved equivalent.

91.2.6 HYDRANTS

Conforming to AWWA C502 - Fire hydrants for ordinary waterworks service.

The following manufactures are approved for use in Aquatera's operating area:

1. McAvity (Clow Canada)
2. Mueller / Canada Valve

Hydrants to be supplied with a minimum of one 300mm lower barrel extension. The combined length of the lower barrel and the 300mm extension shall allow at least 2.9 metres depth of bury for the watermain.

For hydrants with a depth of bury in excess of 4.3m an inline valve shall be used with the depth of the valve not to exceed 3.0m.

150 mm inlet connection with compression type push-on rubber ring joint to suit the watermain pipe.

Hydrants shall be supplied with break-away type ground level flanges.

Hydrants shall have two 63.5 mm hose nozzles threaded to conform to the Alberta Mutual Aid Thread Standard of 8 threads per 25.4 mm and open in a counter clockwise direction.

Hydrants shall also have a single 100mm pumper nozzle with an integral Stortz coupling and nozzle cover conforming to CSA CAN4-S543 threaded to conform to the Alberta Mutual Aid Thread Standard of 8 threads per 25.4 mm and open in a counter clockwise direction. All nozzle caps and operating nuts shall be pentagonal in shape.

Hydrants on public property are to be painted Hi-Vis Yellow. Hi-Vis Yellow shall conform to General Paint Self-Prime Gloss Urethane Enamel Rust Resistant Formula, 16-242 Hi-Visible Yellow. All hydrants and caps shall be pre-painted prior to being supplied to site. It will not be acceptable to paint over paint or paint hydrant parts in the field.

Hydrants on private property are to be painted red.

Nozzle covers are to be painted the same colour as the hydrant barrel.

All hydrants are to have bolt down tops.

Hydrant leads length should be minimized. In commercial service applications, services to the building should be close to hydrant to avoid stagnant water.

Hydrants shall be equipped with a threaded drain which shall not be plugged unless so directed by Aquatera in consideration of the water table.

All flange nuts and bolts shall be stainless type 304 steel with hexagonal heads conforming to ASTM standards. Bolts and nuts shall be the size and length recommended by the valve and flange manufacturer. All bolts shall be installed with the bolt head on top.

A 2 mil. filter fabric shall be required at the top of the sump. The sump shall be constructed with washed crushed gravel meeting the following specifications:

Sieve Size (CGSB Spec)	Allowable Passing (percent)
5,000	100
2,000	70 to 95
400	30 to 65
160	10 to 25
80	2 to 10

91.2.7 BEDDING

a) Sand

Sand bedding shall have an even gradation falling within the following limits:

Sieve Size	% Passing
25,000	100
20,000	60 - 95
16,000	35 - 65
12,500	10 - 30
10,000	5 - 15
5,000	0 - 5

b) Granular (B1)

Granular bedding shall have an even gradation falling within the following limits:

Sieve Size (CGSB Spec)	Allowable Passing (percent)
20,000	95 to 100
12,500	75 to 95
5,000	40 to 60
2,000	25 to 45
400	10 to 25
80	2 to 10

c) Select Native

Shall be well graded soil selected by the Contractor from the excavated trench material. It shall contain no particles larger than 32mm in its largest dimension. It shall contain no frozen soil, roots or other objectionable material in quantities that might cause pipe damage, excessive settlement or inadequate compaction. The moisture content shall be such as to allow proper placing and compaction.

d) Concrete

Fillcrete shall be a minimum of 0.5 MPa, air 5.5% and the use shall be approved by Aquatera.

91.2.8 HYDRANT MARKERS

Hydrant markers shall be Briteside Series 10.3.1 in diamond grade yellow minimum 3" wide or an equivalent approved in writing by Aquatera.

91.2.9 THRUST BLOCKING

Thrust blocking shall be done with 25 MPa ASTM Type 50 sulphate resistant concrete only. The dimensions of the thrust blocking shall be as shown in the Typical Detail Drawings unless specified by the Engineer.

91.2.10 CATHODIC PROTECTION

Ground Bed, Test station and access chamber, as shown in Typical Detail Drawings or an equivalent approved by Aquatera. (see section 19 & detail 19-01)

91.2.11 TRACER WIRE

Tracer wire shall be installed on all water mains and services. For open trench, tracer wire shall be a minimum 12 gauge, solid copper wire with plastic coating, attached to the piping system every 3 m with PVC tape.

For augured pipe and directional drilling, 3 strands with a minimum of 12 gauge high strength steel wire shall be used.

Where spliced-in connections occur, a manufacturer approved water-tight direct bury connector shall be used to provide electrical continuity.

91.2.12 WATER CHAMBERS

Chambers are structures for closed or pressurized systems.

Shall be constructed with min of 50mm insulation to a depth of 2.75m, in accordance with the approved design drawings.

All chambers require a frost cover as per detail 91-09

Covers for chambers shall only have 1 vent hole.

All chambers shall be watertight. Sumps should be considered as back ups

Chambers shall not be constructed in ponding areas.

Pipes entering Chambers shall be a minimum of 300mm from the interior chamber floor to the bottom of the pipe. HDPE and PVC shall not be used to enter walls for pressure systems.

Shall be designed with air releases at high points and/or where applicable.

91.3 INSTALLATION

91.3.1 PIPE

a) Placement

i) All pipe laying and connecting shall be in strict accordance with the manufacturer's recommended practice unless otherwise specified by Aquatera.

Pipe shall be laid at the depth and location shown in the Detailed Engineering Drawings and verified by the Engineer.

Aquatera must be notified prior to backfill if the specified pipe depth cannot be achieved.

ii) The Contractor shall remove all water from the trench prior to and during the installation of water mains and appurtenances.

All foreign material shall be kept out of the pipe before, during and after installation. When pipe laying is not in progress the pipe shall be temporarily plugged to prevent entry of water or other foreign material.

iii) It is the Contractor's responsibility to locate and protect all other structures, buried or above ground, in the vicinity of the work.

b) Stubs

Stubs extending past the valve and terminating with a plug shall be a minimum of 6 m in length.

c) Open Cut Installation

Refers to the installation of pipe in an open trench.

d) Augered Installation

Augered Installation refers to the installation of pipe into a cased or uncased tunnel or hole. Refer to Auger Specifications for detailed installation procedures.

e) Link seals (when connecting pipe through concrete chamber walls)

When installing the link seal, the bolt heads shall be installed inside the manhole, so they are accessible for adjustments after installation is complete.

The Link seal manufacturer shall be contacted to ensure proper sizing.

Double link seals shall be avoided. Only one link seal shall be used for pipe to manhole wall connections.

f) In the event of infiltration, attempts shall be made to seal leaks on exterior of manhole via injection within the chamber using poly urethane grout.

91.3.2 FITTINGS

Fittings shall be installed in the watermain at the required location. Pipe shall be cut and the joints made to provide a watertight pipeline.

All fittings shall have thrust blocking installed.

91.3.3 TRANSITION COUPLINGS

Transition Couplings shall be installed at all locations where the water pipes are of dissimilar materials.

Any portion of the protective coating which is damaged before or while being put into service shall be repaired with the appropriate repair kit recommended by the coating manufacturer.

All transition couplings shall be wrapped with "Denso" tape and paste. Unless stainless steel fittings are used.

The use of transition couplings will not be permitted when connecting PVC pipe sections, where PVC couplings are manufactured for this purpose.

91.3.4 VALVES

Valves shall be installed in the watermain at the required location. Pipes shall be cut and the joints made to produce a water-tight pipeline.

Concrete thrust blocks shall be constructed at all valves.

All valves are to be wrapped with Denso Tape.

91.3.5 VALVE BOXES

Valve boxes shall be installed centered and plumb over the wrench nut of the gate valve, and shall be supported in a manner such that strain or shock cannot be transmitted to the valve.

The valve box cover shall be set 5 mm below to flush with the existing pavement or ground surface unless otherwise approved by Aquatera.

The rock disk nut shall be 300 – 900mm below finished grade. Rock disks shall be bolted onto the operating rod.

91.3.6 HYDRANTS

a) Placement

Hydrants shall be installed in the designated locations at the required elevations.

All hydrants shall stand plumb with the hose nozzles parallel to the street centreline and the pumper nozzle facing the street.

Concrete thrust blocks shall be constructed at hydrants. All hydrants shall be constructed with a 150mm isolation valve (see detail 91-02).

Hydrants shall be installed with a minimum clearance of 1.15m from the back of curb/sidewalk (BOC) to the center of the hydrant.

b) Sump/Hydrant Drain Hole

A coarse gravel sump the width of the trench, from the back of the trench to 450 mm in front of the hydrant and 600 mm deep shall be placed around the hydrant after the pouring and placement of thrust block and base.

Top of the sump to be 150 mm above the hydrant drain holes.

The sump shall be wrapped with a 2 mil filter fabric to prevent intrusion of clay or silt into the gravel.

The hydrant drain shall be clear of obstructions.

Where the water table is above the bottom of the hydrant, the consultant shall identify which hydrants are to be plugged and the sump will not be required, based on geotechnical design & field conditions.

91.3.7 HYDRANT MARKERS

Hydrant markers shall be installed on all hydrants as identified on the detailed engineering drawings or where directed by Aquatera.

91.3.8 BEDDING

a) Placement

The bedding shall be shaped so as to provide a uniform and continuous support for the pipe and fittings. Proper allowance shall be made for bells and couplings such that the coupling does not bear directly on the bedding or support the weight of the pipe.

Bedding shall refer to and include all soil or concrete material placed from the bottom of the trench to 300 mm above the pipe.

Concrete bedding shall be placed only to the springline of the pipe.

No Bedding shall be laid in water or on frozen ground or in any conditions considered unsuitable by Aquatera.

Unless otherwise required by the municipality, bedding shall be placed by hand up to 300 mm above the crown of the pipe in maximum 300 mm lifts. This material shall be well tamped with hand tools along both sides of the pipe and compacted to 98% Standard Proctor Density unless otherwise specified.

A minimum of 1 test per trench is required and shall be continued in 75 lineal metre intervals, which includes water mains and services. Aquatera reserves the right to extend the maintenance period if inadequate testing is provided.

b) Alternative Material

Where granular bedding is specified, an approved sand may be used with approval of Aquatera provided the pipe diameter is less than 375 mm and the pipe has watertight joints unless specified by the Engineer.

c) Classes

Unless otherwise approved, B1 Bedding shall be used.

Backfill

Shall be specified by the municipality. In the absence of a municipal specification a maximum of 300mm lifts shall be used, compacted to 98% Standard Proctor Density

91.3.9 TRACER WIRE

Tracer wire shall be installed on all water main pipes and service pipes.

Tracer wire shall be attached to the piping system every 3 m with PVC tape.

The wire shall wrap around the base and surface at every service valve box. Tracer wire is required on valves in landscaped areas and is brought up on the outside of casing. Tracer wire is not required to surface at valves that are in roadways.

The wire shall surface above ground at every hydrant and wrap around a flange bolt between the 2 flanges.

The wire shall be of sufficient length to allow the wire to be uncoiled and extended 0.3 m above ground.

Tracer wire connections shall be spaced at a maximum of 800 metres and shall be placed adjacent to roads or approaches wherever possible for access. Including surfacing at main valves or chambers where possible.

Where spliced-in connections occur, a manufacturer approved water-tight direct bury connector shall be used to provide electrical continuity.

The contractor/consultant shall provide a tracer wire report to Aquatera confirming lines were able to be located and have conductivity with locating equipment. (see form in section 91).

Tracer wire installation shall be considered complete and acceptable when Aquatera can

locate the underground infrastructure using locating equipment.

91.3.10 THRUST BLOCKING

Concrete thrust blocking shall be provided at valves, tees, wyes, bends, caps and plugs, and where changes in pipe diameter occur at reducers and fittings. It shall be placed between undisturbed soil and the fittings and the area of thrust block bearing shall be as shown on the Typical Detail Drawings unless otherwise specified by the Engineer.

The fitting shall be wrapped in a plastic bond breaker so that the concrete is not in direct contact with the fitting.

The blocking shall be placed so that the pipe at fitting joints and the bolts at flanged joints will be accessible for repairs.

Thrust blocking will be considered part of the installation of valves, fittings and hydrants.

The concrete shall have a minimum 12 hour set time before backfilling.

See 103.6.4 Inspection and Testing for thrust blocking HDPE watermains

91.3.11 TIE-IN TO EXISTING WATERMAIN

The work under this item shall consist of removing existing plugs or fittings and making the connections as required to the existing pipe or fitting and shall include all trenching, bedding, laying and jointing of pipe, backfilling and clean-up, and other items necessary to complete the work as specified including all necessary adapters and fittings. All connections to existing pipelines shall be made with Ring-tite joints in accordance to manufacturer's recommendations. Should a transition coupling be required to connect pipes of dissimilar materials it shall be Robar style or Aquatera approved equivalent.

91.3.12 CUT-IN TO EXISTING WATERMAIN

The work under this item shall consist of cutting into existing pipes in order to install fittings to make the connections as required and shall include all trenching, bedding, laying and jointing of pipe, backfilling and clean-up, and other items necessary to complete the work as specified including all necessary adapters and fittings.

91.3.13 RELOCATION (lowering) OF EXISTING WATER MAIN

Relocation of an existing water main shall be carried out in accordance with the Material Specifications, installation of Waterworks Specifications, and all other relevant Specifications and Detailed Engineering Drawings.

An existing waterline shall only be relocated in the event that the pipe being laid comes within 500 mm of intersecting the existing pipe. Relocation shall only be carried out with the express approval of Aquatera. It shall be the Contractor's responsibility to obtain approval

from the authority maintaining the existing pipe prior to relocation. Unless otherwise directed by Aquatera an existing waterline shall be relocated below the new crossing line with a minimum separation of 500 mm between the two pipes.

The bedding for the pipe passing below shall be class B-1 with compacted granular material or non-shrinkable fill completely filling the void between the two pipes. The bedding between the two crossing pipes shall be firmly compacted to a density of 98% Standard Proctor Density.

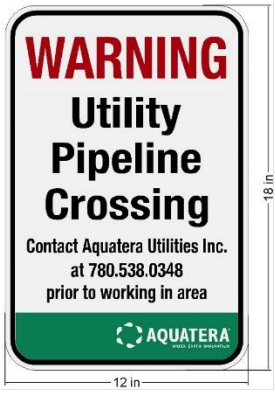
91.3.14 CATHODIC PROTECTION

Cathodic protection shall be placed on all buried metallic pipe, fittings or appurtenances unless a geotechnical report recommends otherwise. Cathodic Protection is required on hydrants and valves. Installation shall be as per Typical Detail Drawings. Denso tape and paste shall also be applied to all metallic fittings and parts. The entire fitting shall be wrapped.

91.3.15 CROSSING OTHER PIPELINES OR UTILITIES

Where the watermain being installed must cross another pipeline or utility the void between the two lines shall be completely filled with granular or sand material compacted to 98% Standard Proctor Density. Under normal conditions, watermains shall cross above sewers with a sufficient vertical separation to allow for proper bedding and structural support of the water and sewer mains.

Where the watermain and the existing pipe or utility cross within 500mm of each other, the watermain shall be lowered to cross under the existing pipe or utility such that a clearance of 500mm is obtained between the two. The void between the two lines and the excavated portion of the crossed pipe or utility shall be filled with approved granular material; hand placed and compacted to 98% Standard Proctor Density or non-shrinkable fill. There shall be no connections or joints in the watermain being laid within 1000mm of the pipeline crossing. Where possible, all crossings shall be marked with standard signs as shown below. The proof is available upon request. (see below)



91.3.16 DISINFECTION AND CLEANING

At the Contractor's expense and before placing into service all potable water mains, fittings and appurtenances shall be thoroughly cleaned and disinfected. Methods used must be approved by Aquatera and Alberta Environmental Protection. Where a line is plugged and cannot be flushed through an existing hydrant, a suitable flush point designed by the consultant and in accordance with AWWA requirements shall be installed at the end of the line. The flush point is to be removed once the line is extended into future development phase. If the water main is to remain a dead end by design, the blow off/flush point shall remain in place permanently.

All temporary injection points used as part of the disinfection process shall be stainless steel service saddles, Robar 2606 series or equivalent. Upon completion of the disinfection process and approval by Aquatera Utilities, the main stop shall be turned to the off position and the service line cut and crimped if copper, or plugged if plastic, approximately 150mm from the main stop. (please see abandonment of services section 33.1.3)

For the complete disinfection and bacteriological testing requirements, refer to Section 91.4.3 (b) (iii).

91.3.17 OFFSITE MARKER POSTS

Steel marker posts shall be required on all water appurtenances located off site. The marker post shall be a 63mm diameter x 2600mm steel post painted blue and embedded between 900mm and 1200mm below finished ground level. The marker post shall be installed 1m away from the water appurtenance.

91.3.18 CHAMBER MANHOLES

Chamber will be constructed to have positive grade away from the frame and covers.

Chambers shall be watertight.

All chamber manhole lids will only have one vent hole.

HDPE/PVC shall not be used to enter manhole walls stainless steel pups shall be used.

Pups shall have one end with a welded stainless steel flange and/or stainless steel Victaulic coupler or Aquatera approval equivalent.

91.4 TESTING REQUIREMENTS

The Consulting Engineer shall co-ordinate all testing (turbidity, pressure, chlorine, bacteriological) with Aquatera Utilities Engineering Services Department at inspection@aquatera.ca or (780)538-0348. Aquatera shall be contacted by the Contractor to schedule the meter cart installation, and operation of the boundary valve. Under no circumstances shall the boundary valve be operated by anyone other than Aquatera in

accordance with City of Grande Prairie By-law C-1139 Section 8.06 and Schedule "D" Subsection 11.01. (please also see testing sequence document in section 300)

91.4.1 PRE-INSTALLATION

a) Materials: The Contractor shall provide copies of sieve analysis of bedding material.

b) Systems: None required.

91.4.2 INSTALLATION

a) Materials: None required.

b) Systems: None required.

91.4.3 POST-INSTALLATION (please see testing sequence document section 300)

It is recommended that, no mains shall be charged and no pressure and leakage tests shall be permitted between October 15th to April 15th inclusive. If pressure testing occurs during these months, Aquatera reserves the right to request re-testing when temperatures are above zero.

a) Materials: None required. Aquatera may request the material list of products used from the contractor or supplier.

b) Systems:

i) Potable Water Pipe Cleaning

Before filling, pressurizing, testing, and disinfecting the installed line, the contractor shall ensure the line is clean in conformance with AWWA C605-13 & ANSI/AWWA C651. To facilitate effective disinfection and minimize the chlorine dosage needed, when practicable, pre-disinfection flushing shall continue until the discharge turbidity drops below 5 NTU, using measurement procedures described in AWWA Manual M12.

ii) Hydrostatic and Leakage Tests

All water mains shall be tested in accordance with AWWA C605-13, PVC Water Main Testing, or the latest revision thereof. All connections to main shall be installed to mains prior to conducting pressure testing.

Each section of pipeline shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to Aquatera. The pump, pipe connection, taps, gauges and all other materials and labour shall be furnished by the Contractor.

During the filling of the pipe and before applying the specified test pressure, all air shall be expelled from the pipeline. To accomplish this, taps shall be made, if necessary, at points of highest elevation, and after completion of tests the taps shall be killed, unless otherwise specified. The test shall be made in sections containing no more than 100 joints or as directed by the Engineer. Hydrostatic test pressure shall be 1035 kPa (150 psi) for a period of two hours. For PVC pipe, the overall leakage for the section of line tested shall not exceed the rate of leakage specified in the Table below. The Contractor shall in the presence of the Engineer, examine the entire pipe and repair leakage as required to the satisfaction of the Engineer. The hydrostatic test shall be repeated until the results are satisfactory to Aquatera. Water loss values shall be supported with detailed calculations.

(Also see 103.6.5d, 1,2,3,4 for HDPE Material)

TABLE: Maximum Allowable Leakage (L/100 Joints/Hour) For PVC Pipe

	Test Pressure (kPa/psi)							
Pipe Dia.	**345/50**	**515/75**	**690/100**	**860/125**	**1035/150**	**1380/200**	**1550/225**	**1724/250**
100 mm (4")	1.46	1.77	2.00	2.28	2.46	2.90	3.07	3.28
150 mm (6")	2.17	2.65	3.07	3.43	3.76	4.34	4.60	4.82
200 mm (8")	2.90	3.54	4.09	4.57	5.02	5.79	6.14	6.46
250 mm (10")	3.62	4.42	5.12	5.71	6.27	7.34	7.67	8.10
300 mm (12")	4.34	5.30	6.14	6.86	7.52	8.69	9.20	9.70
350 (14") mm	5.07	6.19	7.16	8.00	8.77	10.13	10.74	11.33
400 (16") mm	5.79	7.07	8.19	9.14	10.03	11.58	12.27	12.94
450 (18") mm	6.51	7.96	9.21	10.28	11.28	13.03	13.80	14.56

Allowable leakage calculation is based upon the following formula:

PVC pipe $L = ND(P^{0.5})/128,320$

- L - allowable leakage in litres per hour
- N - number of joints
- D - nominal diameter (mm)
- P - test pressure (kPa) (1.0 psi = 6.9 kPa)

Aquatera shall be contacted when leaks or repairs are conducted & specified area shall be inspected prior to backfill.

iii) Chlorine Residual and Bacterial Testing

All the watermains shall be disinfected in accordance with the latest version of AWWA Specification C651.

Minimum residual chlorine after 24 hours shall be 10 mg/L free chlorine.

After final flushing, following the primary disinfection period, and before the new water main is connected to the distribution system, two consecutive sets of acceptable bacteriological samples, taken at least 24 hours apart, shall be collected from the new main. At least one set of samples shall be collected from each 366m of the new main, plus one set from the end of the line and one set from each branch. All samples shall be tested for bacteriological quality in accordance with the Standard Methods for the Examination of Water and Wastewater and shall show the absence of coliform organisms. Samples for bacteriological analysis shall be collected from blow-offs or service taps. Sampling from hydrants shall be avoided. Bacterial Test results and the disinfection records are to be submitted to Aquatera Engineering for review and approval. Upon approval, Aquatera will place new water lines into service by opening the boundary valves. Bacteriological tests must be undertaken at an approved provincial laboratory.

iv) Disinfection Procedures and Testing

Chlorine residual and Bacterialogical testing

Water Pipe Disinfection

1. Inspect materials to ensure integrity
2. Prevent contamination of material during construction

3. Flush water pipe with potable water to remove contaminants prior to disinfection

4. Chlorinate water pipe

5. Flush super chlorinated water from water pipe

Methods of Chlorination

There are three methods for chlorination for water distribution pipes.

1. Continuous Feed Method

2. Tablet Method

3. Slug Method

Aquatera prefers the use of the continuous feed method. Tablet or slug method may be used upon written approval of an Aquatera representative.

Continuous Feed Chlorination Method

1. Flush water pipe with potable water to remove contaminants prior to chlorine injection.

2. Water supplied from an existing potable water source shall be fed through a backflow prevention device.

3. At a point designated by the Engineer, chlorine shall be applied at a rate not less than 25 mg/L. Free chorine tests shall be taken at regular intervals to ensure a consistent concentration of chlorine has been applied throughout the water pipes.

4. Operate all valves to ensure contact of chlorine to all surfaces.

5. When uniform chlorination is achieved, free chorine residual tests shall be taken from test points designated by the Engineer. Digital test kits shall be used to acquire free chlorine results. The free chlorine residual shall exceed 25 mg/L.

6. After a time period greater than 24 hrs, free chorine residual tests shall be taken from the respective designated test points. The free chlorine residual shall not be less than 10 mg/L. If the free chlorine residual is less than 10 mg/L, the line shall be thoroughly flushed with potable water and the chlorination procedure repeated.

7. Following disinfection of all the water pipes, all super chlorinated water shall be flushed completely from all water pipe, in an acceptable manner.

8. Upon completion of flushing super chlorinated water, free and total chlorine residuals shall be taken from designated test points. All samples shall be tested for bacteriological quality in accordance with the Standard Methods for the Examination of Water and Wasterwater and shall show the absence of coliforms organisms. Two bacteriological samples shall be taken from each designated test point not less than 24 hours apart. Samples for bacteriological analysis shall be collected from blow-offs or service taps. Sampling from hydrants shall be avoided.

9. Test results shall be submitted to Aquatera for review and approval.

v) Disinfection and Bacteriological Test Reporting Procedures

Forms are provided in the back of this section for reporting results obtained from the Primary Disinfection Period and Chlorine Residual and Bacteriological Sampling. These reports are to be completed in full and submitted to Aquatera along with other test results, prior to construction completion. The report for the Primary Disinfection Period must have a sketch showing the test area, the chlorine application point, chlorine sampling points, the disinfection method employed and initial and 24 hour residual concentrations of free chlorine. The Chlorine Residual and Bacteriological Sampling Report for Environmental Operations shall include a sketch showing the test area, bacteriological sampling locations, total and free chlorine residuals and the results from bacteriological samples which must accompany the report. These reports shall be certified, stamped and signed by a Professional Engineer licensed to practice by APEGA.

Currently Aquatera accepts results to be provided by the following labs:

Provincial Lab, Exova, AGAT & ALS. Any other lab must be approved by Aquatera 1 month prior to testing commencing.

At a minimum, bacteriological sample reports shall include results for:

- Total coliforms
- Fecal Coliforms
- Escherichia coli (E.coli)
- Unique reference numbers

Drinking water category shall be indicated by the contractor on the chain of custody forms upon submission of samples to labs.

Please note that sample submission for AGAT labs a separate custom form is required to test for an E.coli indication.

Drinking water category shall be identified by the lab on the test results or reports submitted with test package.

Please note that sample submissions for Exova require contractors to contact Exova labs 5 days prior to bacterial test being taken to order sample bottles with pre-logged lot numbers.

vi) Flushing and Dechlorination

After the applicable retention period is over, heavily chlorinated water should not remain in prolonged contact with the pipe and should be flushed from the line as soon as possible to prevent damage to the pipe itself. Flushing of the line should continue until chlorine measurements show that the water leaving the main is no higher than that which is generally prevailing in the distribution system or is at an acceptable level for domestic use.

Discharge of heavily chlorinated water shall be neutralised by chemicals and apparatus suitable for that purpose. If approved by Aquatera, the chlorinated water may be discharged directly into the sanitary sewer. Contractors shall have a water truck or water tanks on site to catch the chlorinated water and dechlorinate it completely before releasing it or shall dispose of it at special dump facility (Tervita or Newalta). Aquatera cannot dechlorinate chlorine higher than system chlorine with our equipment. Aquatera may approve other methods if requests are submitted in writing to Aquatera Engineering, 1 month prior to commencing testing.

vii) After filling, pressurizing, testing, and disinfecting the installed line, the contractor shall ensure the line is clean in conformance with AWWA 605-13 & ANSI/AWWA C651. To facilitate effective disinfection and minimize the chlorine dosage needed, when practicable, post-disinfection flushing shall continue until the discharge turbidity drops below 2 NTU, using measurement procedures described in AWWA Manual M12.

viii) Any failed bacteriological tests may require re-disinfection of the failed section as per the procedures as stated from above (iii) to (v). Disinfection records and bacterial test results must be reviewed and approved by Aquatera prior to the water lines being put into service. Test results that are received and dated more than sixty (60) days shall be considered stale dated, and as such will not be accepted by Aquatera. The newly installed pipes shall be flushed and a single bacterial re-test shall be submitted from each sample point in accordance with the disinfection plan. Any failed bacterial tests will require retesting of the turbidity, chlorine and the 2 day bacteria tests.

ix) Hydrant Flow Tests

Tests of designated hydrants shall be conducted by Aquatera to verify that the flows and pressures identified in the design calculations are being provided in the field. Where the actual flows do not meet the minimum fire and service requirements all

hydrants in the project must be tested and the Developer must advise the corrective actions he shall be taking to provide the necessary service level. The location and extent of initial testing shall be as required by Aquatera. As a minimum the hydrant with the lowest design flow shall be tested for each water zone.

x) Tracer wire installation shall be considered complete and acceptable when Aquatera can locate the water distribution systems using locating equipment.

91.5 PAYMENT

91.5.1 PIPE

Payment for water mains, system testing and disinfection shall be paid as one item at the unit prices per lineal metre shown in the Tender Form for the various types of bedding and pipe sizes indicated. Such payment will be full compensation for all materials, labour, equipment, supervision and all incidentals necessary to complete the work to these specifications.

The length of the main shall be taken as the assembled length of pipe installed.

91.5.2 FITTINGS

Payment for the supply of all materials and the installation of all fittings, including thrust blocking, will be the unit price for each shown in the Tender Form. Such payment will be full compensation for all materials, labour, equipment, supervision and all incidentals necessary to complete the work to these specifications.

91.5.3 TRANSITION COUPLINGS

Transition Couplings shall be considered part of the connections to existing systems and there shall be no additional payment for Transition Couplings.

91.5.4 VALVES

Payment for the supply of all materials and the installation of all valves will be the unit price for each shown in the Tender Form. Such payment will be full compensation for all materials, labour, equipment, supervision and all incidentals necessary to complete the work to these specifications.

91.5.5 VALVE BOXES

Valve Boxes shall be considered part of the installation of valves and there shall be

no additional payment for valve boxes.

91.5.6 HYDRANTS

Payment for the supply of all materials and the installation of all hydrants will be the unit price for each shown in the Tender Form. Such payment will be full compensation for all materials, labour, equipment, supervision and all incidentals necessary to complete the work to these specifications.

91.5.7 TRACER WIRE

There shall be no additional payment for tracer wire. Tracer wire shall be considered incidental to the water distribution system installation.

91.5.8 THRUST BLOCKING

Thrust and Anchor blocking shall be considered part of the installation of valves, fittings, and hydrants and there shall be no additional payment for thrust blocking.

91.5.9 CONNECTIONS TO EXISTING SYSTEMS

Payment for connections to existing system will be at the unit price per tie shown in the Tender Form. Such payment will be full compensation for all materials, fittings, adapters, labour, equipment, supervision and all incidentals necessary to complete the work to these specifications.

91.5.10 RELOCATION OF EXISTING WATERLINE

Payment for relocating an existing waterline shall be at the Lump Sum rate quoted in the Tender. Such payment will be full compensation for all materials, fittings, adapters, labour, equipment, supervision and all incidentals necessary to complete the work to these specifications.

91.5.11 WATERMAIN CROSSING OTHER UTILITIES

There shall be no additional payment for crossing other buried pipelines or utilities beyond the normal payment made for Watermain installation.

91.5.12 CATHODIC PROTECTION

There shall be no additional payment for cathodic protection. Cathodic protection shall be considered incidental to Watermain installation.

91.5.13 DISINFECTION AND CLEANING

There shall be no additional payment for disinfection and cleaning. It is considered incidental to Watermain installation.

91.5.14 TESTING REQUIREMENTS OF THE CONTRACTOR

There shall be no additional payment for testing required by the Contractor. It is considered incidental to Watermain installation.

TURBIDITY SAMPLING REPORT
FOR ENVIRONMENTAL OPERATIONS

DEVELOPER:_____ SUBDIVISION: _____

CONSULTANT:_____ DATE:_____

CONTRACTOR:_____ TOTAL PIPE VOLUME:_____

LOCATION:_____

Please Attach Sketch or Testing Plan from the Approved drawings and highlight the test area

The Consulting Engineer shall co-ordinate all testing (turbidity, pressure, chlorine, bacteriological) with Aquatera Utilities Engineering Services Department at inspection@aquatera.ca. If velocities cannot be achieved other cleaning methods shall be used. See current AWWA 651 Disinfecting water mains table 3 for velocities.

LOCATION	DATE/ TIME	PIPE SIZE	VELOCITY (l/min)	TURBIDITY PRE-PRESSURE TEST <5 ntu	DATE/ TIME	VELOCITY (l/min)	TURBIDITY POST De-CHLORINATION <2 ntu
1)							
2)							
3)							
4)							
5)							
6)							
7)							
8)							

Note: _____

Contractor-Tester Name**:**_____

Consulting Engineer Name and Signature: _____

Aquatera Representative Name and Signature: _____

PRESSURE TEST – PVC (2 hour test)
FOR ENVIRONMENTAL OPERATIONS

DEVELOPER:_____ SUBDIVISION: _____

CONSULTANT:_____ DATE:_____

CONTRACTOR:_____ PUMP LOCATION:_____

LOCATION:_____

Please Attach Sketch or Testing Plan from the Approved drawings and highlight the test area

The Consulting Engineer shall co-ordinate all testing (turbidity, pressure, chlorine, bacteriological) with Aquatera Utilities Engineering Services Department at inspection@aquatera.ca

Pressure shall be maintained within 5 PSI of test pressure.

Note:_____

Time	Read Pressure psi/kPa	Length	Size	Material Type	# of Joints	Make up water
Start	_____	m	____mm	_____	_____	_____L
Finish	_____	m	____mm	_____	_____	_____L
		m	____mm	_____	_____	_____L
Centimetres				Number of Hydrants		_____
Litres				Total Allowable Make up water		L
				Total Actual Make up water		L
Contractor-Tester Name:						
Consulting Engineer Name and Signature: _____						
Aquatera Representative Name and Signature: _____						

PRESSURE TEST – HDPE (5 hour test)
FOR ENVIRONMENTAL OPERATIONS

DEVELOPER:_____ SUBDIVISION: _____

CONSULTANT:_____ DATE:_____

CONTRACTOR:_____ PUMP LOCATION:_____

LOCATION:_____

Please Attach Sketch or Testing Plan from the Approved drawings and highlight the test area

The Consulting Engineer shall co-ordinate all testing (turbidity, pressure, chlorine, bacteriological) with Aquatera Utilities Engineering Services Department at inspection@aquatera.ca

Tests should not start after 12pm.

NOTE:_____

Length of pipe tested:			**HDPE Type:**
Time	**Read Pressure psi/kPa**	**Time**	**Pressure Drop Reading psi/kPa**
Start _____am	_____	_____am	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____pm	_____	Finish _____pm	_____
5% of Final Reduced Pressure	_____		

Note: _____

Contractor-Tester Name**:**_____

Consulting Engineer Name and Signature: _____

Aquatera Representative Name and Signature: _____

CHLORINE RESIDUAL REPORT
FOR ENVIRONMENTAL OPERATIONS

DEVELOPER:_____ SUBDIVISION: _____

CONSULTANT:_____ DATE:_____

CONTRACTOR:_____ PUMP LOCATION:_____

LOCATION:_____

Please Attach Sketch or Testing Plan from the Approved drawings and highlight the test area

The Consulting Engineer shall co-ordinate all testing (turbidity, pressure, chlorine, bacteriological) with Aquatera Utilities Engineering Services Department at inspection@aquatera.ca

Consultants shall use free and total meter for samples. Samples shall be diluted with distilled water to achieve free results.

	SUPERCHLORINATION METHOD USED:		**POST-SUPERCHLORINATION**		**DATE & TIME:**	
LOCATION	**TEST DATE AND TIME Day 1**	**FREE CL_2(mg/L) High End**	**TEST DATE AND TIME Day 2**	**FREE CL_2(mg/L) Low End**	**FREE CL_2(mg/L)**	**TOTAL CL_2(mg/L)**
1)						
2)						
3)						
4)						
5)						
6)						
7)						
8)						

Note: _____

Consulting Engineer Name and Signature: _____

Aquatera Representative Name and Signature: _____

BACTERIAL SAMPLING REPORT
FOR ENVIRONMENTAL OPERATIONS

DEVELOPER:_____ SUBDIVISION: _____

CONSULTANT:_____ DATE:_____

CONTRACTOR:_____ PUMP LOCATION:_____

LOCATION:_____

Please Attach Sketch or Testing Plan from the Approved drawings and highlight the test area

The Consulting Engineer shall co-ordinate all testing (turbidity, pressure, chlorine, bacteriological for drinking water quality) with Aquatera Utilities Engineering Services Department at inspection@aquatera.ca All bacterial samples shall have unique reference numbers.

LOCATION	FIRST TEST SAMPLE DATE, TIME AND REFERENCE #	SECOND TEST SAMPLE DATE, TIME AND REFERENCE #
1)		
2)		
3)		
4)		
5)		
6)		
7)		
8)		
9)		
10)		

Note: _____

Consulting Engineer Name and Signature: _____

Aquatera Representative Name and Signature: _____

CCTV REVIEW
FOR ENVIRONMENTAL OPERATIONS

DEVELOPER:_____ SUBDIVISION: _____

CONSULTANT:_____ DATE:_____

CONTRACTOR:_____ COMPLETION DATE:_____

LOCATION:_____

Please Attach Sketch or Testing Plan from the Approved drawings and highlight the test area

NOTE:_____

Consultant Review date: _____

CCTV Reviewed by

Consulting Engineer Name and Signature: _____

FIELD DENSITY REVIEW
FOR ENVIRONMENTAL OPERATIONS

DEVELOPER:_____ SUBDIVISION: _____

CONSULTANT:_____ DATE:_____

CONTRACTOR:_____ COMPLETION DATE:_____

LOCATION:_____

Please Attach Sketch or Testing Plan from the Approved drawings and highlight the test area

NOTE:_____

Watermain length : _____

Sanitary sewer length : _____

Number of Services: _____

Has the pipe been installed at design depth: yes / no

Consultant Review date: _____

Field Densities Reviewed by

Consulting Engineer Name and Signature: _____

TRENCHLESS LOG REVIEW
FOR ENVIRONMENTAL OPERATIONS

DEVELOPER:_____ SUBDIVISION: _____

CONSULTANT:_____ DATE:_____

CONTRACTOR:_____ COMPLETION DATE:_____

LOCATION:_____

Please Attach Sketch or Testing Plan from the Approved drawings and highlight the test area

NOTE:_____

Watermain length : _____

Sanitary sewer length : _____

Number of Services: _____

Start Location Elevation: _____

Exit Location Elevation: _____

Has the pipe been installed at design depth: yes / no

Consultant Review date: _____

Trenchless Logs Reviewed by

Consulting Engineer Name and Signature: _____

TRACER WIRE REVIEW
FOR ENVIRONMENTAL OPERATIONS

DEVELOPER:_____ SUBDIVISION: _____

CONSULTANT:_____ DATE:_____

CONTRACTOR:_____ COMPLETION DATE:_____

LOCATION:_____

Please Attach Sketch or Testing Plan from the Approved drawings and highlight the test area

All hydrants and services should be located. All tracer wire surface points should be located and have conductivity.

NOTE:_____

Contact test point location 1: _____

Test points located: _____

Contact test point location 2: _____

Test points located: _____

Contact test point location 3: _____

Test points located: _____

Contact test point location 4: _____

Test points located: _____

Contact test point location 5: _____

Test points located: _____

Is all the underground infrastructure able to be located: yes / no

Company performing conductivity test and operator name:_____

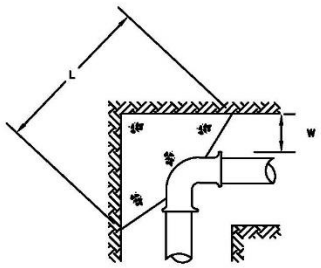
Test points with no conductivity: _____

Have they been repaired: yes / no Repair date: _____

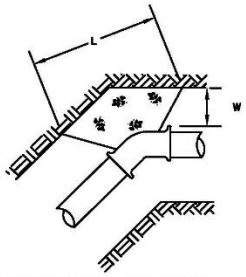
Consultant Review date: _____

Tracer wire Logs Reviewed by

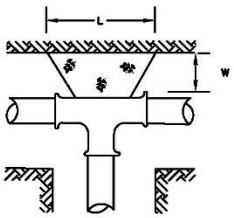
Consulting Engineer Name and Signature: _____



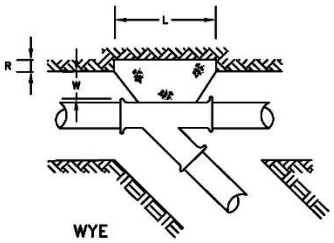
HORIZONTAL 90° BEND



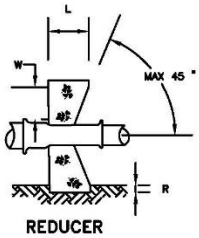
HORIZONTAL 45° BEND



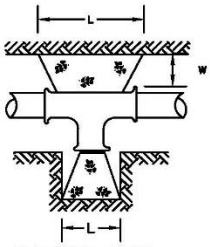
TEE



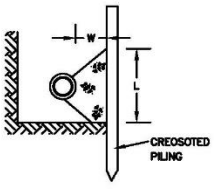
WYE



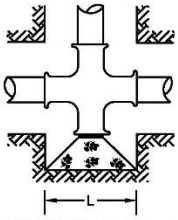
REDUCER



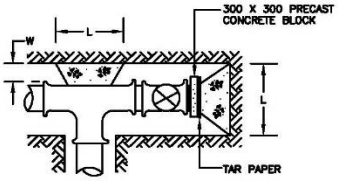
TEE WITH PLUG



VALVE, TEE, AND 90°



CROSS WITH PLUG



TEE WITH VALVE

NOTE:
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
2. WHERE GROUND CANNOT BE EXCAVATED TO FREE STANDING UNDISTURBED SOIL, A SMALL PLANK SHEET PILING SHALL BE DRIVEN TO PROVIDE UNDISTURBED THRUST AREA. THE PILING IS TO BE DRIVEN PRIOR TO EXCAVATING FOR THRUST BLOCK. THE PILING SHOULD BE USED ONLY BELOW THE PERMANENT WATER TABLE.
3. "*" DENOTES DIMENSIONS APPLY TO THE LARGER DIAMETER END OF FITTING.

MINIMUM THRUST AREAS FOR FITTINGS AT 1035 kPa PRESSURE AND FOR SOILS WITH MINIMUM BEARING OF 9765 kg/m² OR 95 kPa (NOT TO BE USED FOR SOFT CLAY, MUCK, PEAT, ETC.)

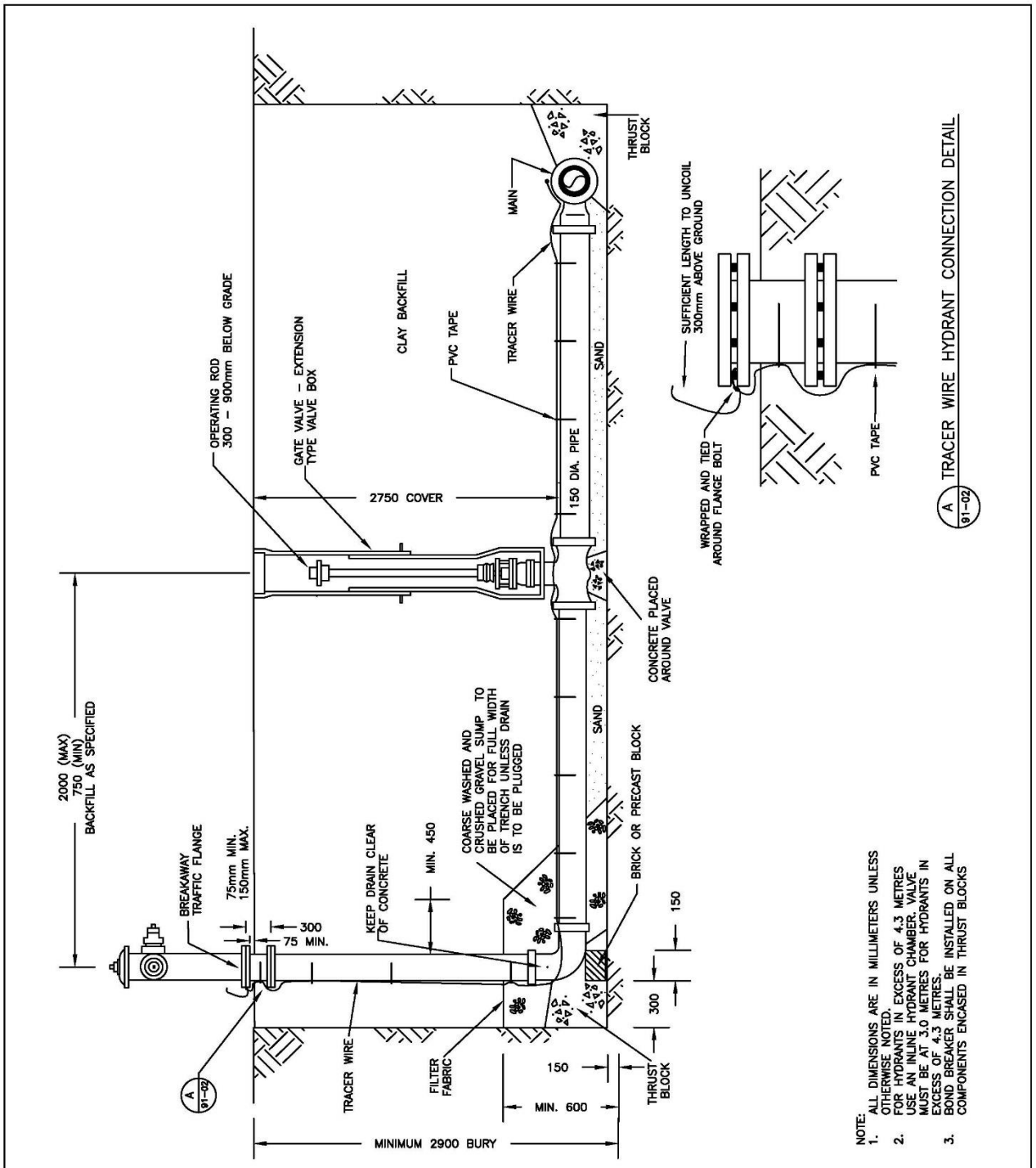
TYPE OF FITTING	FITTING SIZE	OUTSIDE OF FITTING TO BEARING FACE	RECESS IN TRENCH WALL	LENGTH	HEIGHT	TYPE OF FITTING	FITTING SIZE	OUTSIDE OF FITTING TO BEARING FACE	RECESS IN TRENCH WALL	LENGTH	HEIGHT
	D	W	R	L	H		D	W	R	L	H
90° BEND	150 200 250 300	300 350 375 400		900 1050 1445 1650	450 600 750 900	CROSS	150 200 250 300	300 350 375 400		600 825 975 1200	450 600 825 900
45° BEND	150 200 250 300	300 350 375 400		450 600 750 900	450 600 750 900	45° WYE	150 200 250 300	300 350 375 400	300 400 500 600	450 600 825 900	450 600 825 900
22 1/2° BEND	150 200 250 300	300 350 375 400		450 600 825 900	230 300 450 450	REDUCER *	150 200 250 300	300 350 375 400	150 200 250 300	450 600 825 900	450 600 825 900
TEE	150 200 250 300	300 350 375 400		600 825 975 1200	450 600 825 900	CAPS AND PLUGS (IF NOT BOLTED)	150 200 250 300	300 350 375 400		450 600 825 900	450 600 825 900

Revisions	
Date	Details
11/28/13	ADDED TITLE TO VALVE, TEE, AND 90° DETAIL
10/15/15	REMOVE CITY FILE #

AQUATERA

THRUST BLOCK DETAILS

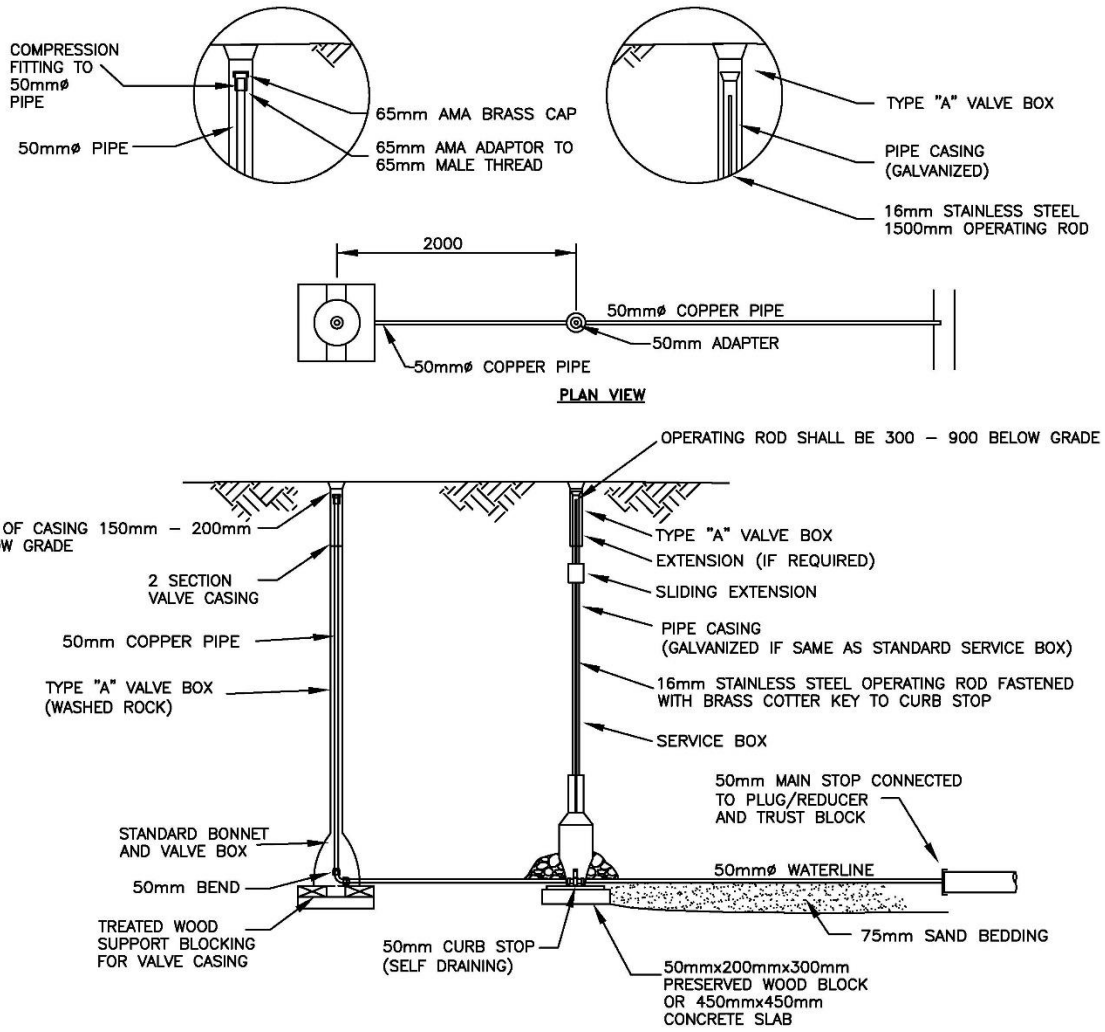
Approved by Timothy Lau P.Eng.	Date 12/07/12	Standard Detail 91–01
Checked by Brad Vall C.E.T.	Scale N.T.S.	
Drawn by Scott Walls	Permit Number P09242	File Number



Revisions	
Date	Details
12/06/12	RESIZED ROCK CATCHER TO SMALLER DIAMETER
12/06/12	ADDED NOTE 3
3/12/13	ADDED TRACER WIRE
3/12/13	ADDED TRACER WIRE HYDRANT CONNECTION DETAIL
11/26/13	LOWERED OPERATING NUT IN CASING
10/15/15	ADDED HYDRANT FLANGE RANGE, REMOVE CITY FILE NUMBER

HYDRANT CONNECTION

Approved by Timothy Lau P.Eng.	Date 12/06/12	Standard Detail 91-02
Checked by Brad Vall C.E.T.	Scale N.T.S.	
Drawn by Scott Walls	Permit Number P09242	File Number



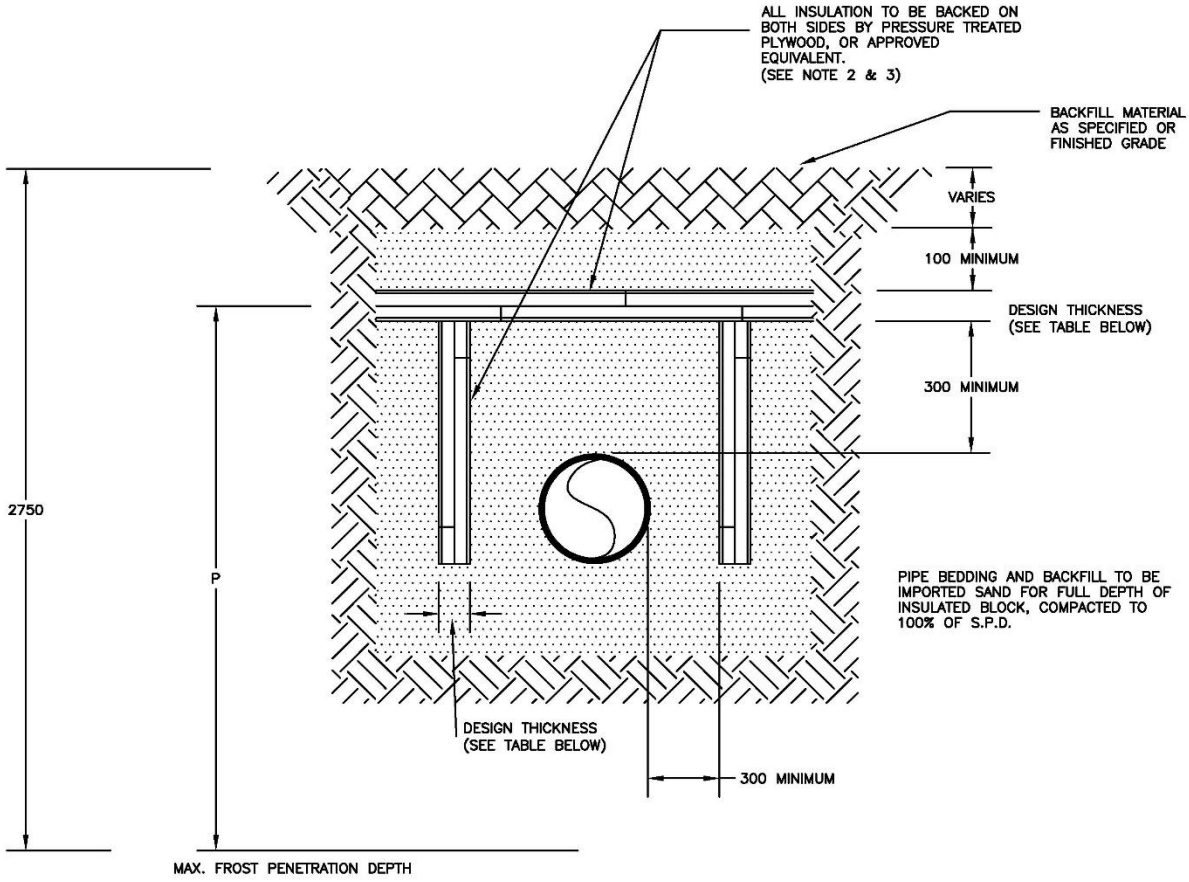
NOTE:
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
2. VALVE BOX, SERVICE BOX, AND APPURTENANCES ARE TO MEET AQUATERA SPECIFICATIONS.
3. TEMPORARY BLOW OFF DETAILS TO BE SUBMITTED TO AQUATERA FOR APPROVAL.

Revisions	
Date	Details
12/06/12	REMOVED THRUST BLOCK ON BLOW-OFF VALVE
12/02/13	ADDED F-80 FRAME AND COVER
12/08/14	INCREASE SEPARATION BETWEEN CC AND B.O., ADD TYPE A CASING TO CC, EXTEND CASING TYPE A
10/14/17	TO SAND BEDDING & REMOVE CITY FILE # TS ADDED NOTE 3, TEMP B.O. DETAIL NEEDS APPROVAL & MODIFIED MAIN CONNECTION

PERMANENT 2" BLOW-OFF

Approved by Timothy Lau P.Eng.
Checked by Brad Vall C.E.T.
Drawn by Scott Walls
Date 12/06/12
Scale N.T.S.
Permit Number P09242

Standard Detail 91-03
File Number



MINIMUM THICKNESS GUIDE			
SANDY SOIL		CLAY SOIL	
P	THICKNESS	P	THICKNESS
1600	100		
2100	150	1500	175
2400	200	2400	225

"R" VALUE IS 5 PER 25mm

"P" IS THE DISTANCE FROM THE MAX FROST PENETRATION DEPTH TO THE TOP OF THE INSULATION.
EX) IF "P" IS 2400 IT MEANS YOUR PIPE IS AS CLOSE TO THE ROAD SURFACE AS POSSIBLE AND THICKER INSULATION IS REQUIRED.
EX) IF "P" IS 1600 IT MEANS YOUR PIPE IS FURTHER AWAY FROM THE SURFACE AND THINNER INSULATION IS REQUIRED.

NOTE:
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
2. INSULATION TO BE MINIMUM 100mm THICKNESS.
3. PLYWOOD TO BE MINIMUM 10mm THICKNESS.
4. BACKFILLING TO BE DONE CAREFULLY TO PREVENT BREAKING OR CRUSHING THE INSULATION. CRUSHED SHEETS SHALL BE REMOVED AND REPLACED.

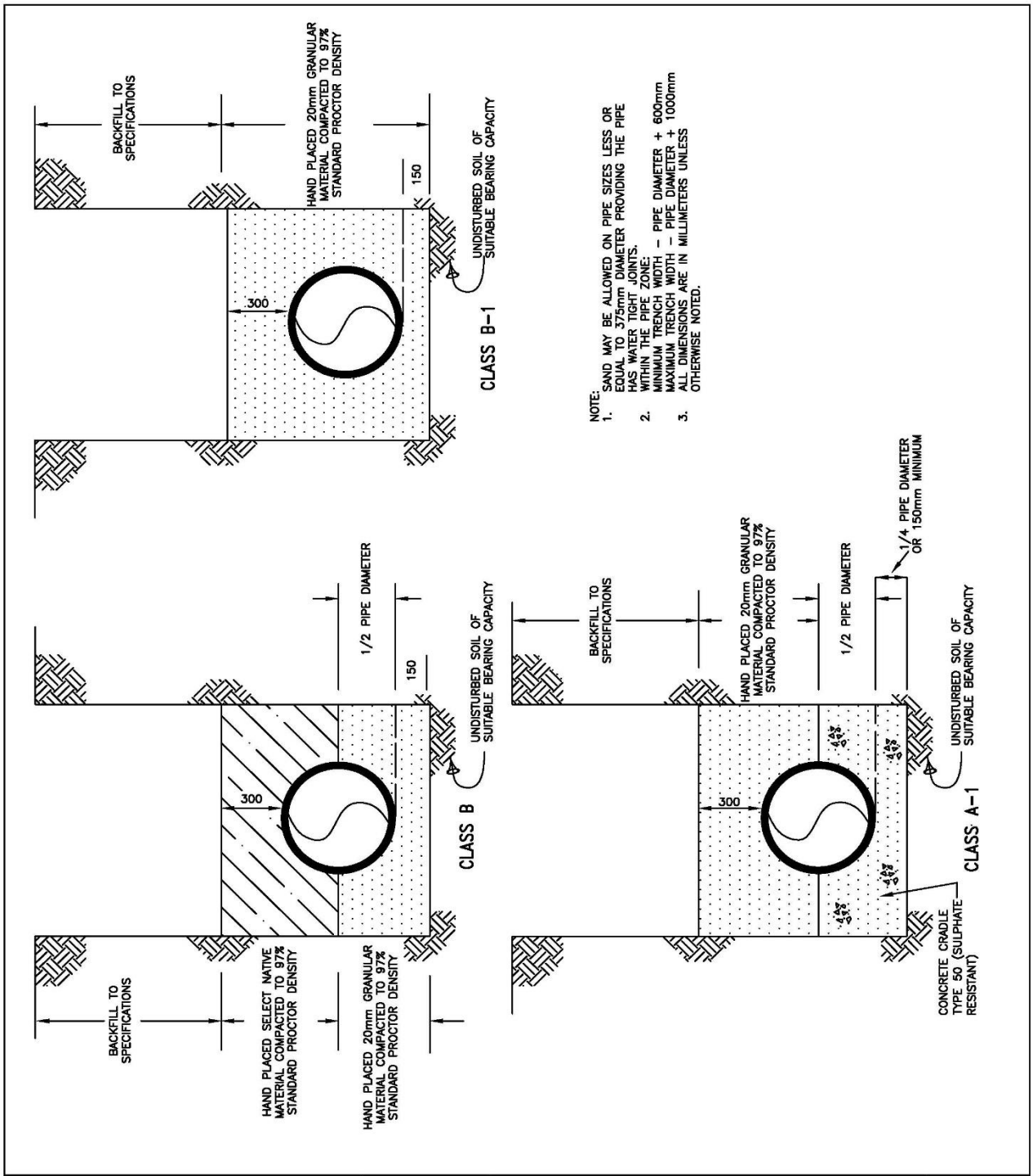
Revisions	
Date	Details
11/14/13	CHANGED DEPTH OF FILL ABOVE INSULATION
10/15/15	ADDED PLYWOOD SIZE, REMOVE CITY FILE #
03/23/16	ADD NOTES BELOW CHART FOR CLARIFICATION
11/31/16	ADD DEPTH OF FROST, CHANGE TITLE

FROST BOX
PIPE INSULATION DETAIL

Standard Detail
91–04

Approved by Timothy Lau P.Eng.	Date 12/07/12
Checked by Brad Vall C.E.T.	Scale N.T.S.
Drawn by Scott Walls	Permit Number P09242

File Number

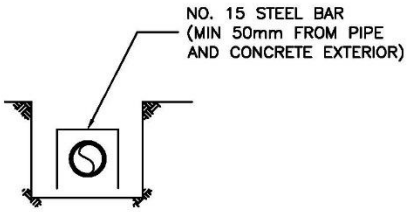


Revisions	
Date	Details
10/19/15	REMOVE CITY FILE #

AQUATERA

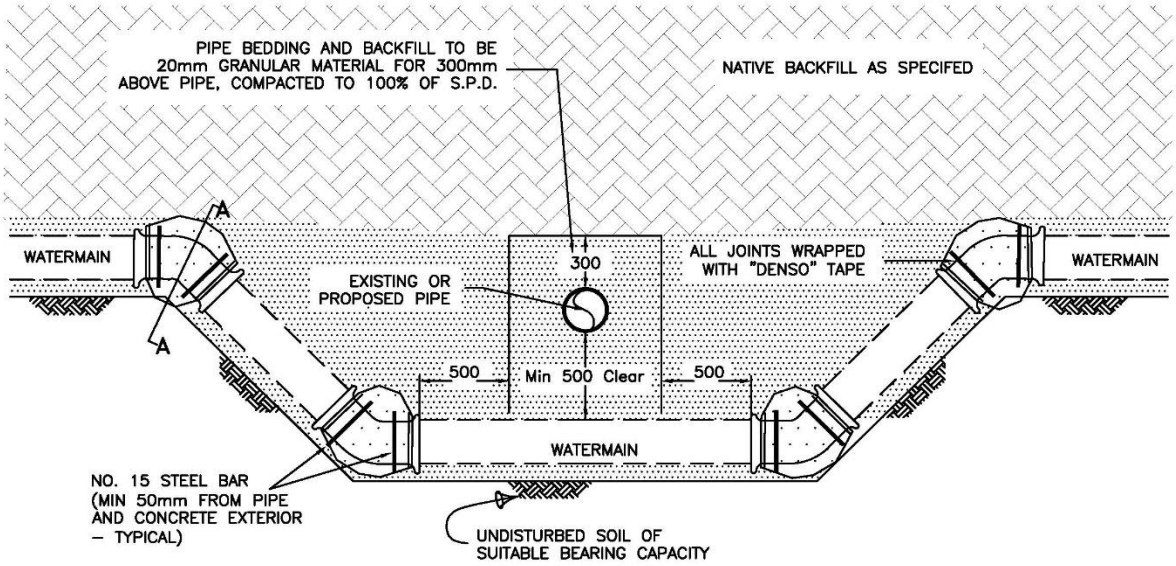
BEDDING DETAILS

Approved by Timothy Lau P.Eng.	Date 12/07/12	Standard Detail 91–05
Checked by Brad Vall C.E.T.	Scale N.T.S.	
Drawn by Scott Walls	Permit Number P09242	File Number



SECTION A – A

NOTE
1. CONCRETE DOES NOT ENCASE BELLS OR PIPE.
2. CONCRETE STRENGTH IS 25 MPa AT 28 DAYS
3. CONCRETE CLEARS BELLS, PIPE AND IS UNDER ALL FITTINGS.
4. REQUIRED BEARING AREA FOR THRUST BLOCKS = 0.80m²
5. ALL BENDS TO BE 45°
6. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED
7. BOND BREAKER SHALL BE INSTALLED ON ALL COMPONENTS ENCASED IN CONCRETE

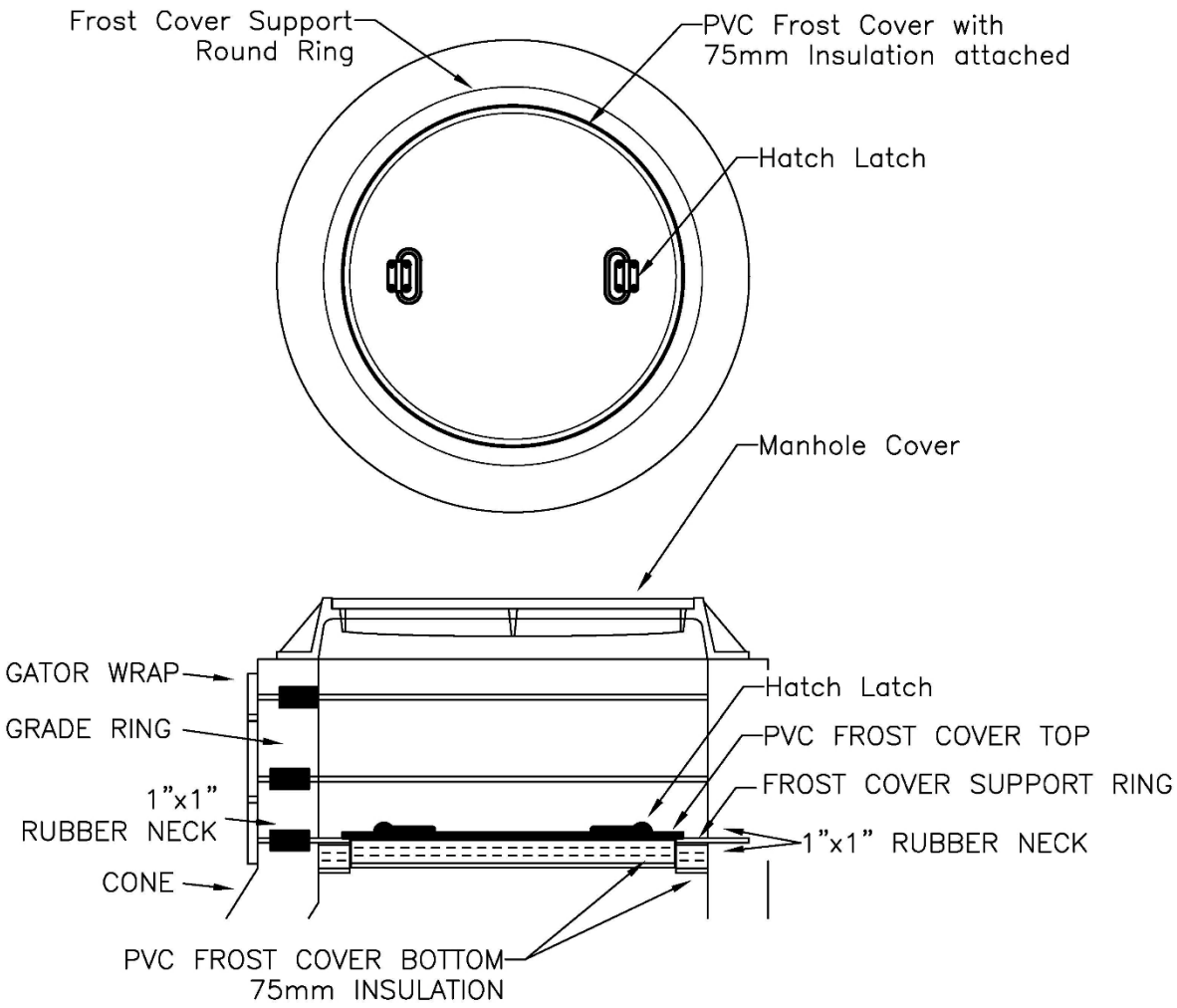


Revisions	
Date	Details
12/07/12	ADDED NOTE 7
10/15/15	REMOVE CITY FILE #

WATERMAIN CROSSING DETAIL

Standard Detail 91–08

Approved by Timothy Lau P.Eng.	Date 12/07/12
Checked by Brad Vall C.E.T.	Scale N.T.S.
Drawn by Scott Walls	Permit Number P09242
	File Number



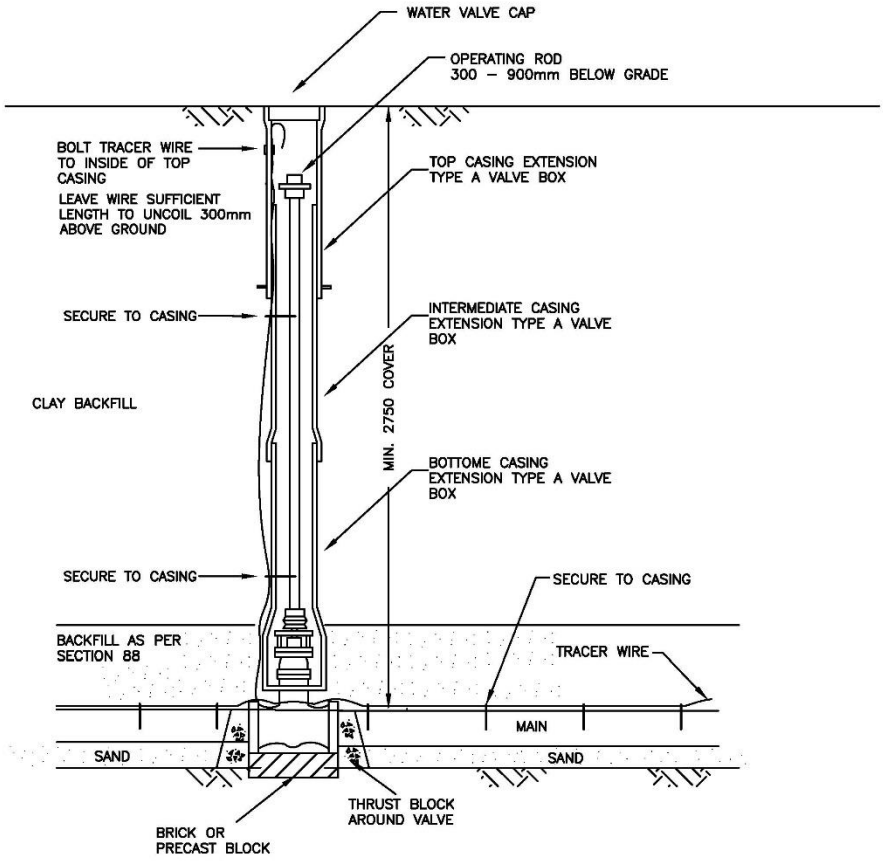
NOTES:
1) WOSELEY OR APPROVED EQUIVALENT

Revisions		
Date	Details	
FEB 26/20	MODIFIED SUPPLIER	TS

AQUATERA

PRE MANUFACTURED
FROST COVER DETAIL

Approved by Brad Vall C.E.T.	Date 11/17/17	Standard Detail 91–09
Checked by MARCUS OESER	Scale N.T.S.	
Drawn by Troy Smith C.E.T.	Permit Number	File Number



NOTE:
1. CASINGS SHALL BE PLUM.
2. LONGER INTERMEDIATE CASINGS SHALL BE USED TO AVOID NON–PLUM CASINGS.
3. BOND BREAKER SHALL BE INSTALLED ON ALL COMPONENTS ENCASED IN THRUST BLOCKS.
4. TRACER WIRE IS NOT REQUIRED FOR VALVES IN ROADS OR SIDEWALKS.

Revisions				
Date	Details	TYP. VALVE CASING		Standard Detail
–	–			91–10
		Approved by Brad Vall C.E.T.	Date 20/11/18	
		Checked by Markus Oeser	Scale N.T.S.	
		Drawn by Troy Smith C.E.T.	Permit Number P09242	File Number